

INTERNATIONAL

ENERGY

AGENCY



# Energy Technologies for a Low Carbon Future

*Insights from Energy Technology Perspectives 2008*

Dr Peter Taylor

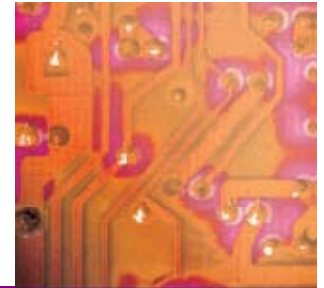
Acting Head, Energy Technology Policy Division

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)



ENERGY  
TECHNOLOGY  
PERSPECTIVES  
2008

Scenarios &  
Strategies  
to 2050

INTERNATIONAL

ENERGY

AGENCY



# ETP2008: Coverage

- Which technologies can reduce CO<sub>2</sub> emissions between now and 2050?
- How much will it cost?
- What need to be done to promote technology research, demonstration & deployment?



# ETP2008: Content

## ● Scenarios to 2050

- Baseline
- ACT (CO<sub>2</sub> emissions stabilisation)
- BLUE (50% reduction in CO<sub>2</sub> emissions)

## ● Technology Analysis

- Power sector
- End-use sectors

## ● Transition Roadmaps

- 17 Key technologies

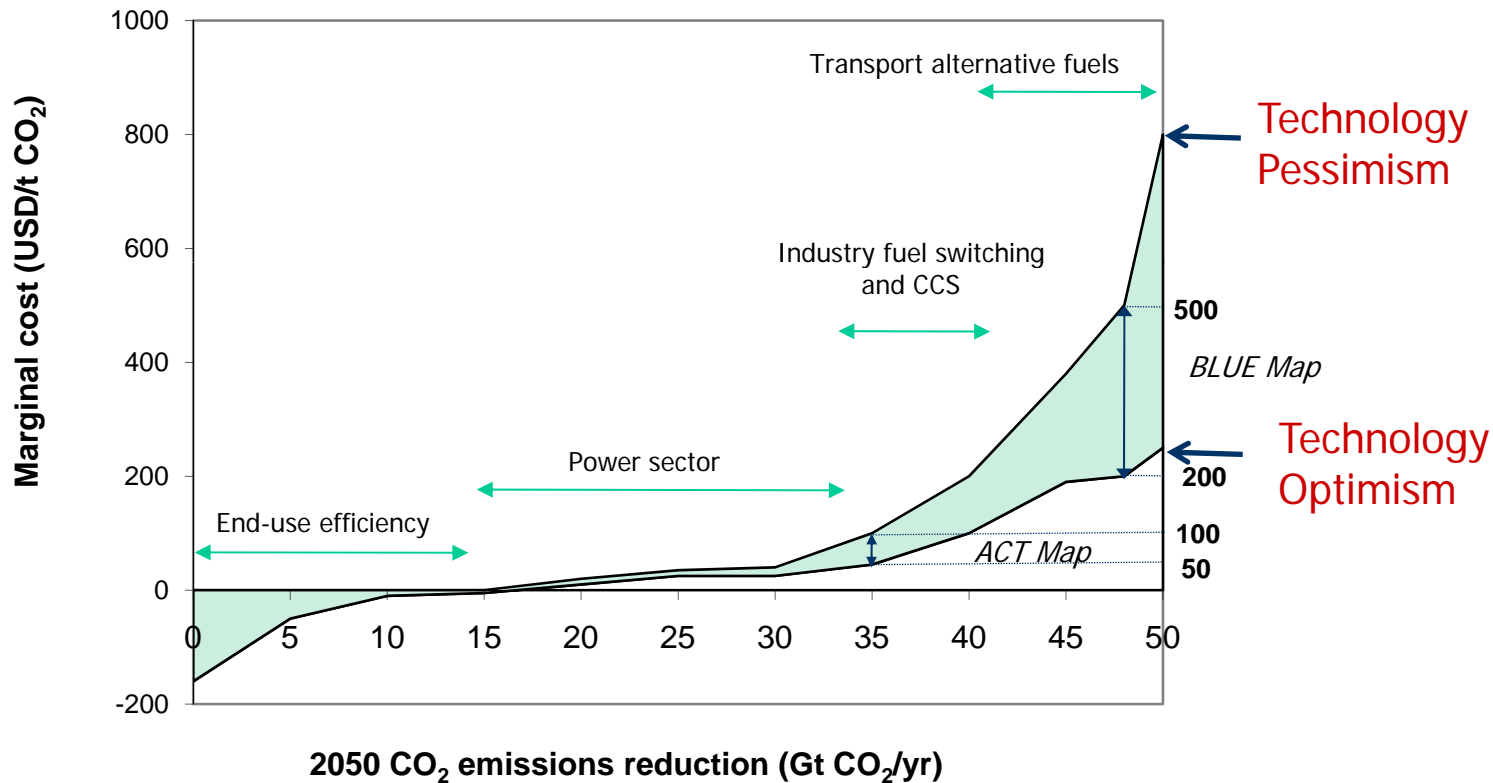


ENERGY  
TECHNOLOGY  
PERSPECTIVES  
2008

Scenarios &  
Strategies  
to 2050

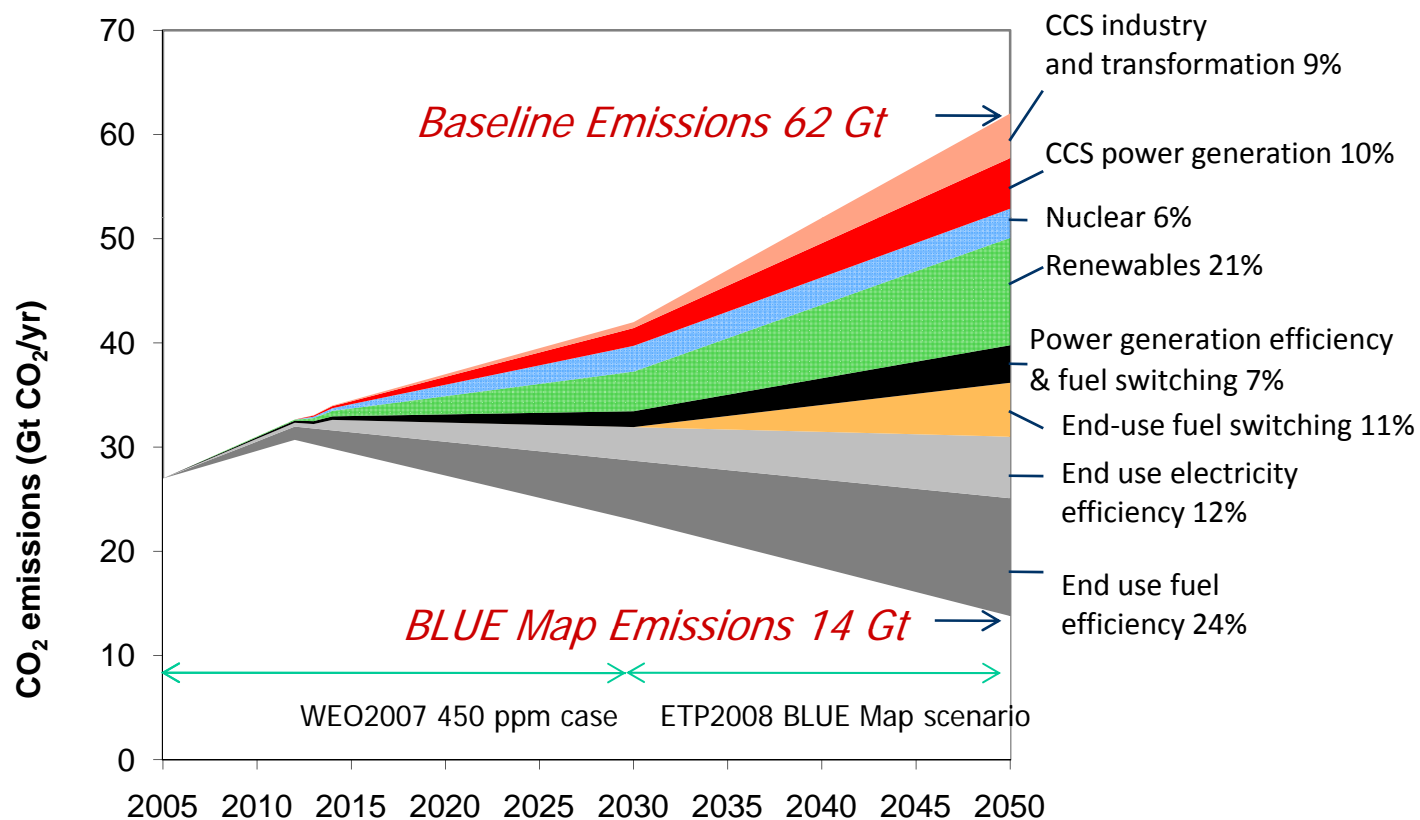
INTERNATIONAL  
ENERGY  
AGENCY 

# 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.