



International
Energy Agency

World Energy Outlook

World Energy Outlook 2009

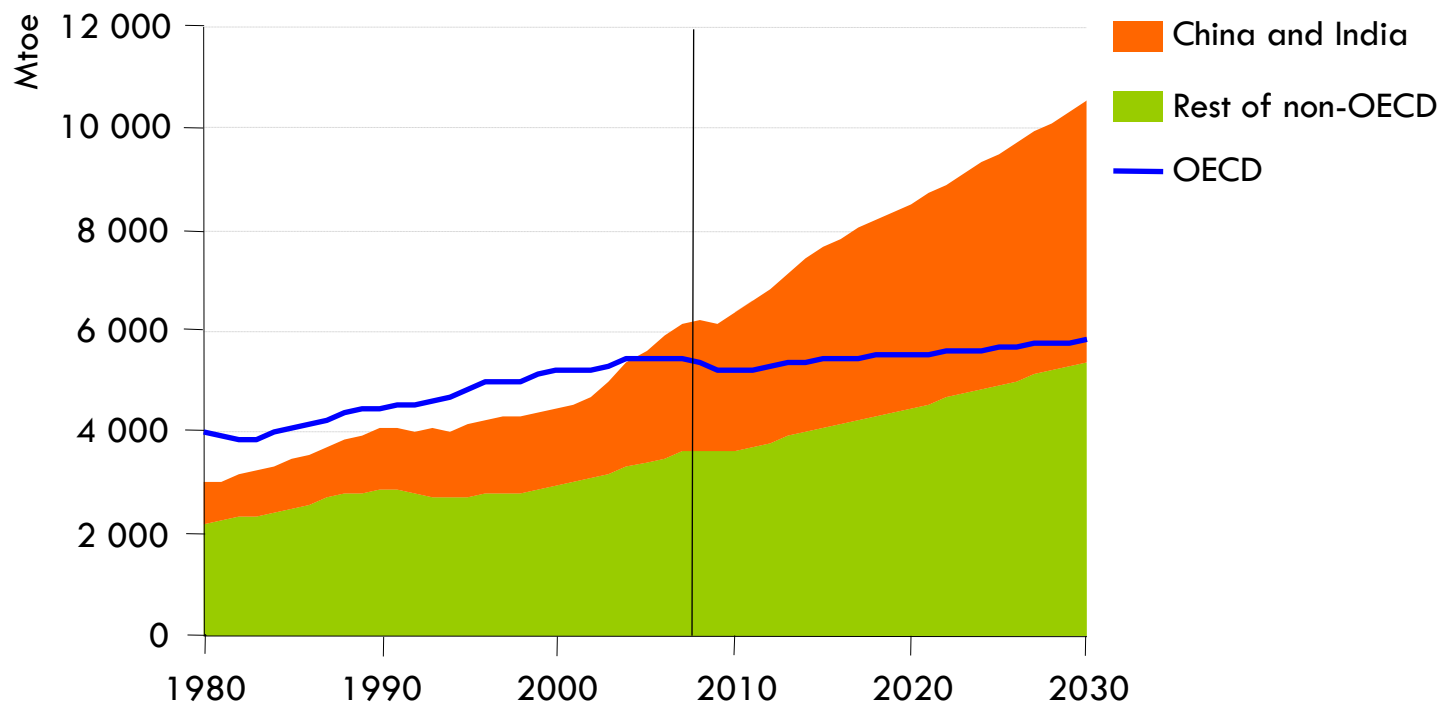
Energy Sector Implications Post-Copenhagen

