

The IEA CCS Roadmap Contributing to Global Climate Goals

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International Energy Agency

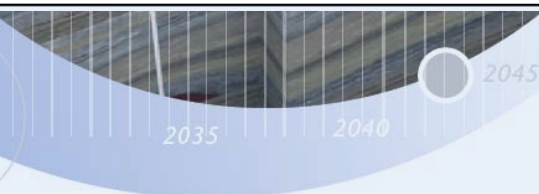
Technology Roadmap

Carbon capture and storage

Overview



- Introduction
- CCS Status Today
- CCS deployment in the BLUE Map Scenario
- Actions and Milestones
 - Technology
 - Financing
 - Legal and regulatory
 - Public education and engagement
 - International collaborations
- Conclusion: Near-term actions for stakeholders



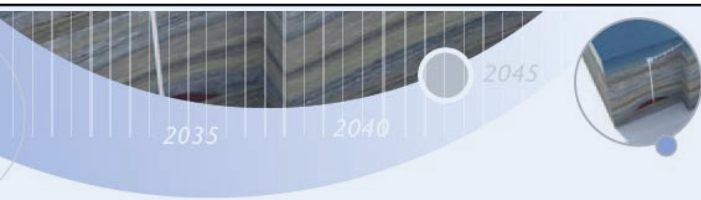
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Carbon capture and storage

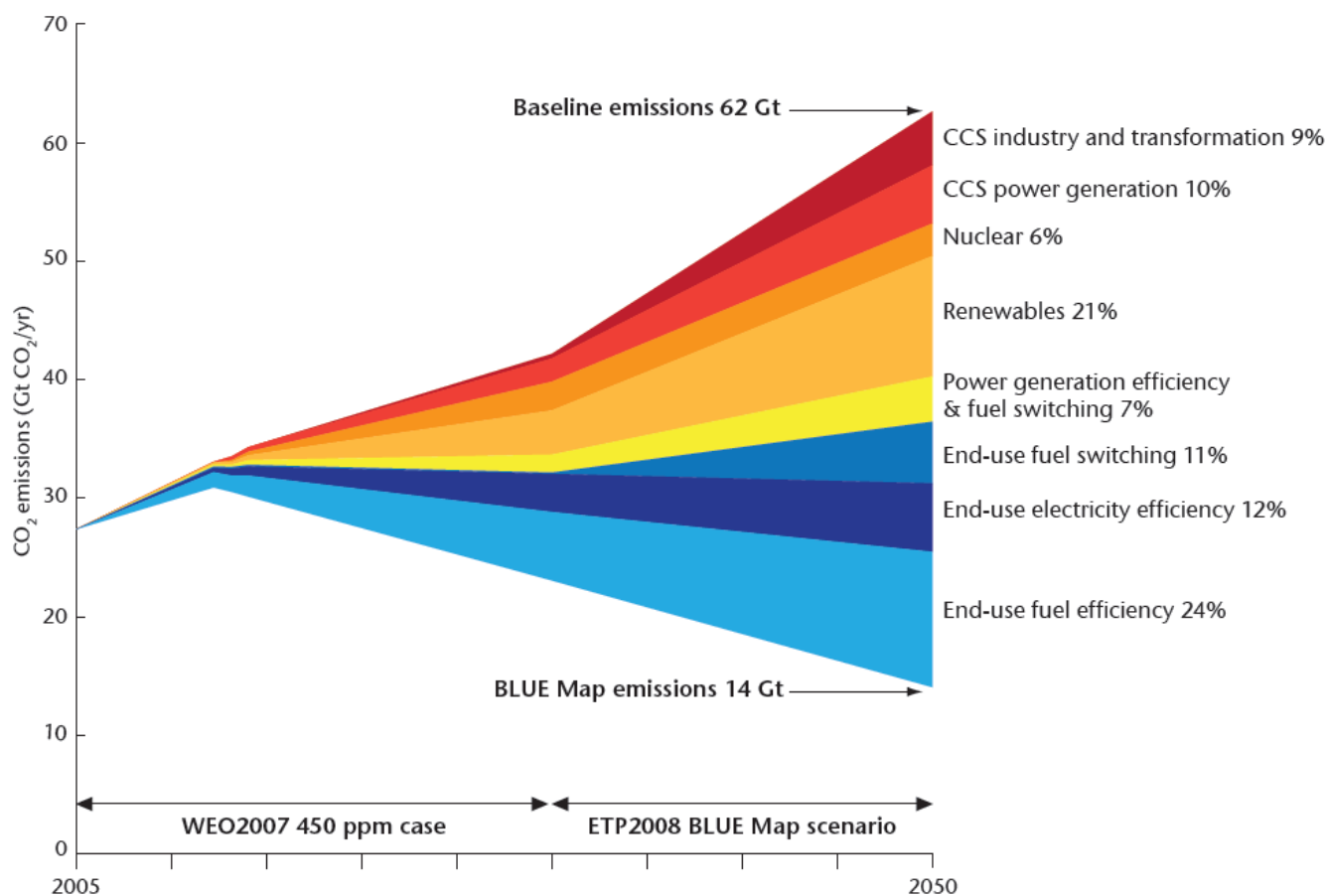
The rationale for CCS



- Without new policies, global emissions increase by 130% by 2050, leading to a 4-7°C temperature rise
- CCS provides one-fifth of the needed CO₂ reductions in 2050
- Without CCS, cost of stabilization rises by 70%
- CCS is the only low-carbon solution for gas/coal, cement, and iron & steel sectors



The ETP BLUE Map Scenario



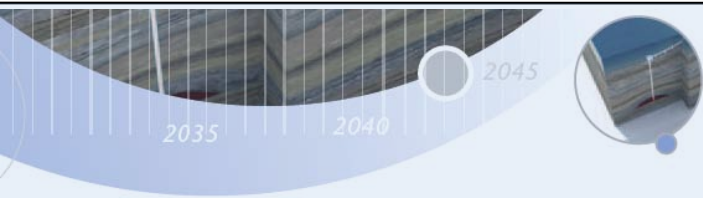
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The roadmap process



