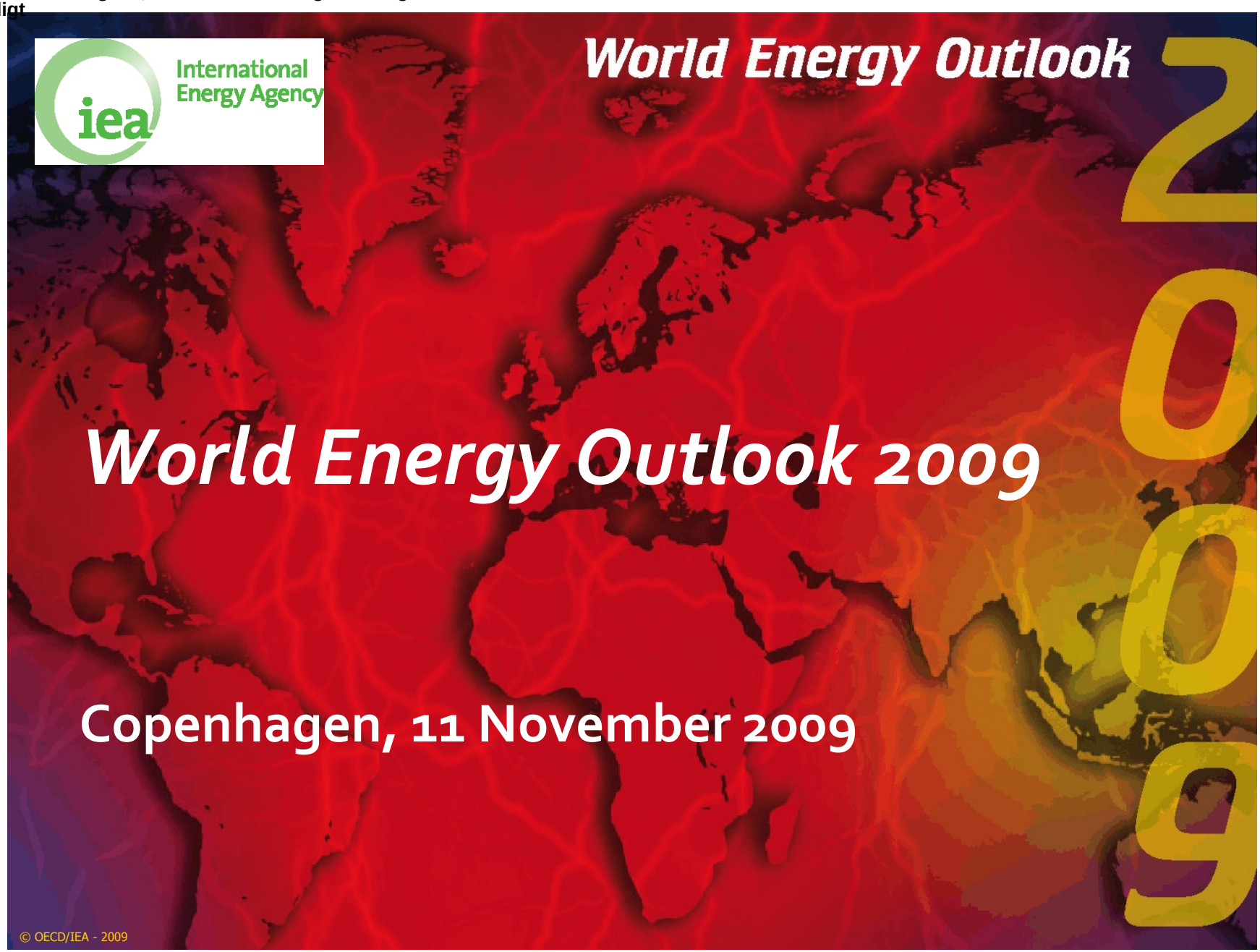
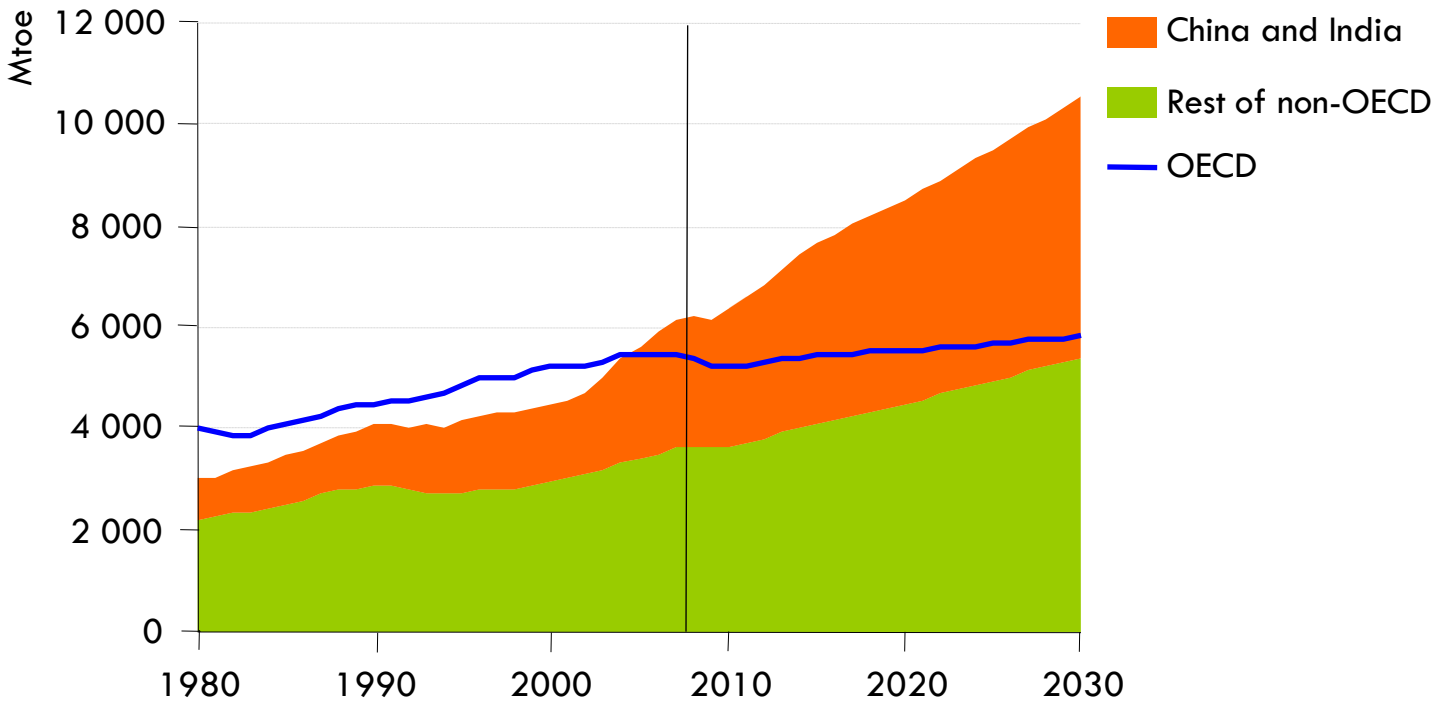


