International Energy Agency

World Energy Outlook 2009

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Pawel Olejarnik
Energy Analyst

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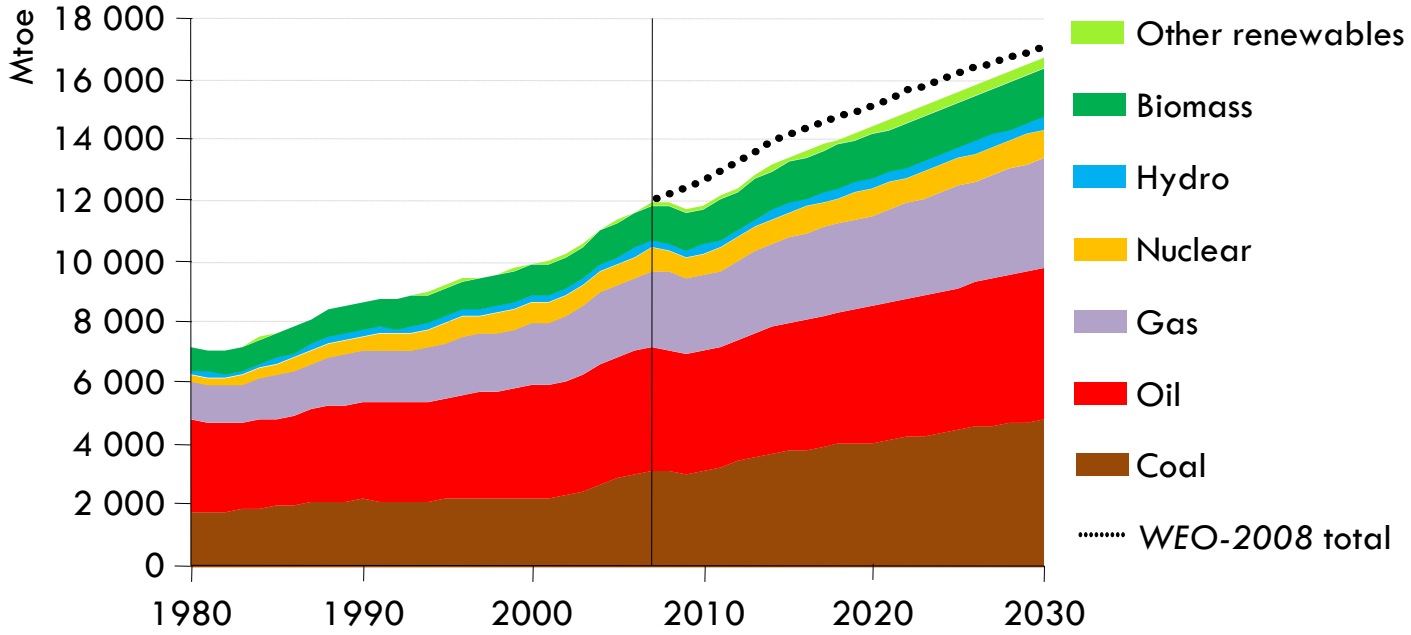
World primary energy demand by fuel in the Reference Scenario



Global demand grows by 40% between 2007 and 2030, with coal use rising most in absolute terms

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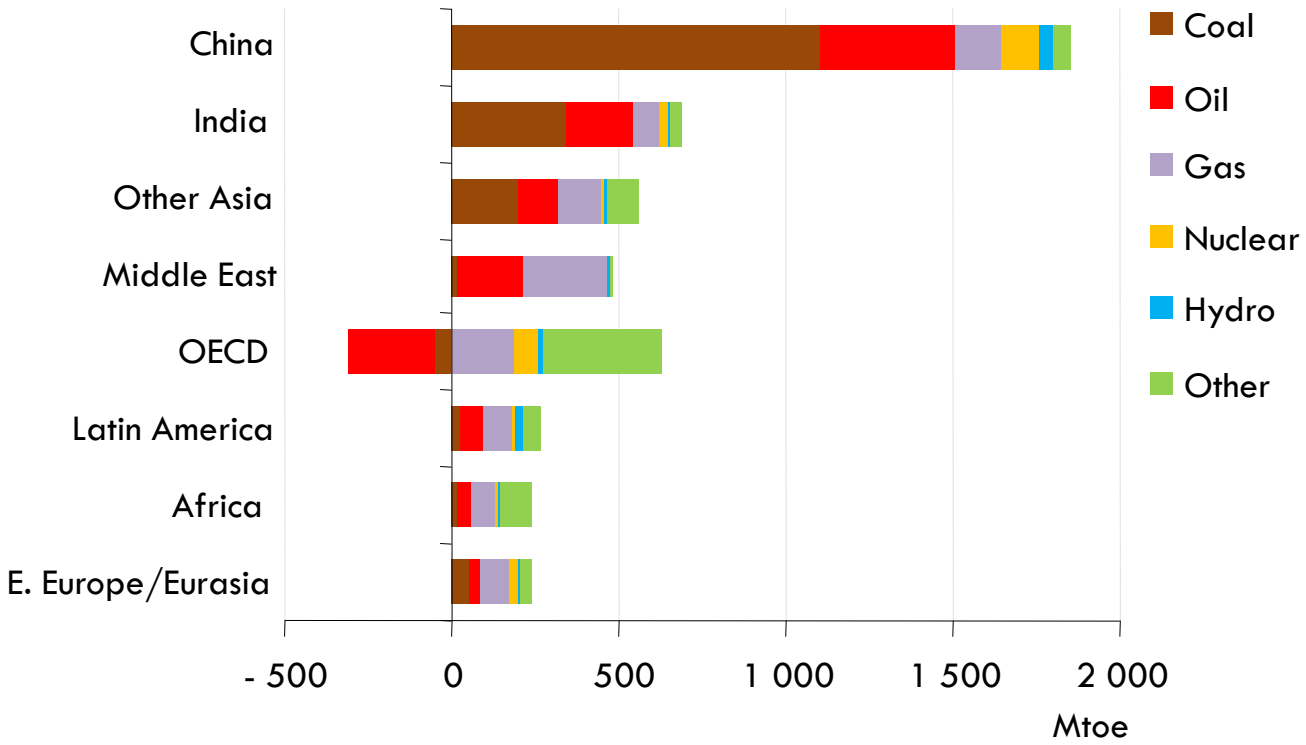
Change in primary energy demand by fuel in the Reference Scenario, 2007-2030



The increase in China's demand for energy – for coal in particular – dwarfs that of all other countries & regions