- IEA is developing technology roadmaps for key low-carbon energy technologies
- Process begins by convening experts to establish the current technology baseline
- Assume a 50% reduction in energy-related CO₂ by 2050
 - Use BLUE Map scenario to map growth pathway
- Create technical, policy, legal, financial, and public acceptance milestones to achieve 2050 targets
- Identify priority near-term actions
- Create a process for enhanced collaboration
- Implement actions and track progress



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Carbon capture and storage

The CCS value chain

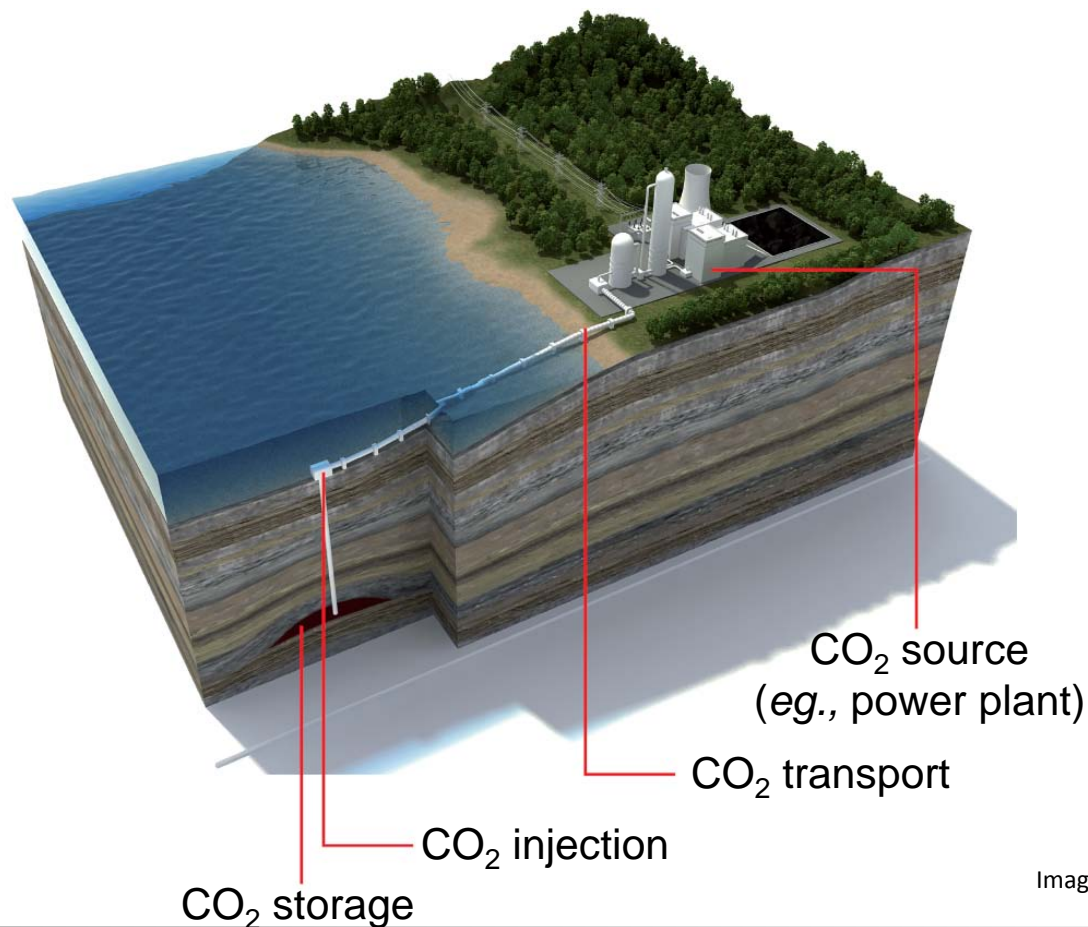
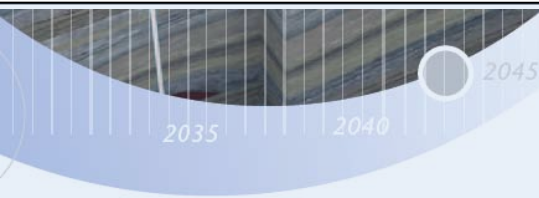


Image courtesy Bellona Foundation

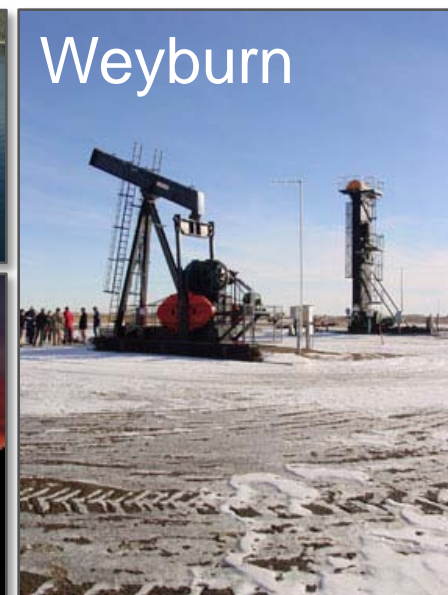


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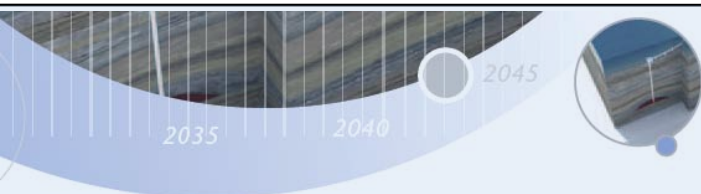
Carbon capture and storage

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CCS is operational today...