The context

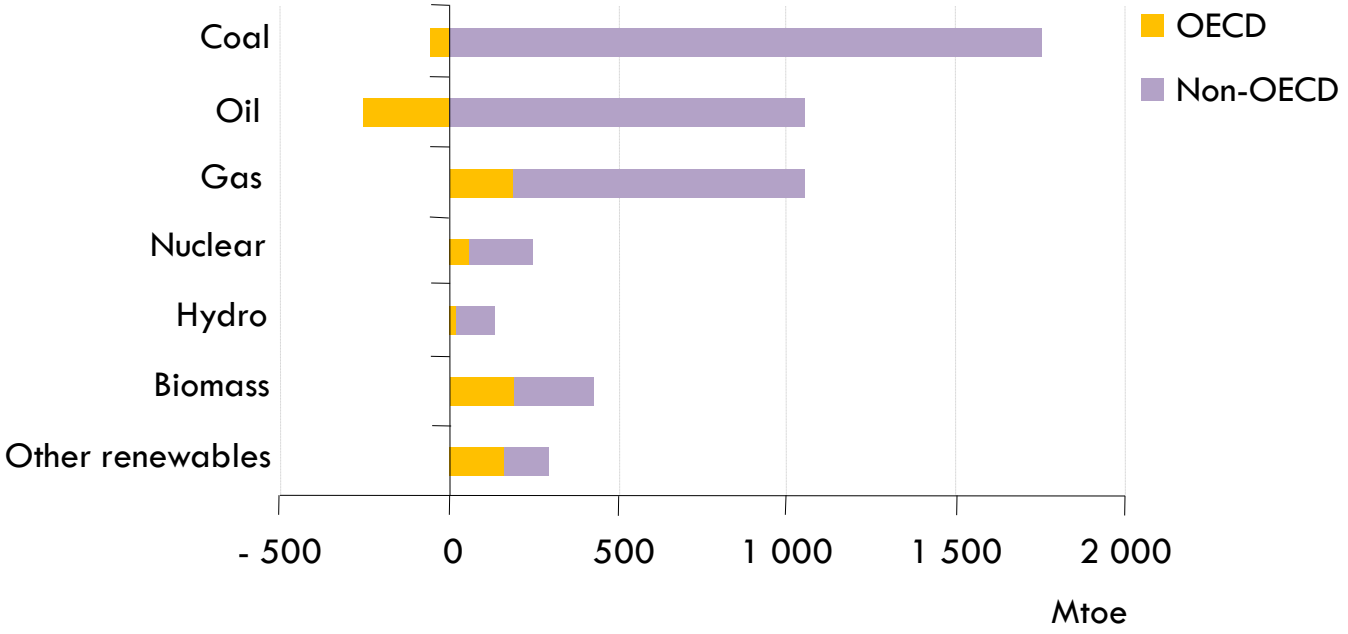
- The worst economic slump since the 2nd World War & signs of recovery – *but how fast?*
- An oil price collapse & then a rebound – *rising marginal costs point to higher prices in the longer term, but are current levels sustainable?*
- A slump in energy investment due to the financial & economic crisis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

World primary energy demand in the Reference Scenario



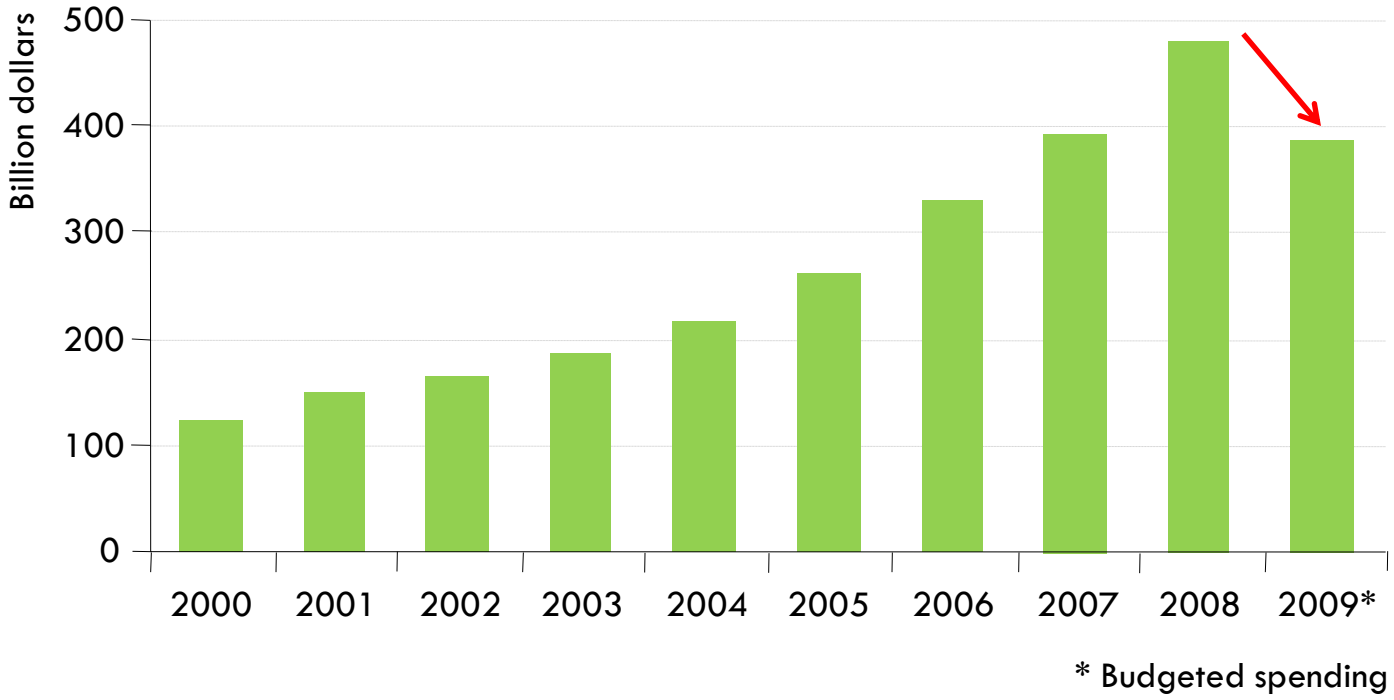
Non-OECD countries account for 93% of the increase in global demand between 2007 & 2030, driven largely by China & India

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



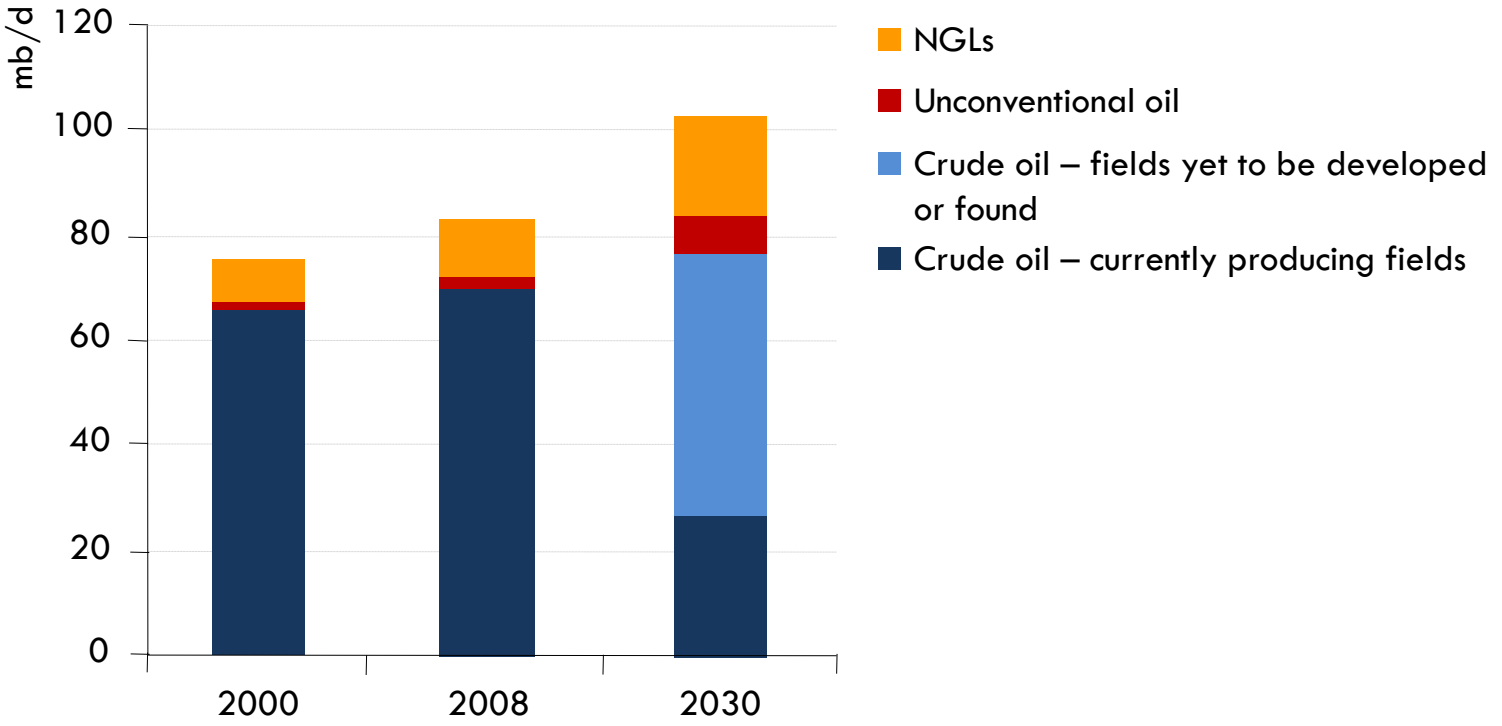
Fossil fuels account for 77% of the increase in world primary energy demand in 2007-2030, with oil demand rising from 85 mb/d in 2008 to 88 mb/d in 2015 & 105 mb/d in 2030