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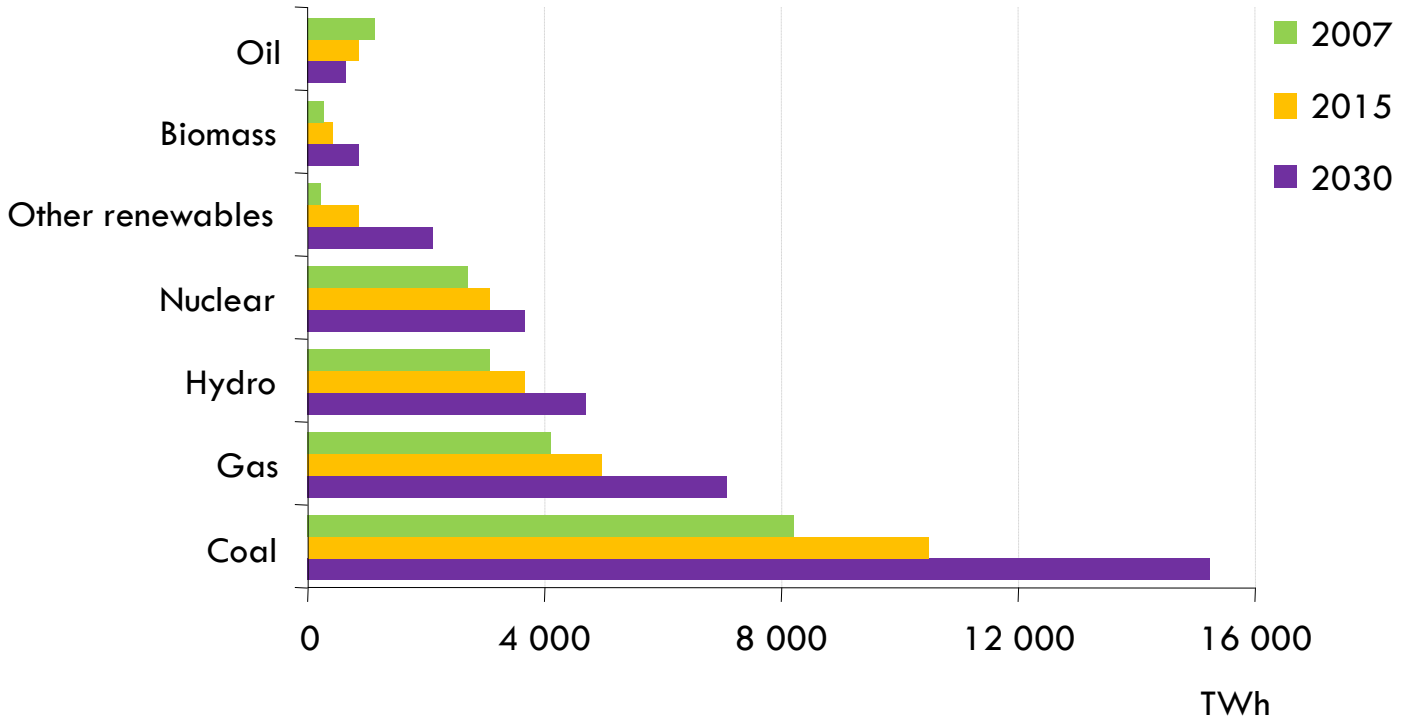
World electricity generation by fuel in the Reference Scenario



Power generation based on all types of energy except oil is projected to grow, with the biggest increases in absolute terms coming from coal- and gas-fired capacity

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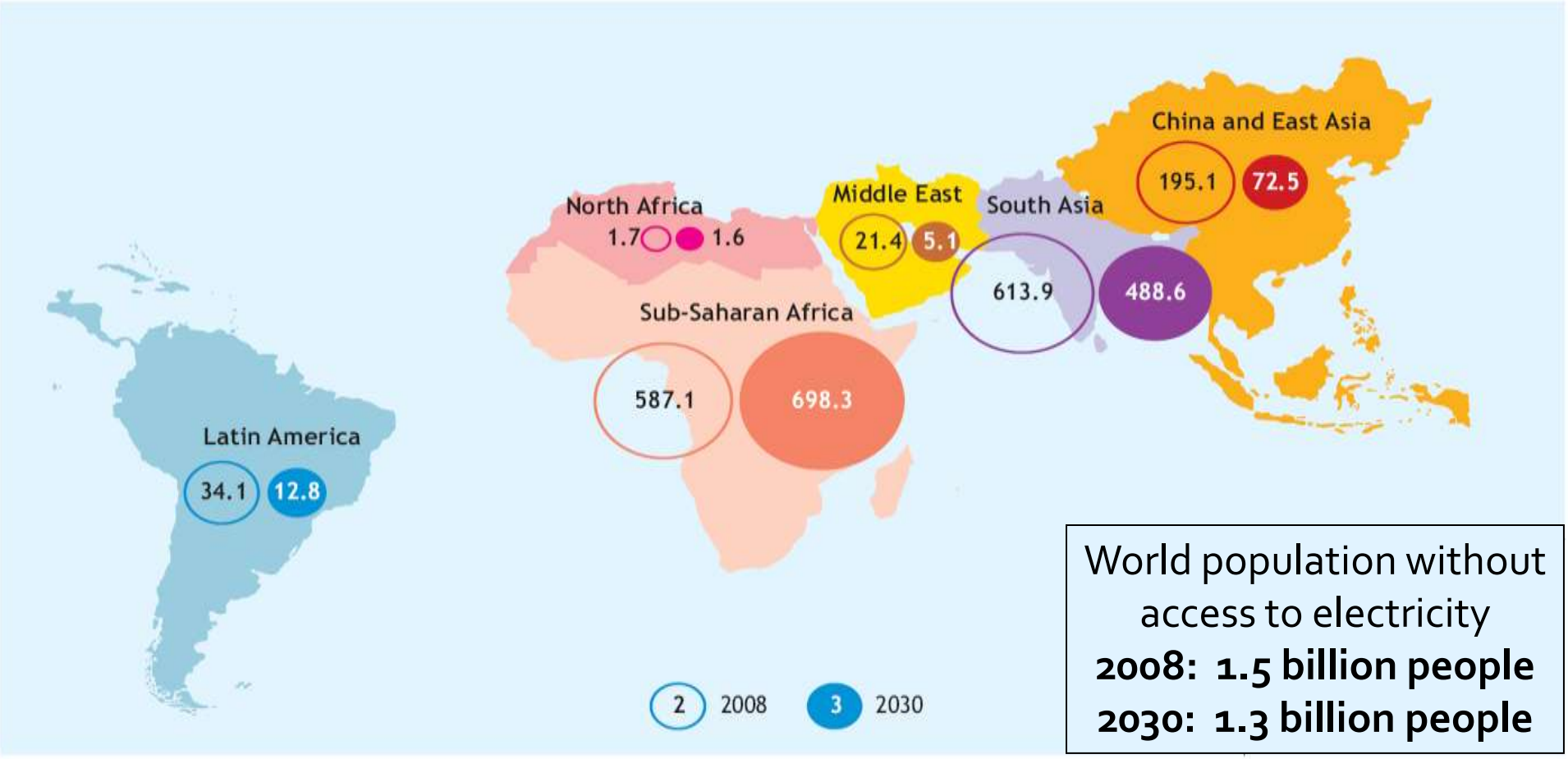
Number of people without access to electricity in the Reference Scenario (millions)



