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Energy Technologies for a Low Carbon Future

Insights from Energy Technology Perspectives 2008

Dr Peter Taylor

Acting Head, Energy Technology Policy Division

IEA Side-Event: *You say you want a revolution – energy policy and technology for a sustainable future*

COP14, Wednesday, 10 December 2008, 7.30-9.00 pm

Background

- Request for alternative scenarios by G8 at Gleneagles summit (2005)
- ETP2008 launched in Tokyo on 6 June 2008
- Conclusions reported to G8 Energy Ministers (June) and G8 Leaders (July)

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ETP2008: Coverage

- **Which technologies can reduce CO_2 emissions between now and 2050?**
- **How much will it cost?**
- **What need to be done to promote technology research, demonstration & deployment?**

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ETP2008: Content

- **Scenarios to 2050**
  - Baseline
  - ACT (CO_2 emissions stabilisation)
  - BLUE (50 % reduction in CO_2 emissions)
- **Technology Analysis**
  - Power sector
  - End-use sectors
- **Transition Roadmaps**
  - 17 Key technologies

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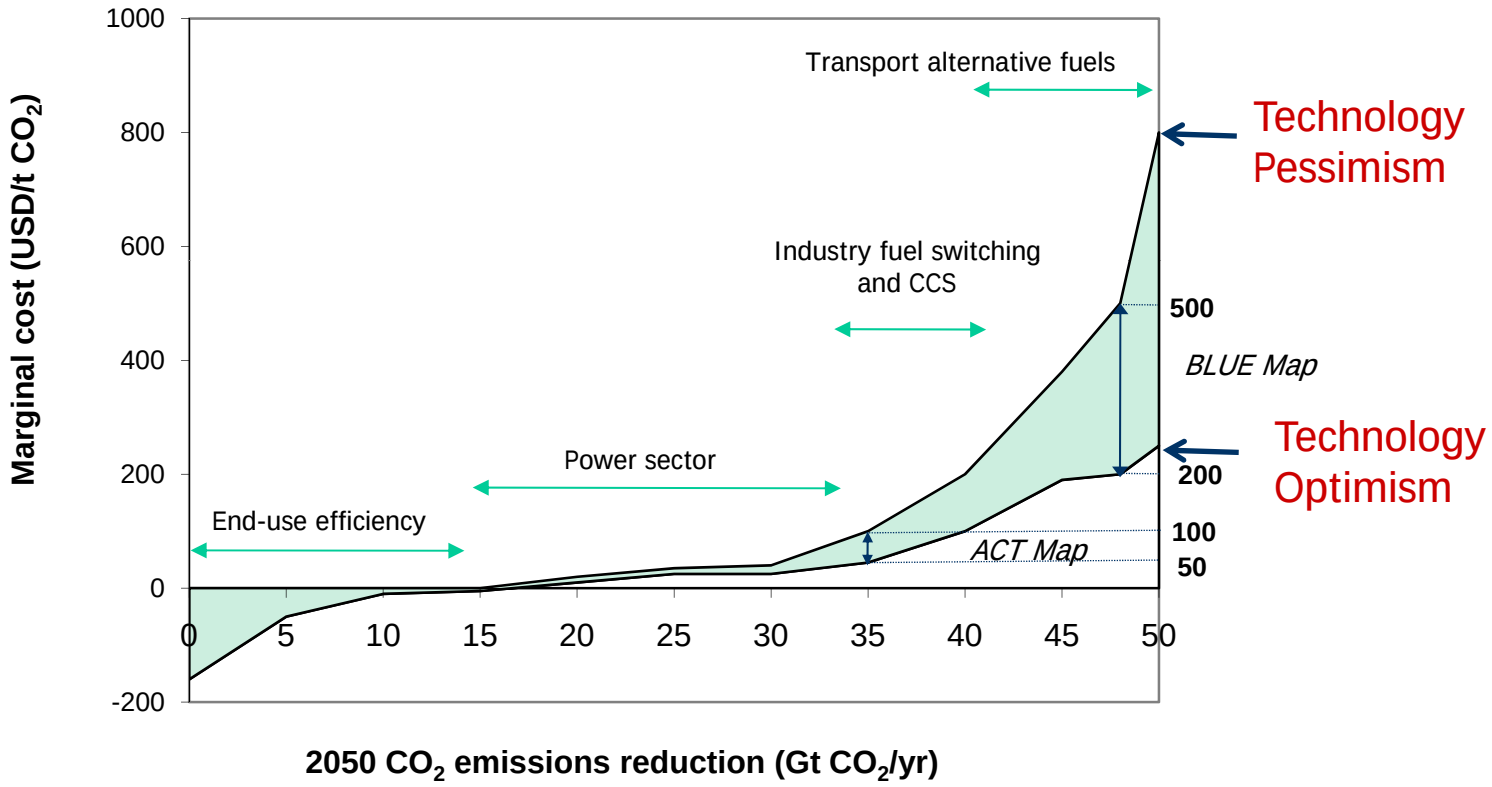
A New Energy Revolution?



