CARBON CAPTURE AND STORAGE

International Energy Agency

CCS IN CHINA: Aspects of Financing

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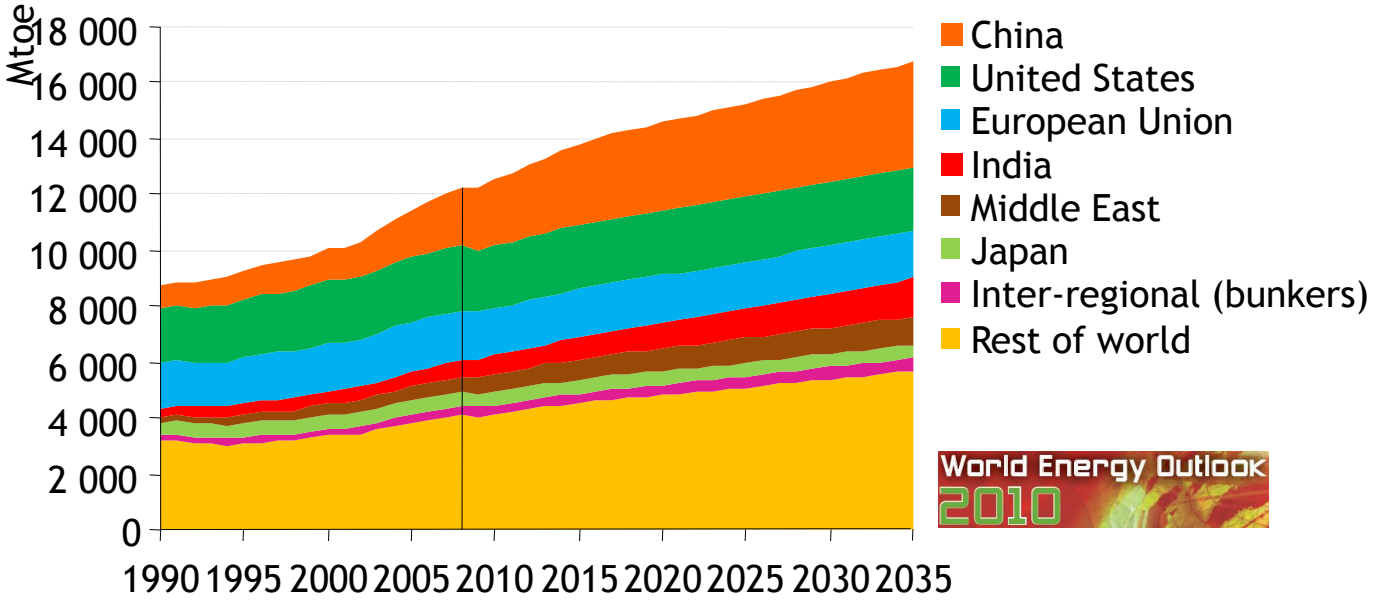
CHINA IS A BIG PART OF THE WORLD'S ENERGY PICTURE

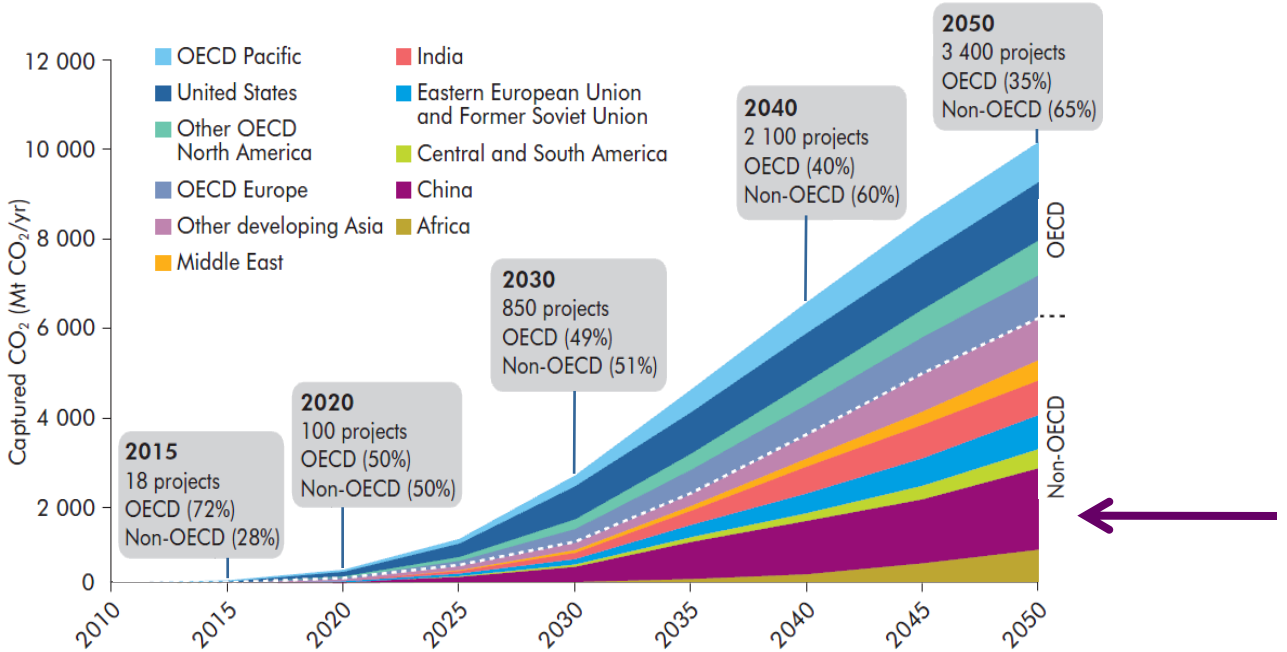
Global primary energy demand ("New Policies Scenario", IEA World Energy Outlook 2010)



