# Charting an energy technology revolution: energy technology roadmaps and the global RD&D gap

IEA Event - COP

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### **Overview**

- An energy technology revolution is needed
- What is the gap?
- The role of roadmaps
- Results from CCS roadmap
- Next steps





### An energy technology revolution is needed

Technology contributions to 50%  $CO_2$  reduction scenario, 2005-2050



### Where are we today? IEA global RD&D mapping exercise

- Assess current RD&D spending across 9 technology areas for Major Economies Forum (MEF) countries
  - IEA data, other sources for non-IEA countries
- Define RD&D priorities
  - IEA roadmaps, other studies
- Identify the gap between current levels of activity and IEA BLUE Map 2050 technology targets
- Collect one-time stimulus spending data separately
- Compare results against other studies





### **RD&D** mapping results

#### Clean energy RD&D spending and gap \$ Billions



- Roughly 3-8c increase fromcurrent public RD&D levels needed to meet innovation needs identified by IEA
- Other analyses suggest an increase of 3-10x current spending levels, with the consensus around 3-4x
- Strong technology policy would also spur private innovation investment

Spending needs to increase 3-6 times current levels

Secretariat for the MEF Global Partnership





### Next steps

- Increase public sector spending
- Improve data quality, availability
  - Improve IEA member country data
  - Expand collection with non-member countries
  - Analysis does not include private RD&D investment; will work with key sectors to develop data
- Many policy approaches to stimulate energy technology innovation; spending is just one means
  - Document other energy innovation policies
- Increase international collaboration on energy technology RD&D





### The IEA roadmap approach

- Engage cross-section of stakeholders
- Identify a baseline where is technology today?
- Use *ETP* BLUE Map results for deployment pathway to 2050
- Identify milestones technical, regulatory, policy, financial, consumer adoption/public acceptance
- Develop implementation action items for stakeholders





### **CCS ROADMAP RESULTS**





### **CCS** is operating today



#### ...but needs to rapidly expand; need to turn announcements into projects





## **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 CO<sub>2</sub> 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





### An ambitious growth pathway



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





### CCS is not just about "clean coal"







### Technology actions and milestones: CO<sub>2</sub> transport

#### **Priority actions**

- Analyze and incentivize optimized source and/or sink transport hubs
- Analyze and incentivize optimized country/region-wide pipeline network
- Use tanker transport of CO<sub>2</sub> in near term
- Improve understanding of CO<sub>2</sub>
  transport leakage scenarios and effects of impurities

### Global CO<sub>2</sub> pipeline needs







### Technology actions and milestones: CO<sub>2</sub> storage

- 144.7 Gt CO<sub>2</sub> stored in 2050 will use less than 1% of total global theoretical capacity
- Priority actions
  - Agree on a common CO<sub>2</sub> storage capacity methodology by 2010; assess global capacity by 2012
  - 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





# 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
  - Incentivise CCS via bonus allowances in cap-and-trade schemes, emissions performance standards or carbon taxes





# The next ten years: a critical period for CCS

- Legal/regulatory milestones
  - Provide recognition of CCS in CDM or alternate mechanism
  - 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 CO<sub>2</sub>
    - China and India alone account for 26%
  - Expand capacity building efforts in emerging fossil-based economies
  - Provide an average annual investment of USD 1.5-2.5bn between 2010-20 in non-OECD regions











### **Roadmap status**

#### 2009 releases

- Carbon capture & storage
- Electric / plug-in hybrid vehicles
- Cement
- Wind

#### 2010 releases

- Solar photovoltaic
- Concentrating solar power
- Efficient heating and cooling in buildings
- Nuclear power
- Smart grids
- Biofuels
- Vehicle efficiency
- Iron & steel





### Help IEA to implement the roadmaps

- Seeking industry, NGO partners to endorse roadmap and help track/implement
- Looking to set timeline/format/process for reporting on progress
- Developing roadmaps in emerging economies
- Expanding the IEA Implementing Agreements on RD&D







International Energy Agency

### Thank you

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