To bring emissions back to current levels by 2050 options with a cost up to USD 50/t are needed. Reducing emissions by 50% would require options with a cost up to USD 200/t.

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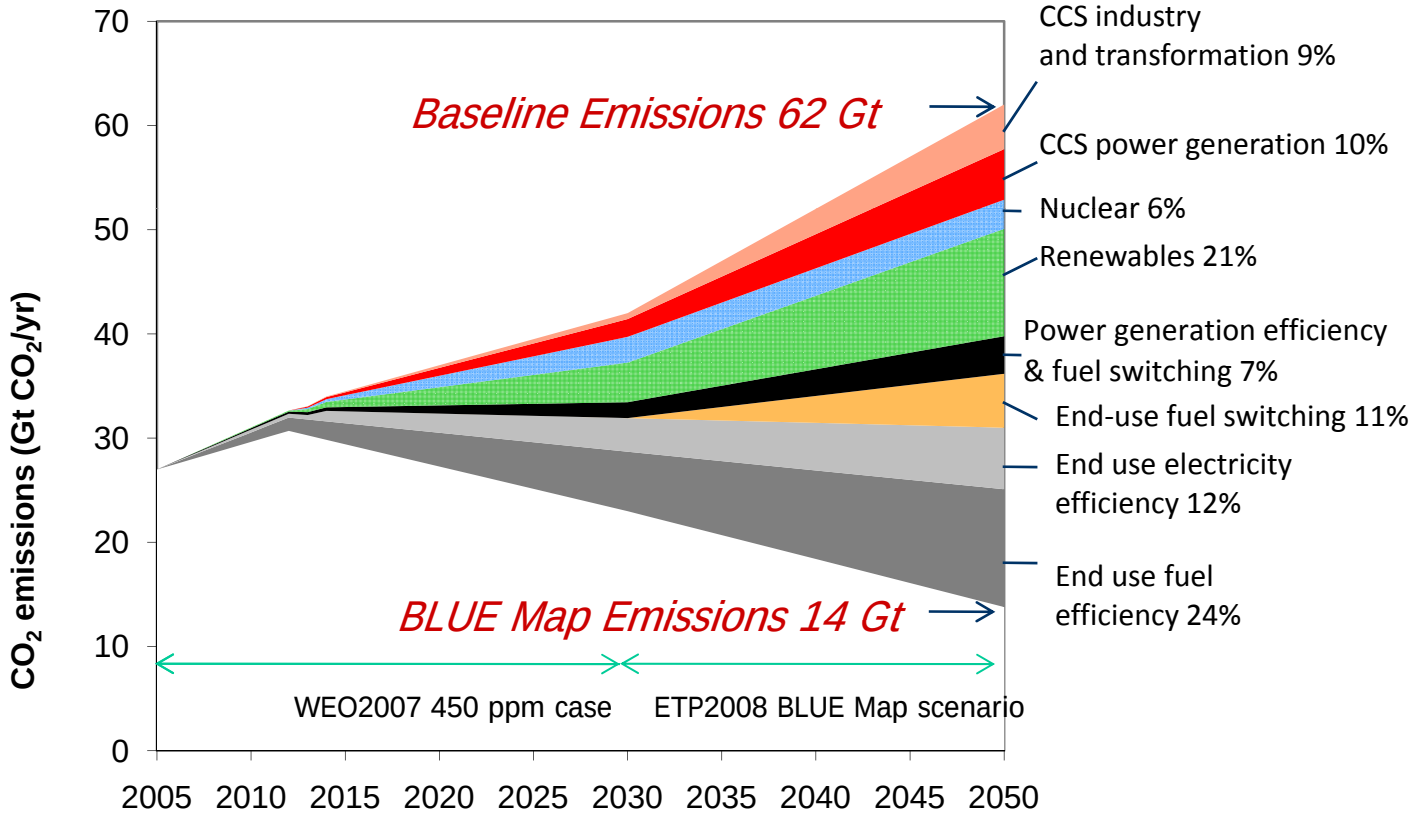
Contributions of Technology Wedges



