Perspectives on Greenhouse Gas Mitigation

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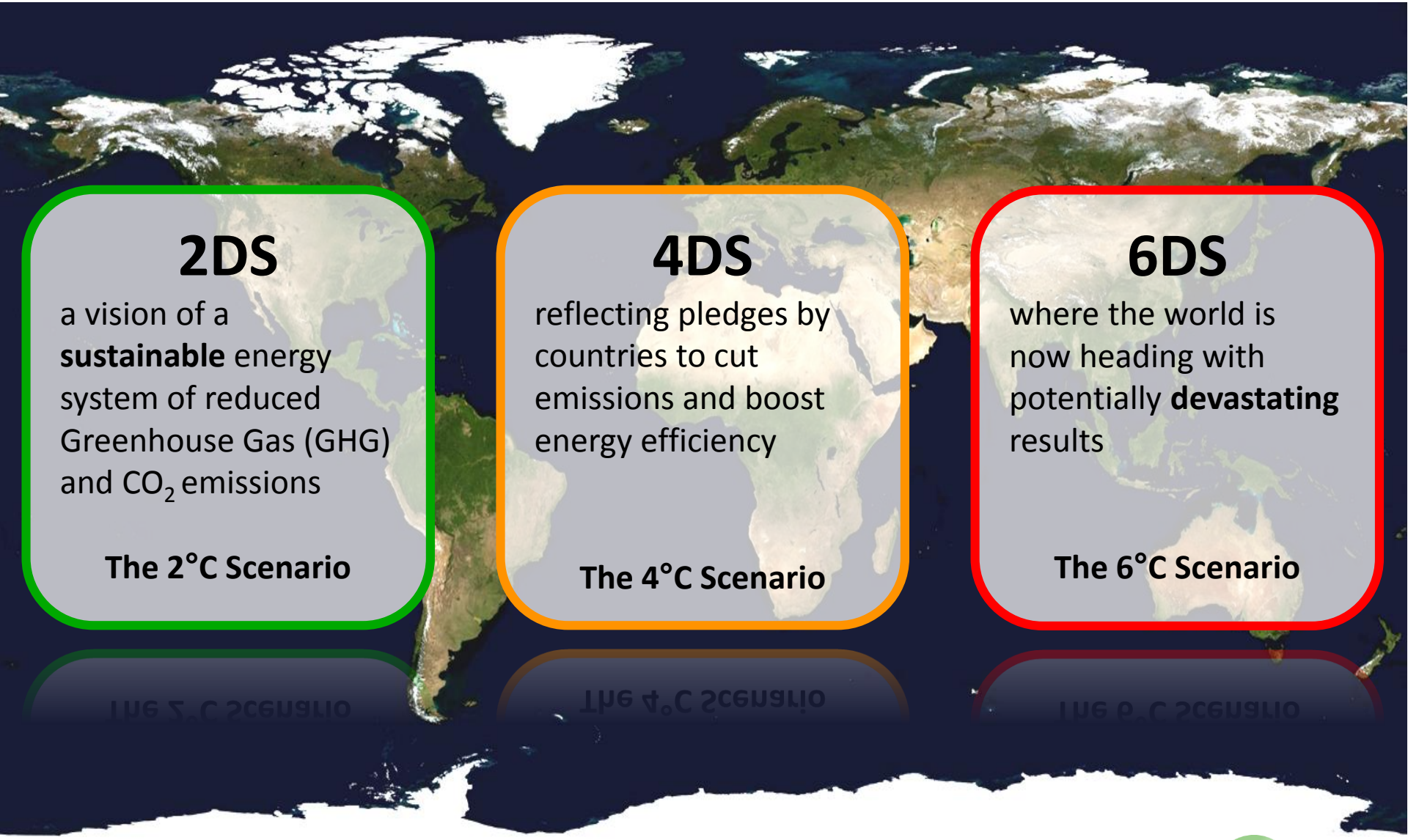
IPICEA Seminar, 23rd June 2014, London UK.

