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CO_2 Capture and Storage: Global Status Update

Poland CCS Roundtable

18 June 2009

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Office of Sustainable Policy and Technology

Overview

- The Importance of CCS
- CCS Status Globally
- CCS in the Future: Issues and Challenges
- The IEA's CCS Activities

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International Energy Agency

Created in 1973; currently 28 Member Countries

Goals:

- energy security
- environmental protection
- economic growth

Activities:

- co-ordinates efforts to ensure energy security
- compiles energy statistics
- conducts policy analysis
- reviews energy policies & programs
- convenes, mobilizes science & technology experts

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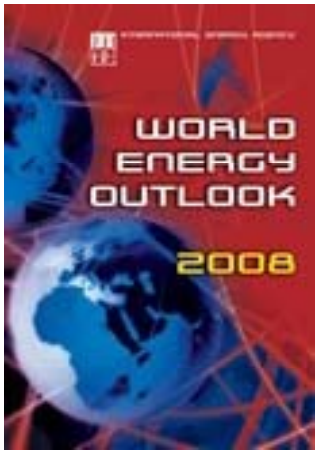
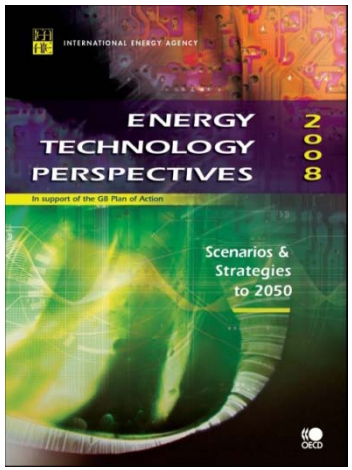
Global Analysis for a Clean Energy Future

- **World Energy Outlook**
  - Base case and advanced policy case
  - Timeline: 2030
  - Published annually in November



- **Energy Technology Perspectives**
  - Assessments of technology options and portfolio
  - Timeline: 2050
  - Published biennually



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The Importance of CCS

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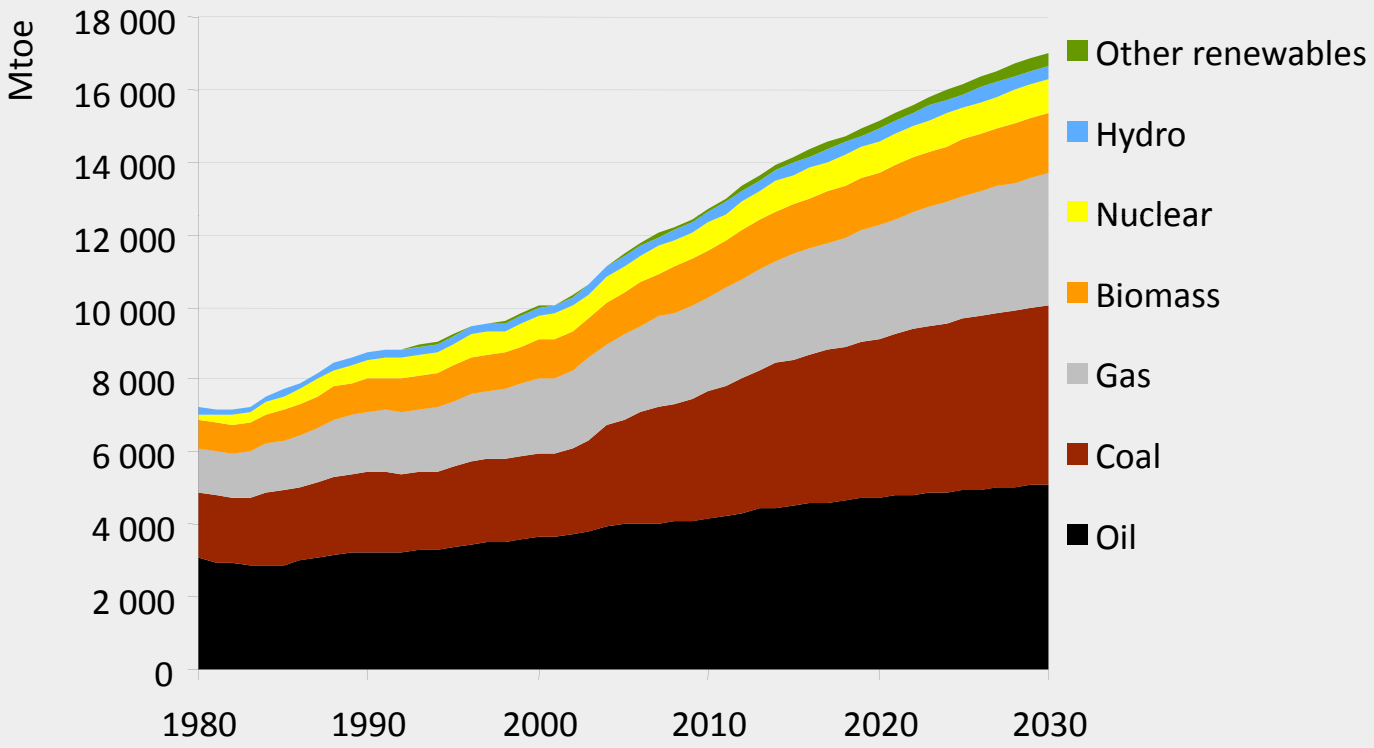
World primary energy demand in the Reference Scenario