World population without access to electricity

2008: 1.5 billion people

2030: 1.3 billion people

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$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

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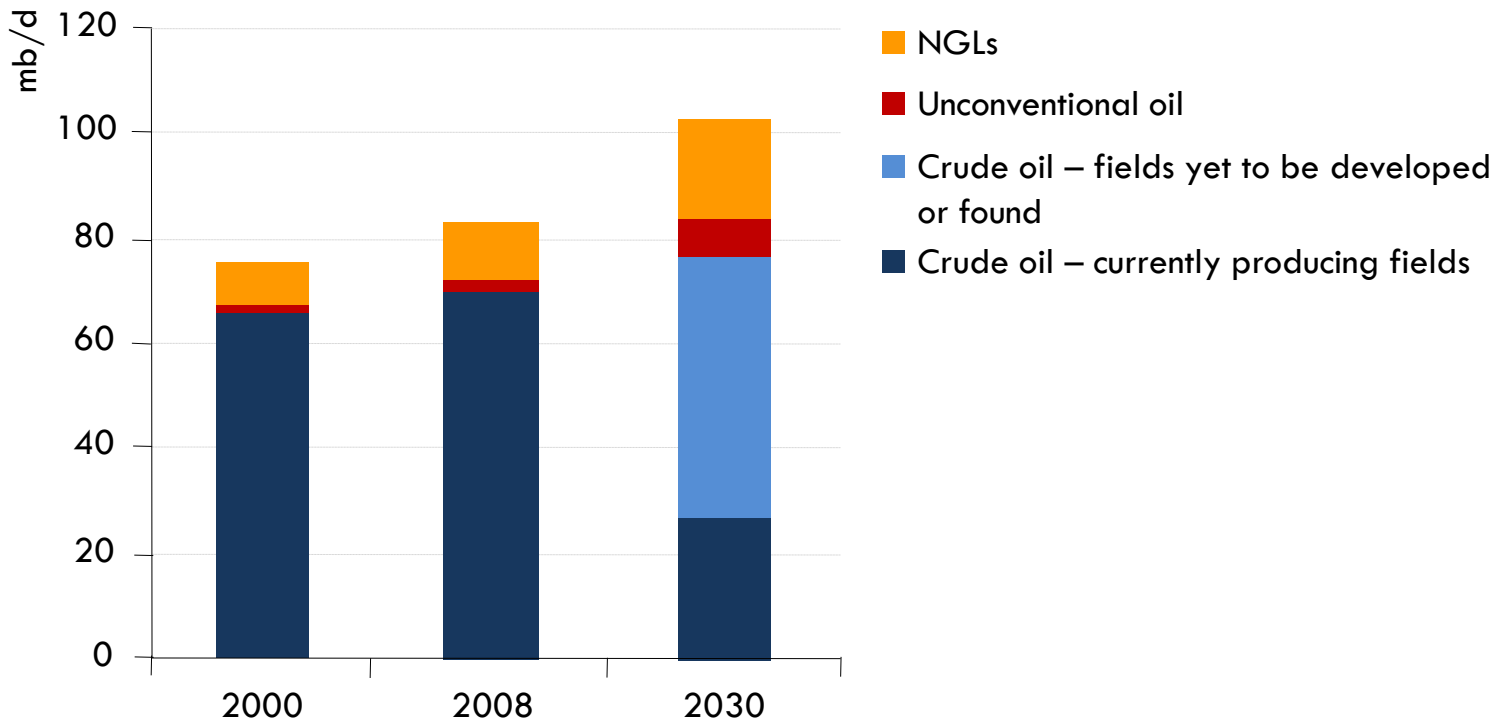
Oil production in the Reference Scenario



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

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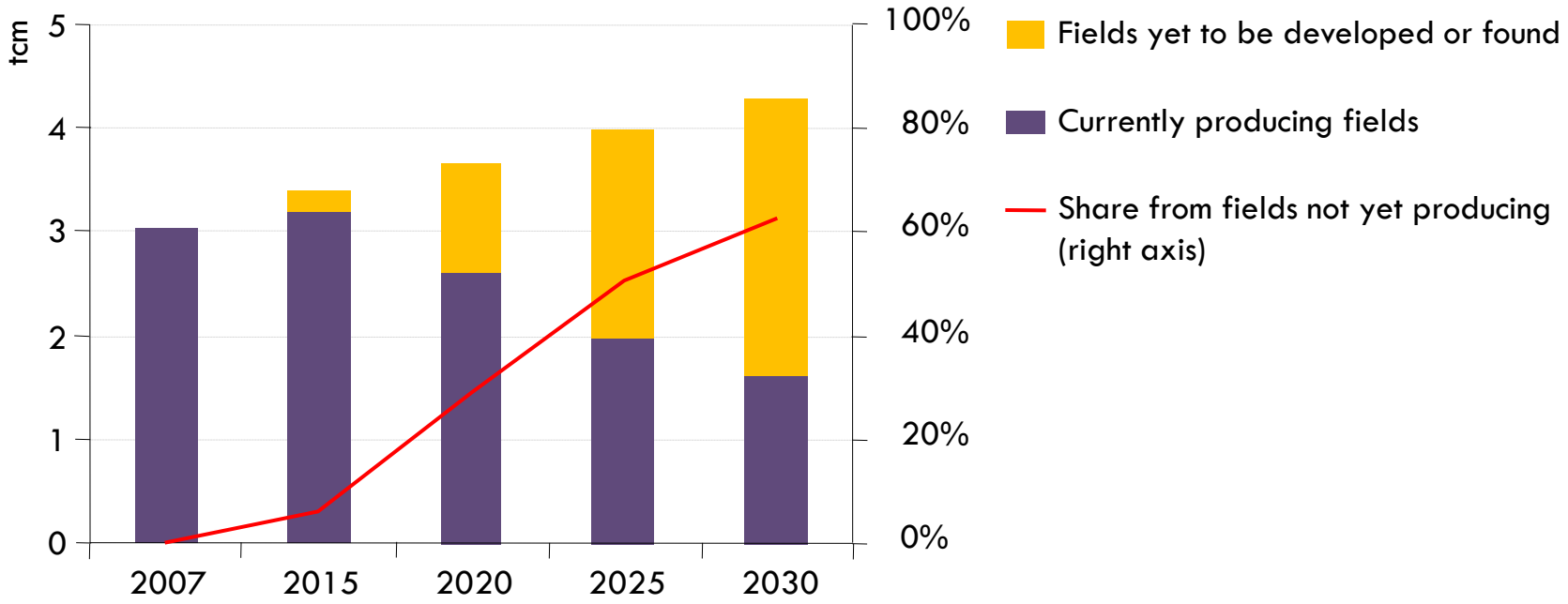
Impact of decline on world natural gas production in the Reference Scenario