Laura Cozzi

IEA Day, Copenhagen, 16 December 2009

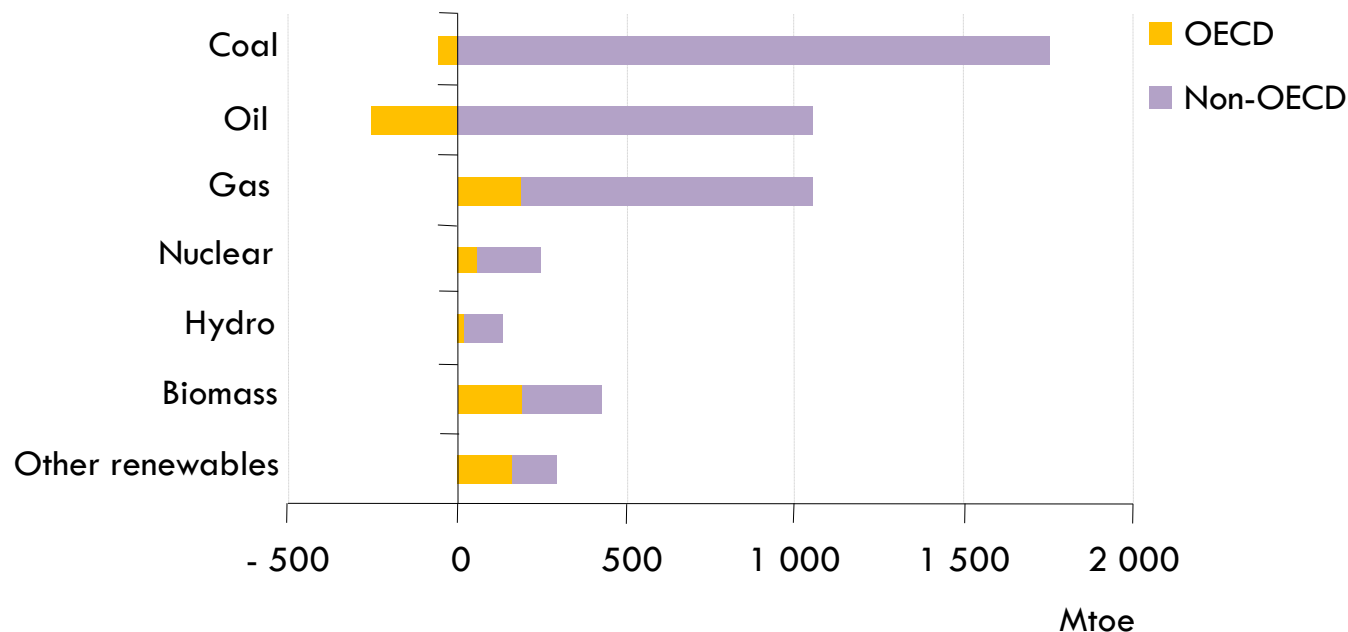
2009

World primary energy demand in the absence of an agreement in Copenhagen



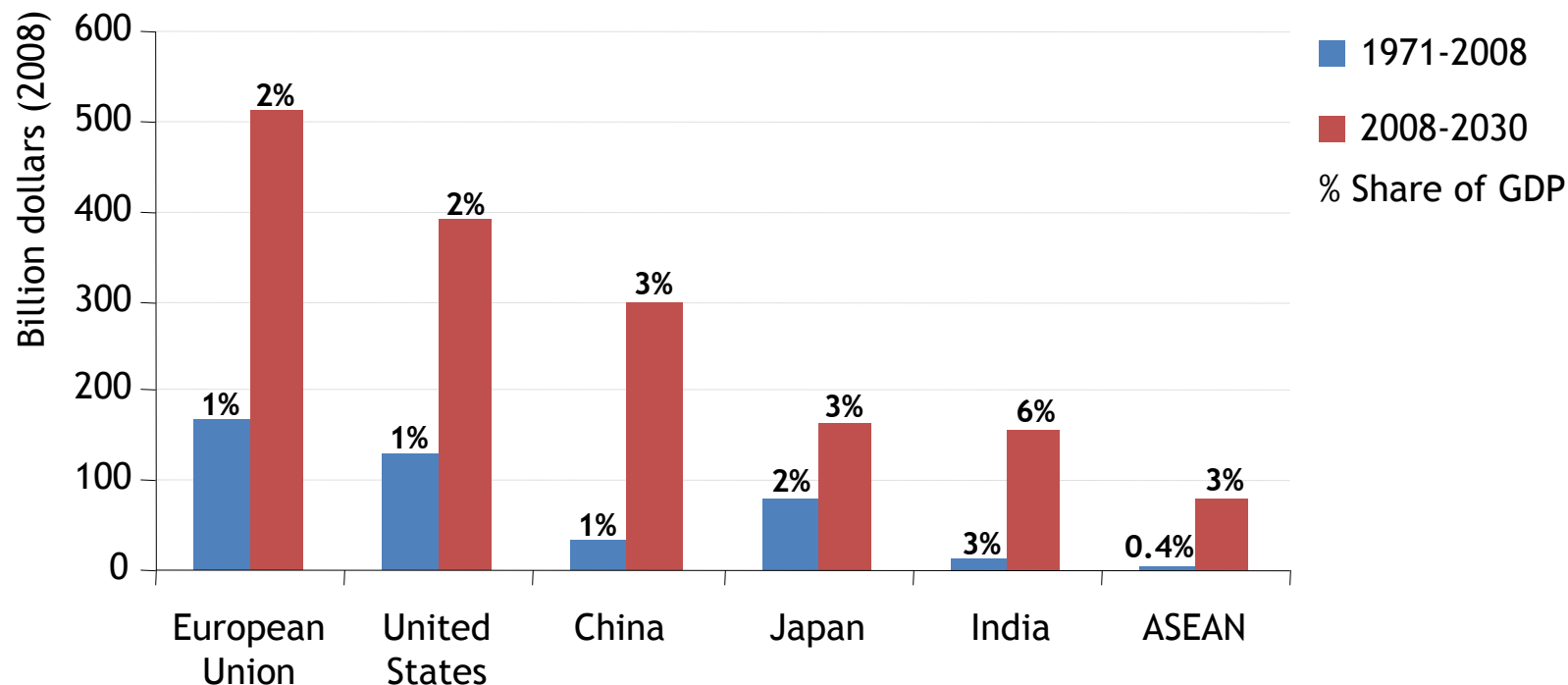
***Non-OECD countries account for 93% of the increase in global demand
between 2007 & 2030, driven largely by China & India***

Change in primary energy demand, in the absence of an agreement in Copenhagen, 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

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

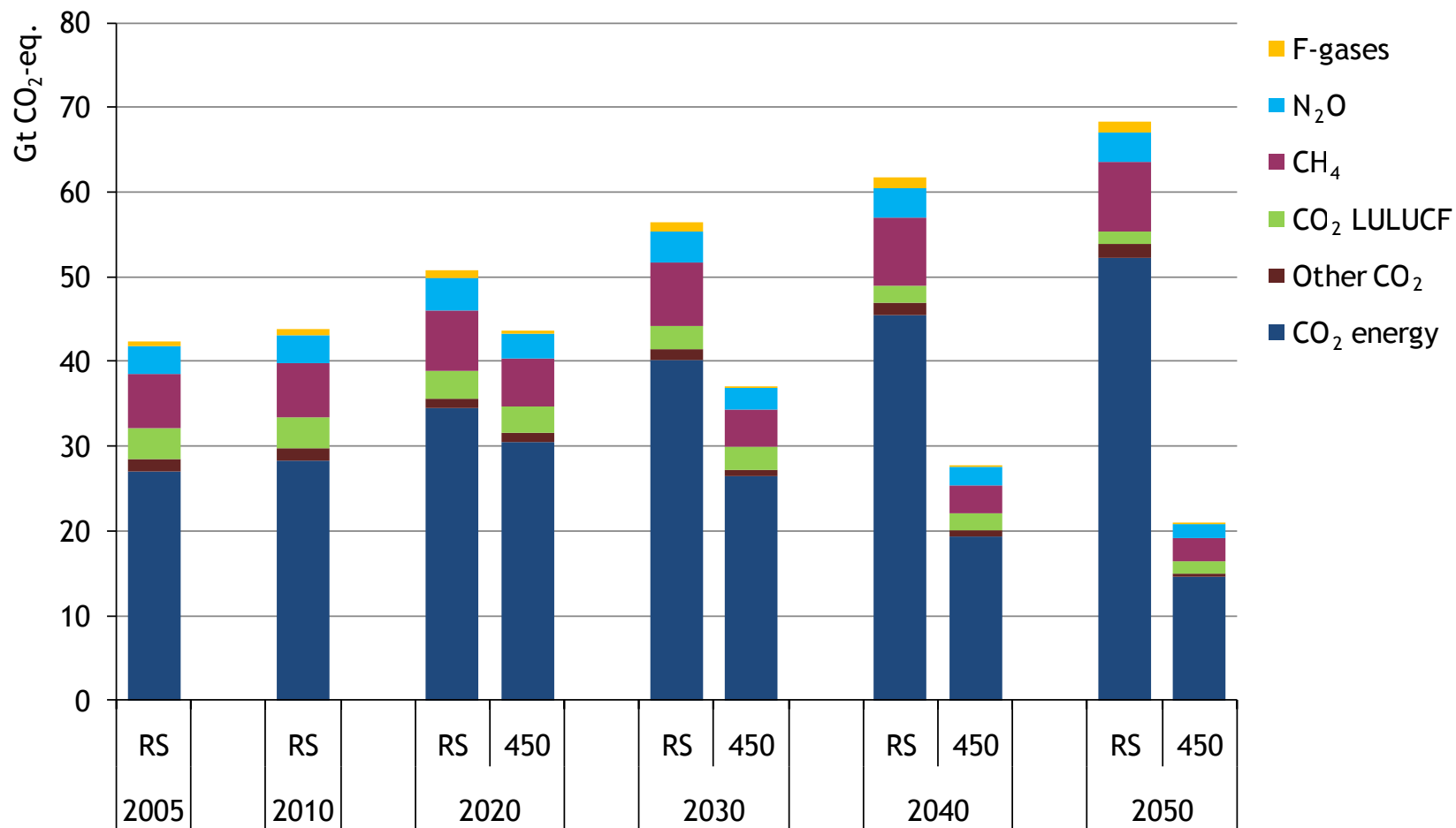


The Reference Scenario implies persistently high spending on oil & gas imports, with China overtaking the United States by around 2025 to become the world's biggest spender

The policy mechanisms in the 450 Scenario

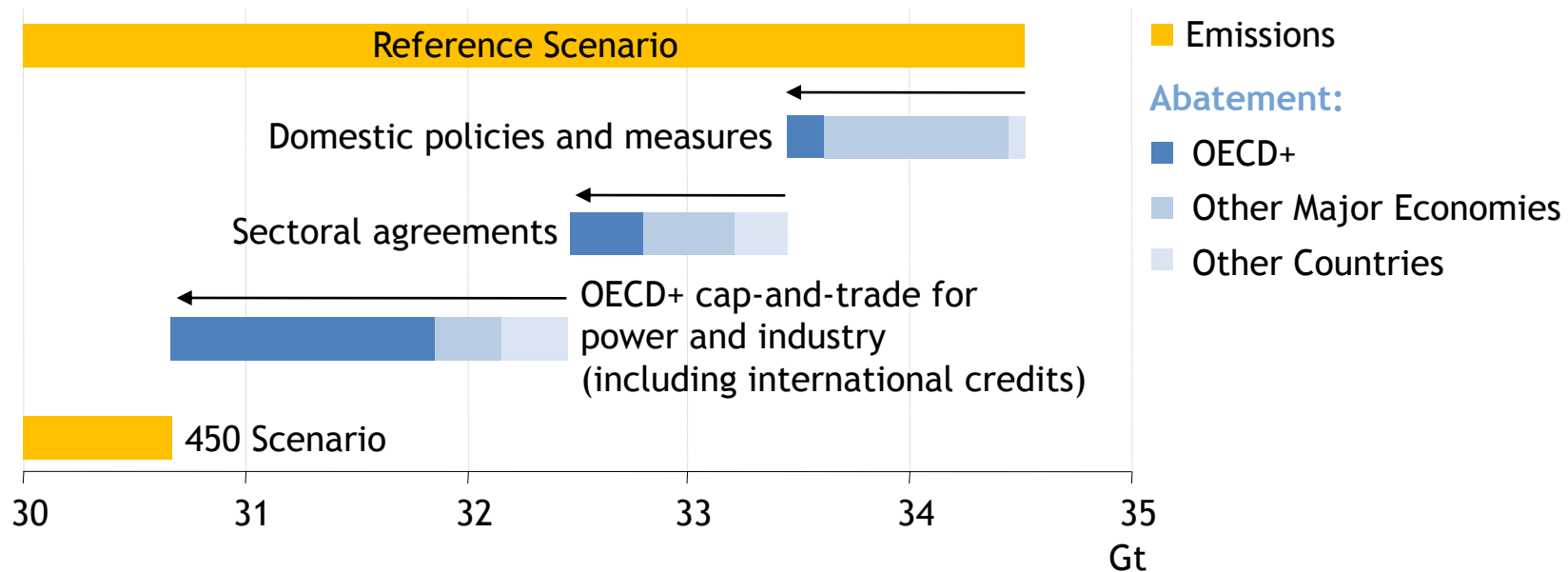
- A combination of policy mechanisms, which best reflects nations' varied circumstances & negotiating positions
- We differentiate on the basis of three country groupings
 - > *OECD+: OECD & other non-OECD EU countries*
 - > *Other Major Economies (OME): Brazil, China, Middle East, Russia & South Africa*
 - > *Other Countries (OC): all other countries, including India*
- 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 CO₂ 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*