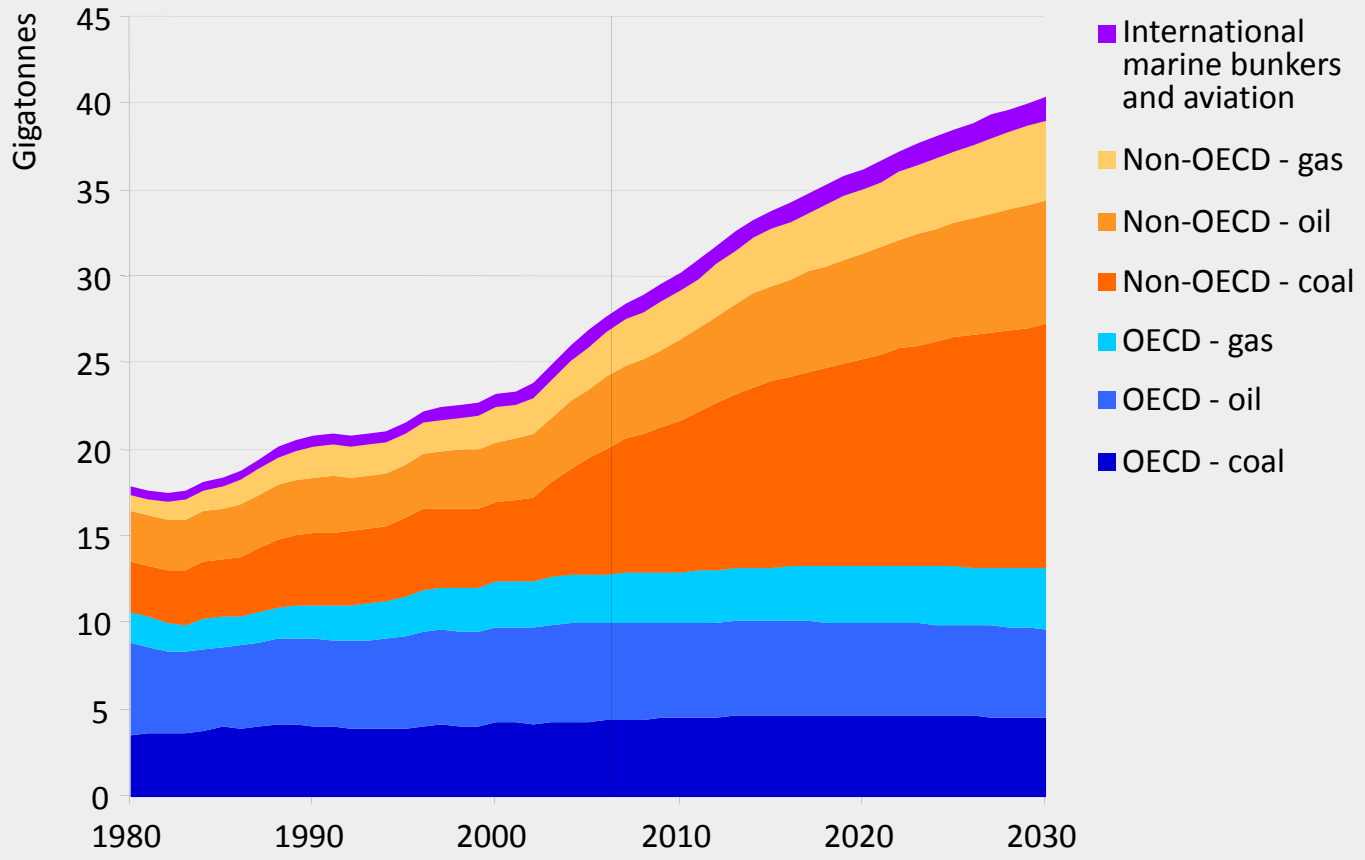
World Energy Outlook 2008



World energy demand expands by 45% between now and 2030 – an average rate of increase of 1.6% per year – with coal accounting for more than a third of the overall rise