Five large-scale integrated projects are successfully storing CO₂

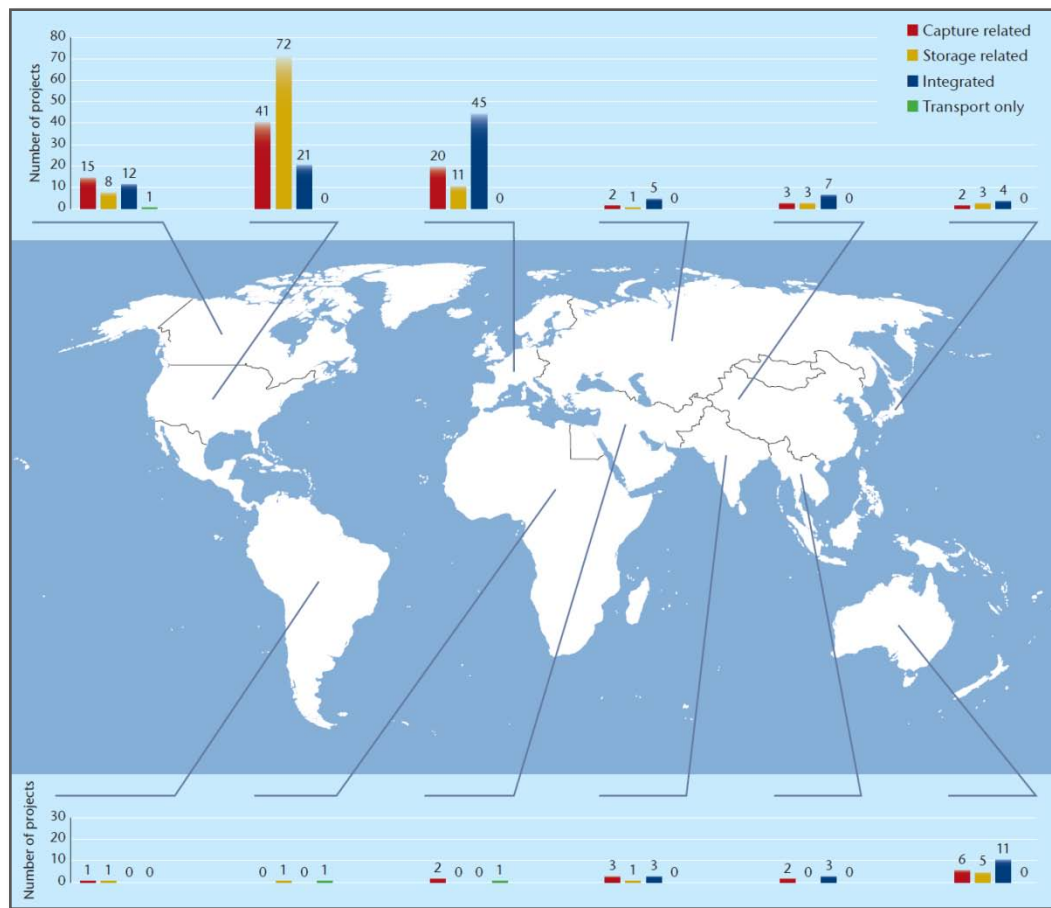


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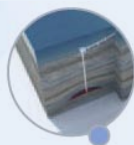
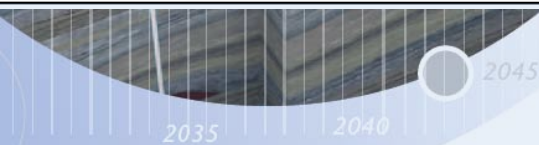
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...with many more projects planned



*Over 70
integrated
projects
planned*

Image courtesy GCCSI



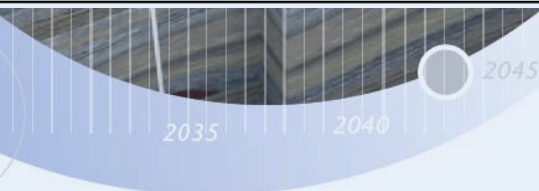
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CCS financing today



- Australia: Aus\$2bn; Aus\$300 for GCCSI
- Canada: Can\$1.3bn; Can\$2bn from Alberta
- EU: €1.05bn from Economic Recovery Energy Programme and 300m allowances in the EU ETS
- Japan: JPY10.8bn
- Norway: ~US\$40/tonne CO₂ tax on offshore oil and gas operations; NOK1.2bn government investment
- UK: GBP 7.2-9.5 billion to cover additional costs for 1-4 CCS plants raised thru levy on electricity suppliers
- US: US\$3.4bn from Economic Recovery Act; US\$3.3bn in other federal government RD&D support



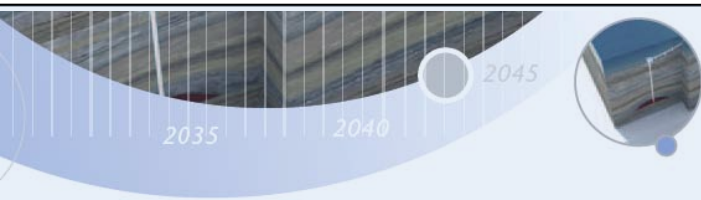
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CCS laws and regulations today