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

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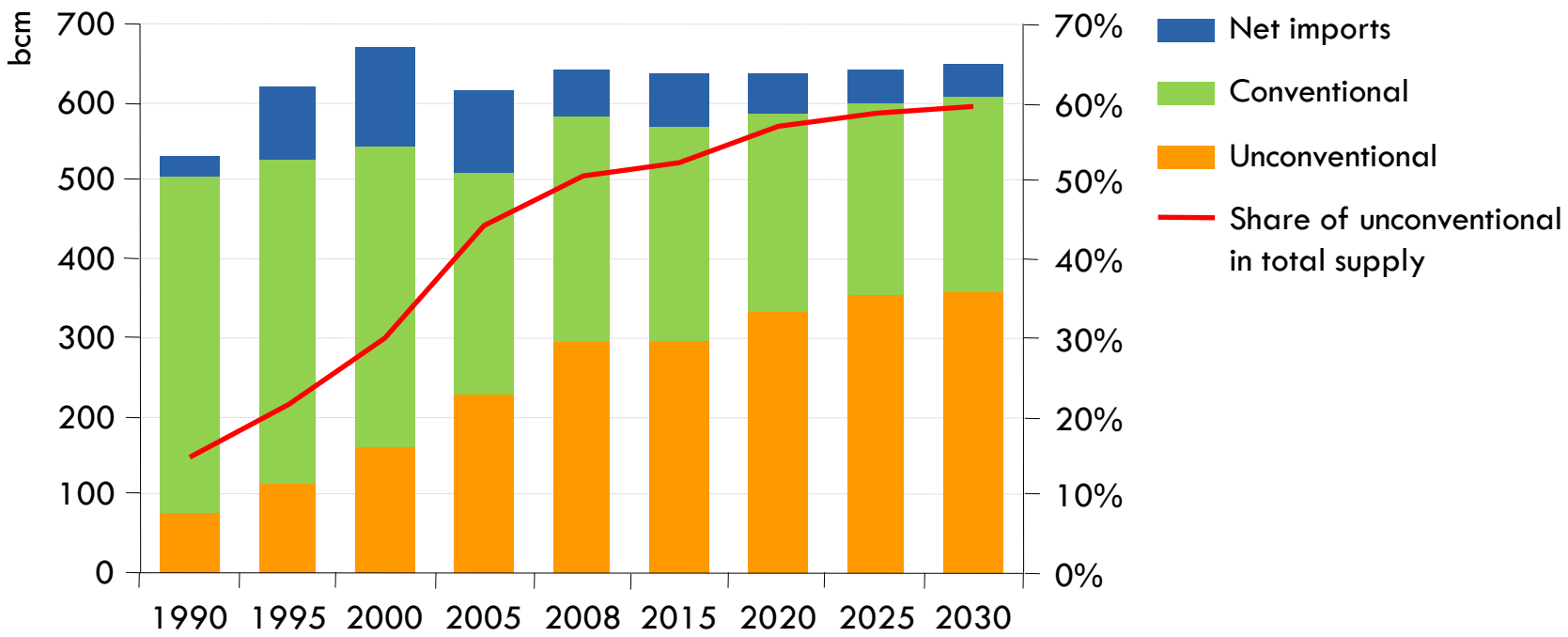
US natural gas supply in the Reference Scenario



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

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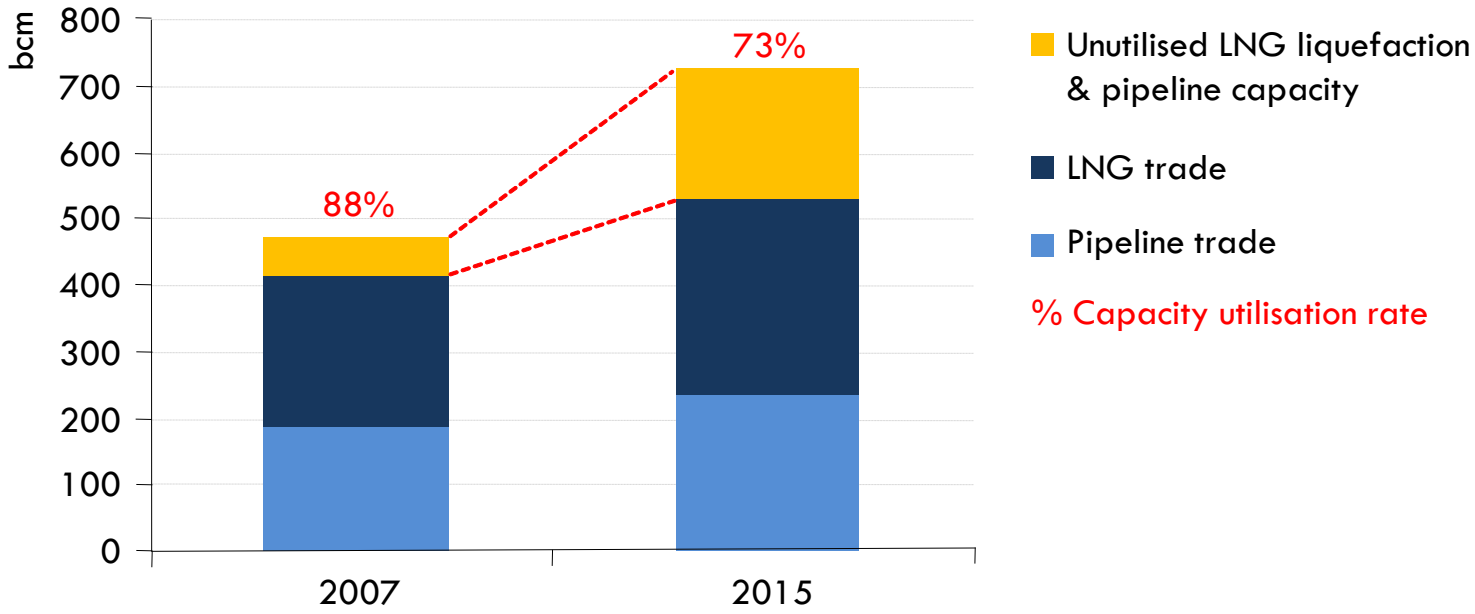
Natural gas transportation capacity



