



Session IV

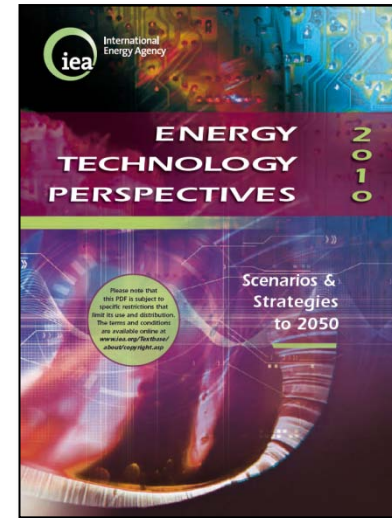
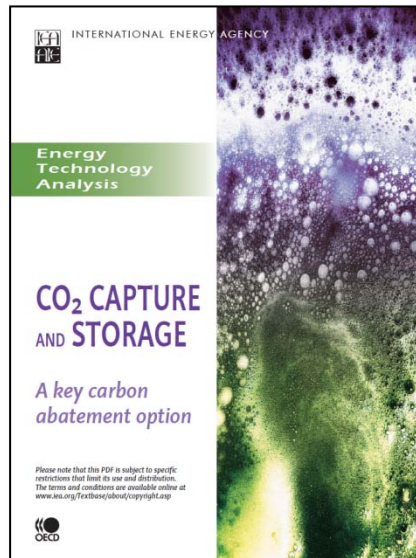
IEA work on CO₂-EOR to date

Paul Zakkour, Carbon Counts

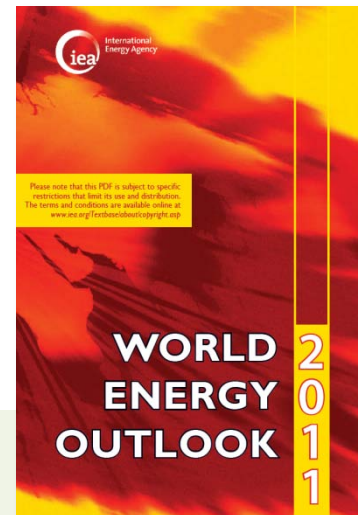
IEA/OPEC CO₂-EOR Workshop
Kuwait City, 7th February 2012

IEA flagship publications

- Energy Technology Perspectives (ETP)