Worldwide upstream oil & gas capital expenditures



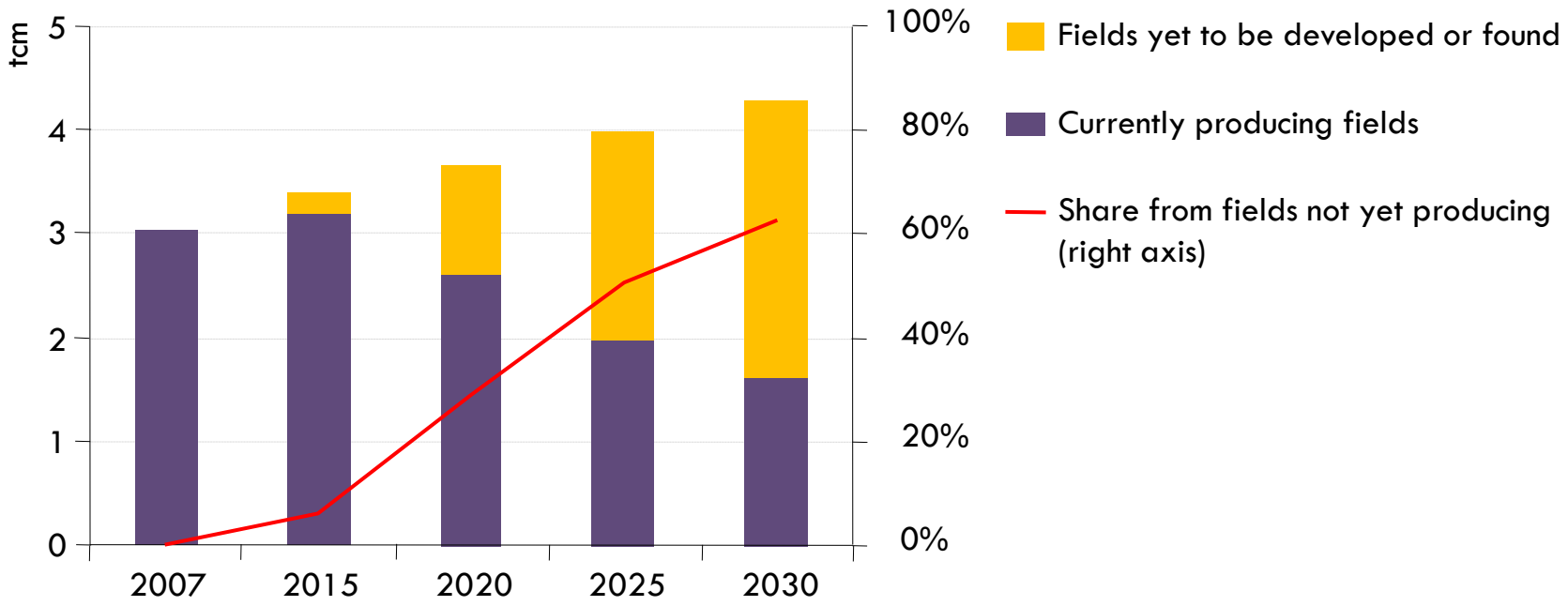
Global upstream spending (excluding acquisitions) is budgeted to fall by over $90 billion, or 19%, in 2009 – the first fall in a decade

Oil production in the Reference Scenario



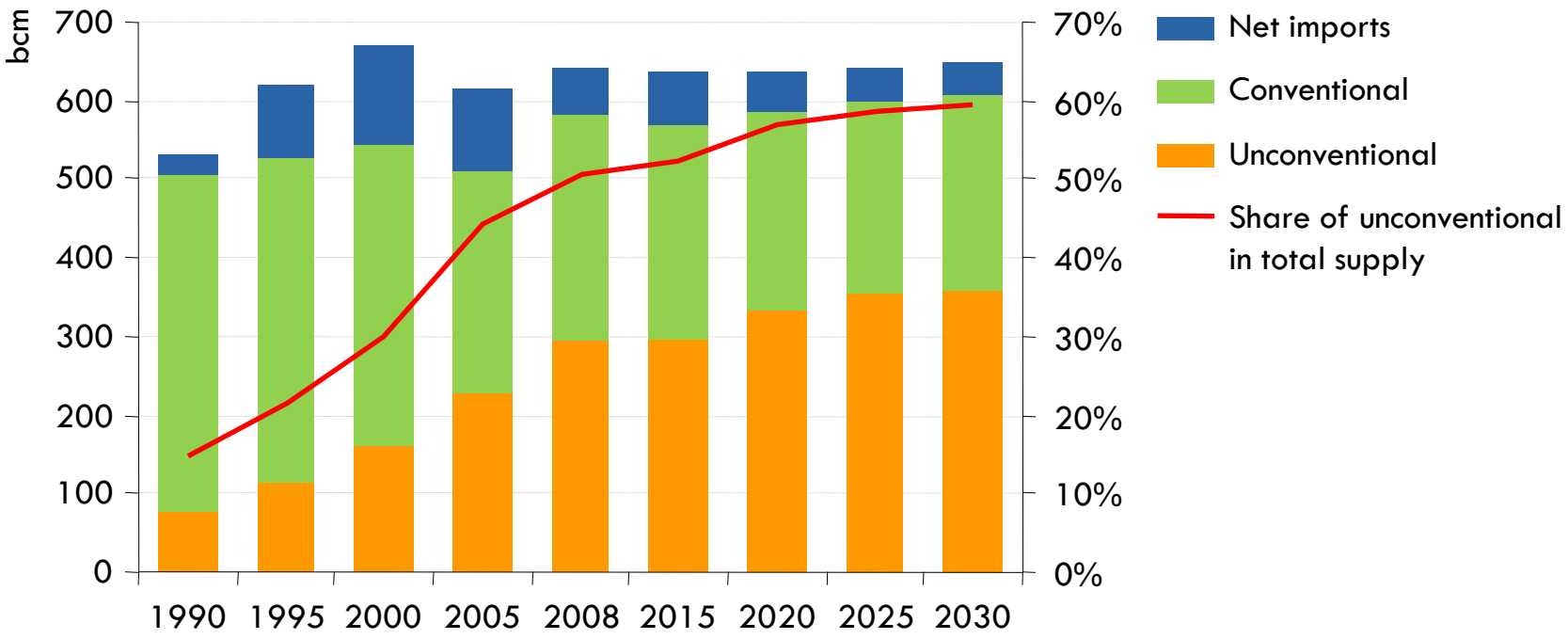
Sustained investment is needed mainly to combat the decline in output at existing fields, which will drop by almost two-thirds by 2030

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



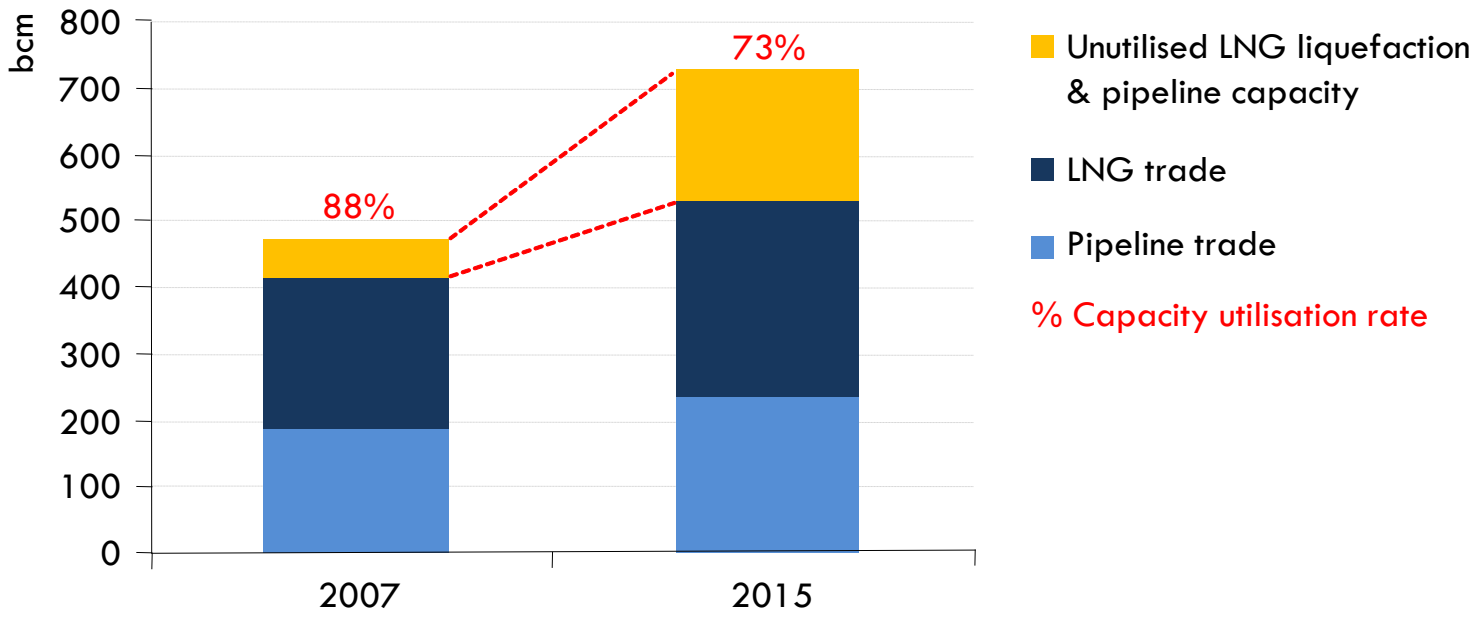
Additional capacity of around 2 700 bcm, or 4 times current Russian capacity, is needed by 2030 – half to offset decline at existing fields & half to meet the increase in demand