Energy-related CO_2 emissions in the Reference Scenario

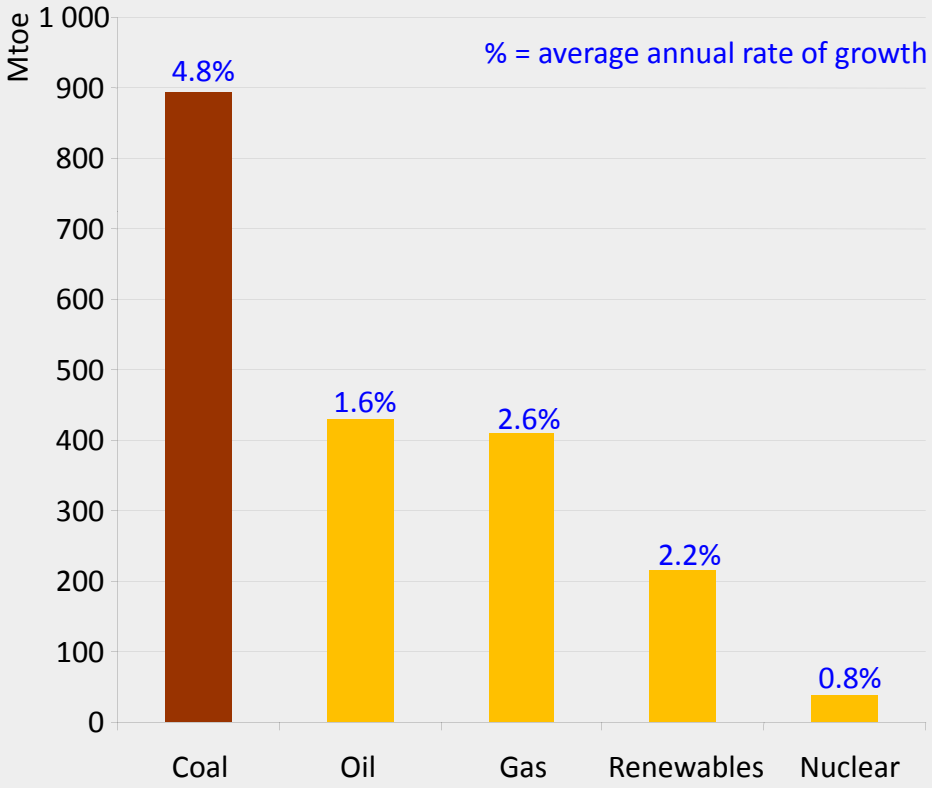
World Energy Outlook 2008

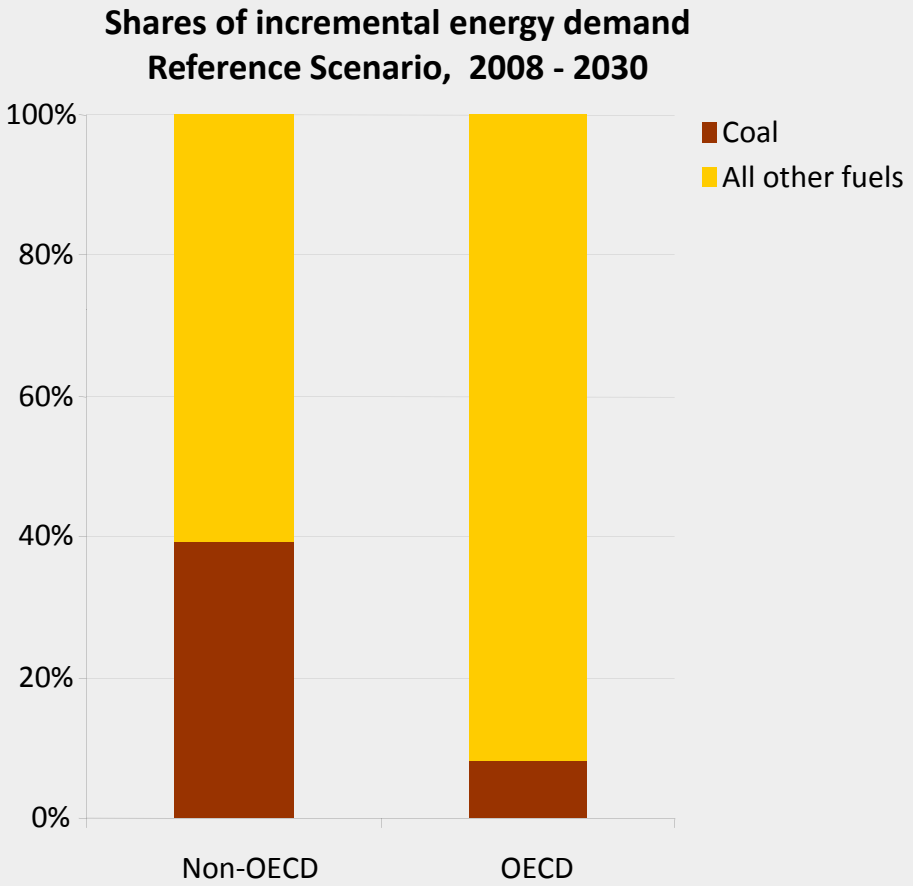


97% of the projected increase in emissions between now & 2030 comes from non-OECD countries – three-quarters from China, India & the Middle East alone