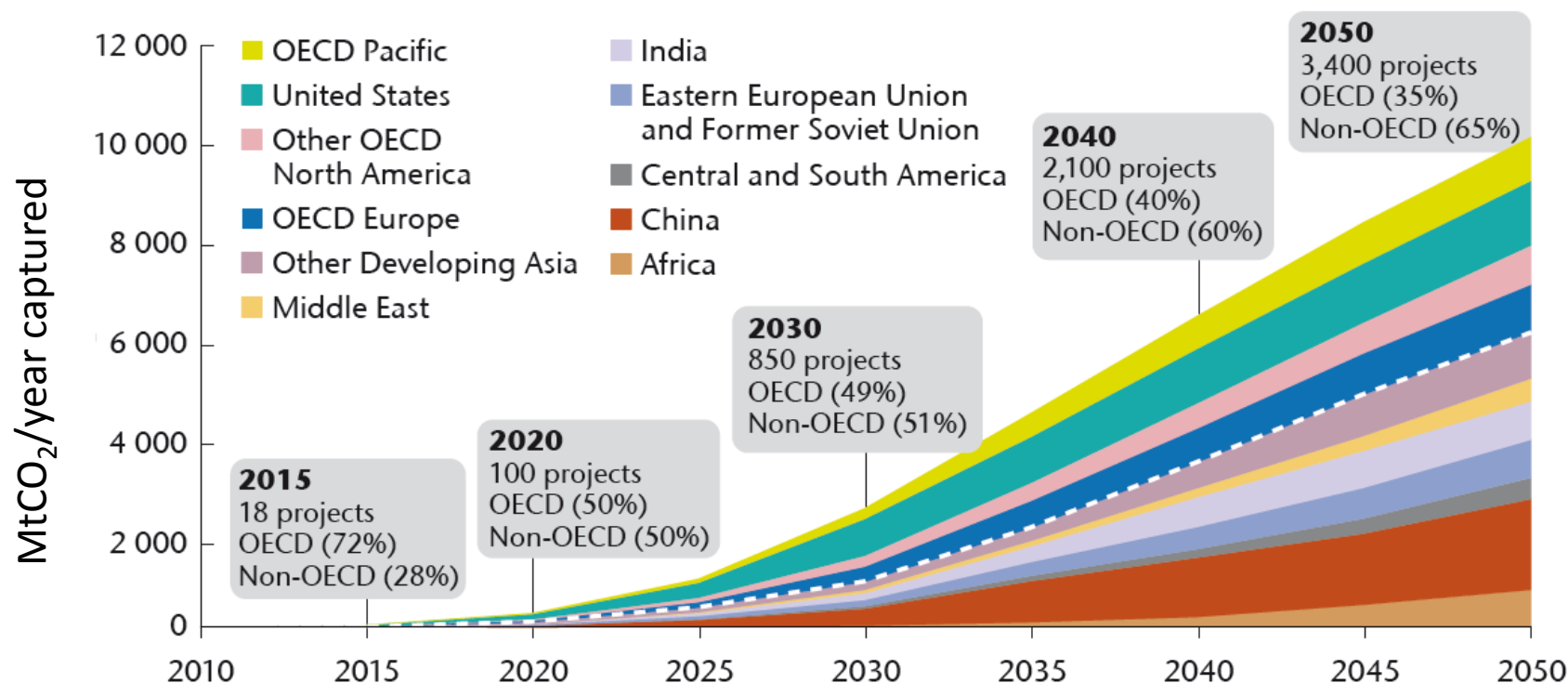
- IPCC 2006 *Inventory Guidelines*
- London Protocol, OSPAR treaty amendments
- EU CCS Directive, EU ETS Directive
- National legal & regulatory developments
 - Australia, US, Canada, Japan, Norway
- UNFCCC
 - Does not qualify under the CDM



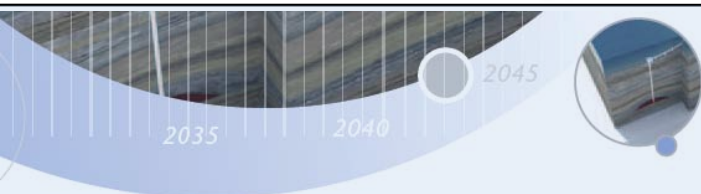
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Carbon capture and storage

An ambitious growth pathway



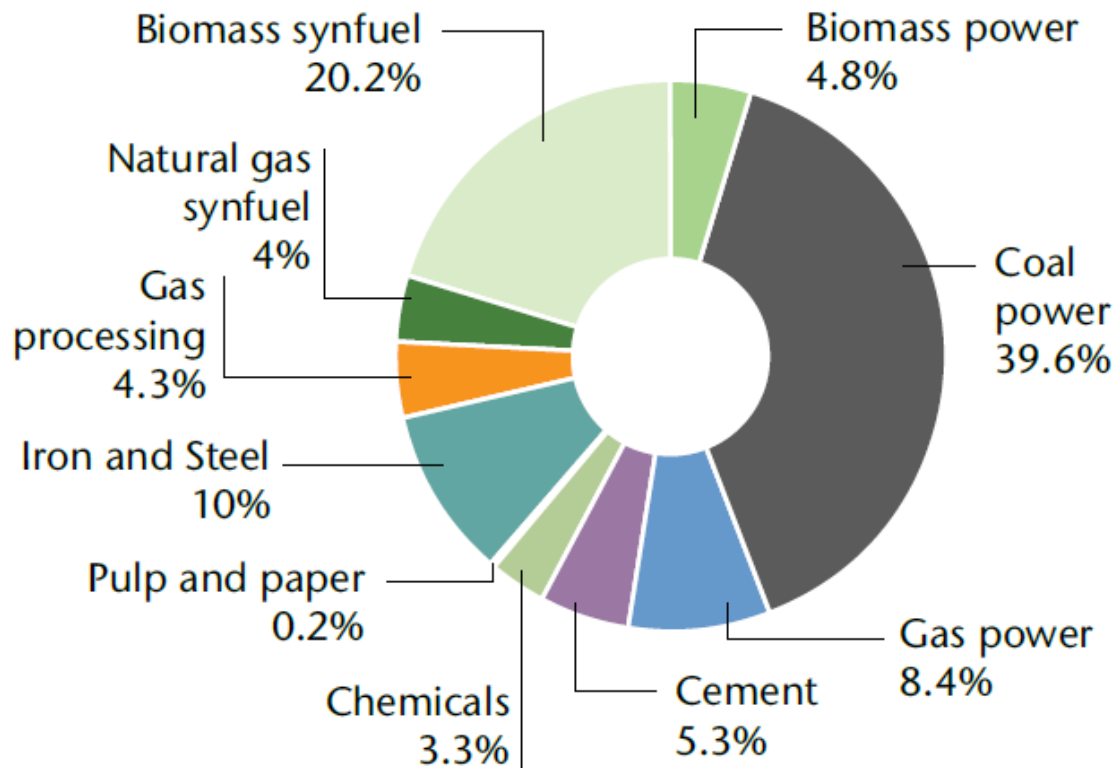
OECD regions must lead in demonstrating CCS, but the technology must quickly spread to the rest of the world