US natural gas supply in the Reference Scenario



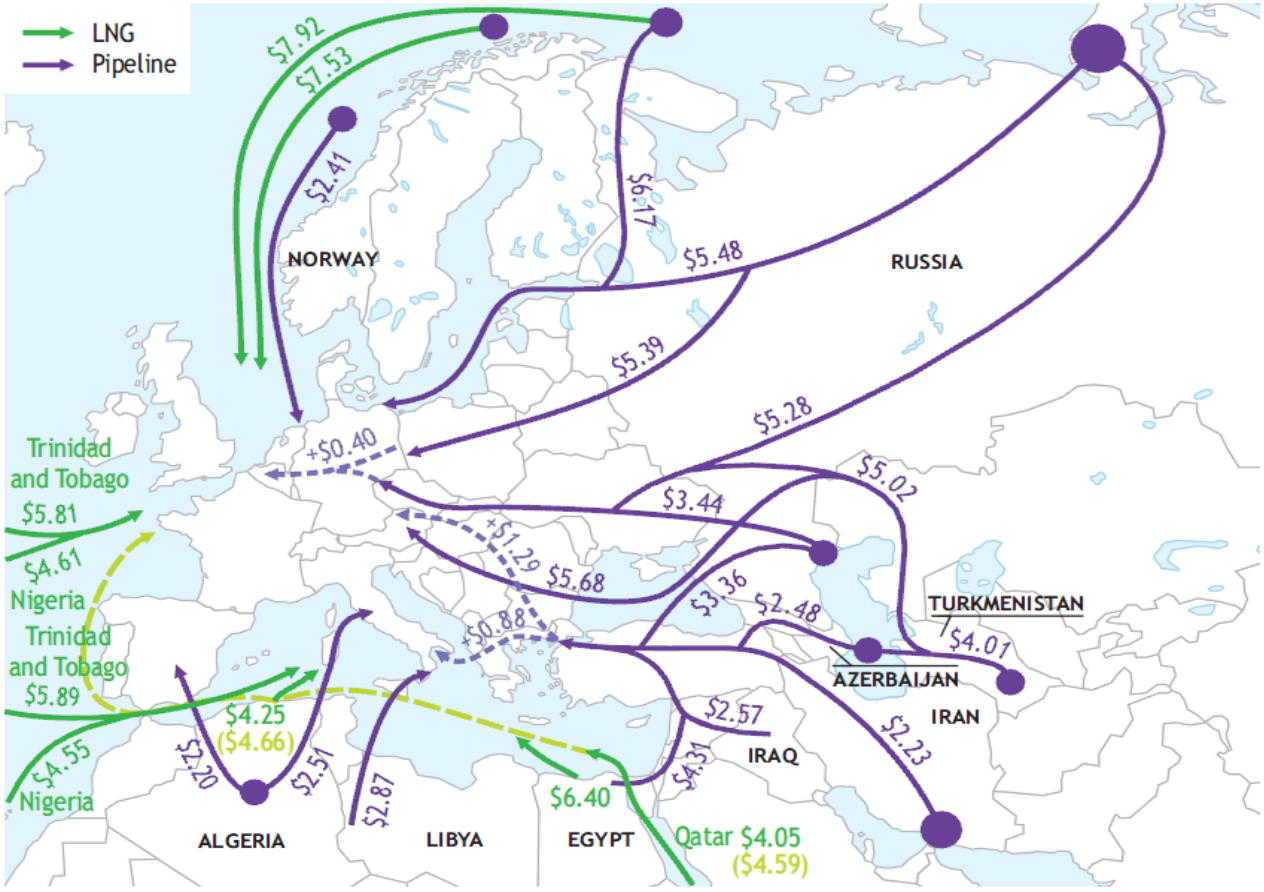
Thanks mainly to shale gas, US gas output grows gradually through to 2030, outstripping demand & squeezing imports

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

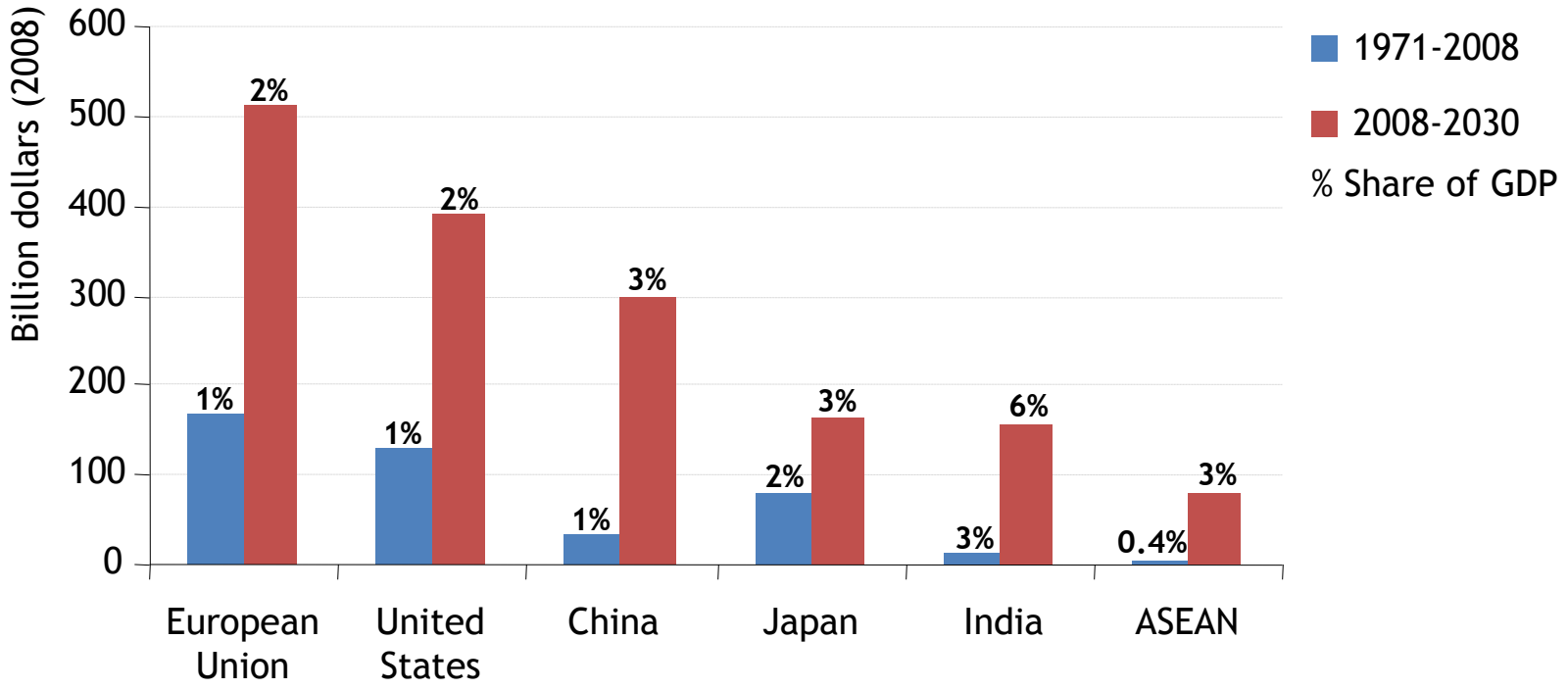
Indicative costs for potential new sources of gas delivered to Europe, 2020 ($/MBtu)



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.