ETP 2014 – A choice of 3 futures



2DS

a vision of a **sustainable** energy system of reduced Greenhouse Gas (GHG) and CO_2 emissions

The 2°C Scenario

4DS

reflecting pledges by countries to cut emissions and boost energy efficiency

The 4°C Scenario

6DS

where the world is now heading with potentially **devastating** results

The 6°C Scenario

International Energy Agency

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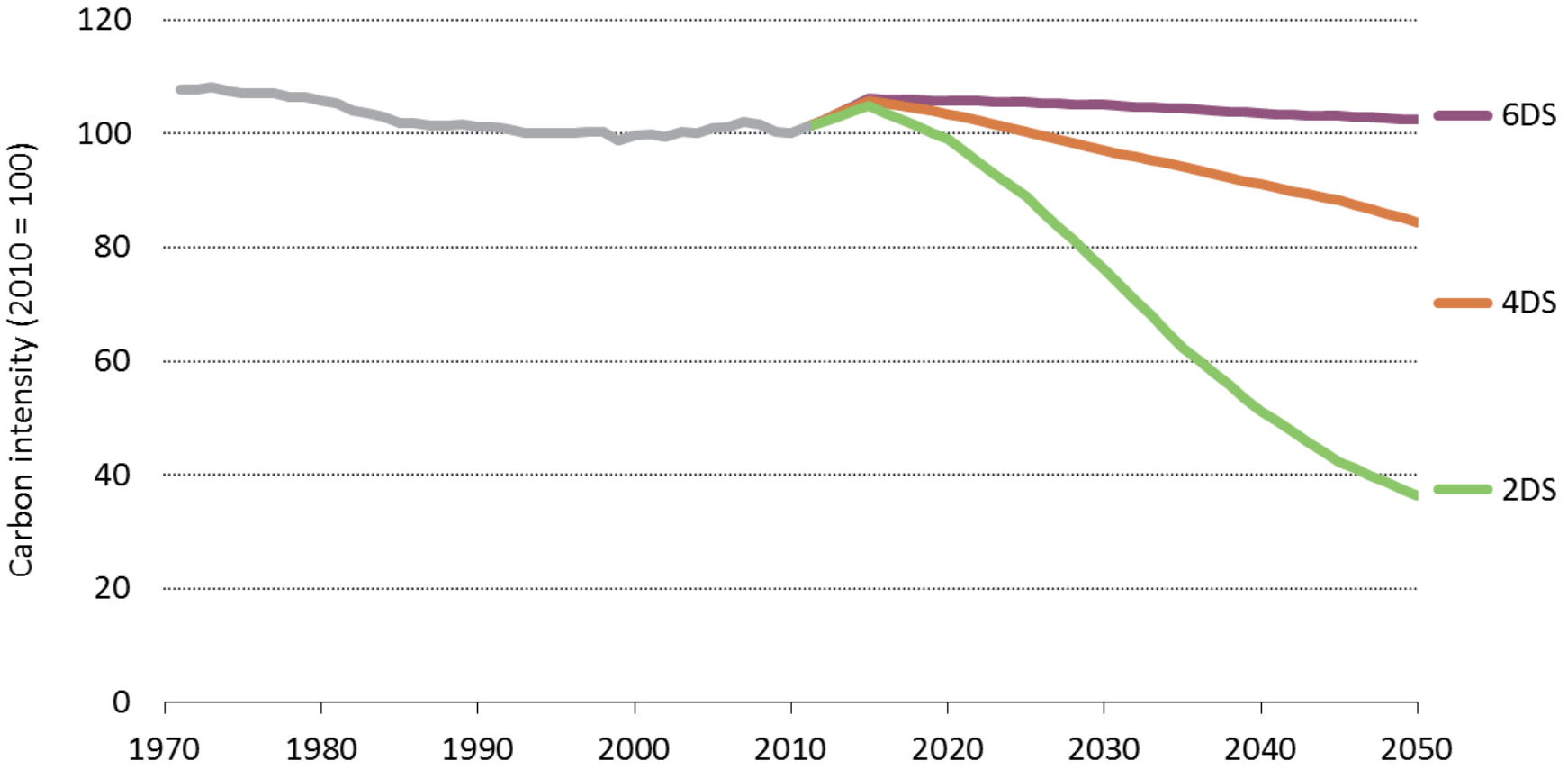
Carbon intensity of supply must fall rapidly



The 4DS and 2DS lead to dramatic reductions of the carbon-intensity index: by 15 points in the 4DS and by 64 points in the 2DS by 2050