The continuing importance of coal in world primary energy demand

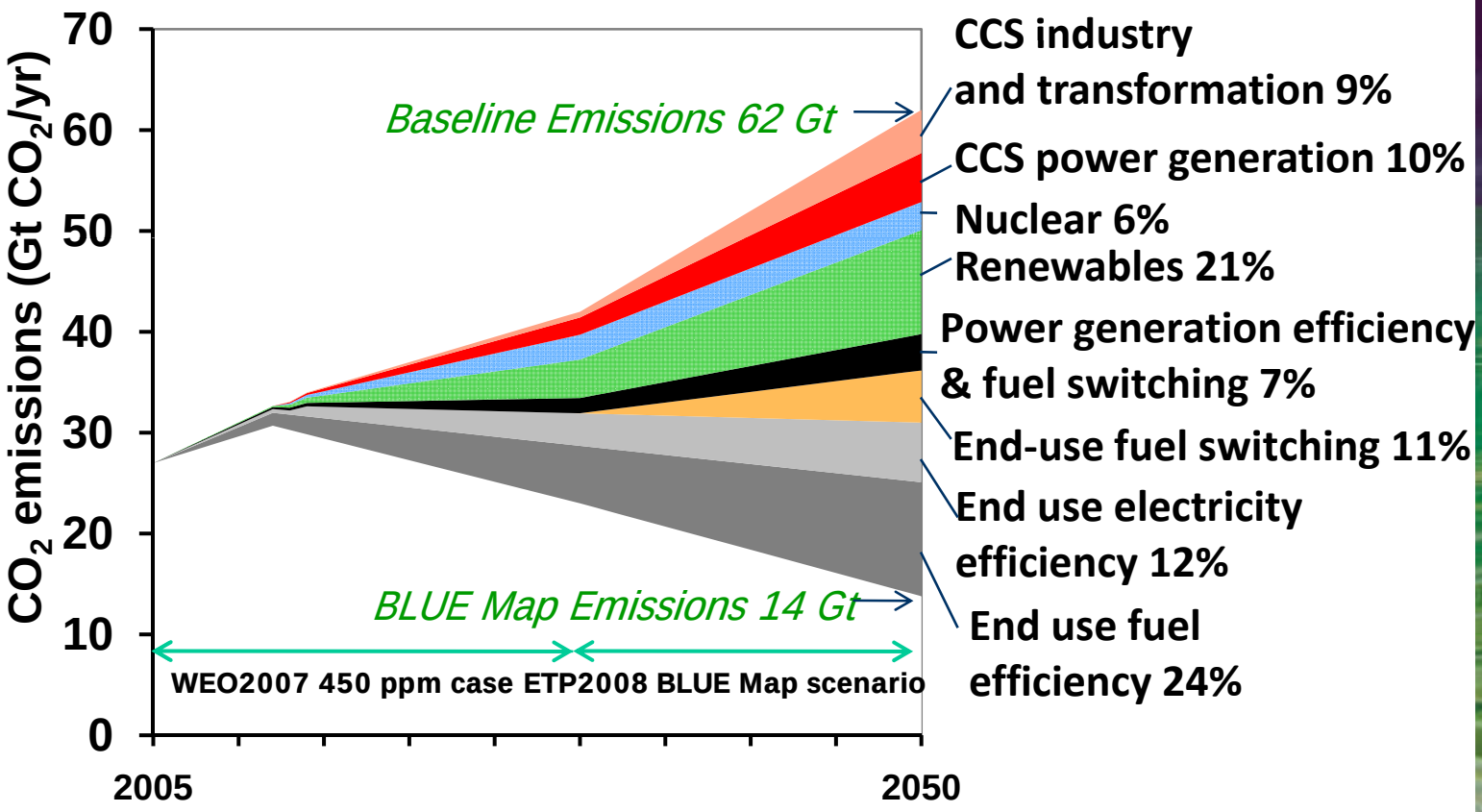
Office of the Chief Economist





Demand for coal has been growing faster than any other energy source & is projected to account for more than a third of incremental global energy demand to 2030

Achieving Global GHG Stabilisation Requires a Technology Revolution



IEA, *Energy Technology Perspectives* (2008).

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Scenarios & Strategies to 2050

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IEA roadmaps to accelerate clean energy technologies

- **Supply side**
  - CCS power generation
  - Coal – IGCC, USCSC
  - Nuclear III & IV
  - Solar photovoltaic
  - Concentrating solar power
  - Wind energy
  - Biomass electricity
  - Advanced electricity networks
  - Second-generation biofuels
- **Demand side**
  - Energy efficiency in buildings
  - Energy efficient motor systems
  - Efficient internal combustion engines
  - Heat pumps
  - Electric vehicles
  - Fuel cell vehicles
  - CCS in industry
  - Solar heating
  - Efficient industry processes (starting with Cement)

Roadmaps for technologies shown in purple will be published in 2009.