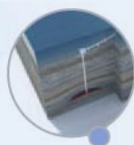
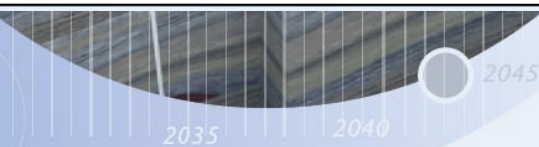
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CCS is not just about “clean coal”



Coal power only makes up around 40% of stored emissions in 2050



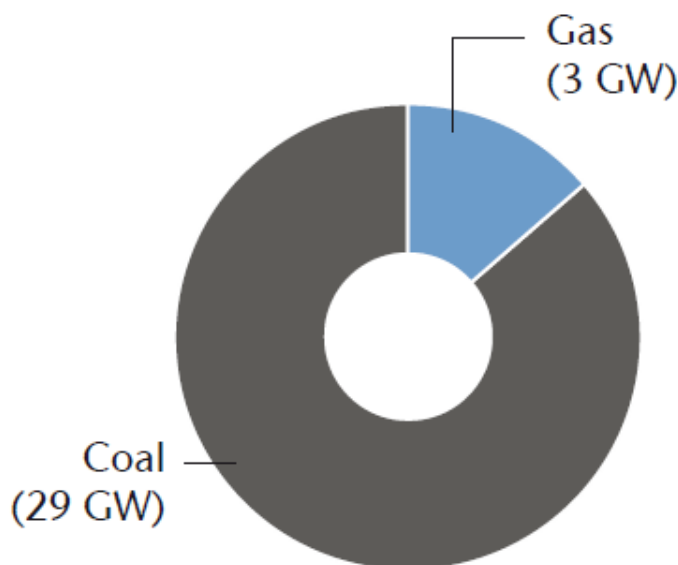
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Carbon capture and storage

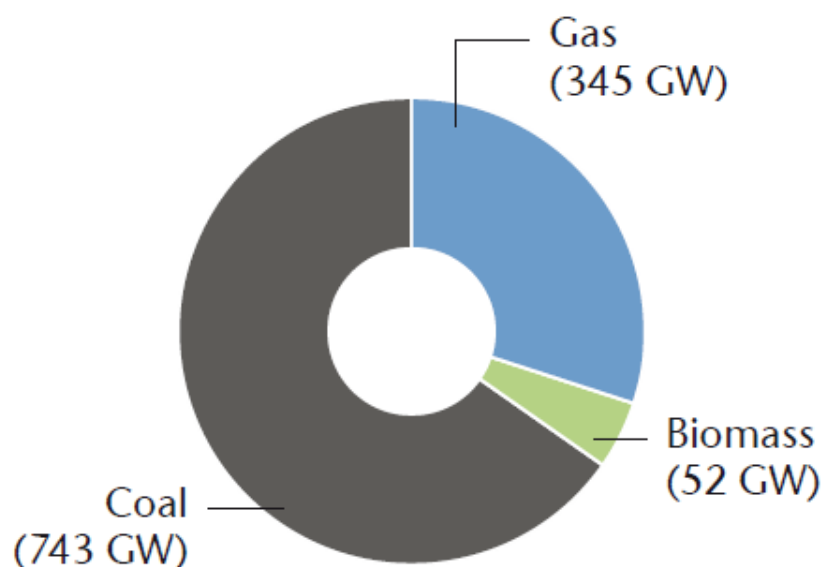
CCS in power generation



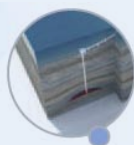
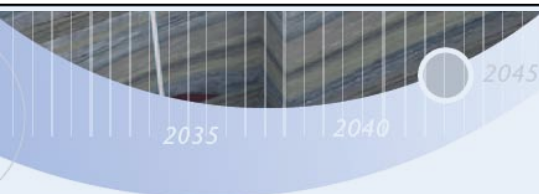
CCS capacity 2020 (22 GW installed)



CCS capacity 2050 (1 140 GW installed)



Power plants must rapidly adopt CCS, with nearly all fossil-based power using the technology by 2040



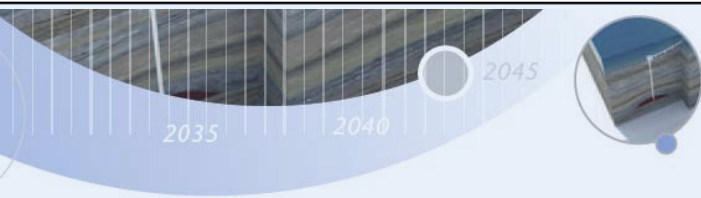
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CCS retrofit and CCS ready plants



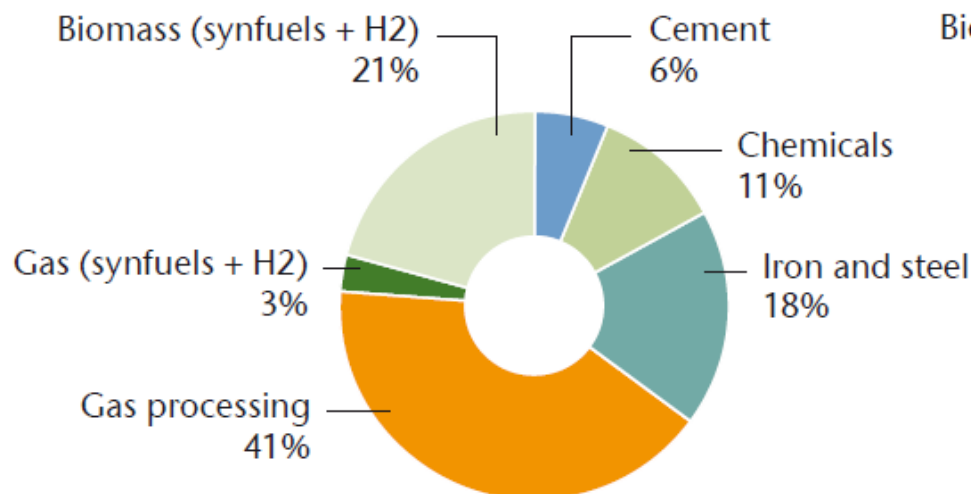
- Plants built today will still be operating in 40 years
- CCS ready prevents CO₂ “lock-in”
- Prevents technical barriers to future CCS retrofit
 - Should include potential barriers to capture, transport and storage
- Around 60 GW of power plant will need to be retrofitted with CCS by 2050
- CCS ready is already mandated in UK for plants over 300 MW