Key options are end-use efficiency (36%), renewables (21%) and CCS (19%)

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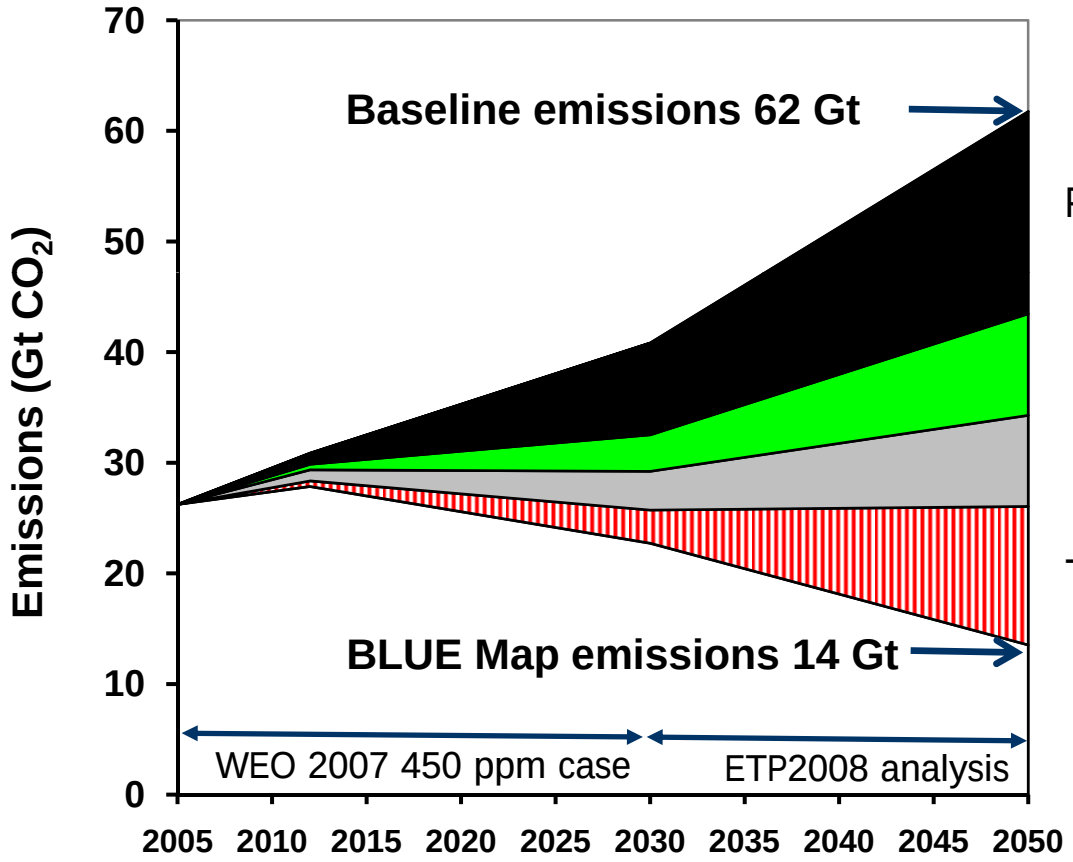
Sectoral Contributions



Power sector (38%)

Industry (19%)

Buildings (17%)

Transport (26%)