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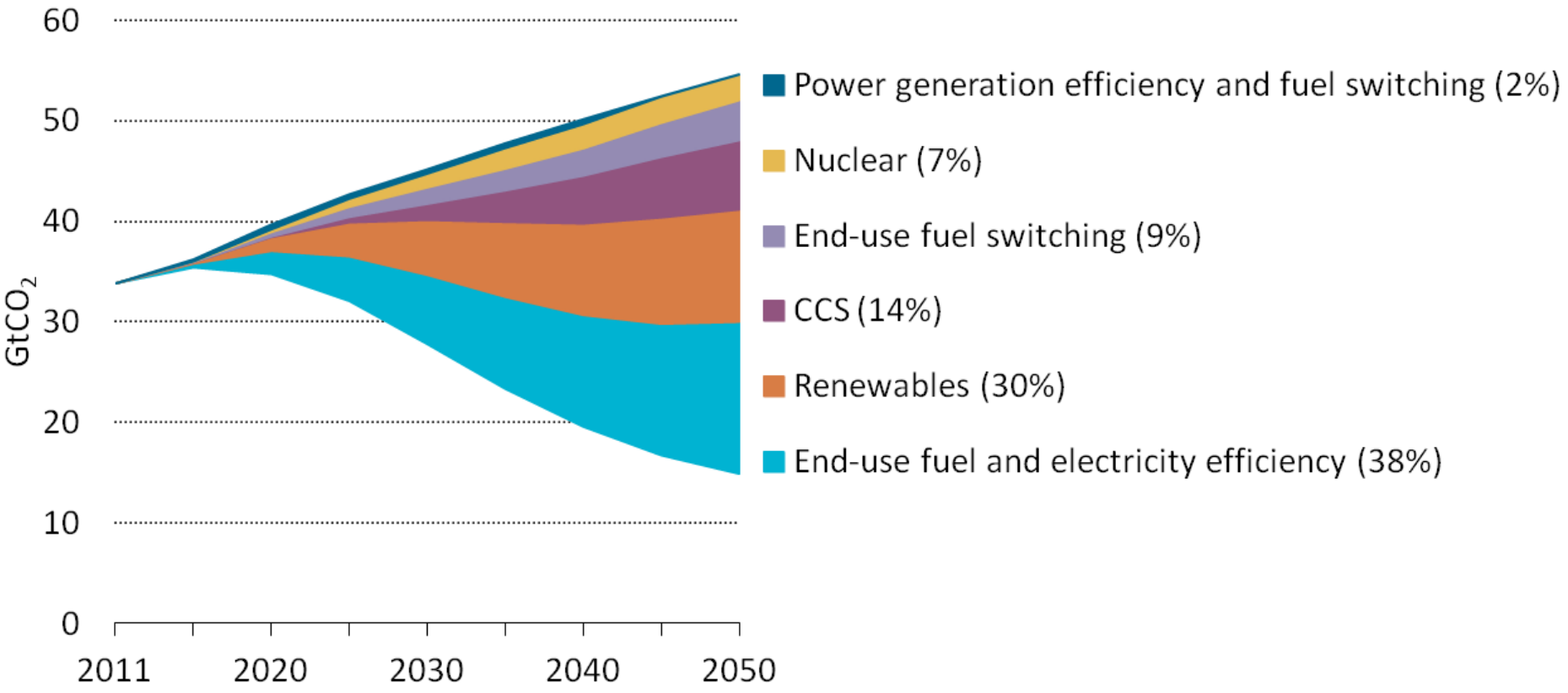
A transformation of supply and use is needed



Carbon capture and storage (CCS) contributes 14% of total emissions reductions through 2050 relative to the 6DS