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

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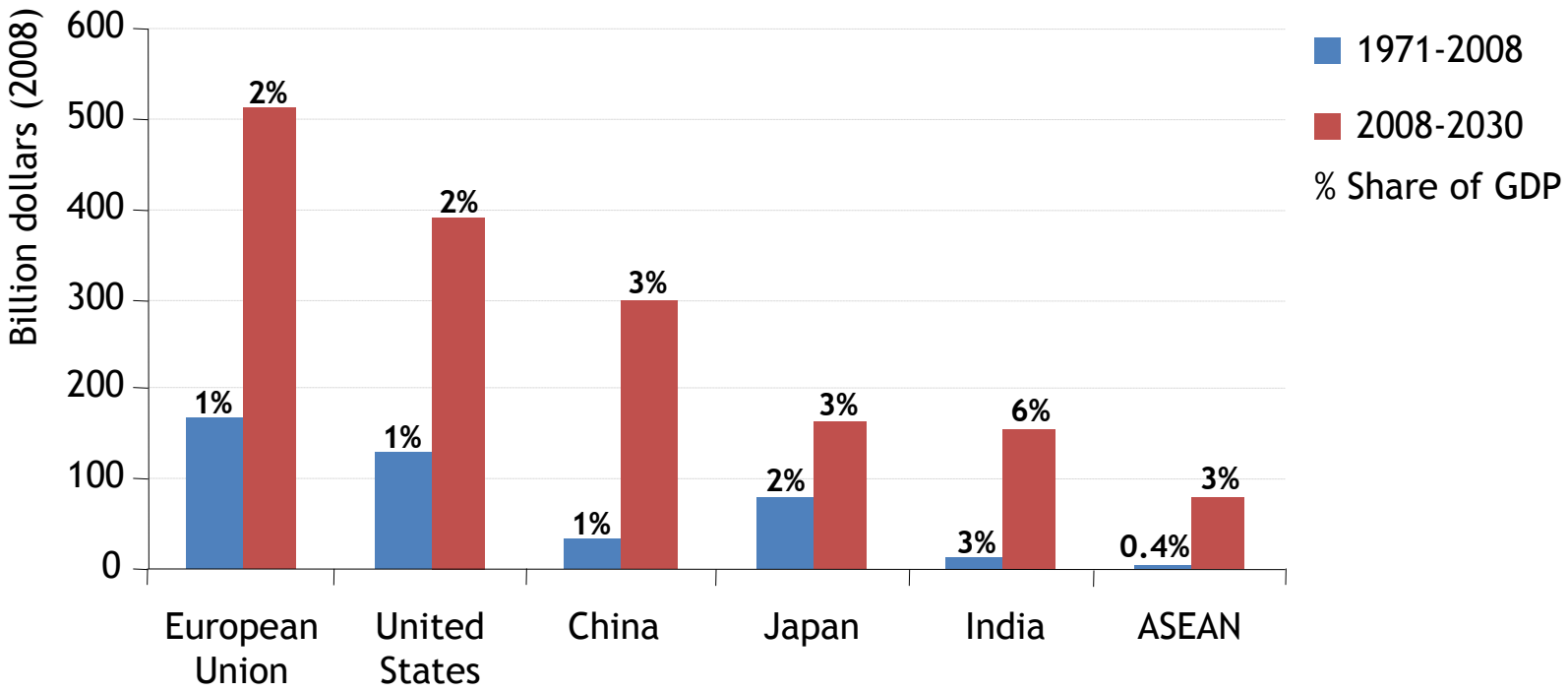
Average annual expenditure on net imports of oil & gas in the Reference Scenario



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

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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 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*

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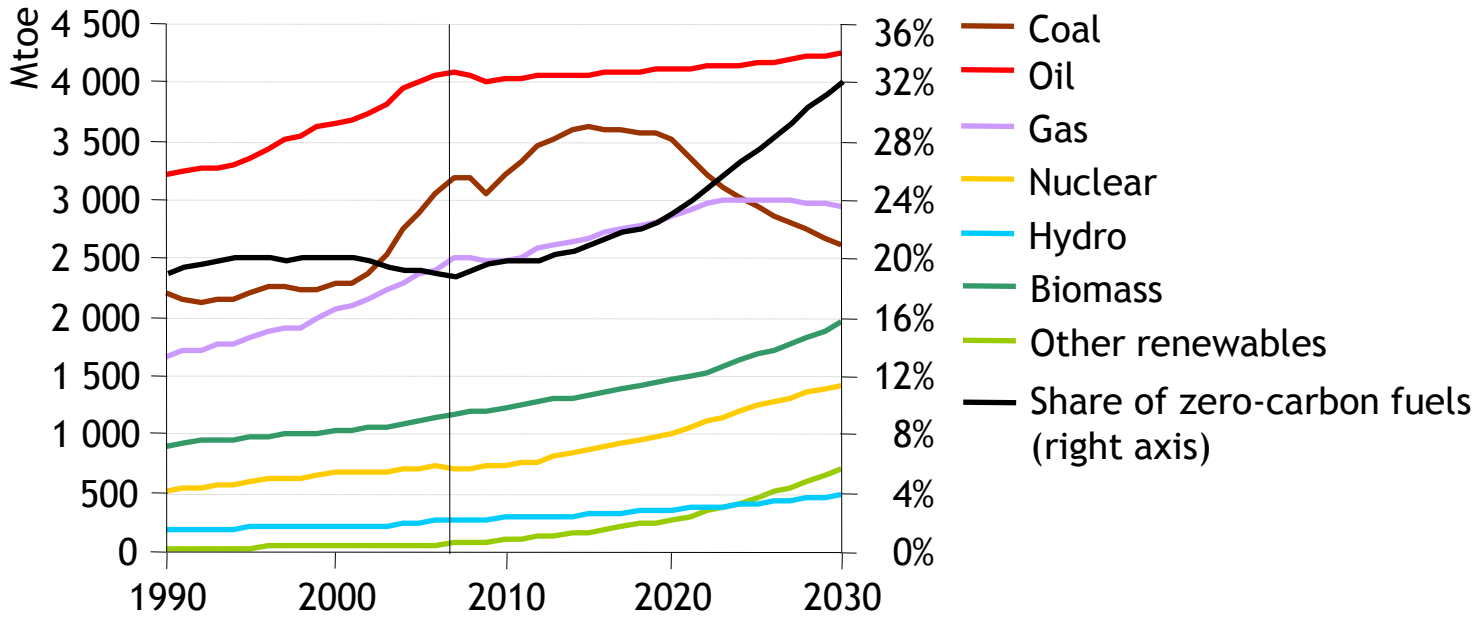
World primary energy demand by fuel in the 450 Scenario