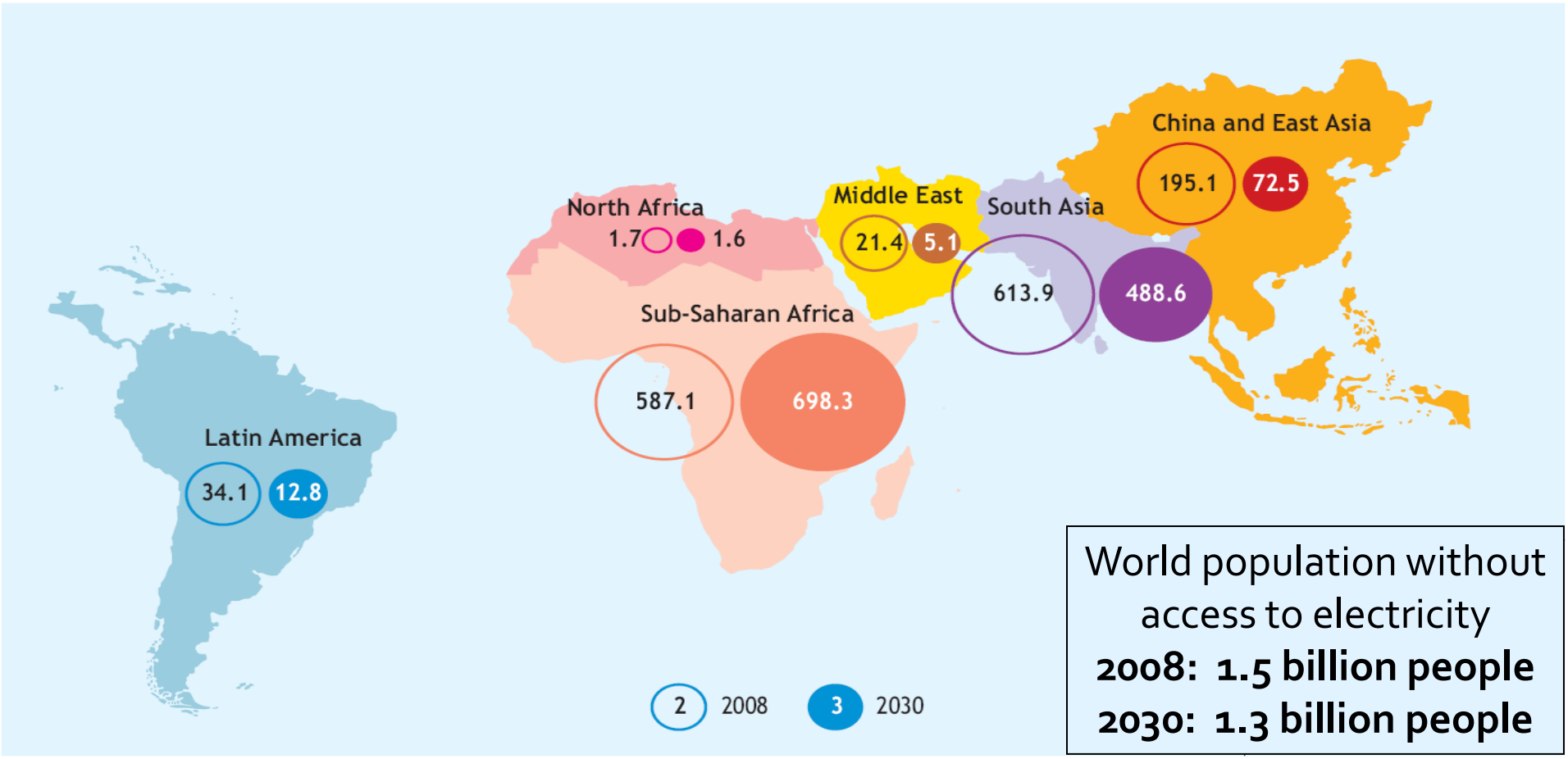
Although indigenous resources are limited & output is declining, Europe is geographically well placed to secure gas supplies from a variety of external sources

Average annual expenditure on net imports of oil & gas in the Reference Scenario



The Reference Scenario implies persistently high spending on oil & gas imports, with China overtaking the United States by around 2025 to become the world's biggest spender