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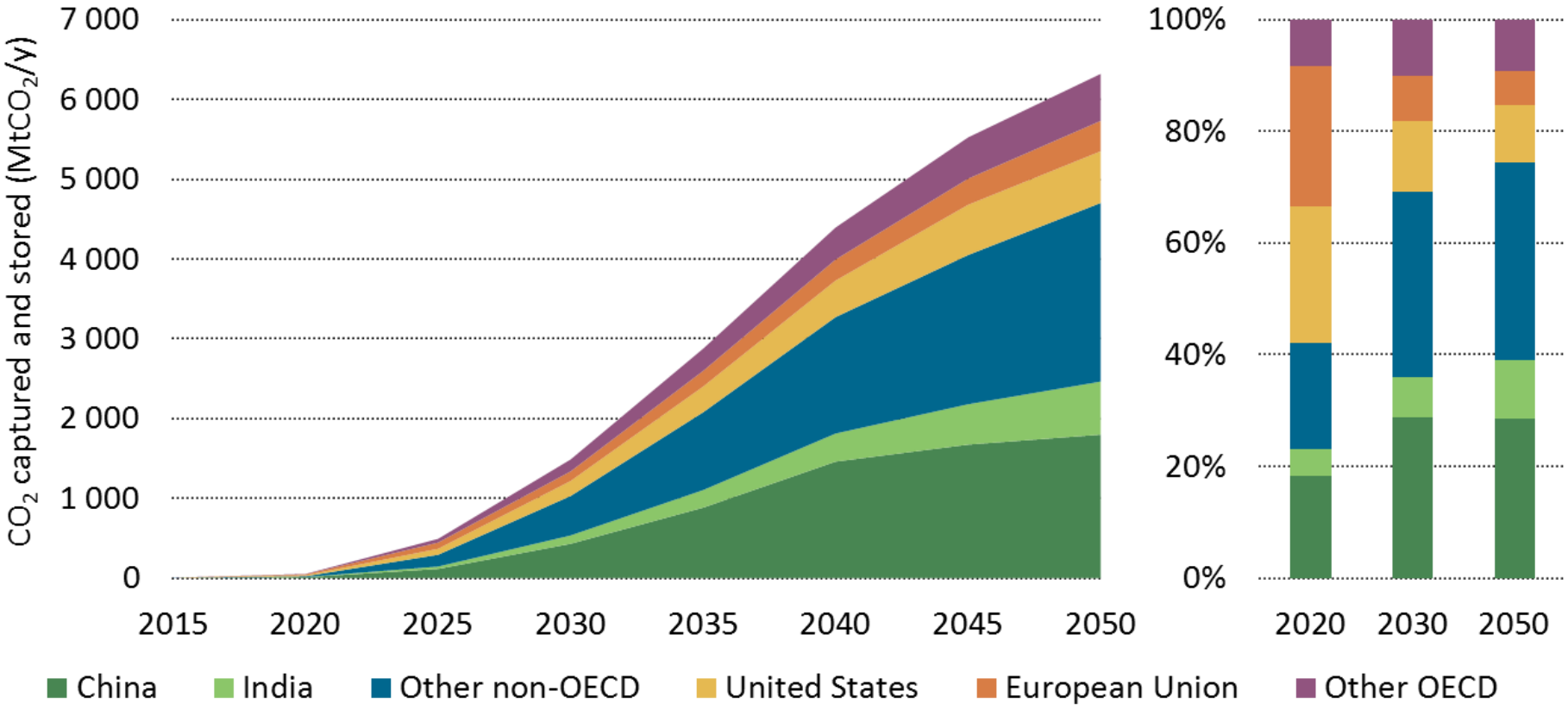
CCS must grow rapidly around the globe



In the near term, the largest amount of CO_2 is captured in OECD countries; by 2050, CO_2 capture in non-OECD countries dominates

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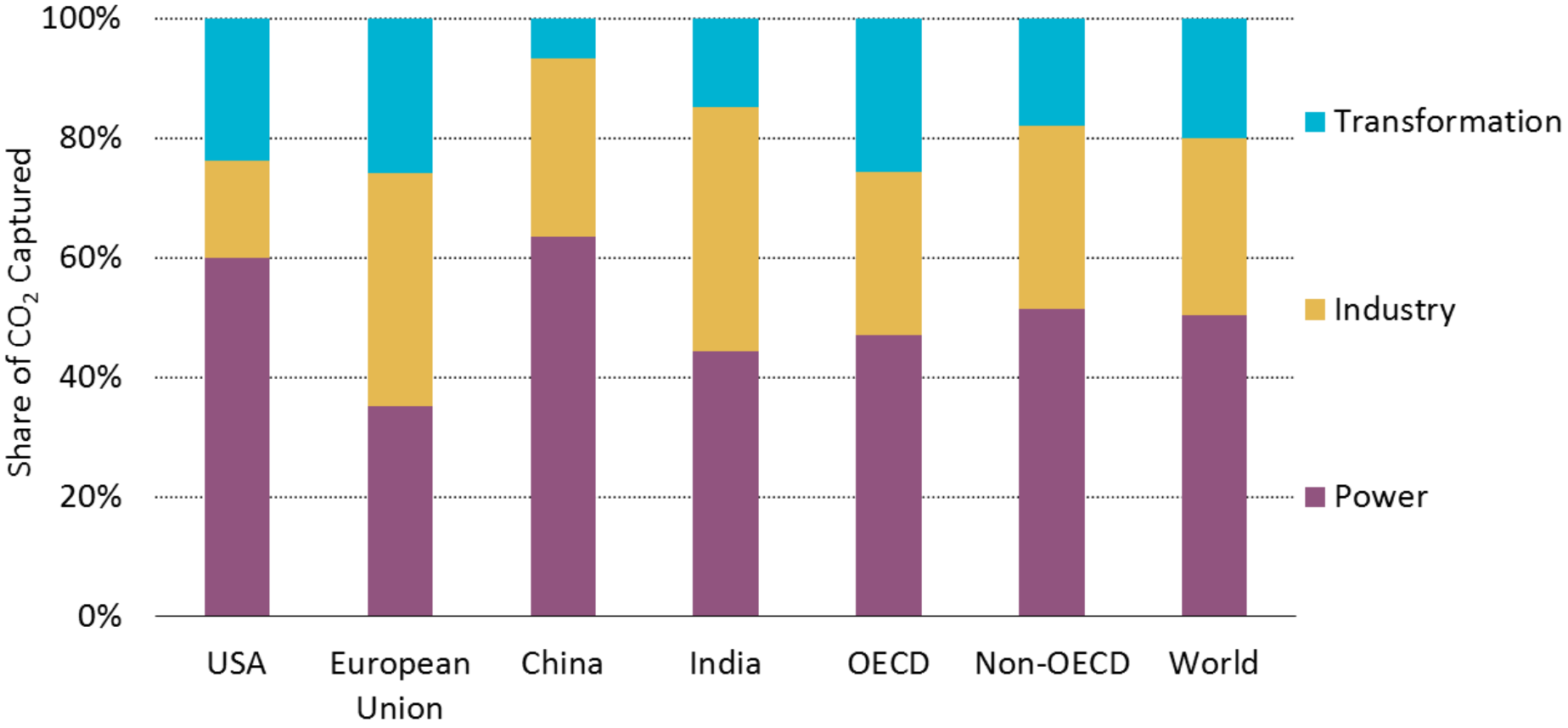
CCS is applied to *more than* just power