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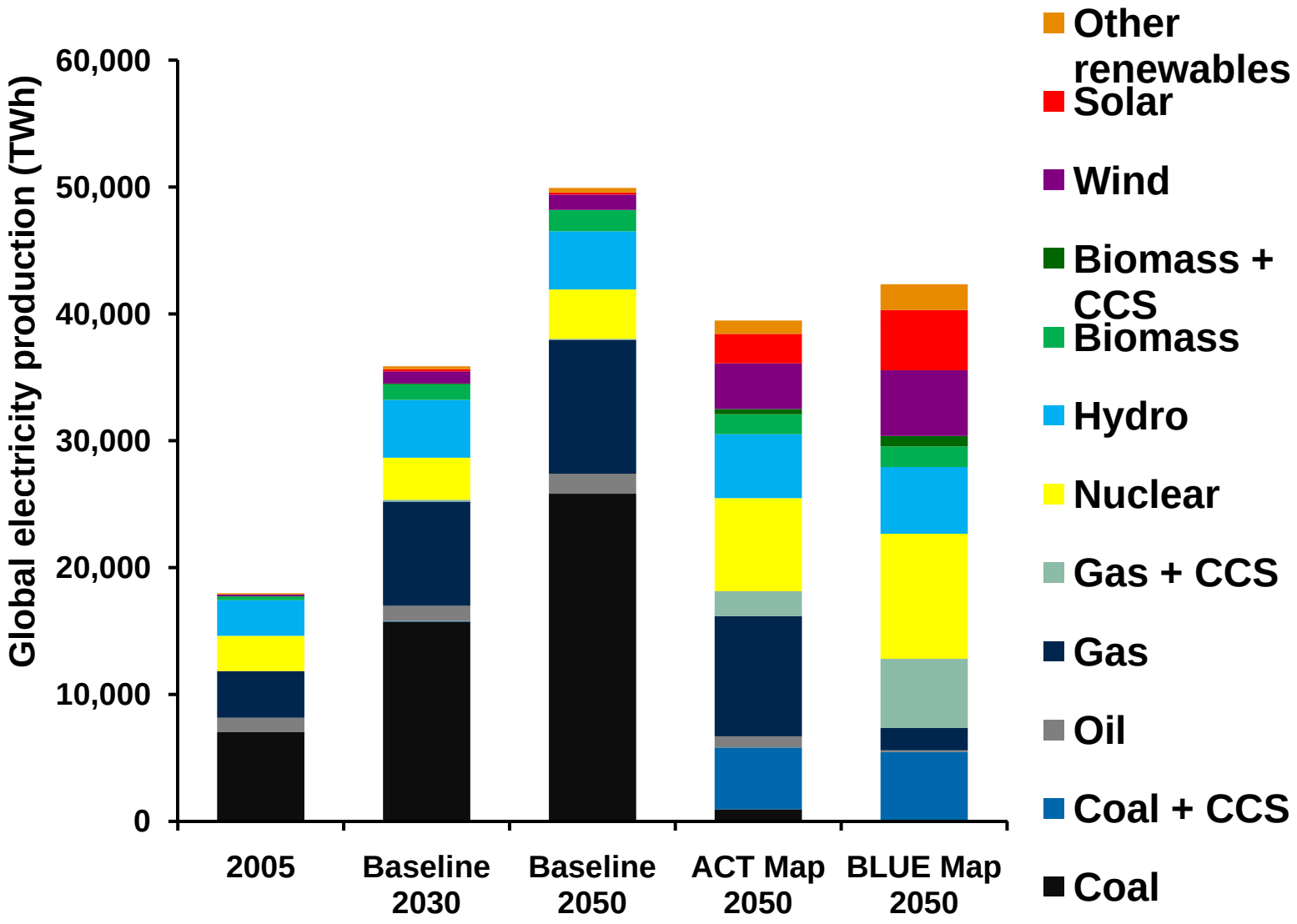
Global Power Generation Mix