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



World population without access to electricity

2008: 1.5 billion people

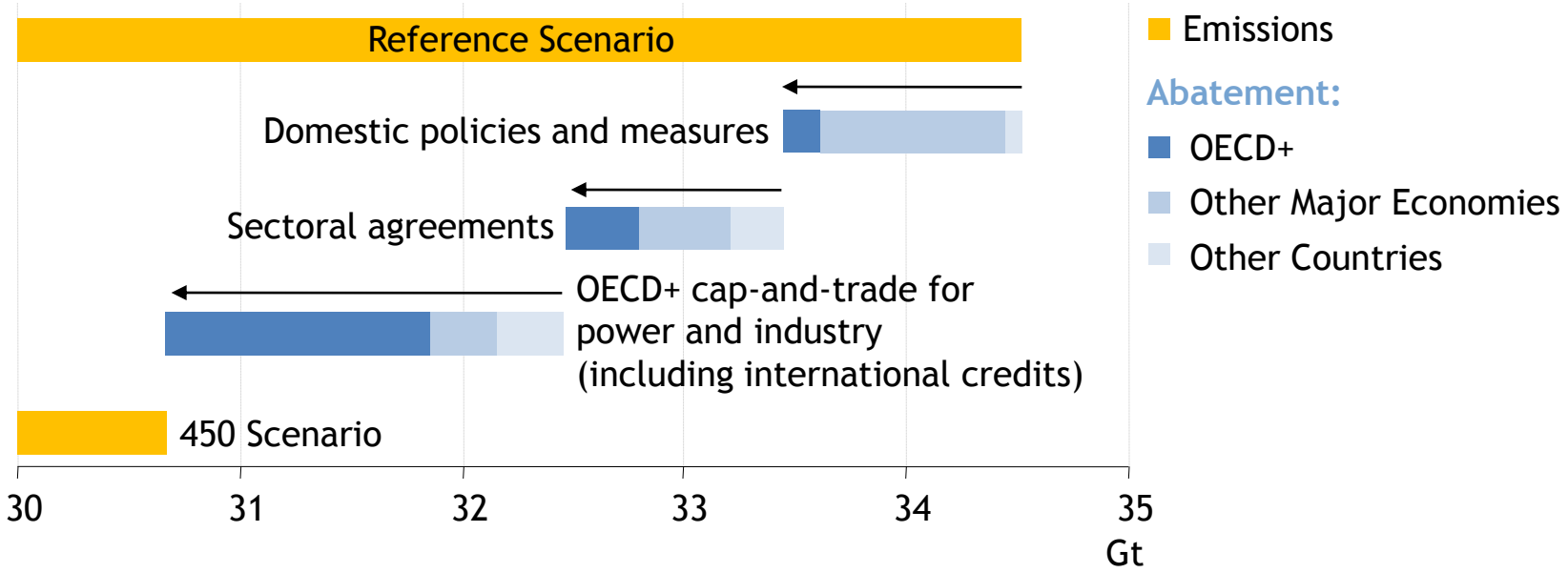
2030: 1.3 billion people

$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

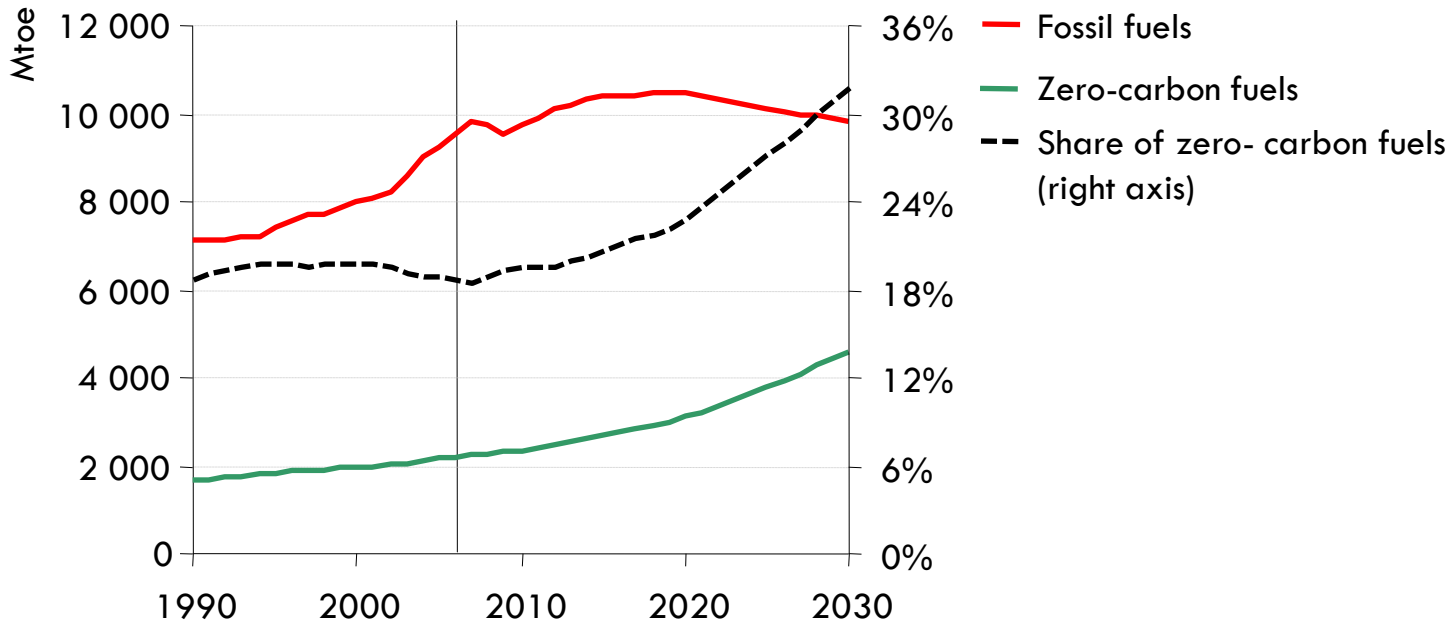
- A combination of policy mechanisms, which best reflects nations' varied circumstances & negotiating positions
- We differentiate on the basis of three country groupings
  - *OECD+: OECD & other non-OECD EU countries*
  - *Other Major Economies (OME): Brazil, China, Middle East, Russia & South Africa*
  - *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*

Abatement by policy type in the 450 Scenario relative to the Reference Scenario, 2020



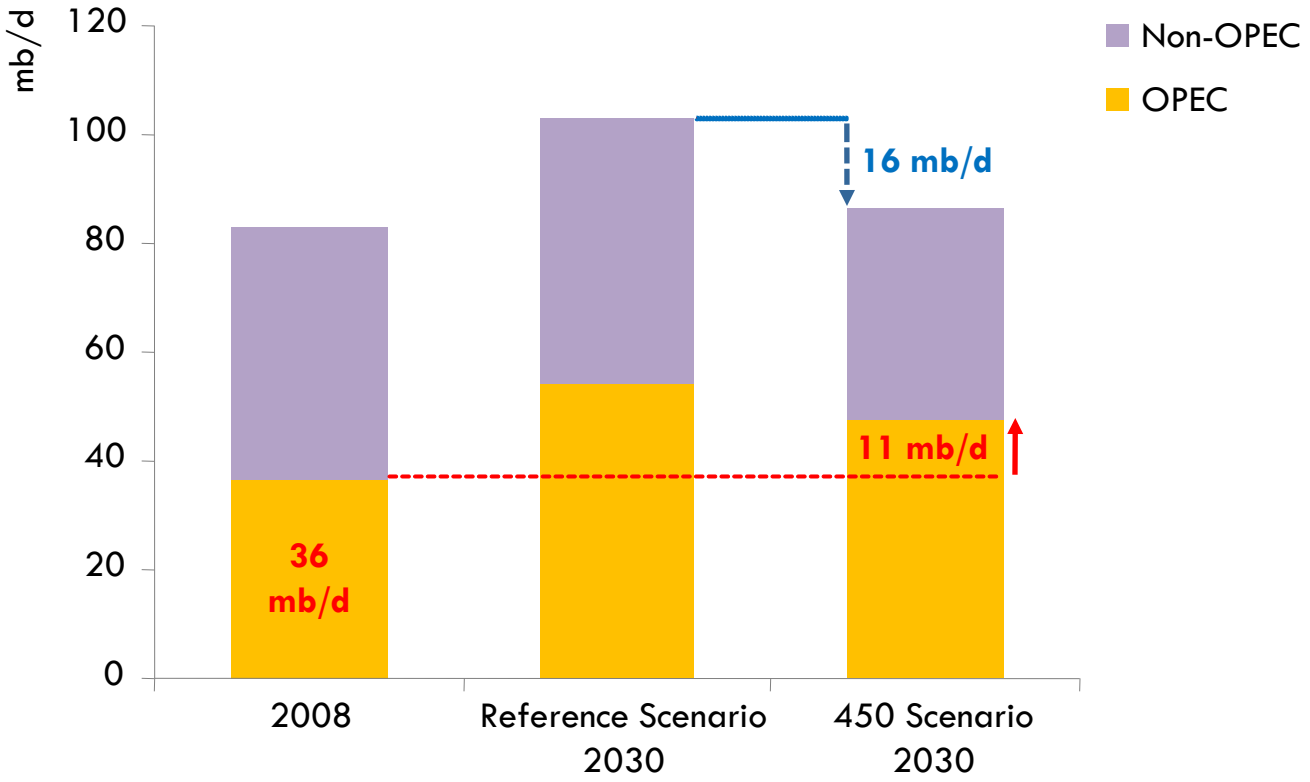
After realising the abatement potential of policies & measures and sectoral approaches, cap-and-trade in OECD+ yields a further 1.8 Gt

World primary energy demand by fuel in the 450 Scenario



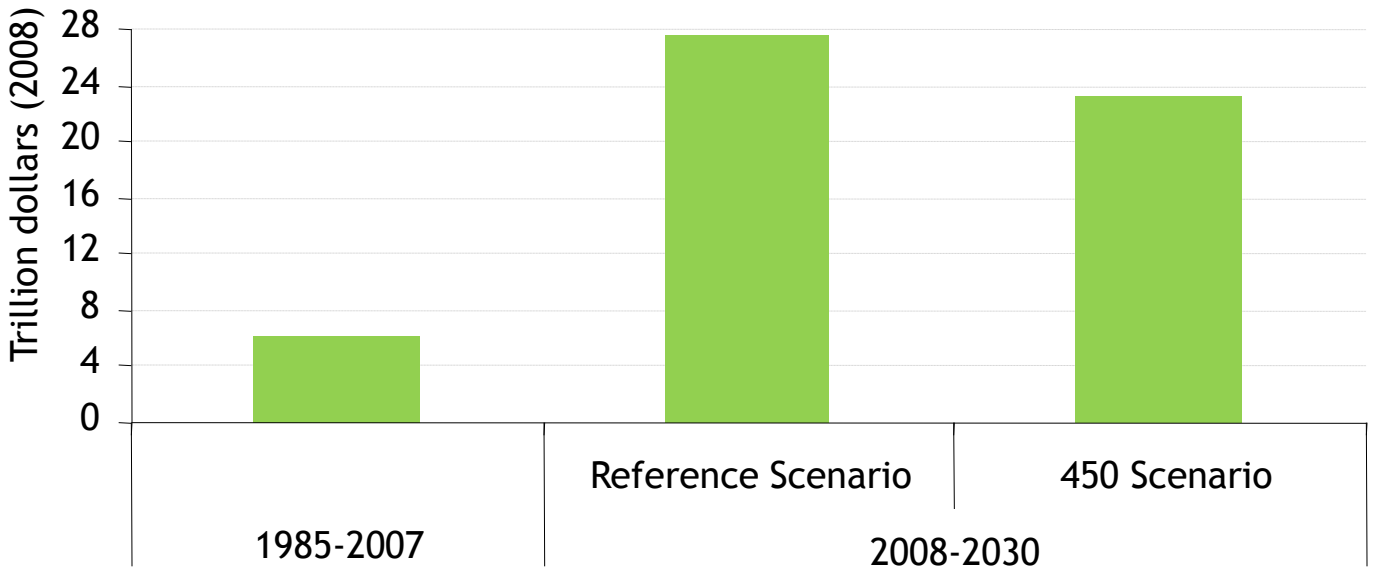
In the 450 Scenario, demand for fossil fuels peaks by 2020, and by 2030 zero-carbon fuels make up a third of the world's primary sources of energy demand