Global Greenhouse Gas Emissions in the Reference Scenario and 450 Scenario



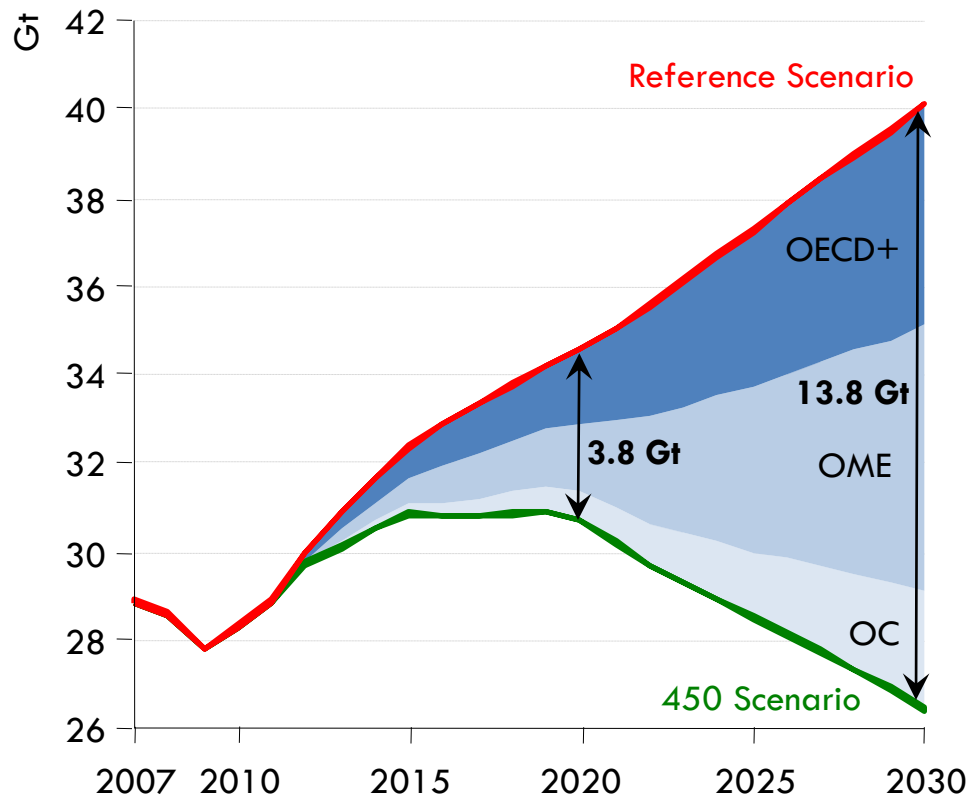
In the 450 Scenario, greenhouse gas emissions are 35% lower in 2030 compared to the Reference Scenario and 70% lower in 2050.

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

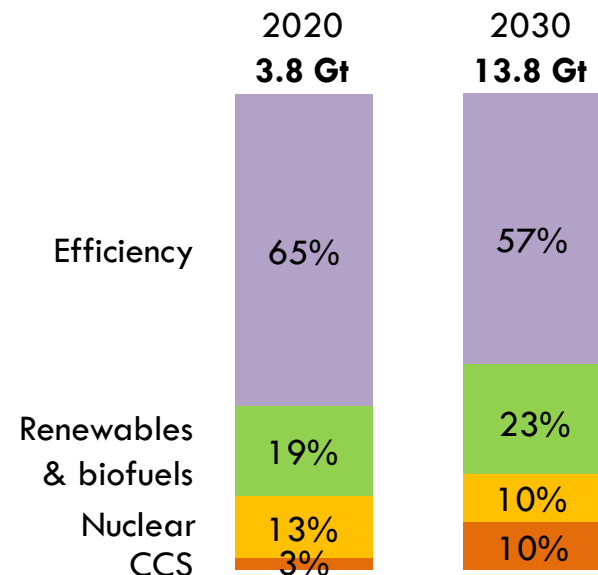


After realising the abatement potential of policies & measures and sectoral approaches, cap-and-trade in OECD+ yields a further 1.8 Gt