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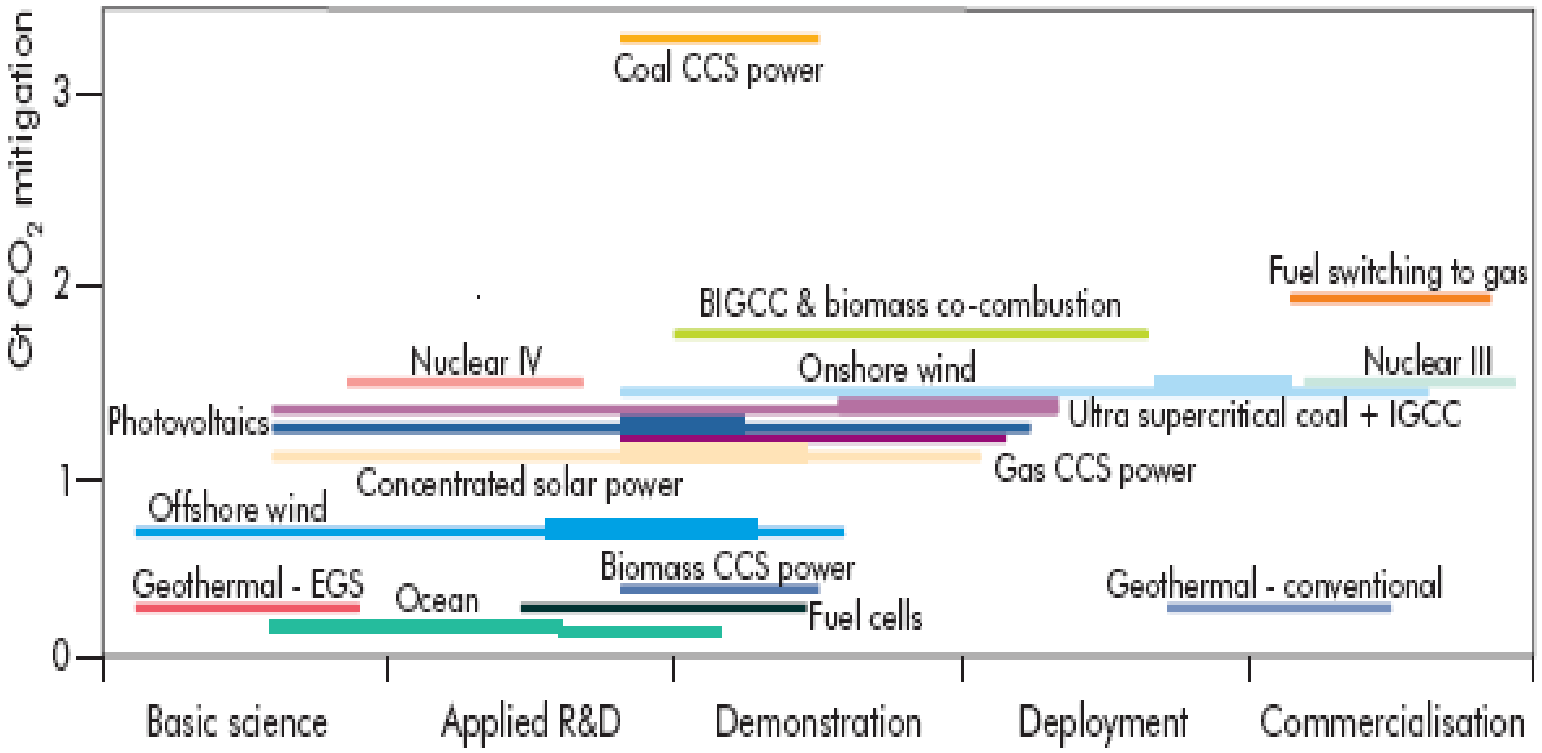
Technology RD&D Needs – Power Generation



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CCS in the Future: Challenges and Opportunities

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CCS Challenges

- **Financing large-scale, integrated demonstration projects**
  - Including retrofits and industrial sector CCS
- **Incorporating CCS into GHG mechanisms**
  - Emissions trading schemes
  - Clean Development Mechanism (CDM)
- **Developing legal frameworks**
  - To ensure safe, permanent CO_2 storage
- **Gaining public awareness / acceptance**
- **Technology diffusion**

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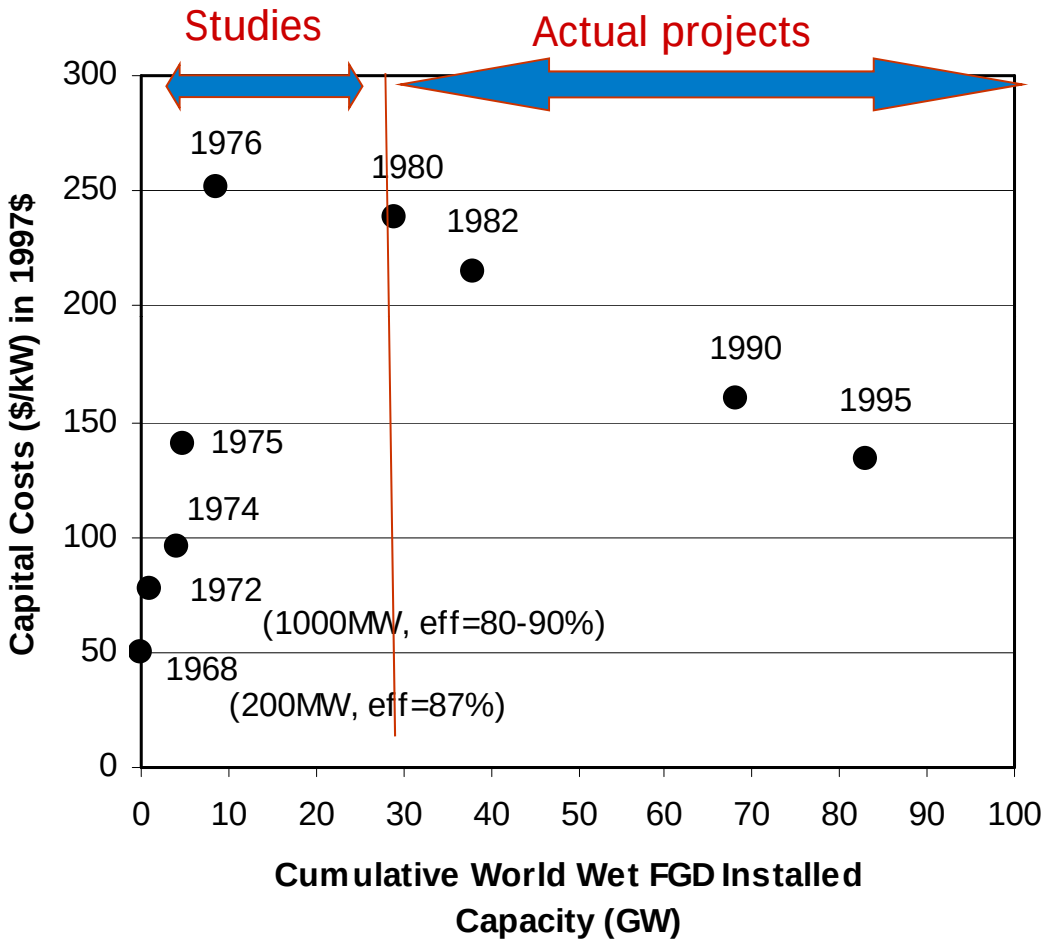
CCS Financing