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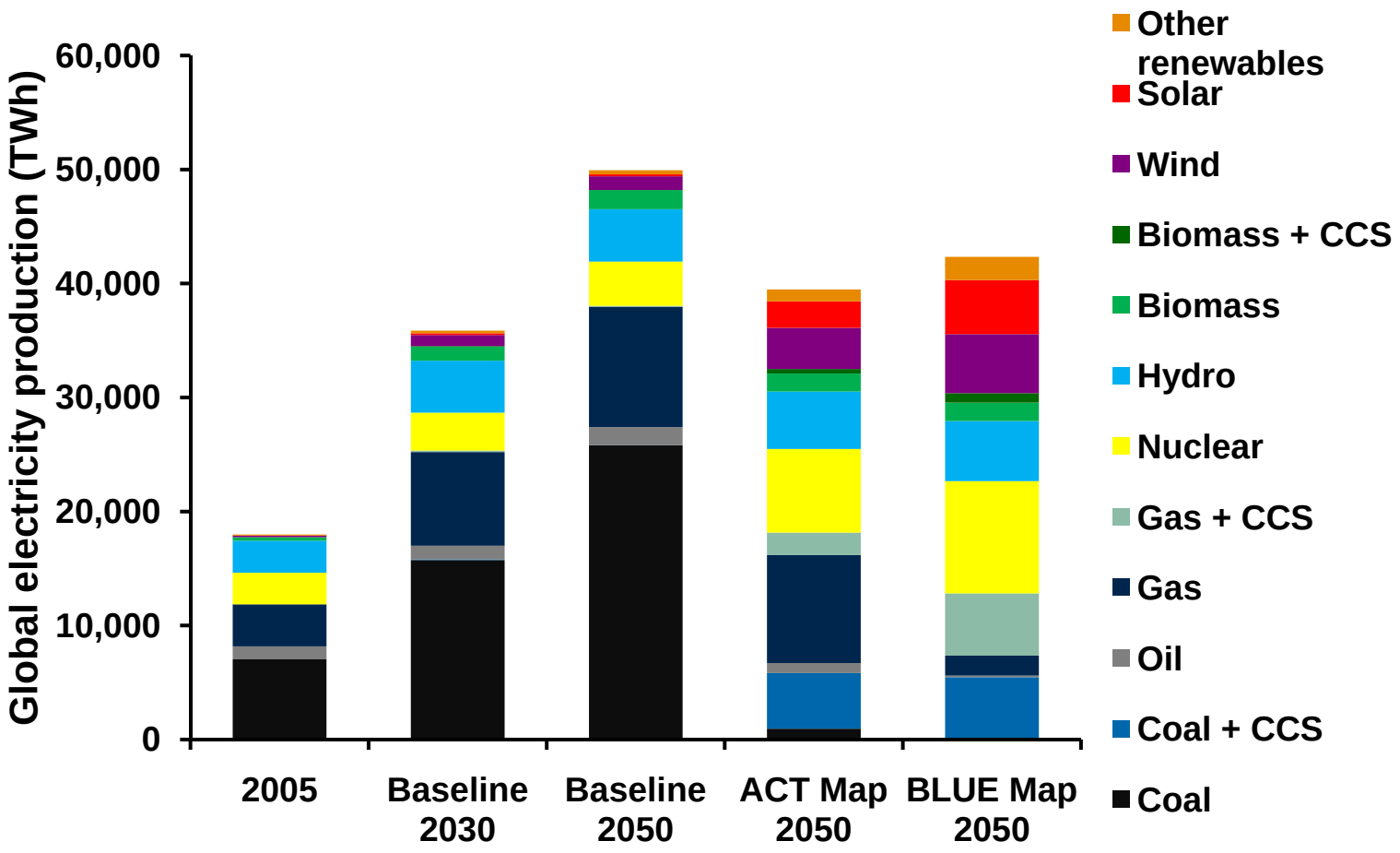
Power Generation Mix