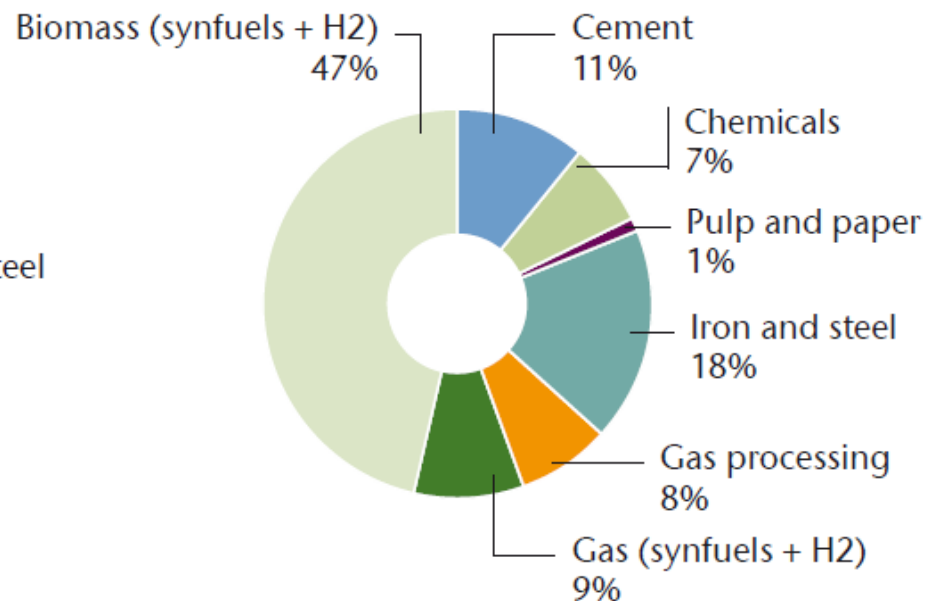
CCS in industry, upstream sectors



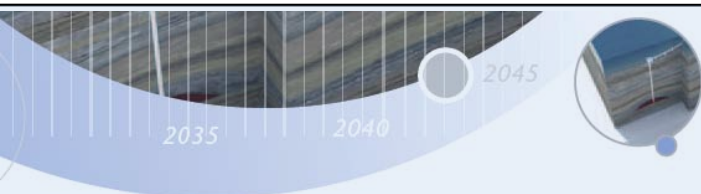
Captured in 2020 (168 Mt CO₂/yr)



Captured in 2050 (4 570 Mt CO₂/yr)



CCS in the industry and upstream sectors start with low-cost gas processing, then transitions to synfuels and hydrogen production



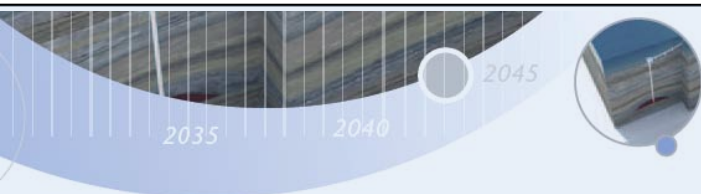
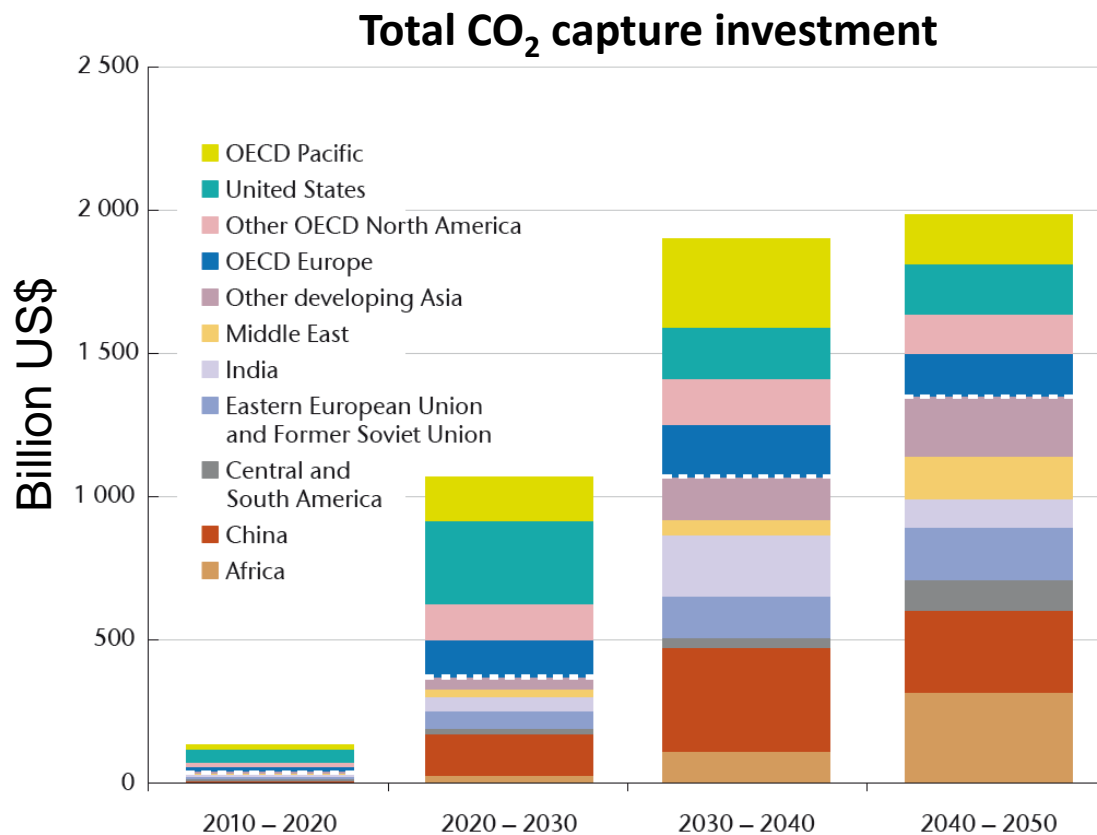
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Carbon capture and storage