- Different financing needs for near-term demonstration and longer-term commercial use
- For demonstration projects, USD 20B incremental funding needed
- Many proposals for special treatment for CCS in GHG emissions schemes
  - Bonus allowances
  - Use of allowance revenues to create special CCS funds
- Economic stimulus packages supporting CCS
  - EU infrastructure package
  - US $3-5B support for demos; tax credit of $20/tonne stored
- CO_2 pipeline transport presents unique challenges in financing, site selection, access rules

Pollution Control Technology Cost Reductions – An Example



FGD = Flue Gas desulphurisation

SCR = Selective catalytic reduction

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Legal & Regulatory Actions

- **Rapid growth of activity in this area**
  - **EU CCS Directive**
  - **London Protocol / OSPAR amendments**
  - **US, Australia, Canada, Japan frameworks**
- **Need to develop flexible, adaptive approaches for early demonstration projects**
  - **Project-specific regulations**
  - **Amendments to existing oil & gas laws**
  - **Require monitoring data from projects**
- **Take permitting schemes, site selection, and M&V methodologies to the next level of detail**
  - **Share results internationally to aid harmonisation**
  - **IPCC 2006 *Inventory Guidelines* a good start**

CCS Regulation Updates - Australia

- **Passed amendment to *Offshore Petroleum Act 2006* which establishes**
  - **property access and property rights**
  - **approvals process to ensure safe and secure storage**
  - **gives regulators power to mitigate/remediate**
  - **mechanisms for interactions with other resource users, especially petroleum**
  - **long term liability framework**
- **10 offshore areas have been released for bidding for exploration permits.**
  - **Successful bidders will have the exclusive right to convert to injection licences, subject to successful exploration and approvals**
  - **Details available from www.ret.gov.au**
- **Some States have developed similar frameworks for their jurisdictions**

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CCS Regulation Updates - Canada

- **Federal/Provincial jurisdictional split**
  - Alberta, Saskatchewan, and BC have well-developed regulatory frameworks for acid gas disposal that include CO_2 injection and monitoring
  - Groundwater protection will fall to provinces

- **Additional issues include long-term liability, M&V, and linkages to GHG regulations**
  - ERCB expects to produce a public document in 2009 with specific regulatory requirements and associated application process for CO_2 disposal
  - Alberta – GHG regulatory framework includes technology fund for CCS, offsets from CO_2 storage; draft long-term liability framework developed
  - Federal government CO_2 intensity limit appears to mandate CCS after 2015

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CCS Regulation Updates - Europe

- **CCS not included in 20% GHG reduction goal for 2020**
- **CCS goal is 12 large-scale demonstrations by 2015**
- **CO_2 capture and transport handled under existing directives**
- **CCS Directive contains framework for CO_2 storage**
  - Permits for exploration
  - Site characterisation and selection criteria
  - Performance-based CO_2 acceptance criteria
  - Monitoring and reporting obligations, notifications for leakage
  - State assumes long-term liability after performance hurdle met
- **For EU ETS, CO_2 captured and stored will not be considered as emitted**
- **Recent decision to set aside 300 M allowances for funding Zero Emissions Platform (ZEP) projects**
- **Financial rescue package also allocates some infrastructure financing to CCS**

Public Awareness

- Need to move beyond opinion surveys
- Pioneering public consultation work being done at local level
  - US Regional Sequestration Partnerships
  - EU ACCSEPT
  - Australia
- Need to synthesize lessons learned from these efforts and share internationally
- Near term focus on public consultation at the local level for demo projects

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The IEA's CCS Activities

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International Collaboration: the IEA CCS Roadmap

- Facilitate greater international coordination
- Accelerate deployment process
- Provide detailed action items for policy makers, industry, NGOs
- Reduce costs, improve efficiencies
- Build from existing efforts
- Engage emerging economies