25% nuclear, 25% fossil + CCS, nearly 50% renewables

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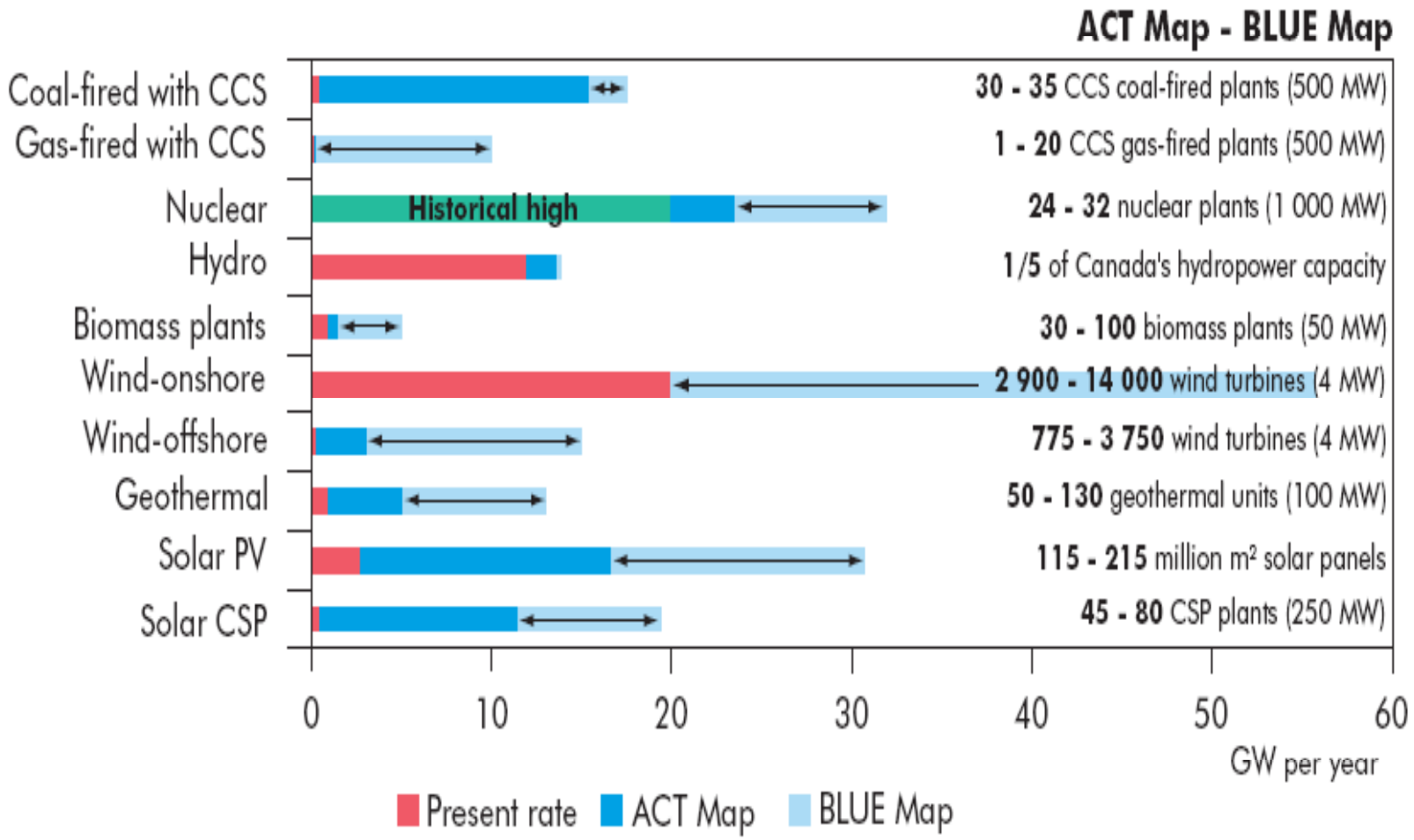
Average Annual Power Generation Capacity Additions, 2010 – 2050