The majority of CO_2 is captured from power generation globally, but in some regions (e.g., the EU) CO_2 captured from industrial applications dominates

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IPCC AR5 WGIII Summary report

- Decarbonizing electricity generation is a key component of cost-effective mitig ation strategies
  - Decarbonization happens more rapidly in electricity generation than in the industry, buildings, and transport sectors
  - The share of low-carbon electricity supply (incl CCS) increases from 30% to more than 80 % by 2050,
  - Fossil fuel power generation without CCS is phased out by 2100.
- GHG emissions reduced significantly by:
  - Replacing average efficiency coal fired power plants with modern high efficiency natural gas plants or CHP
  - Proviso's
    - Natural gas is available
    - Emissions from extraction and supply are low or mitigated
  - Natural gas without CCS is a bridging technology

Energy Transition Case studies

USA

- Shale gas revolution changed energy dynamics
- New EPA rules for fossil fuel power plants
  - Unabated gas
  - Or partial capture on coal fired power plant
- Renewables increase
- Cheap coal to export

Germany

- High renewables penetration
- Nuclear phase out
- Gas has cost and security of supply issues
- Using unabated coal to balance grid demand and reduce costs to consumer
- Co2 emissions going back up

Energy Transition Case studies

China

- Coal dominant energy source for foreseeable future
- Pollution driving change not climate change
- Increasing use of renewables/nuclear and EE
- Shale gas won't take off for a decade or more
- Fossil fuel imports increasing – destabilising regional energy supplies

Japan

- Post Fukushima nuclear conundrum
- CO_2 emissions rising through use of unabated coal
- Limited geological resources for CO_2 storage
- Plans for more renewables/EE
- Coal lowest cost imported fossil fuel with stable supply

Key Messages – Other Mitigation Options

Geoengineering

- Biochar
  - Niche option at best
  - Issues re permenance
- Ocean Fertilisation
  - Still considerable doubts about science
  - Environmental impact etc.,
- Solar Geoengineering
  - More research needed
  - Are not a substitute for CO_2 reductions

Mineralisation

- IEAGHG review in 2005
- Revisited in 2011
- No significant progress made
- Still uncertainties over cost, environmental impact etc.,

Key Messages – Other GHG's

Short Lived Climate Forcers (SLCF)

- New international policy action
  - Climate and Clean Air Coalition (CCAC)
    - Black carbon, CH_4 and HFC's
- Bilateral agreements
  - USA and China
    - To reduce HFC's
- Regional Policy Measures
  - EC to phase out F gases between 2015 and 2020.
- Latest research casts doubt on benefits of SLCF action.

Sulphur Dioxide

- Emissions in North America and Europe have decreased
- In India they have increased
  - No legislation
- China has stabilised at 30% of global emissions
  - Actively fitting FGD
- For the climate, sulphate aerosols act as a cooling agent
  - Climate Modelling
- South East Asian Emissions increasing
  - Transport Sector
- Moves to reduce maritime emissions

Thank you, any Questions?

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