*

# Contributions of Technology Wedges



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

ENERGY  
TECHNOLOGY  
PERSPECTIVES  
2008

Scenarios &  
Strategies  
to 2050

INTERNATIONAL

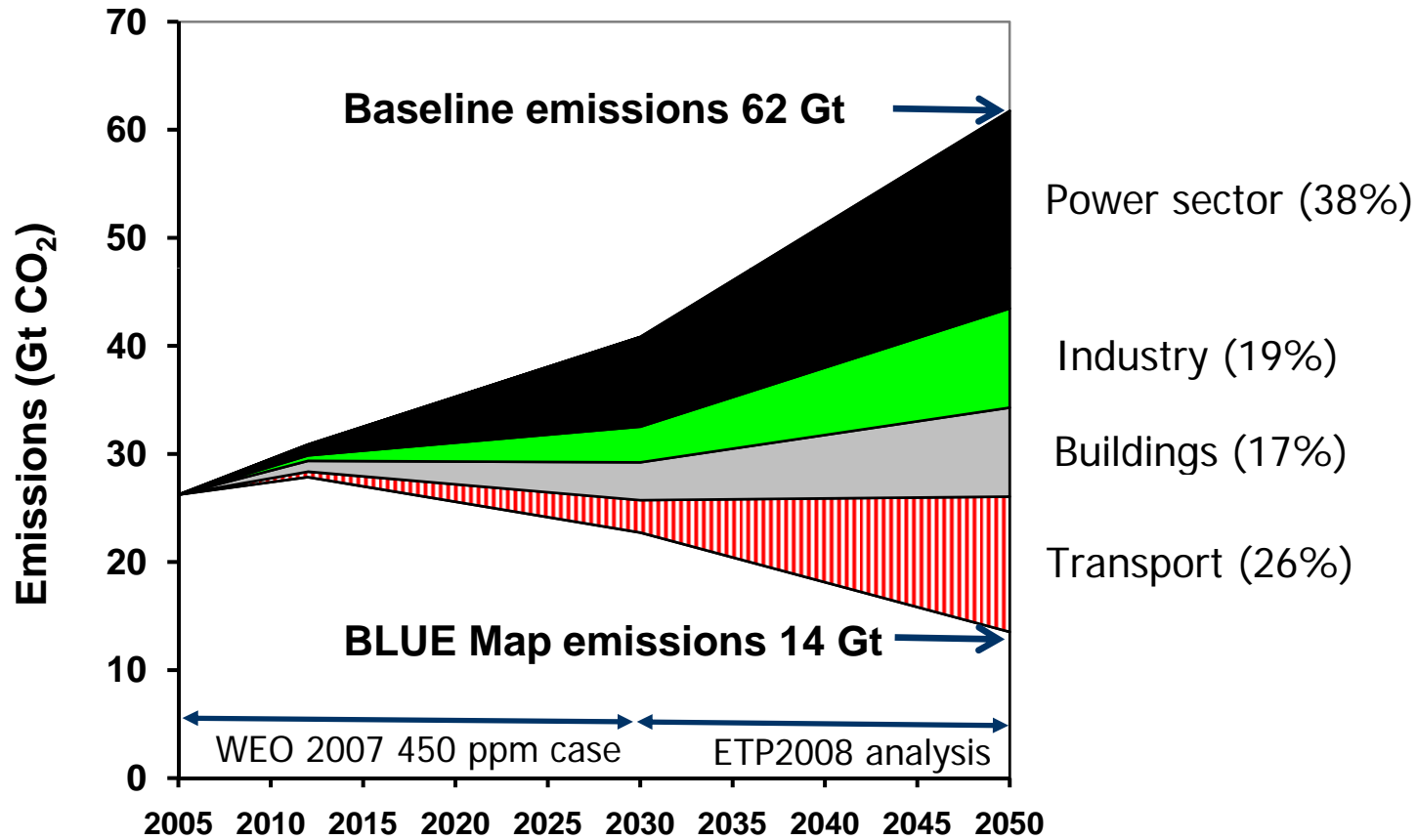
ENERGY

AGENCY





# Sectoral Contributions



ENERGY  
TECHNOLOGY  
PERSPECTIVES  
2008

Scenarios &  
Strategies  
to 2050

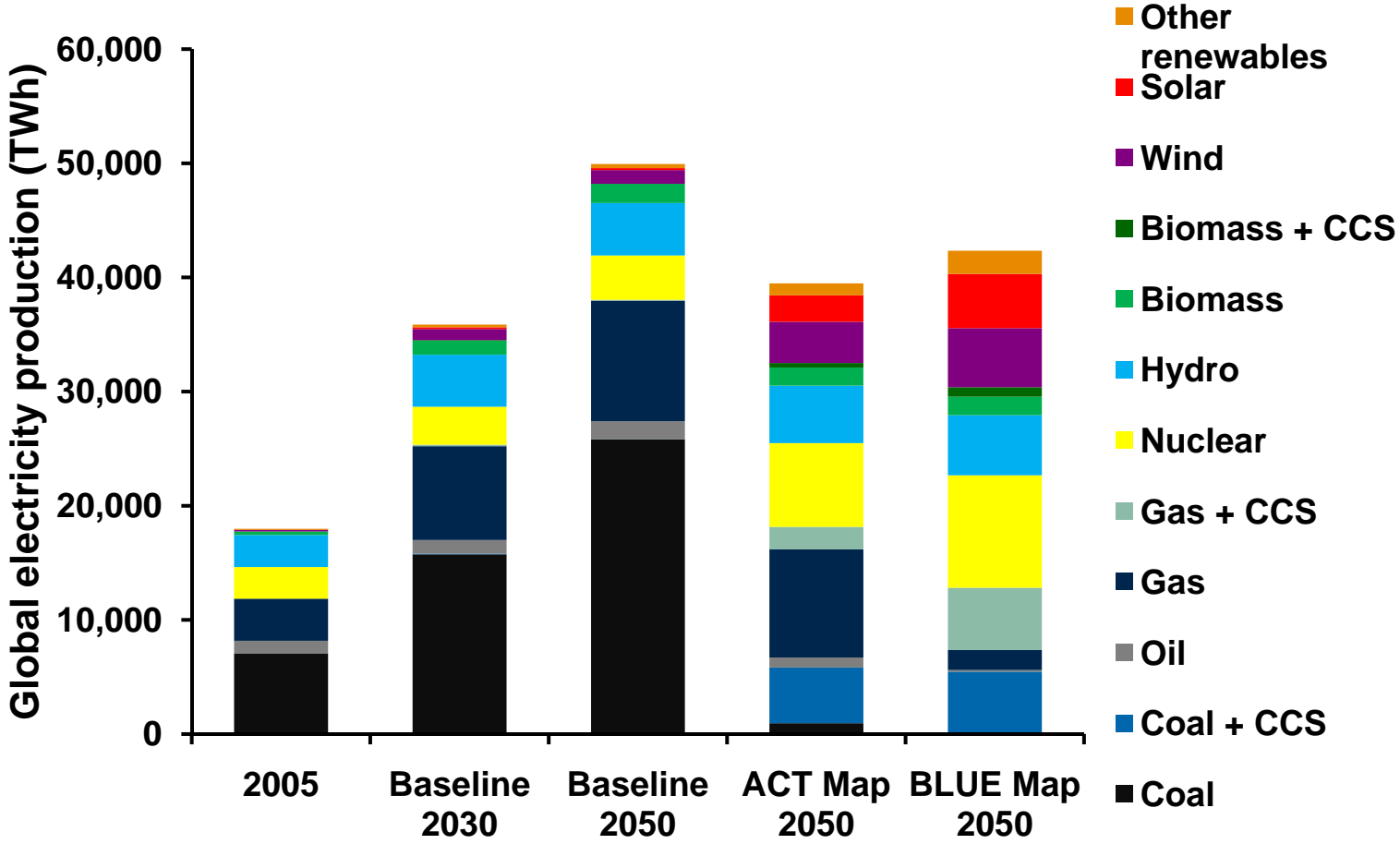