World abatement of energy-related CO₂ emissions in the 450 Scenario

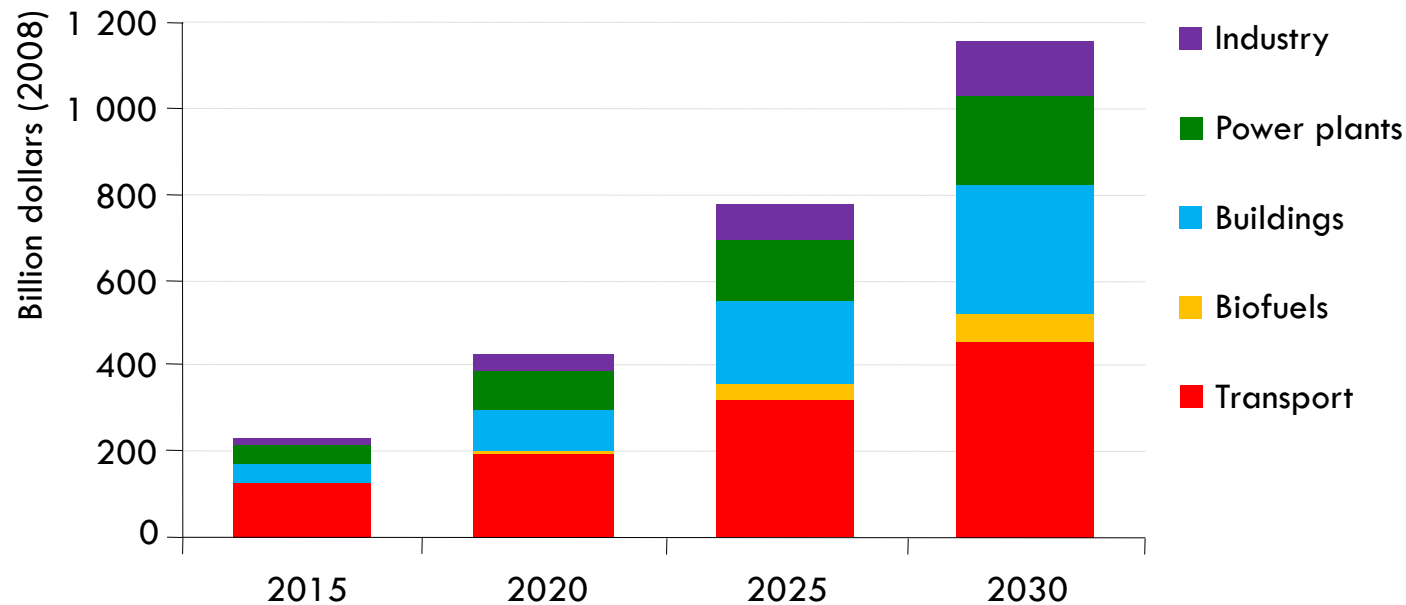


World abatement by technology



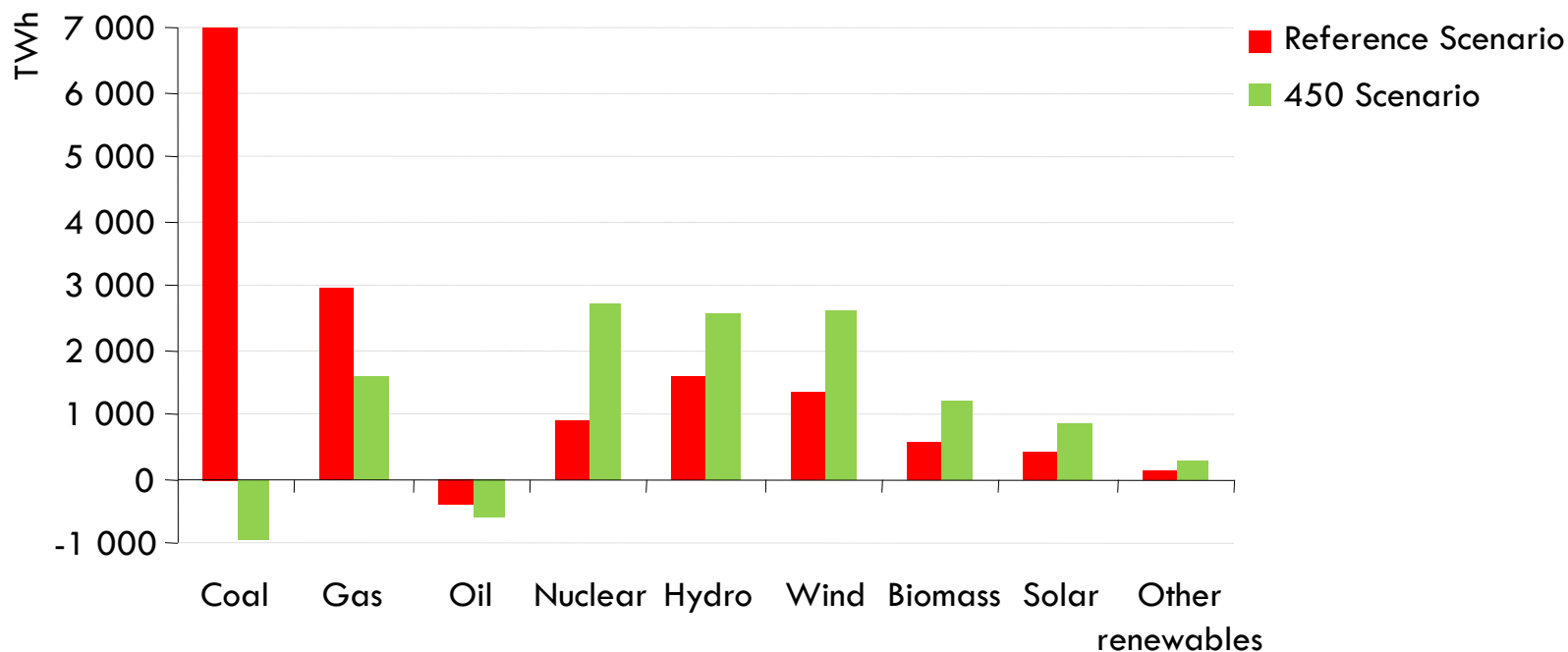
An additional \$10.5 trillion of investment is needed in total in the 450 Scenario, with measures to boost energy efficiency accounting for most of the abatement through to 2030

World additional investment in the 450 Scenario relative to the Reference Scenario



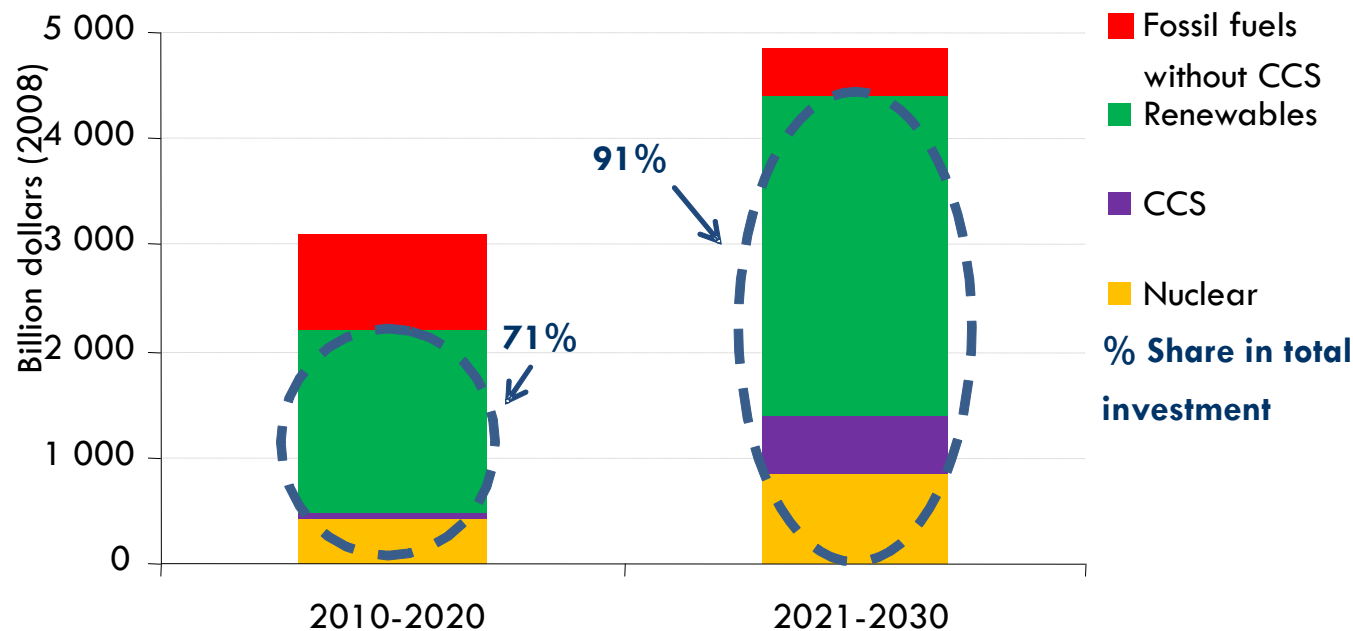
\$10.5 trillion of additional investment is needed in the 450 Scenario in the period 2010-2030 compared with the Reference Scenario, costing 0.5% of GDP in 2020 & 1.1% of GDP in 2030