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

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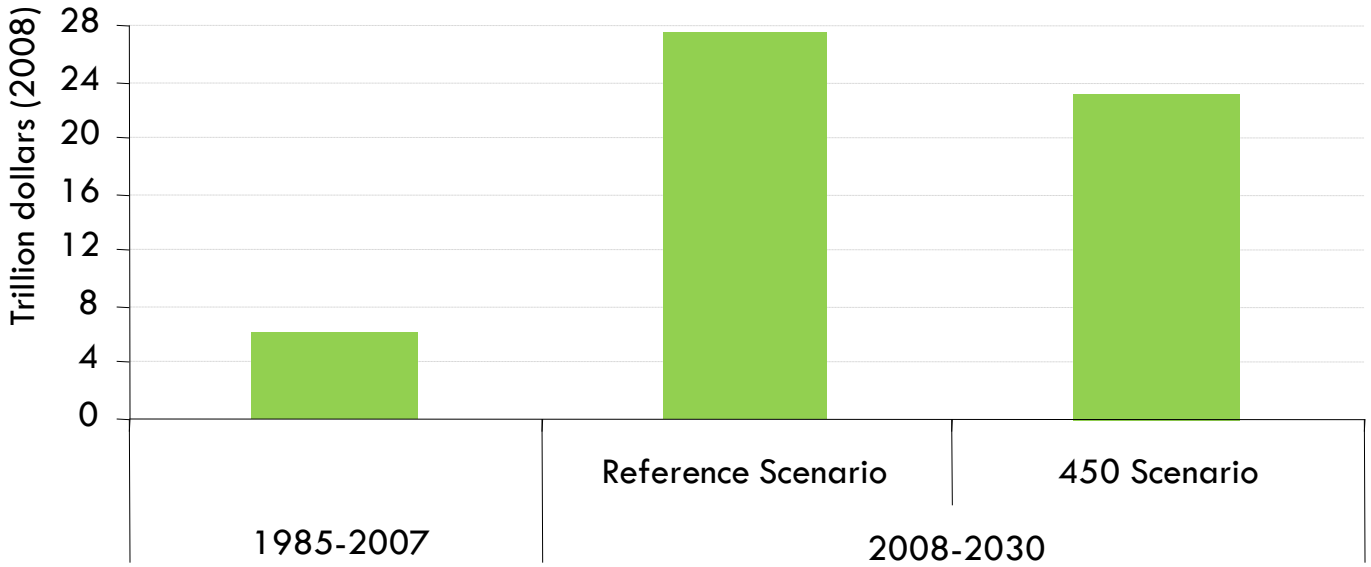
Cumulative OPEC oil export revenues by scenario



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

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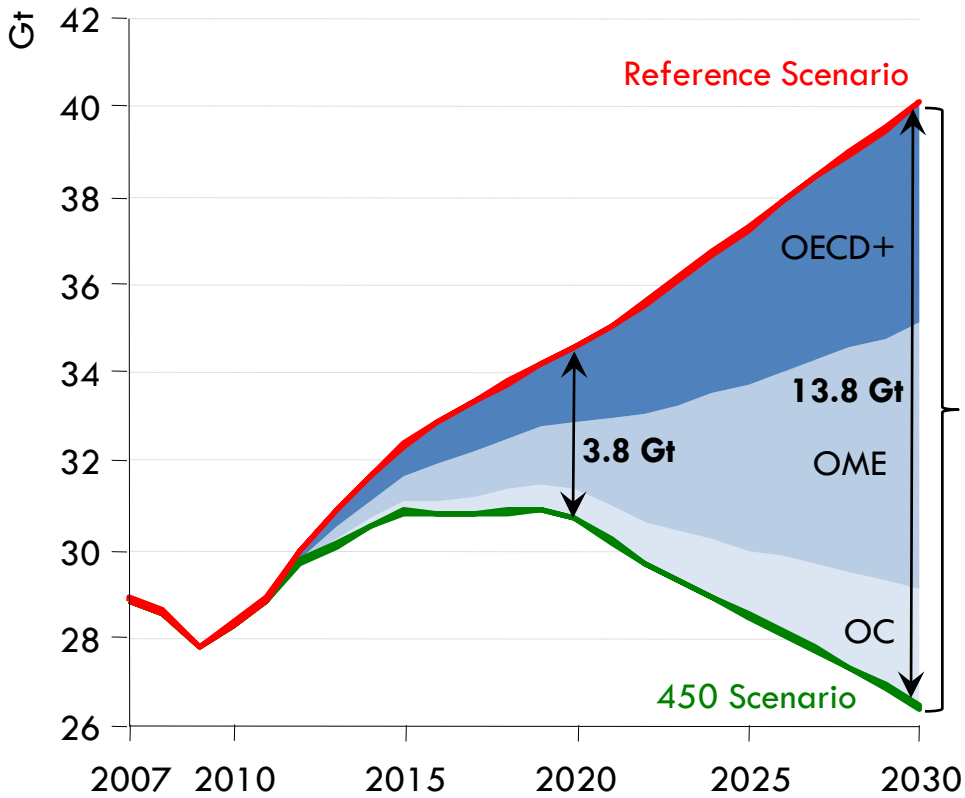
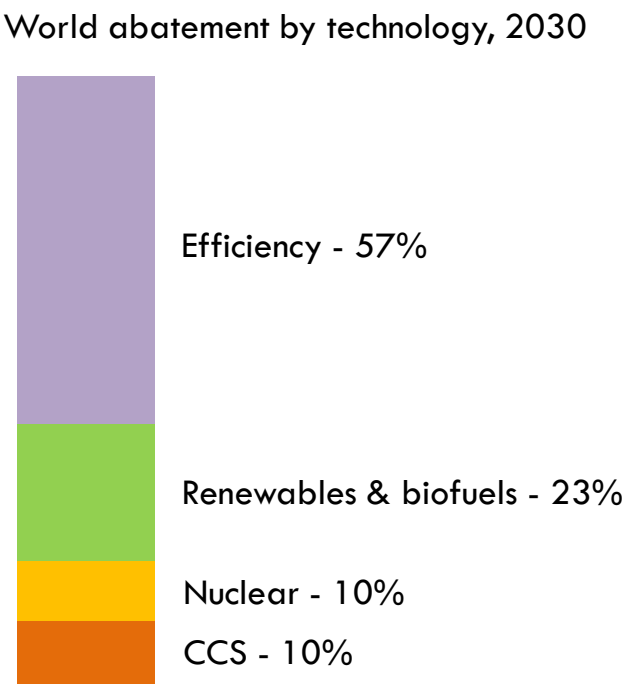
World abatement of energy-related CO_2 emissions in the 450 Scenario