INTERNATIONAL

ENERGY

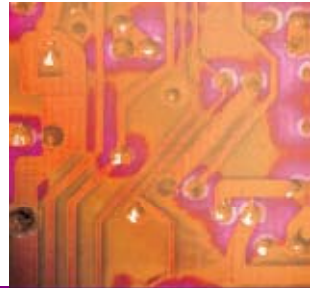
AGENCY



# Power Generation Mix

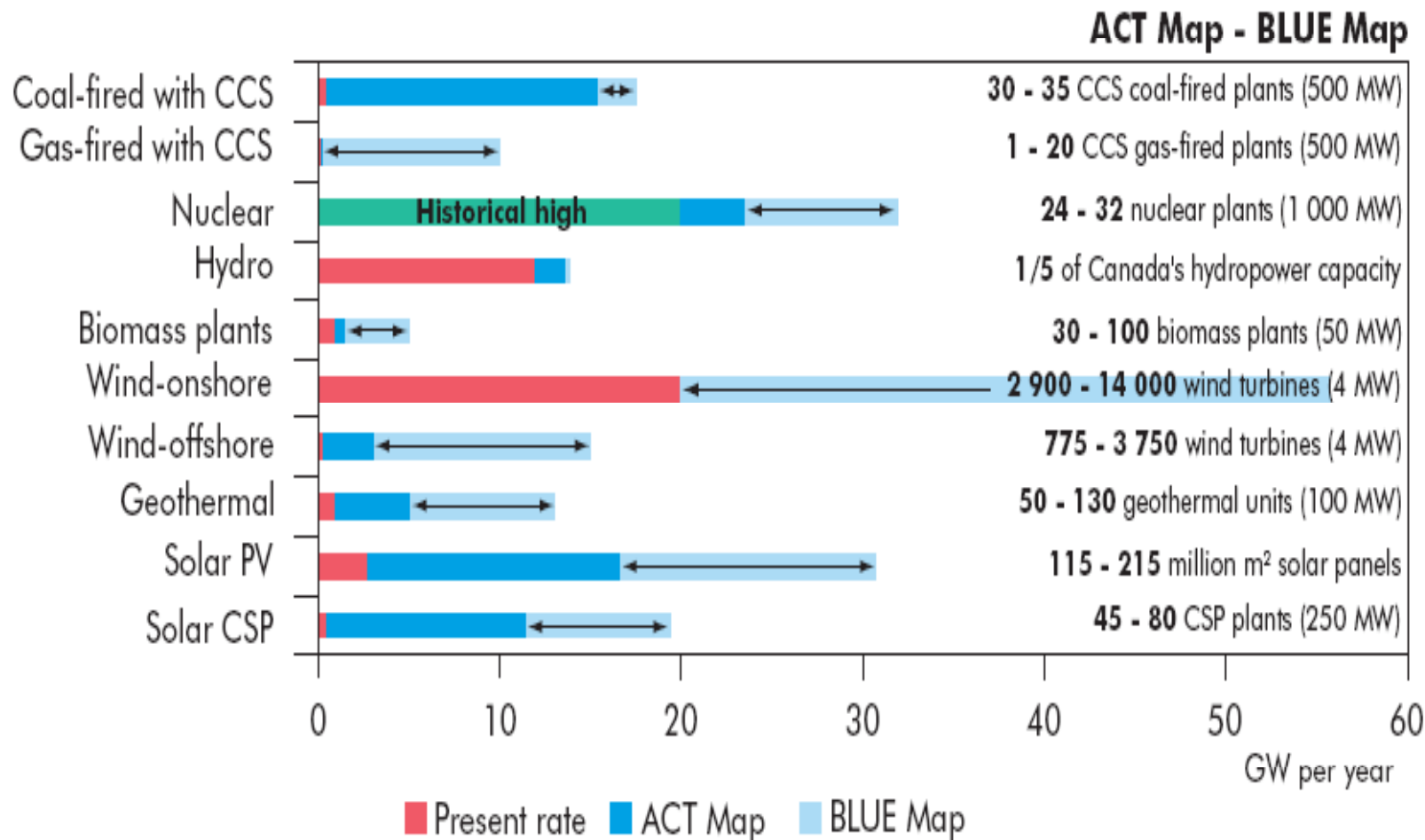


25% nuclear, 25% fossil + CCS, nearly 50% renewables





# Average Annual Power Generation Capacity Additions, 2010 – 2050



ENERGY  
TECHNOLOGY  
PERSPECTIVES

2008

Scenarios &  
Strategies  
to 2050

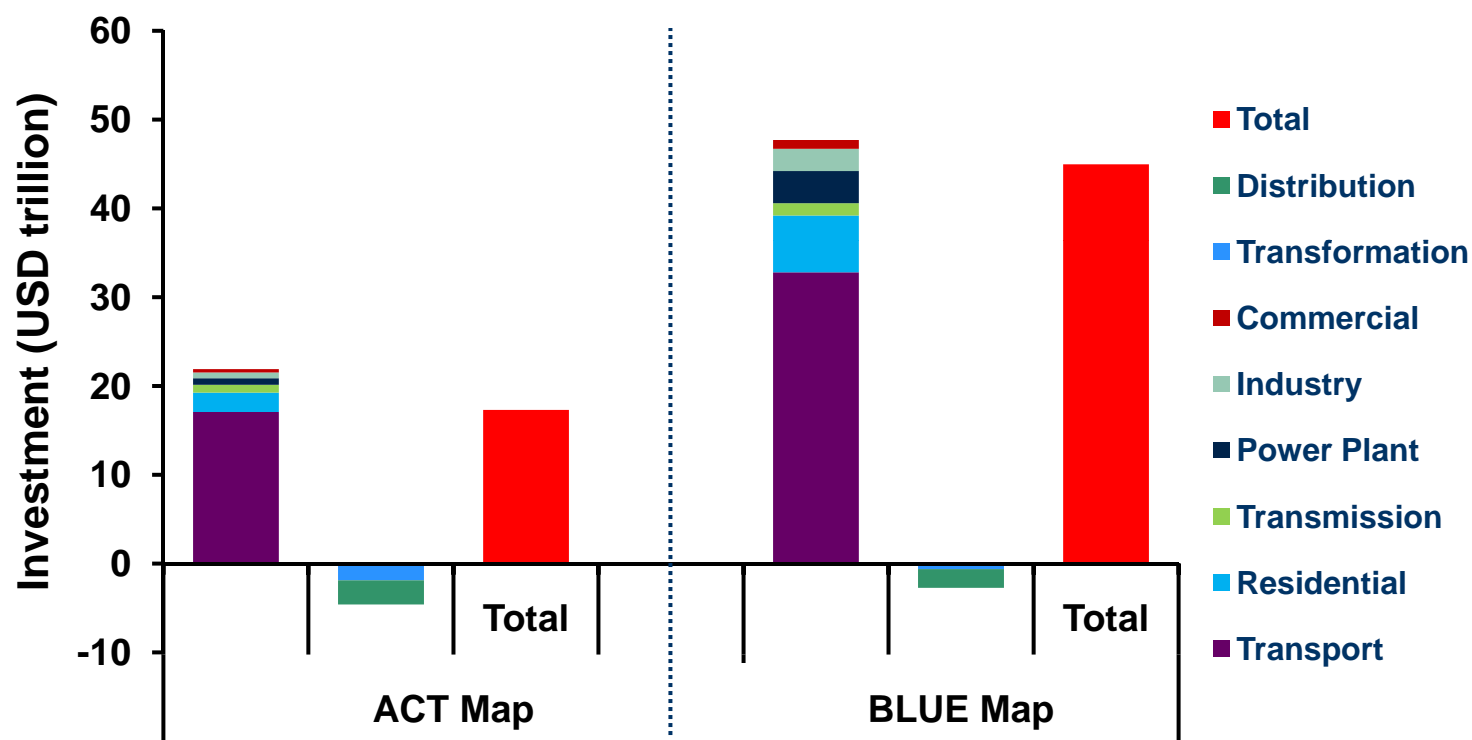
INTERNATIONAL

ENERGY

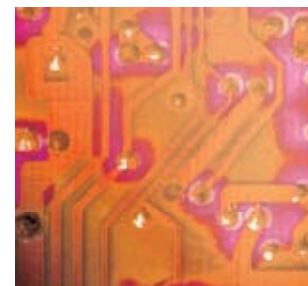
AGENCY



# 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



ENERGY  
TECHNOLOGY  
PERSPECTIVES  
2008

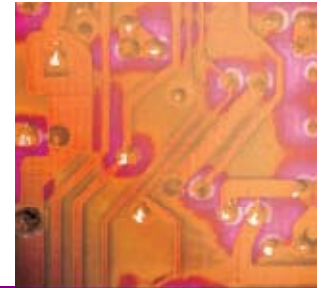
Scenarios &  
Strategies  
to 2050

INTERNATIONAL  
ENERGY  
AGENCY



# 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 ?



ENERGY  
TECHNOLOGY  
PERSPECTIVES  
2008

Scenarios &  
Strategies  
to 2050

INTERNATIONAL  
ENERGY  
AGENCY 

# Roadmaps

17 technology roadmaps provide 87% of CO<sub>2</sub> savings under the Blue scenario

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



# 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
- 2<sup>nd</sup> 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