- China is the world's largest energy consumer and the largest total emitter of energy-related CO_2
- China likely to account for 1/3 of incremental energy demand between 2008 and 2035
- 58% of the global increase in CO_2 emissions to 2035 could come from China alone

CCS DEPLOYMENT AND FINANCING NEEDS

- 2050 vision: 3000+ large-scale projects globally (19% of global energy-related CO2 emission reductions in 2050)
  - 600 projects in China
- 2020 potential: 100 projects globally
  - Up to 12 projects in China
  - Investments needs in China 2010-2020: up to USD 12 billion



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Technology Roadmap
Carbon capture and storage

ENERGY TECHNOLOGY PERSPECTIVES 2010

PROJECTS ARE NEEDED IN NON-OECD COUNTRIES

Region	Operating Projects	Projects in Advanced Planning or Construction[1]	Projects in Early-Planning Stages[2]
OECD	7 (88%)	28 (90%)	27 (71%)
Non-OECD	1 (13%)	3 (10%)	6 (29%)
Total	8	31	38

[1]Defined as those projects in the "Define" or "Execute" stages (GCCSI, 2010)
[2]Defined as those projects in the "Evaluate" or "Identify" stages (GCCSI, 2010)

In China: 2 (out of 3 in non-OECD) projects in Advanced planning and 3 (out of 6 in non-OECD) projects in Early planning.

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KEY BARRIERS/RISKS TO CCS DEVELOPMENT

Risk Type	Key Financing Challenges to be Addressed
Market (Off-take)	Variation in electricity price and demand
Market (Carbon)	Current prices too low to encourage sufficient investment
Fuel	Cost and availability fluctuations
Construction Cost	Costs, schedule, performance
Operational & Maintenance	Cost variation, energy penalty
Technology / Reliability	Integrated operating performance unknown, experience limited, long-term storage uncertainties
Financial	Large financing requirements, long-term return, multiple risks
Regulatory	Storage frameworks emerging but not fully clarified; uncertain climate and carbon policies
Environmental	CO2 leakage to the surface or groundwater contamination
Public Acceptance	Ability to secure permits and execute projects

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STATUS OF CCS COSTS

CO_2 Capture from power generation (IEA, 2011)

Fuel *(capture route)*	Coal *(similar for all capture routes; relative to a pulverized coal baseline)*	Natural gas *(post-combustion)*
Capital costs	3 800 USD/kW (74% increase)	1 700 USD/kW (82% increase)
Cost of CO_2 avoided	55 USD/tCO_2	80 USD/tCO_2

Notes: Averages figures for OECD countries shown (costs in China estimated to be about half for most cases), capital costs are overnight costs

CO_2 Capture from industrial application (UNIDO, 2010)

Refining sector 28-96 €/tCO_2
Cement plant 36-107 €/tCO_2
Pulp and paper 30-40 €/tCO_2
Iron & Steel 30-40 €/tCO_2 (Kuramochi, 2011)

Engineering-Economic Analysis and Historical Experience Curves suggest significant cost reduction potential over time.

CO_2 transport & storage

Very site-specific; likely additional costs of about 20 USD/tCO_2

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DOMESTIC (CHINA) FINANCING OPTIONS

- The State Budget
  - Clean energy investment in 2009 – US $34,6 billion
  - R&D programmes
  - Stimulus package, incl. for energy conservation, environmental issues
- Provincial and Local Governments
  - Development zones
  - Incentives (e.g., renewable energy)
- Self-Funding (role of state-owned enterprises)
  - Interest in CCS EOR or ECBM
- Domestic Bank Loans
  - E.g., domestic banks provided US$195.5 million, representing 47% of project costs to finance GreenGen's Phase I.
- Emerging domestic Carbon Market

INTERNATIONAL FINANCING

- Bilateral Government Funding
  - EU-China
  - U.S.-China
  - China – Australia
  - China – Japan
- Multilateral Development Banks
  - Asian Development Bank (ADB)
  - European Investment Bank (EIB)
  - The World Bank
  - Global Environmental Facility (GEF)
- Carbon Finance
- International organizations providing technical assistance/capacity building
  - E.g.,CSLF; Clean Energy Ministerial; IEA; IEA WPFF, IEA Clean Coal Centre; GHG IA; G20, GCCSI, and others

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POSSIBLE FINANCING MECHANISMS FOR THE FUTURE

- CCS in the CDM
  - Technical issues need to be resolved (Durban?)
  - Would set up a technical framework for CCS projects
  - Legitimize CCS for international carbon market
  - Capacity building: technical, legal
- Green Climate Fund (Proposed) -100bln by 2020
  - CCS should not compete with low hanging fruit options
  - Proposals of a special funding window
- NAMAs
  - CCS needs to be part of national climate and energy strategies
  - Supported and credit-generating NAMAs best suited for CCS

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POSSIBLE FINANCING MECHANISMS FOR THE FUTURE, CONT.

- Green Bonds (Proposed)
  - Guaranteeing long-term carbon price stability
  - Can be issued like tax credits or feed-in tariffs
  - Could be implemented domestically and internationally
- Private Capital
  - Facilitative role of risk sharing and/or insurance mechanisms,
  - International learning sharing,
  - International R&D partnerships.

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Summary

- China is an important player in the global GHG mitigation that will rely on CCS among other measures.
- China has made important advances on CCS development.
- There are several possible financing approaches and sources that could facilitate further development of CCS in China
  - Domestic and
  - International
- International and domestic policy decisions are needed in order to mobilize these sources.

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Thank you!

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