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

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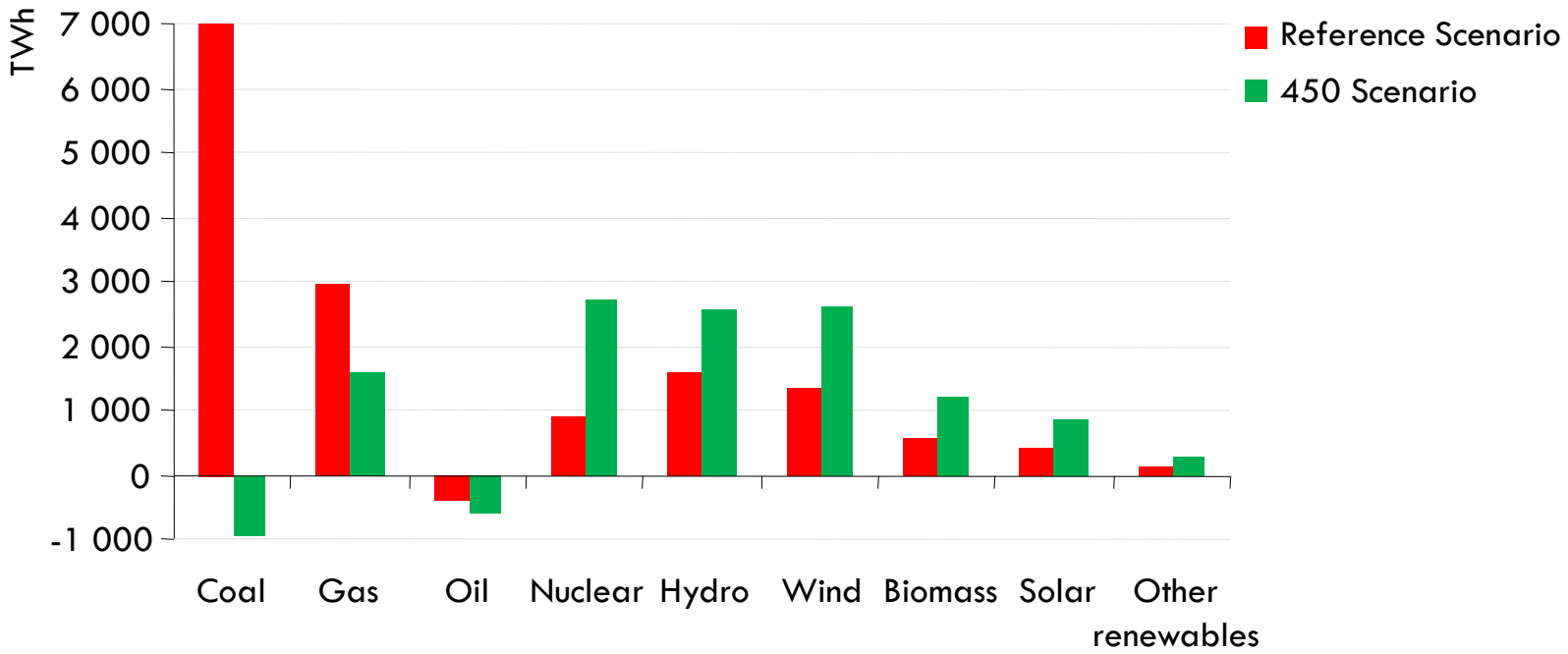
Incremental world electricity production in the Reference and 450 Scenarios, 2007-2030



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

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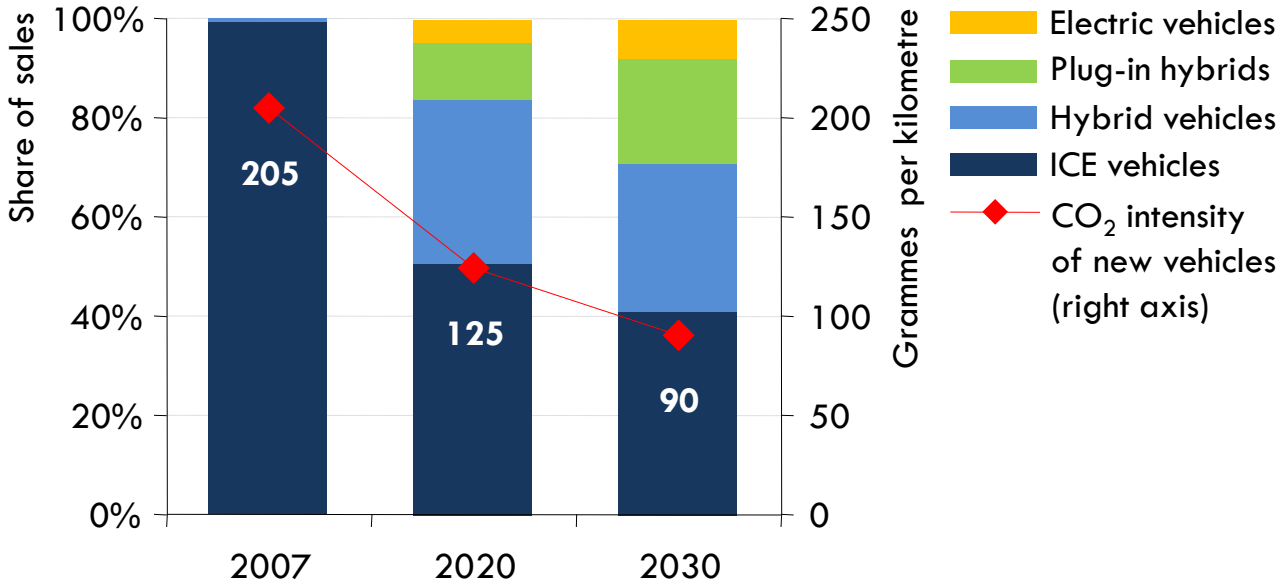
World passenger vehicle sales & average new vehicle CO_2 intensity in the 450 Scenario



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

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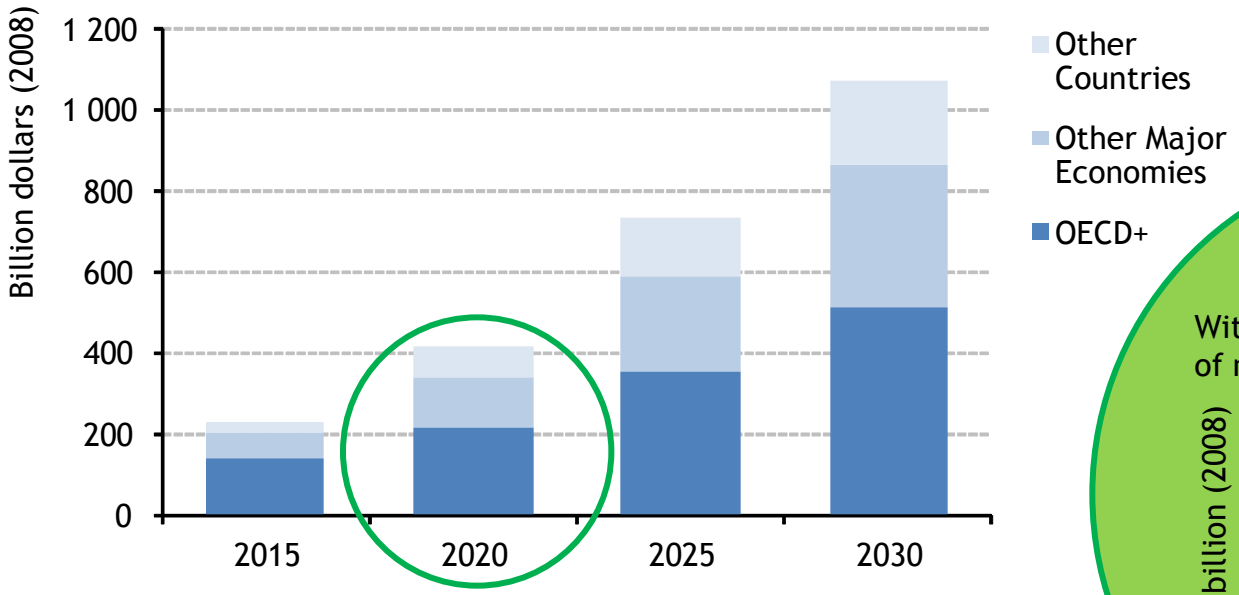
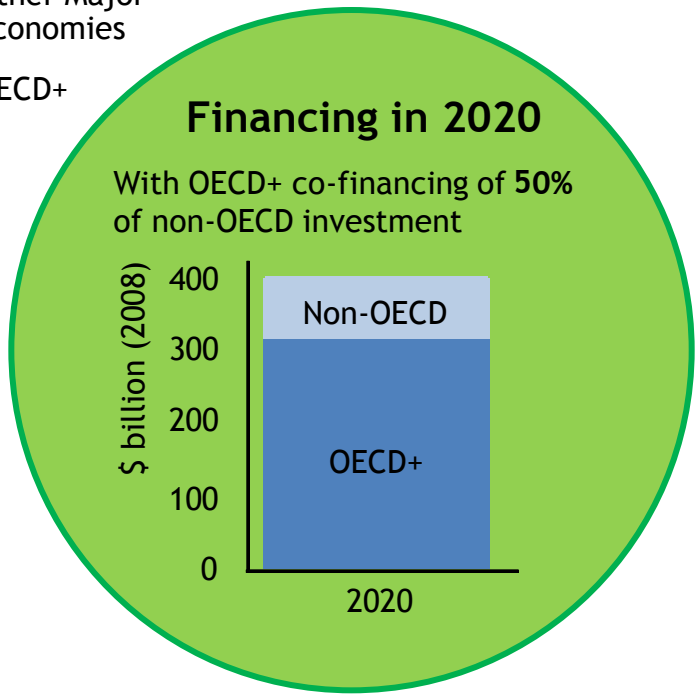
Additional investment in the 450 Scenario relative to the Reference Scenario