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Roadmap Activities

- Set a baseline for current capture, transport and storage RD&D globally
  - Identify breakthrough technologies
  - Identify duplication and gaps
- Identify metrics for capture, transport, storage
- Identify financing options, pros/cons
- Identify regulatory, public awareness action items
- Identify strategies for emerging economies
  - Series of CCS Roundtables
  - Donors' conference planned
- Publish at IEA/CSLF Ministerial October 2009

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CCS Roadmap - Early Findings

- **The number of major CCS demonstration efforts is expanding…**
  - **Alberta, Canada; Australia, US, EU: multi-billion financing for demonstration in 2009**
  - **China's GreenGen, Brazil, S. African initiatives rapidly growing**
- **…but some major economies / regions are not sufficiently investing in CCS**
- **CCS must be urgently demonstrated in key industrial sectors (cement, iron & steel, chemicals)**
- **CCS retrofit demonstrations at coal-fired power plants urgently needed**
- **CCS biomass research & development not receiving sufficient investment**

The next 10 years are critical

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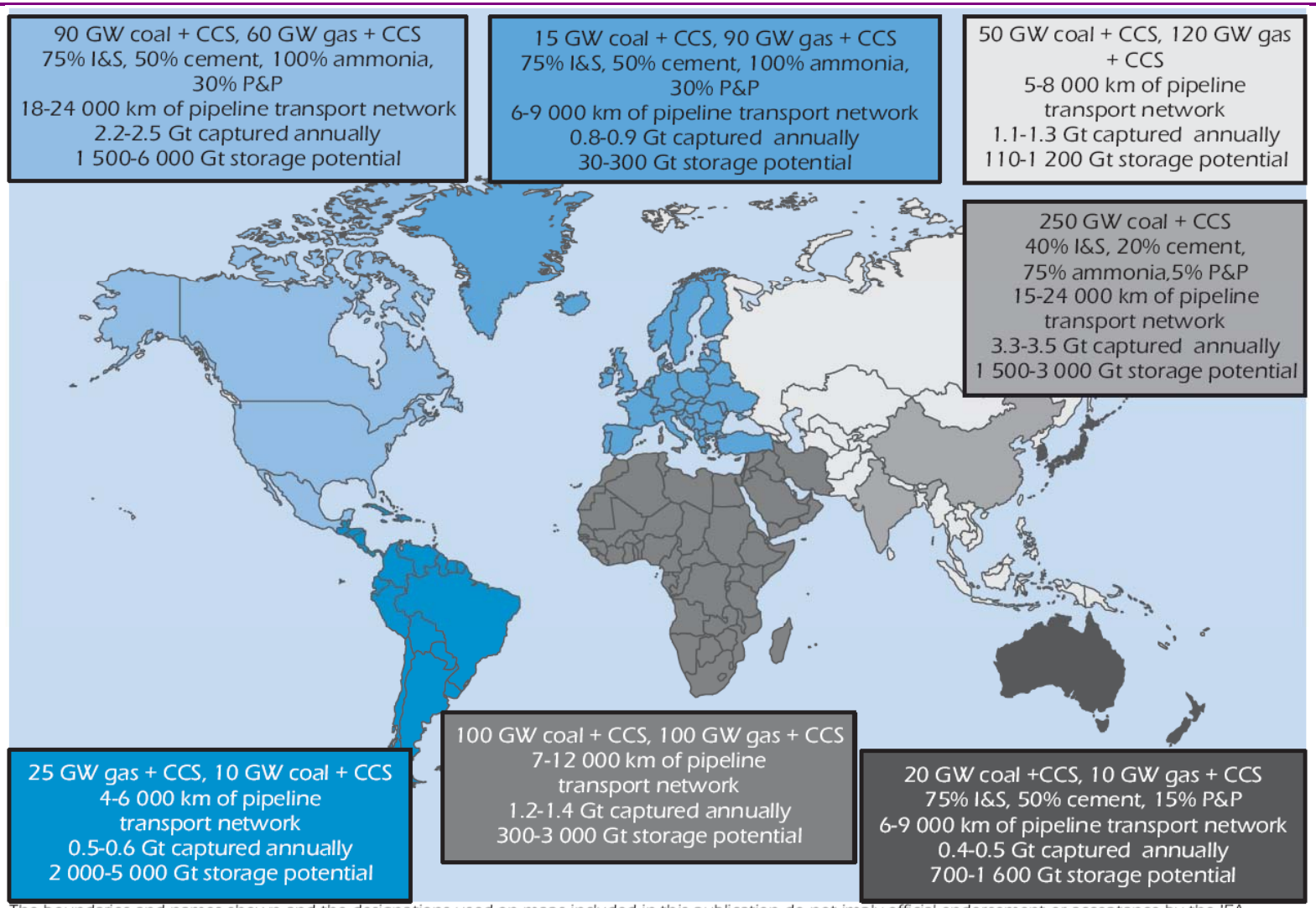
One Vision for 2050



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Thank you

www.iea.org/Textbase/subjectqueries/cdcs.asp

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