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



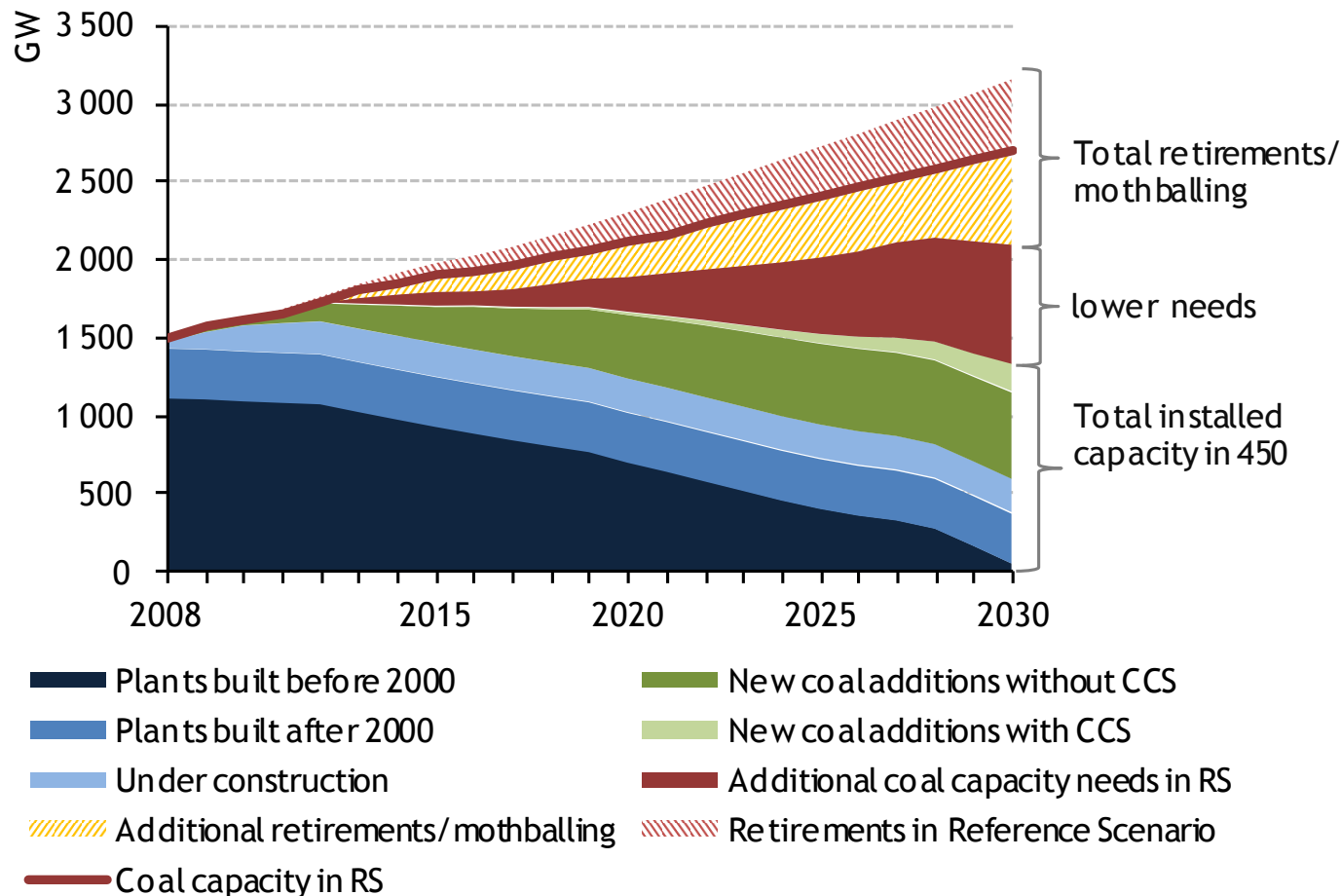
Renewables, nuclear and plants fitted with CCS account for around 60% of electricity generation globally in 2030 in the 450 Scenario, up from less than one-third today

Power generation investment in the 450 Scenario



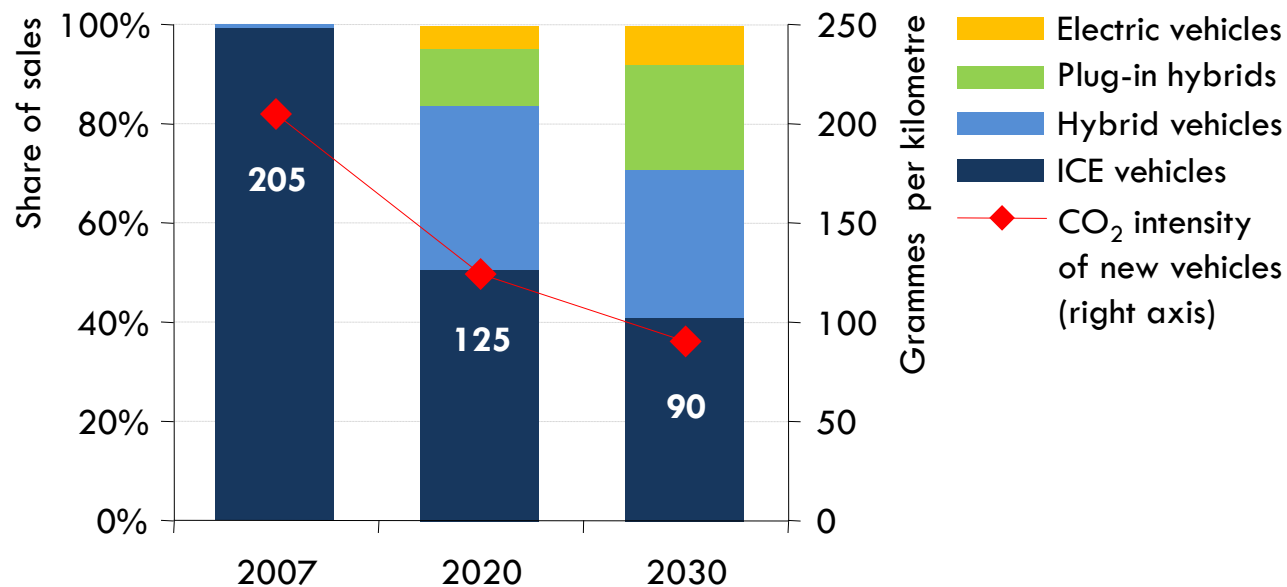
Low-carbon technologies account for an increasing share of power generation investment – reaching more than 90% in the post 2020 period

World installed coal capacity and retirements/mothballing in the 450 Scenario



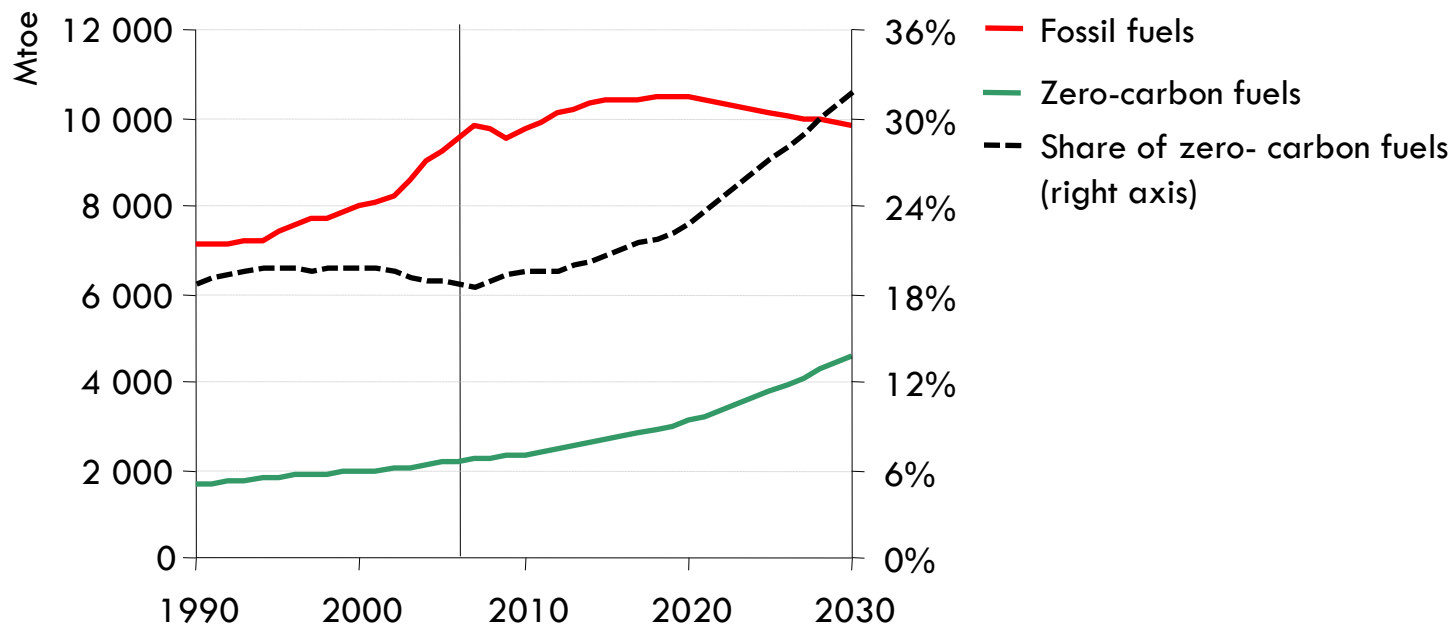
By 2030, coal-fired capacity in the 450 Scenario is about half than in the Reference Scenario, as the majority of coal plants built before 2000 becomes uneconomical