ENERGY  
TECHNOLOGY  
PERSPECTIVES  
2008

Scenarios &  
Strategies  
to 2050

INTERNATIONAL  
ENERGY  
AGENCY

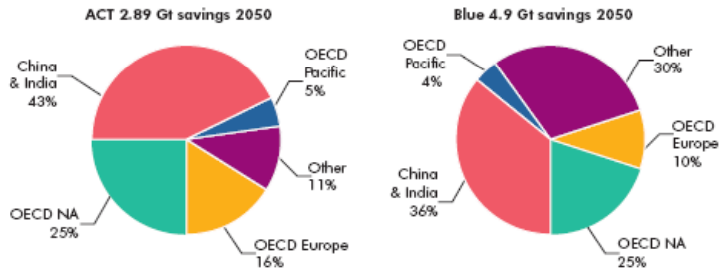




# Roadmaps – Example CCS

## 10% of CO<sub>2</sub> reduction potential in BLUE Map

### CO<sub>2</sub> Capture and Storage - Fossil-Fuel Power Generation

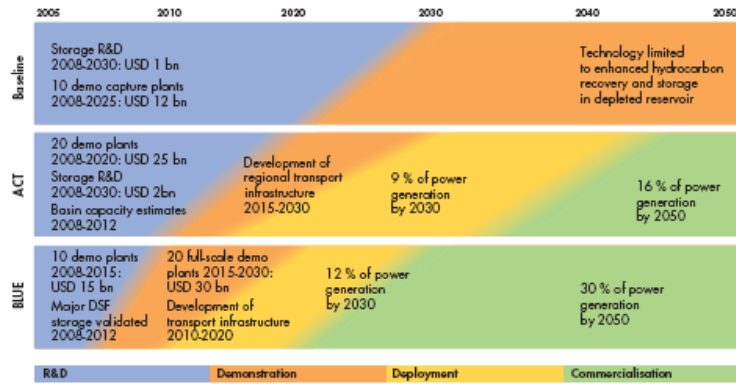


	Global Deployment Share 2030	RDD&D Inv. Cost USD bn 2005-2030	Commercial Inv. Cost* USD bn 2030-2050		Global Deployment Share 2030	RDD&D Inv. Cost USD bn 2005-2030	Commercial Inv. Cost* USD bn 2030-2050
OECD NA	35%	25-30	160-180	OECD NA	35%	30-35	350-400
OECD Europe	35%	25-30	100-120	OECD Europe	35%	30-35	150-200
OECD Pacific	10%	7-8	30-40	OECD Pacific	10%	10-12	70-80
China & India	15%	10-12	280-300	China & India	15%	12-14	450-500
Other	5%	3-4	60-70	Other	5%	4-5	300-350

### Technology Targets

	ACT: Emissions Stabilisation	BLUE: 50% Emissions reduction
<b>RD&amp;D</b>		
Capture technologies for three main options (post-combustion, pre-combustion, and oxy-fuelling)	Technologies tested in small- and large-scale plants. Cost of CO <sub>2</sub> 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
<b>Deployment</b>		
Regional pipeline infrastructure for CO <sub>2</sub> transport	Major transportation pipeline networks developed and CO <sub>2</sub> 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<sub>2</sub>.
- 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<sub>2</sub> 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.

ENERGY  
TECHNOLOGY  
PERSPECTIVES

2008

Scenarios &  
Strategies  
to 2050

INTERNATIONAL

ENERGY

AGENCY





# 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

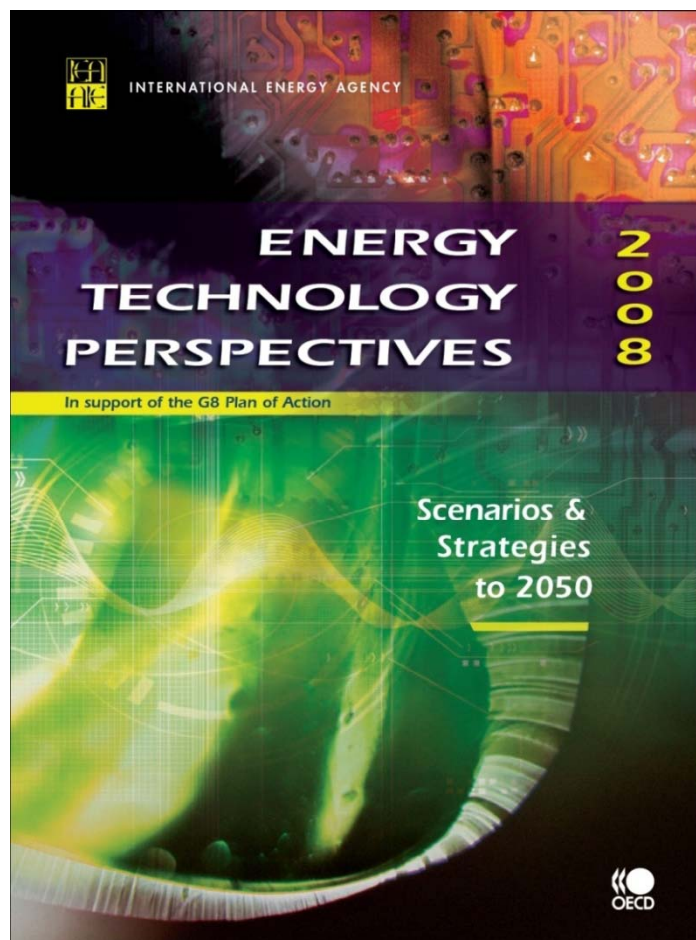


ENERGY  
TECHNOLOGY  
PERSPECTIVES  
2008

Scenarios &  
Strategies  
to 2050

INTERNATIONAL  
ENERGY  
AGENCY 

# Thank You !



[peter.taylor@iea.org](mailto:peter.taylor@iea.org)