World oil production by scenario



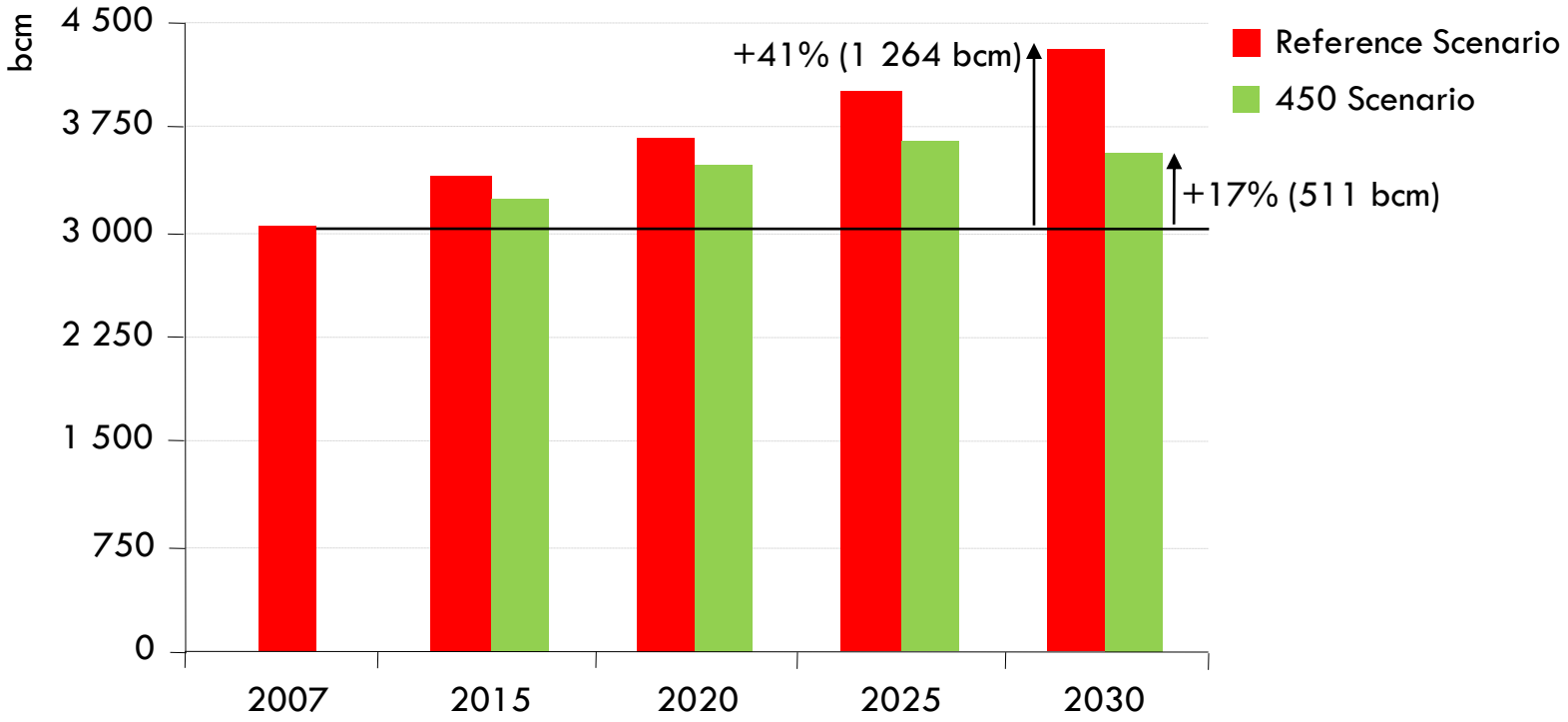
Curbing CO_2 emissions would also improve energy security by cutting oil demand, but even in the 450 Scenario, OPEC production increases by 11 mb/d between now and 2030

Cumulative OPEC oil export revenues by scenario



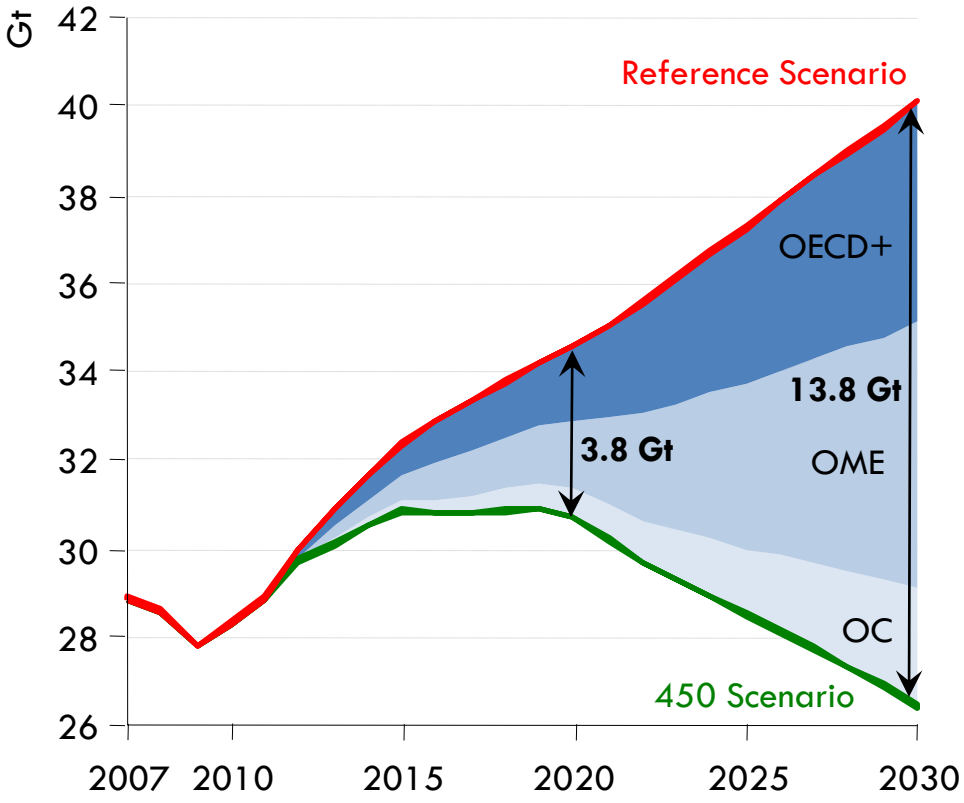
Though slightly lower than in the Reference Scenario, OPEC revenues in the 450 Scenario are over four times as high as in the last 20 years

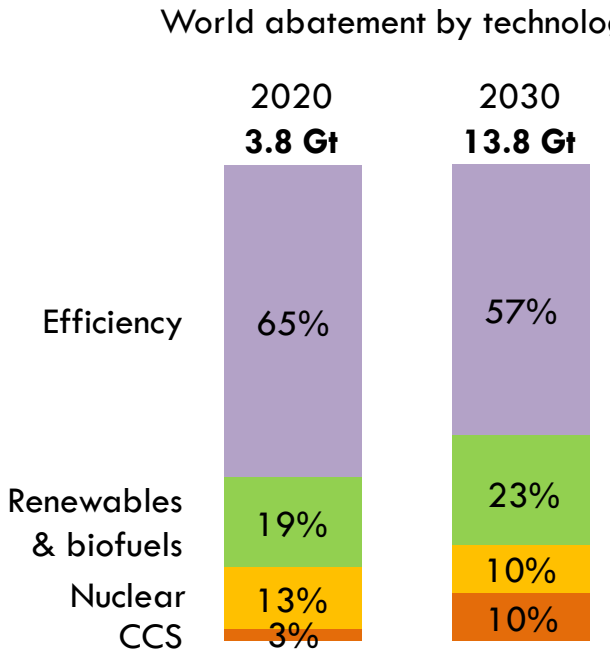
World primary natural gas demand by scenario