Costs and investment needs



	Additional Investment 2010 – 2050 (trillion USD)
Capture	1.3
Transport	0.55 – 1
Storage	0.09 – 0.65
Total	2.5 – 3

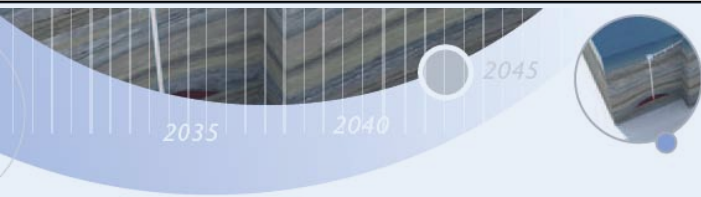


Technology Roadmap

Carbon capture and storage

Roadmap actions and milestones

- Technology
- Financing
- Legal and regulatory
- Public education and engagement
- International collaboration



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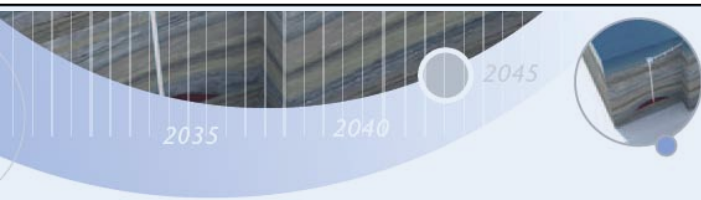
Carbon capture and storage

Technology Actions and Milestones: CO₂ Capture



- All capture technologies
 - Commercially available with capture rates over 85% for all fuel types by 2025
 - All capture systems, all coals, all firing configurations to achieve 45%+ efficiency including CO₂ capture from 2030
 - Reduce capital costs by 10-12% by 2020; an additional 10% by 2030
- Post- and pre-combustion, oxyfuel capture targets

Source: IEA Clean Coal Centre *Roadmap to 2030*



Technology Roadmap

Carbon capture and storage

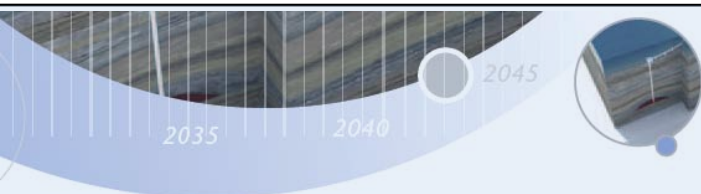
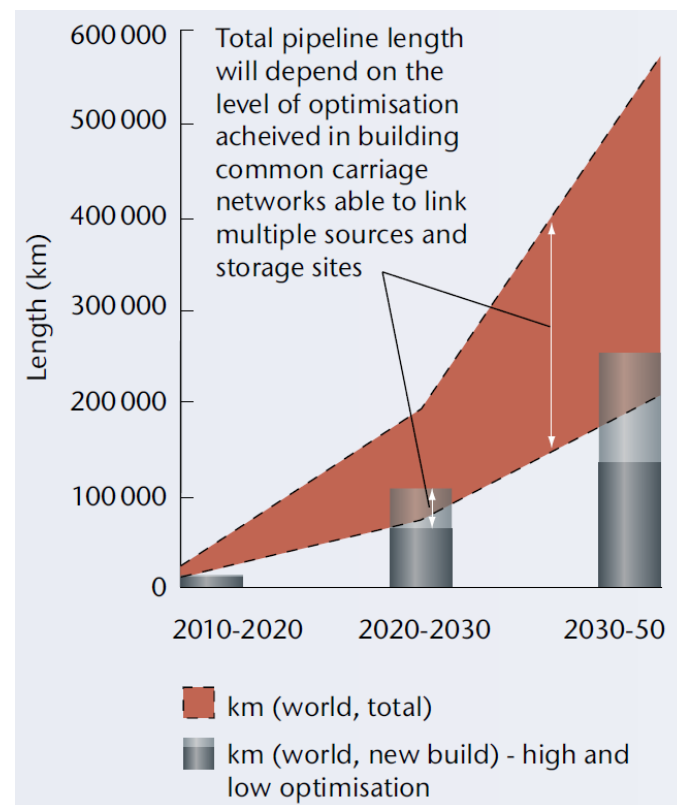
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Technology Actions and Milestones: CO₂ Transport



- Analyze and incentivize optimized source and/or sink transport hubs
- Analyze and incentivize optimized country/region-wide pipeline network
- Conduct studies on tanker transport of CO₂
- Improve understanding of CO₂ transport leakage scenarios and effects of impurities

Global CO₂ pipeline needs



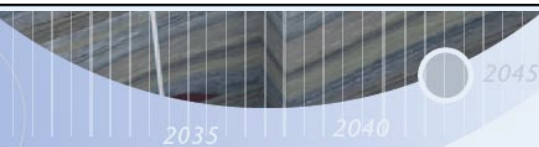
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Technology Actions and Milestones: CO₂ Storage



- Agree on a common CO₂ storage capacity methodology by 2010; assess global capacity by 2012
 - Review gaps in storage data coverage in emissions-intensive regions as a priority
- Develop best-practice guidelines for site selection, operation risk assessment, safety, monitoring, remediation and closure by 2012
- Develop and improve tools for predicting spatial reservoir and caprock properties between 2010-2020