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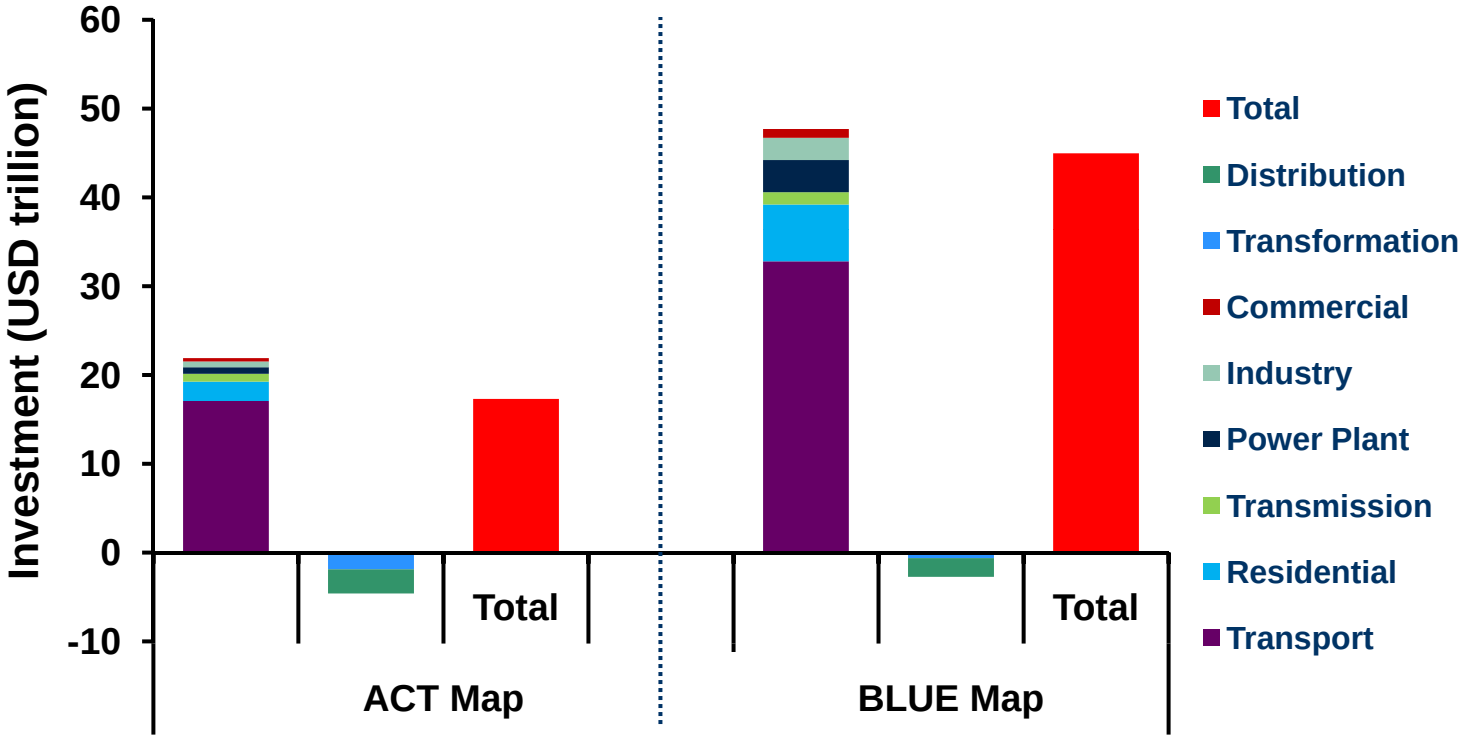
Total Additional Cumulative Investment (2005-2050)



Demand-side investments dominate additional investment needs above the Baseline scenario, energy efficiency helps to reduce upstream investment needs in energy supply and transportation infrastructure

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Need for Extra Energy RD&D

- Both public and private energy RD&D investments have declined since the early 1980s
- Current IEA Governments energy RD&D - USD 10 billion/yr
- Nuclear dominates government RD&D
- Companies energy RD&D - USD 40-60 billion/yr
- Information about industrial energy RD&D trends is scarce
- Unclear how much RD&D would be "sufficient" to meet the goals
  - Literature suggests USD 10-100 billion/yr additional investments
- Leave it to industry or role for government ?
- Cooperation or competition model ?