World passenger vehicle sales & average new vehicle CO₂ intensity in the 450 Scenario



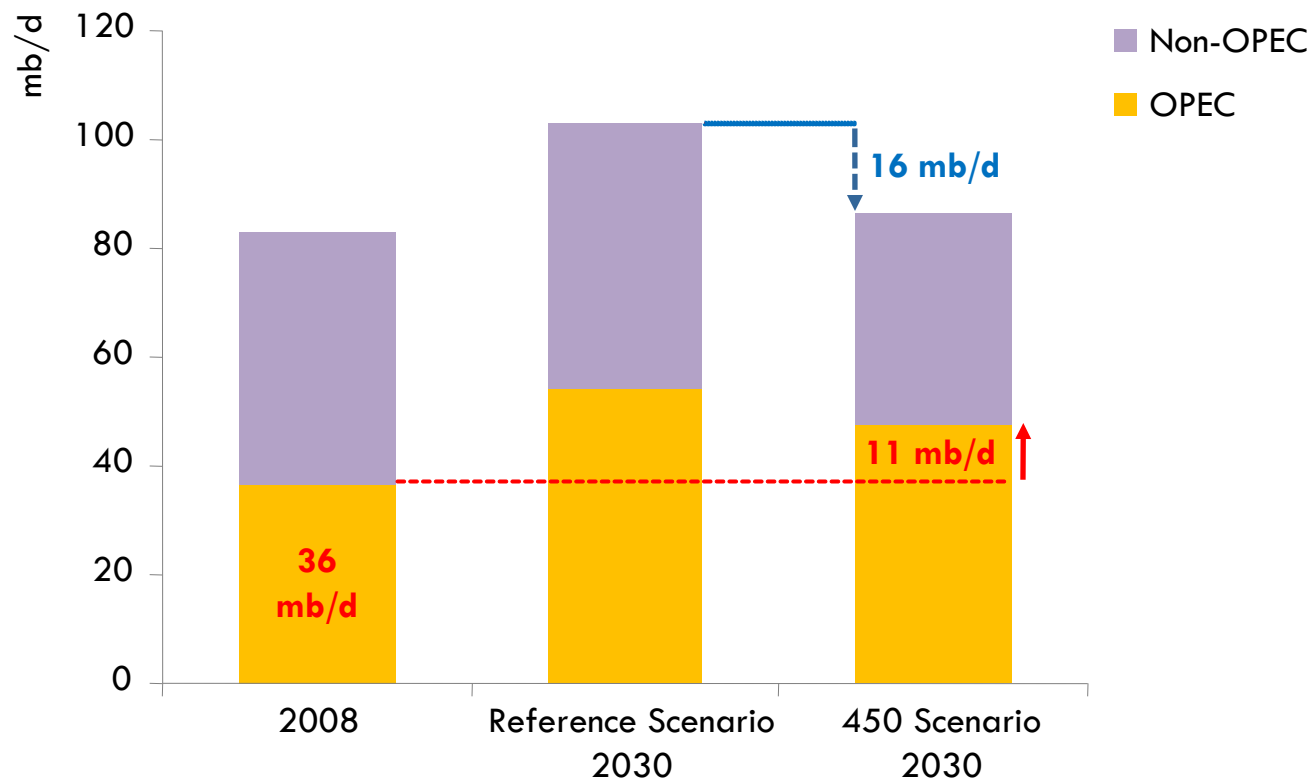
Improvements to the internal combustion engine & the uptake of next-generation vehicles & biofuels lead to a 56% reduction in new-car emission intensity by 2030

World primary energy demand by fuel in the 450 Scenario



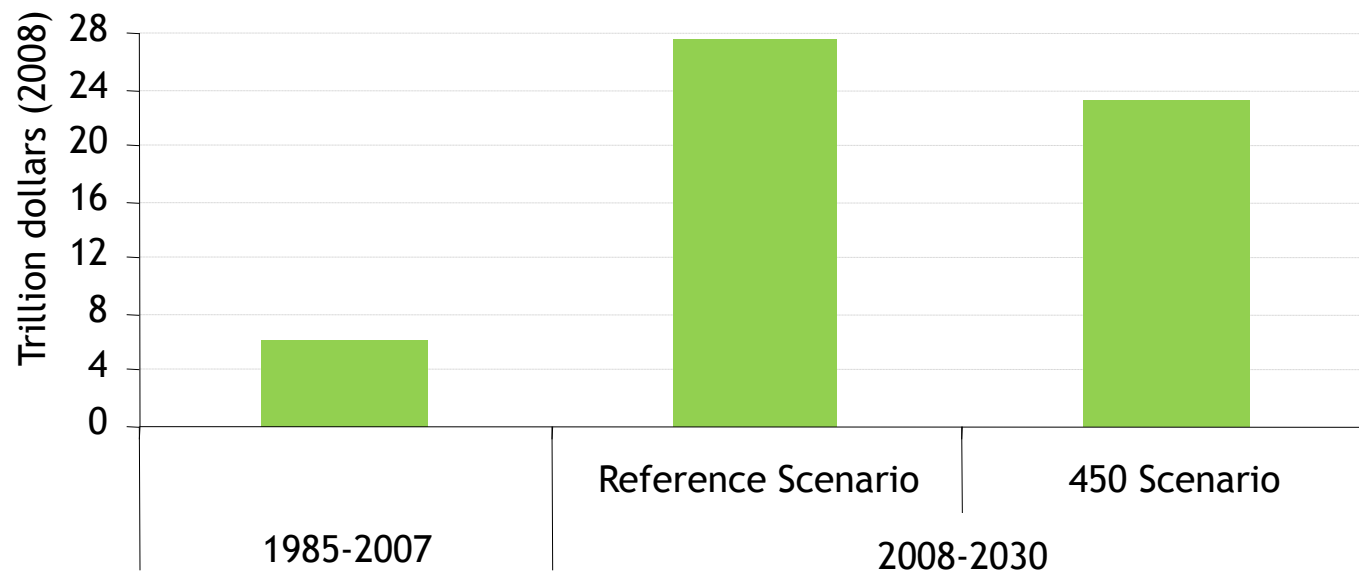
In the 450 Scenario, demand for fossil fuels peaks by 2020, and by 2030 zero-carbon fuels make up a third of the world's primary sources of energy demand