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

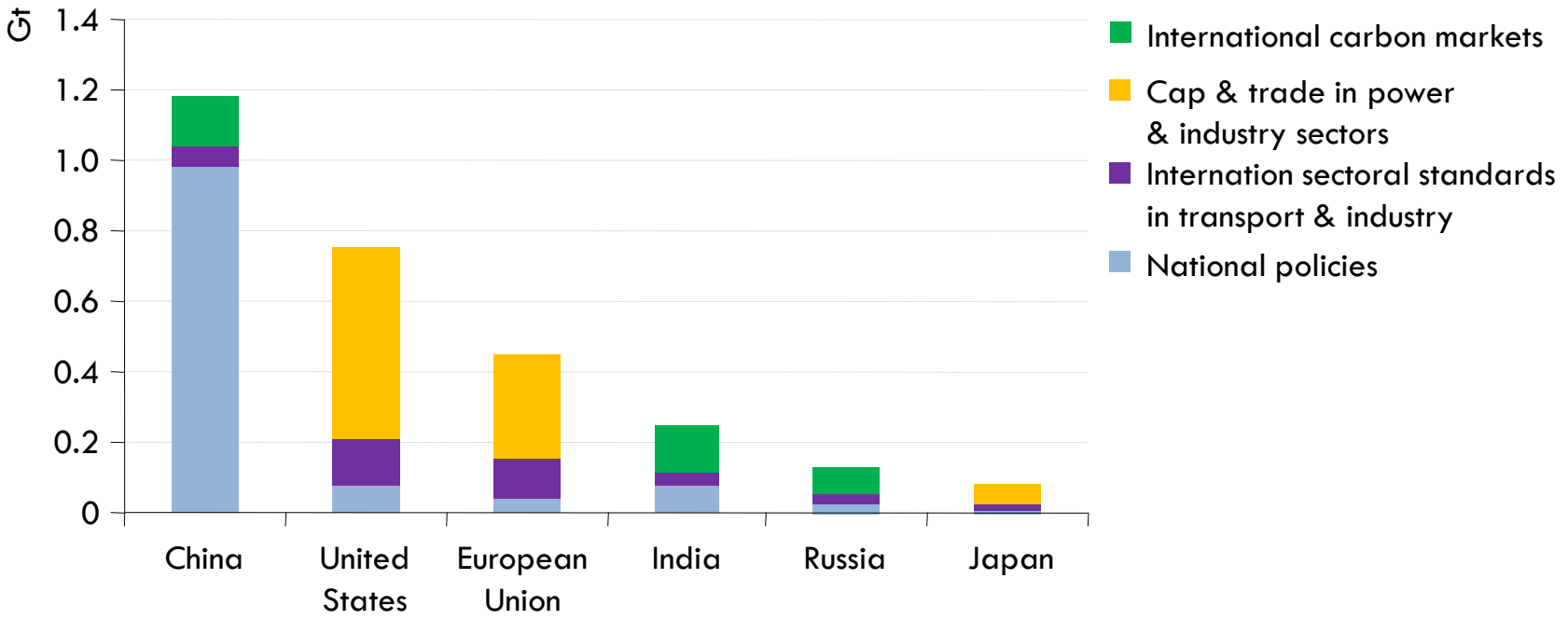
World abatement of energy-related CO_2 emissions in the 450 Scenario





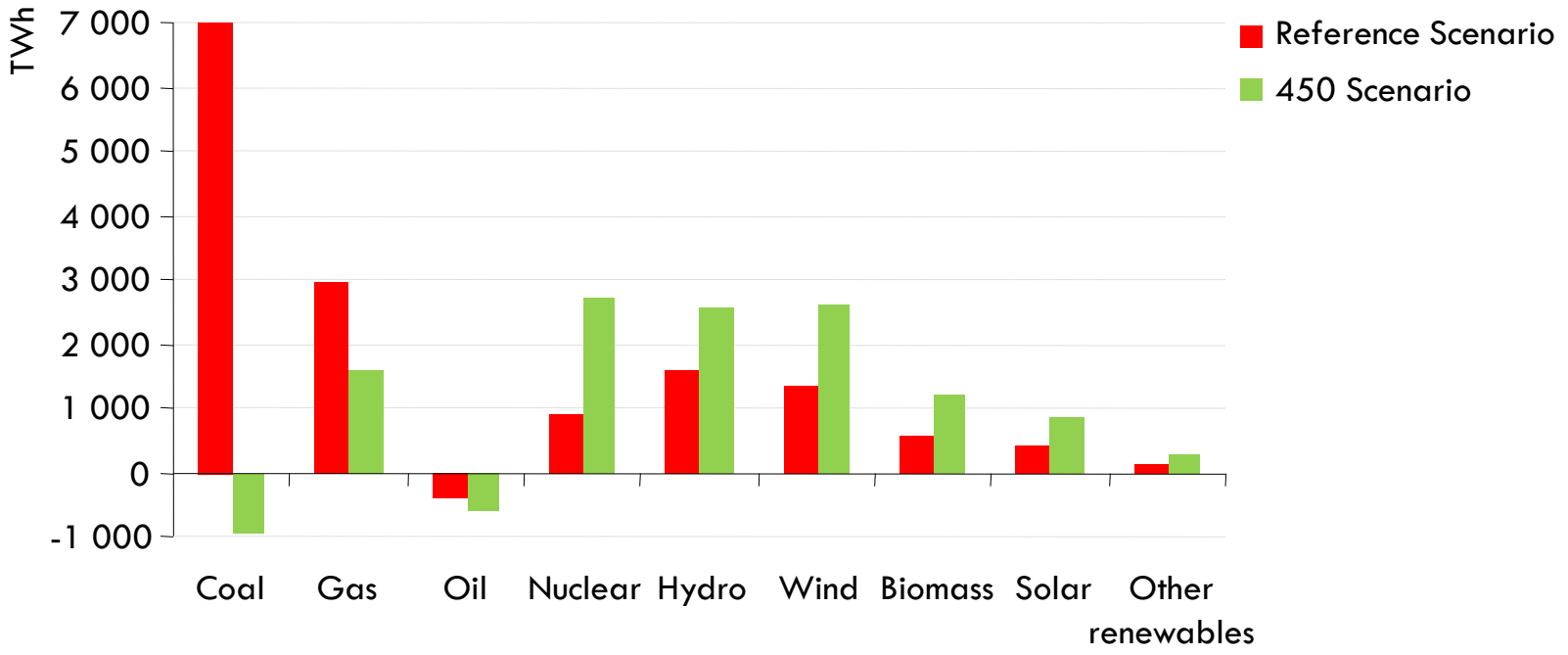
An additional $10.5 trillion of investment is needed in total in the 450 Scenario, with measures to boost energy efficiency accounting for most of the abatement through to 2030

Abatement in the 450 Scenario by key emitters, 2020



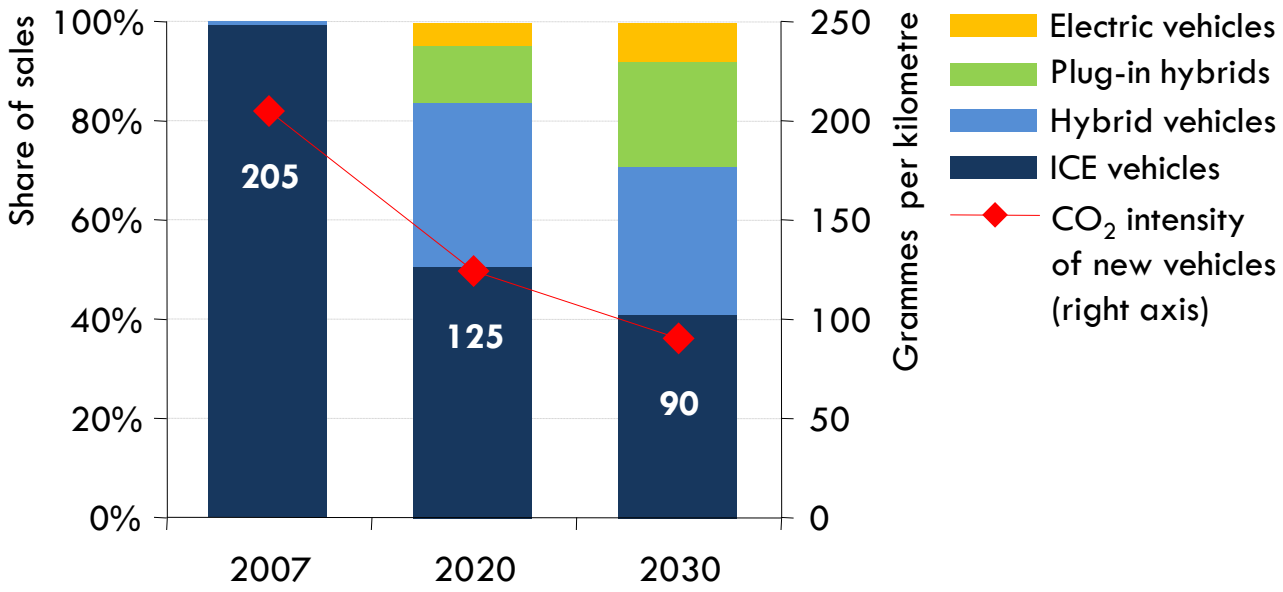
China, the United States, the European Union, India, Russia & Japan account for almost three-quarters of the 3.8 Gt reduction in the 450 Scenario

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

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