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Roadmaps

17 technology roadmaps provide 87% of CO_2 savings under the Blue scenario

- Potentials
- Pathways to commercialization
- Technology targets
- How to get there
- Key actions needed
- Key areas for international cooperation

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Key Technology Options (Roadmaps)

- **Supply side**
  - CCS power generation
  - Nuclear III + IV
  - Wind
  - Biomass – IGCC & co-combustion
  - Solar – PV
  - Solar – CSP
  - Coal – IGCC
  - Coal – USCSC
  - 2nd generation biofuels

- **Demand side**
  - Energy efficiency in buildings
  - Heat pumps
  - Solar space and water heating
  - Energy efficiency in transport
  - Electric and plug-in vehicles
  - Fuel cell vehicles
  - CCS in industry
  - Industrial motor systems

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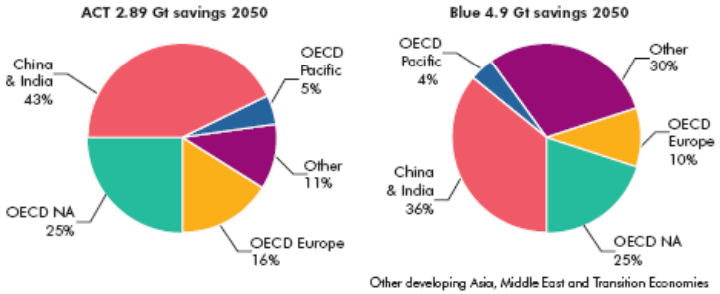
Roadmaps – Example CCS
10 % of CO_2 reduction potential in BLUE Map

CO_2 Capture and Storage - Fossil-Fuel Power Generation



Other developing Asia, Middle East and Transition Economies

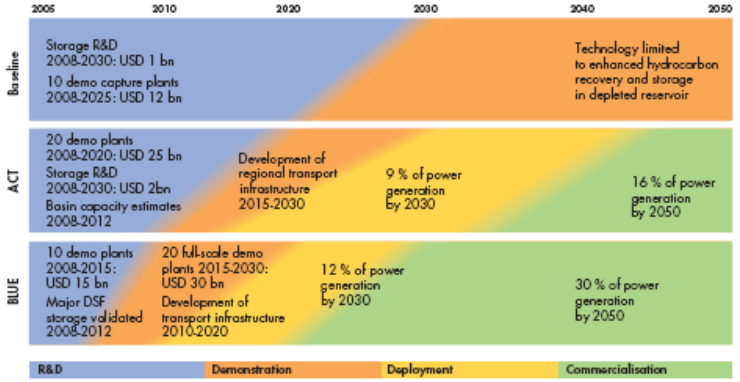
	Global Deployment Share 2030	RDD&D Inv. Cost USD bn 2005-2030	Commercial Inv. Cost* USD bn 2030-2050
OECD NA	35%	25-30	160-180
OECD Europe	35%	25-30	100-120
OECD Pacific	10%	7-8	30-40
China & India	15%	10-12	280-300
Other	5%	3-4	60-70

	Global Deployment Share 2030	RDD&D Inv. Cost USD bn 2005-2030	Commercial Inv. Cost* USD bn 2030-2050
OECD NA	35%	30-35	350-400
OECD Europe	35%	30-35	150-200
OECD Pacific	10%	10-12	70-80
China & India	15%	12-14	450-500
Other	5%	4-5	300-350

Technology Targets

	ACT: Emissions Stabilisation	BLUE: 50% Emissions reduction
RD&D		
Capture technologies for three main options (post-combustion, pre-combustion, and oxy-fuelling)	Technologies tested in small- and large-scale plants. Cost of CO_2 avoided around 50 USD/t by 2020. Chemical looping tested	
Demonstration targets	20 large-scale demo plants with a range of CCS options, including fuel type (coal/gas/biomass) by 2020	30 large-scale demo plants with a range of CCS options, including fuel type (coal/gas/biomass) by 2020
New gas-separation technologies: membranes & solid adsorption	New capture concepts: next-generation processes, such as membranes, solid absorbers and new thermal processes	
Technology transfer	Technology transfer to China and India	Technology transfer to all transition and developing countries
Deployment		
Regional pipeline infrastructure for CO_2 transport	Major transportation pipeline networks developed and CO_2 maritime shipping	
Deployment targets	Early commercial large-scale plants by 2015 (ZEP, ZeroGen, GreenGen)	30% of electricity generated from CCS power plant