World oil production by scenario



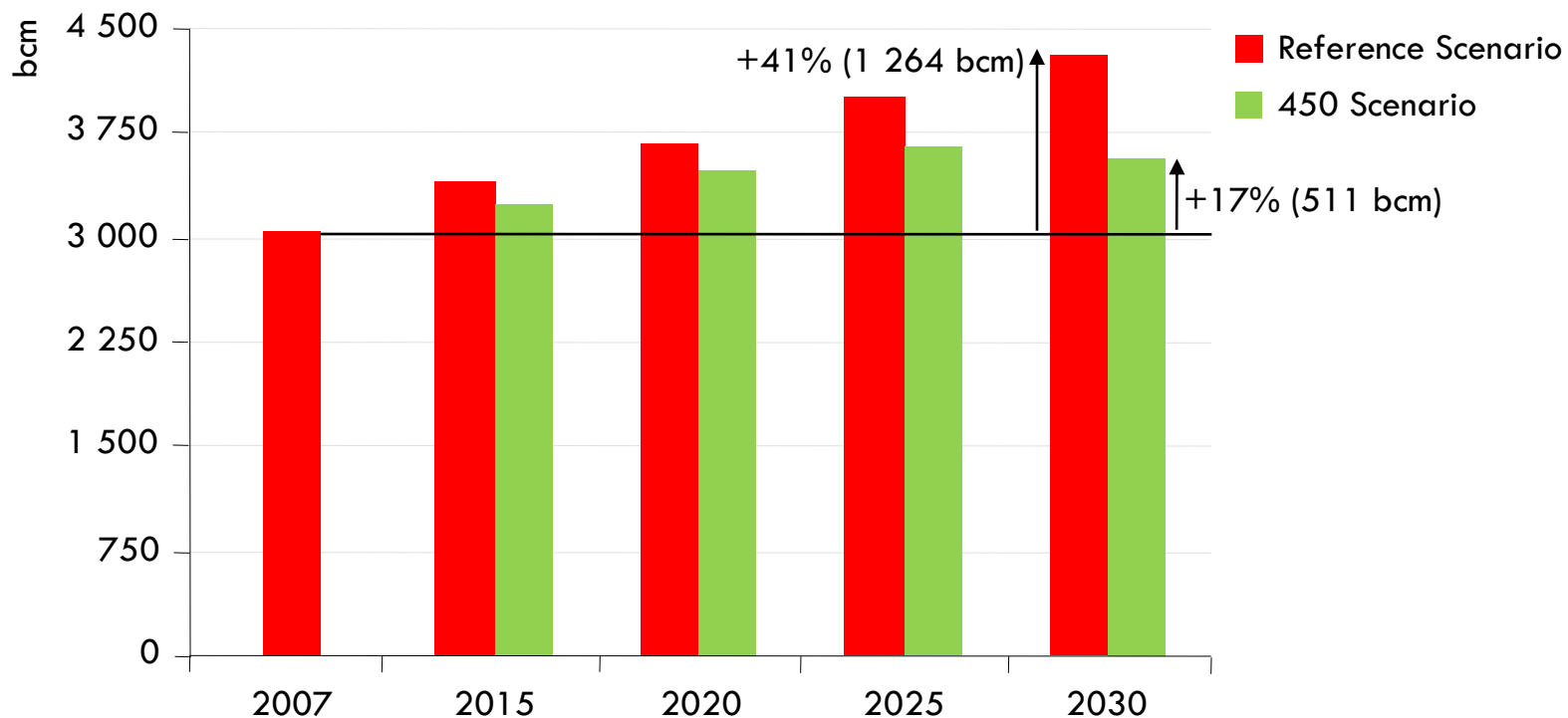
Curbing CO₂ emissions would also improve energy security by cutting oil demand, but even in the 450 Scenario, OPEC production increases by 11 mb/d between now and 2030

Cumulative OPEC oil export revenues by scenario



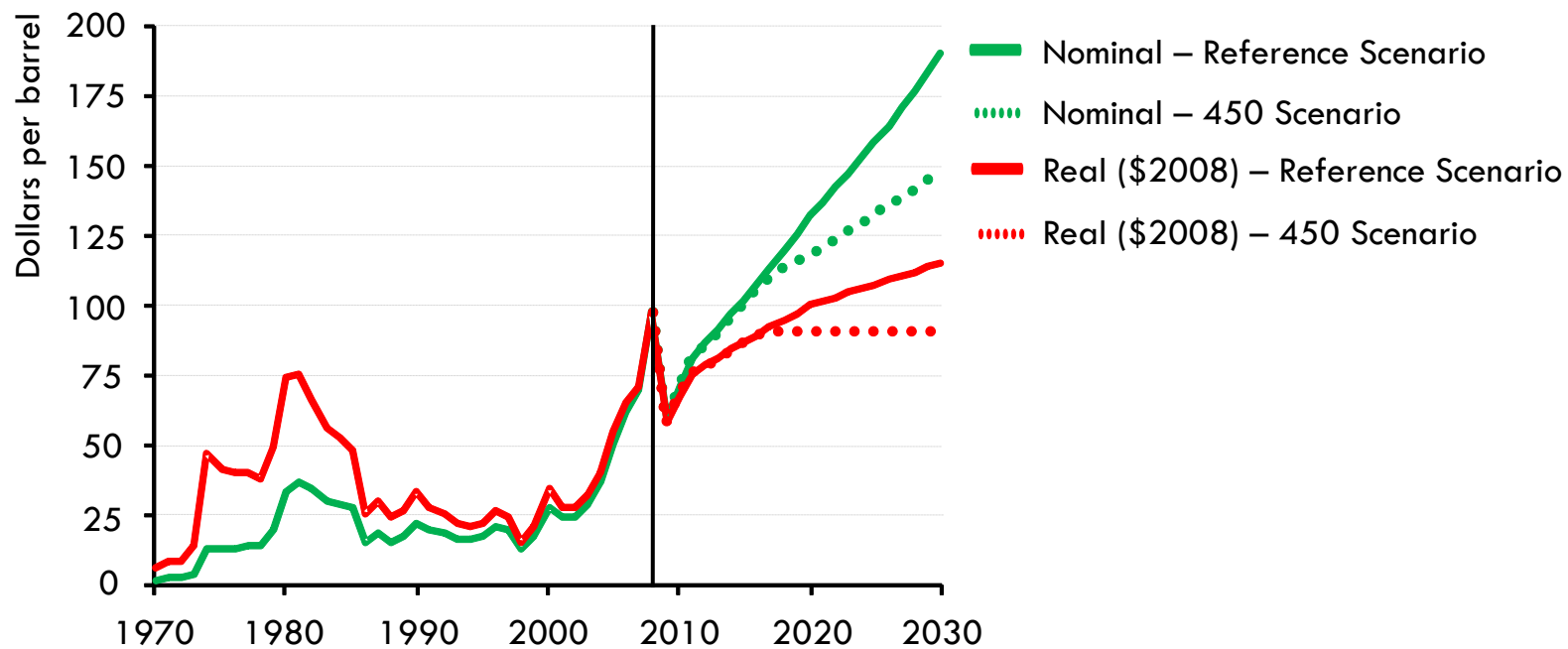
Though slightly lower than in the Reference Scenario, OPEC revenues in the 450 Scenario are over four times as high as in the last 20 years

World primary natural gas demand by scenario



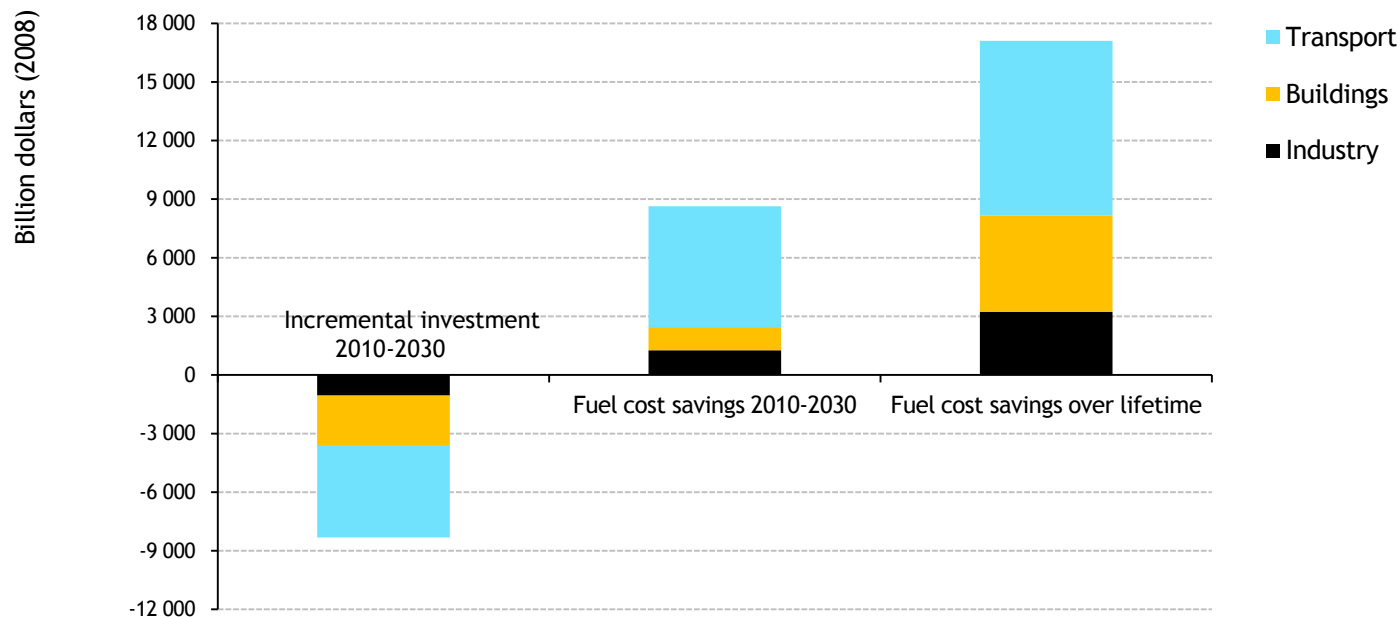
Gas demand continues to grow in both scenarios, peaking by around 2025 in the 450 Scenario & highlighting the potential role of gas as a transition fuel to a clean energy future