The 450 Scenario sees $10.5 trillion of additional investment to the Reference Scenario, costing 0.5% of GDP in 2020 and 1.1% of GDP in 2030

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The benefits of the 450 Scenario

- **Avoiding the worst impacts of climate change**
- **Lower energy bills for consumers: in industry, transport & buildings fuel costs are reduced by a total of $8.6 trillion between 2010 and 2030, compared to additional investment of $8.3 trillion**
  - *Savings in transport alone account for $6.2 trillion*
- **Energy-security benefits and reduced oil & gas imports**
  - *For OECD countries, oil imports are 6 mb/d lower in 2030 than in 2008*
  - *In China & India, oil imports are around 10% and 15% lower, respectively, by 2030 than in the Reference Scenario; China's gas imports are 23% lower by 2030*
- **Sharp reduction in air pollution relative to the Reference Scenario**
  - *In 2030, SO_2 emissions are 29% lower than in the Reference Scenario; NO_x emissions are 19% lower & emissions of particulate matter 9% lower*

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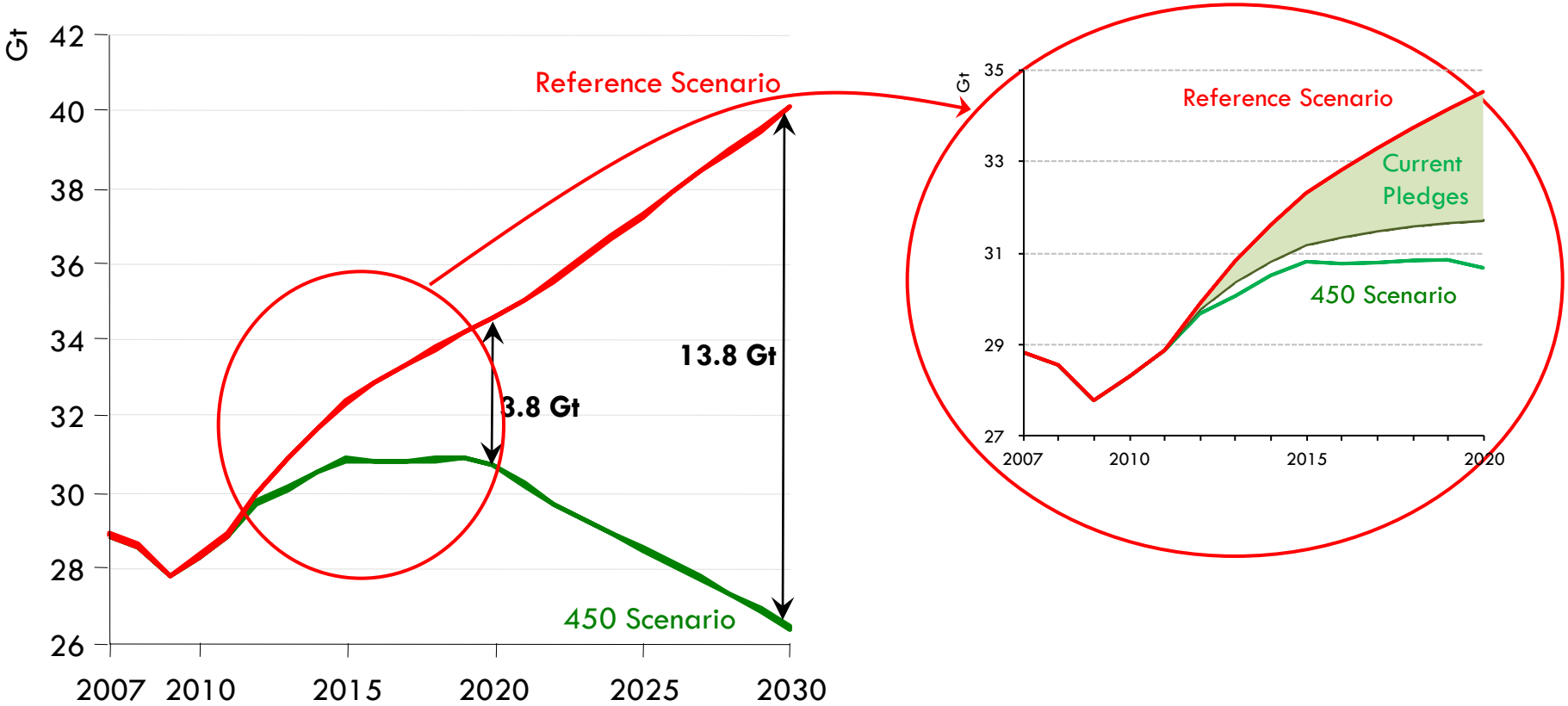
World abatement of energy-related CO_2 emissions in the 450 Scenario



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

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Conclusions

- **Meeting a 450 Scenario is achievable but requires a wholesale transformation of the way we produce & use energy**
- **The investment needs are substantial, but there would be major benefits through fuel savings, enhanced energy security & reduced pollution – *as well as reduced climate change***
- **Financial support holds the key, as many of the abatement options are in non-OECD countries**
- **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 billion to mitigation costs*

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