Technology Timeline



Key Actions Needed

- Develop and enable legal and regulatory frameworks for CCS at the national and international levels, including long-term liability regimes and classification of CO_2.
- Incorporate CCS into emission trading schemes and clean development mechanisms.
- RD&D to reduce capture cost and improve overall system efficiencies.
- RD&D for storage integrity and monitoring. Validation of major storage sites. Monitor and valuation methods for site review, injection & closure periods.
- Raise public awareness and education on CCS.
- Assessment of storage capacity using Carbon Sequestration Leadership Forum methodology at the national, basin and field levels.
- New power plants built after 2020 to have CCS.
- New power plants to be "capture-ready" after 2015.

Key Areas for International Collaboration

- Development and sharing of legal and regulatory frameworks.
- Develop international, regional and national instruments for CO_2 pricing, including CDM and ETS.
- Raise public awareness and education.
- Sharing best practices and lessons learnt from demonstration projects (pilot and large-scale).
- Joint funding of large-scale plants in developing countries by multi-lateral lending institutions, industry and governments.
- Development of standards for national and basin storage estimates and their application.
- Organizations: CSLF, IEA GHG, IEA CCC, IPCC.

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Key Messages from ETP2008

- **Deep emission cuts are technically achievable**
  - **Significant investment required**
  - **Credible long-term targets needed**
- **This change is urgent**
  - **Capital stock turnover is slow**
  - **Technology development needs time**
  - **Non-cost barriers should be addressed**
- **Global energy technology revolution needed**
  - **Cooperation with DCs is essential**

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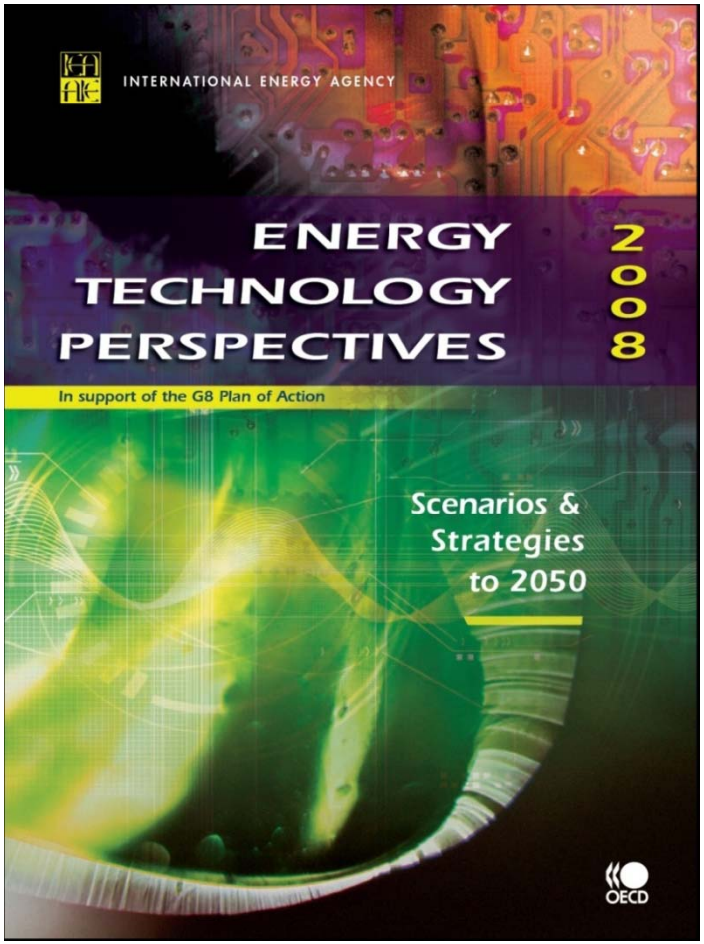
Thank You !



peter.taylor@iea.org