Average IEA crude oil import price



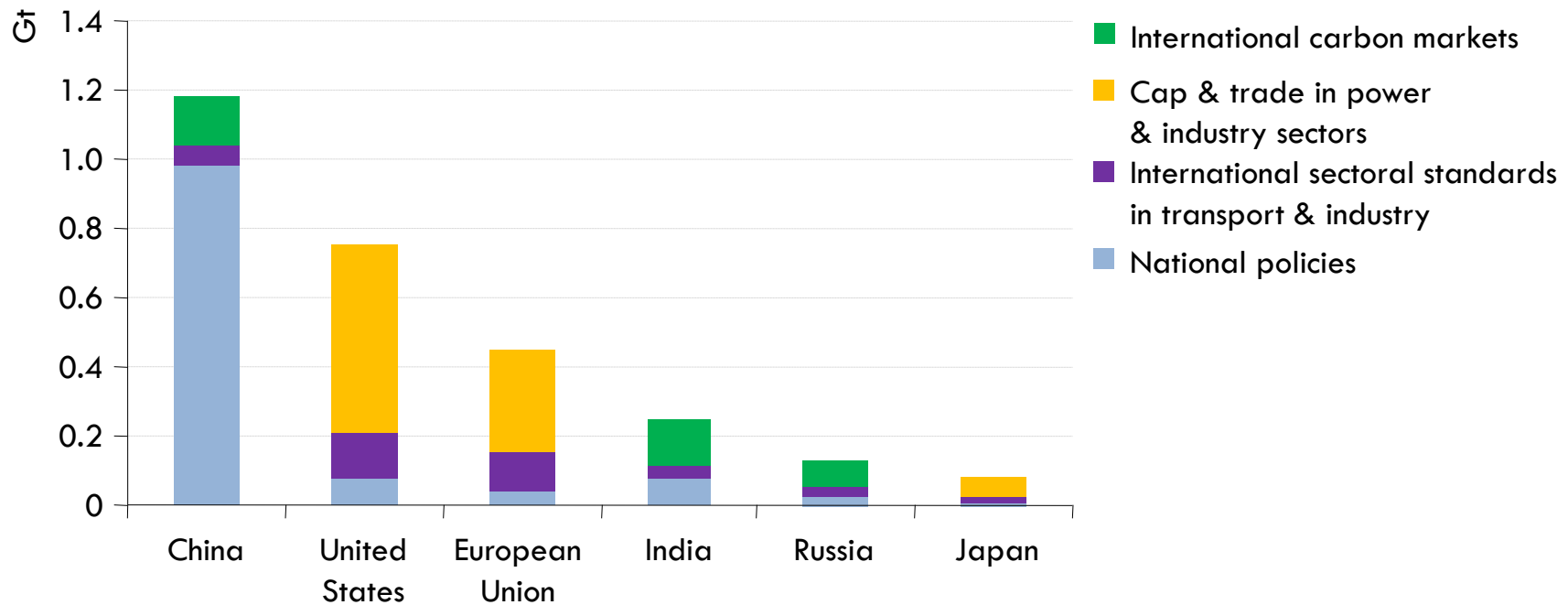
The oil price in real terms is assumed to rebound from around \$60 per barrel in 2009 with the economic recovery, reaching \$100 by 2020 & \$115 per barrel by 2030 in Reference Scenario

Additional investment and fuel-cost savings in the 450 Scenario vs. the Reference Scenario



Fuel cost savings in industry, buildings and transport of \$8.6 trillion over the period 2010-2030 more than offset the additional investment needed of \$8.3 trillion

Abatement in the 450 Scenario by key emitters, 2020

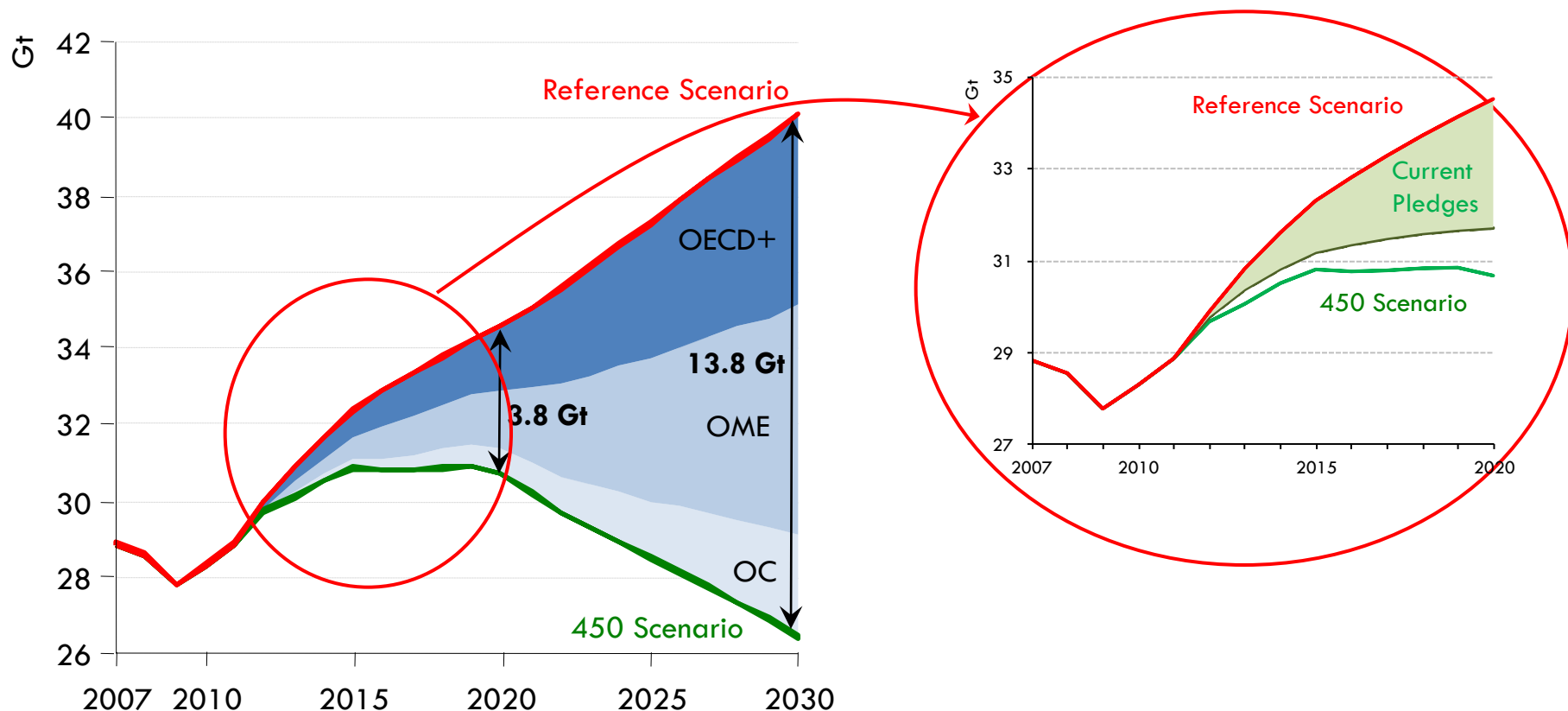


China, the United States, the European Union, India, Russia & Japan account for almost three-quarters of the 3.8 Gt reduction in the 450 Scenario

Additional investment need in non-OECD countries by policy type, 2020

Non-OECD abatement measures co-funded	Abatement (Mt)	Investment (\$ billions)
All 450 Scenario abatement	2166	196.9
Sectoral agreements in industry and transport	660	71.8
National policies and measures	907	71.4
Further measures (market mechanisms)	599	53.7

World abatement of energy-related CO₂ emissions in the 450 Scenario



Current pledges point direction but further efforts would be needed to reach the 450 Scenario

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