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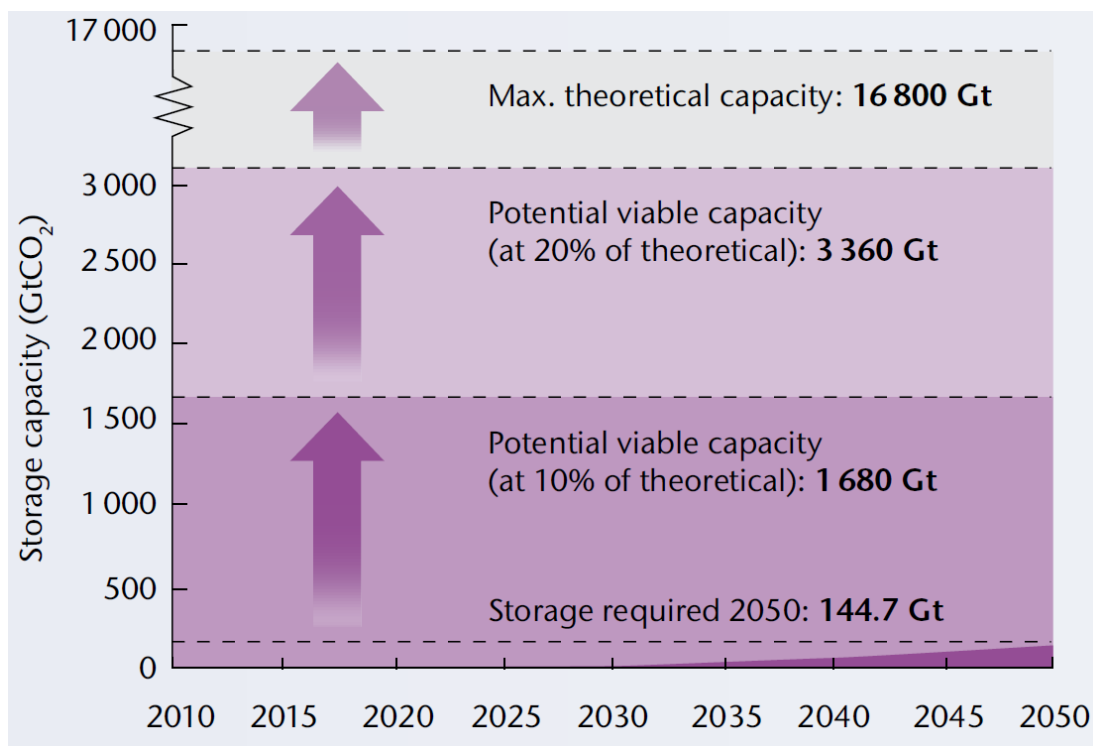
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Technology Actions and Milestones: CO₂ Storage



*Less than 1% of
total theoretical
storage
capacity would
be used by 2050*

**Total theoretical storage capacity &
total storage in 2050**



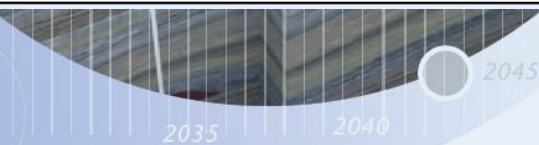
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Near-term actions for stakeholders



- Finance, Environmental, Energy/Resource Ministries
- Training/Science Ministries and/or Universities
- International Development Ministries and/or Multilateral Development Agencies
- Pipeline Regulators
- Industry
- State, Provincial and Local Governments
- Non-Governmental Organizations



Technology Roadmap

Carbon capture and storage

The next ten years: a critical period for CCS

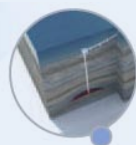
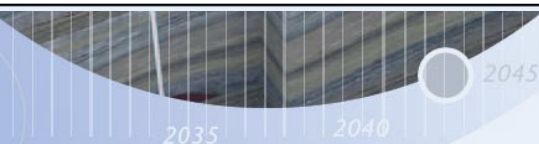


- **Demonstration milestones**

- Meet G8 goal of 20 project announcements by 2010
- Achieve commercialisation with 100 projects by 2020

- **Financial milestones**

- Provide USD42 bn for near-term demonstrations; also need to fund longer-term R&D
- Finance and plan CO₂ transport infrastructure
- Incentivise CCS via bonus allowances in cap-and-trade schemes, emissions performance standards or carbon taxes



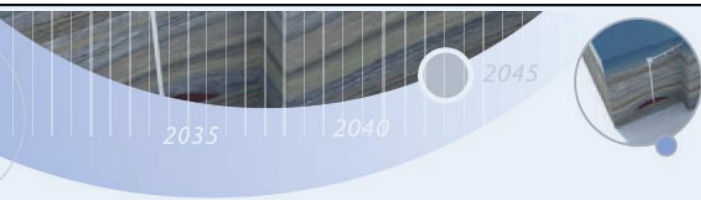
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The next ten years: a critical period for CCS



- **Legal/regulatory milestones**
 - Amend existing frameworks to regulate demonstration projects
 - By 2015, all countries with CCS potential should have comprehensive frameworks
- **Public engagement milestones**
 - Increase government investment in outreach in 2010-2012
 - Provide greater (and earlier) information on planned projects

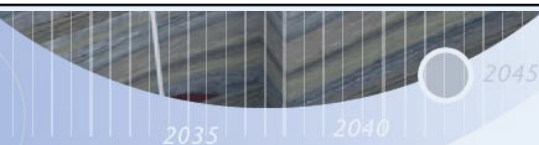


The next ten years: a critical period for CCS



- **International development milestones**

- By 2050, non-OECD regions will account for 64% of captured CO₂
- By 2050, China and India will account for around 26% of the cumulative CO₂ captured
- Expand capacity building efforts in non-OECD countries with fossil fuel economies such as China, India, South Africa
- An average annual investment of \$1.5-2.5bn between 2010-20 in non-OECD regions



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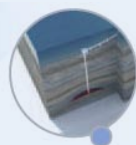
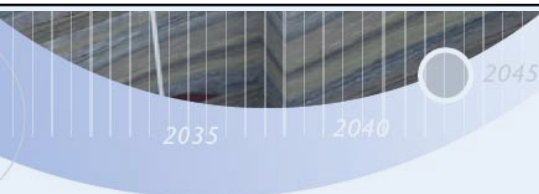
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For more information



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