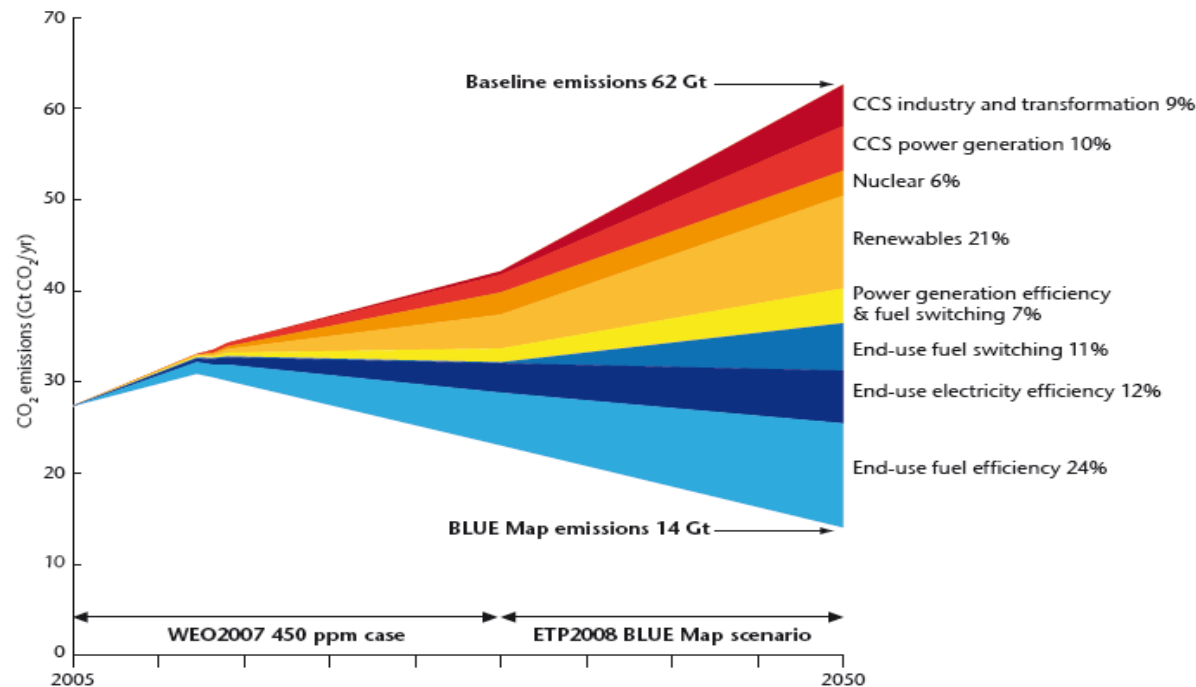
- CCS series of publications



- World Energy Outlook (WEO)

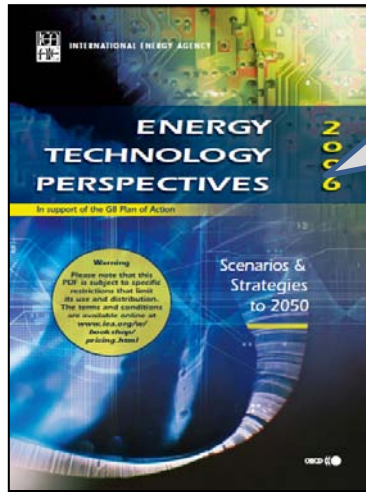
Energy Technology Perspectives

- Launched at 2005 at G8 Summit (Gleneagles)
- Builds on *WEO Alternative Policy Scenarios* and “BAPS”, focussing on role of technology in reducing GHG emissions to 2050
- Now a biennial publication (2006, 2008, 2010...)
- Established “BLUE Map” scenario, which is widely used as the basis for global GHG reduction pathways

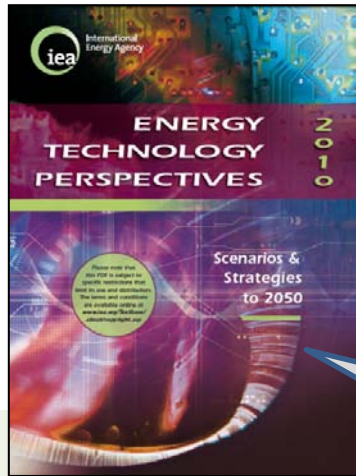


Source: IEA, *Energy Technology Perspectives* (2008a).

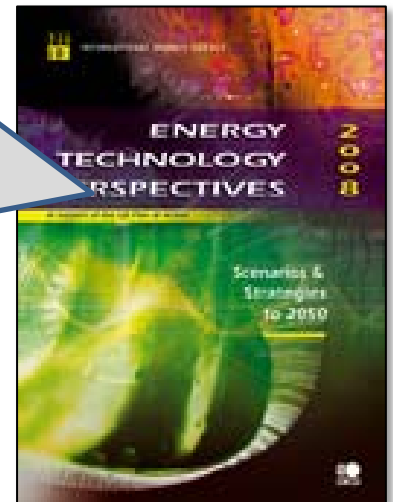
ETP on CO₂-EOR



- ⇒ CO₂-EOR could reduce costs of CCS
- ⇒ Could lead to negative emissions in some cases
- ⇒ Limited potential for storage relative to power plant emissions
- ⇒ US\$30-160 per tonne CO₂ revenue (@ US\$45 bbl). Must be considered in context of competing EOR technologies



- ⇒ CO₂-EOR could reduce costs of CCS,
- ⇒ Support early opportunities for demonstration
- ⇒ 5-23% additional hydrocarbon recovery possible
- ⇒ US\$35-40 per tonne CO₂ stored
- ⇒ Only driver for CCS in absence of carbon price incentive



- ⇒ Only very limited consideration of the role of CO₂-EOR in facilitating CCS deployment

CCS publications



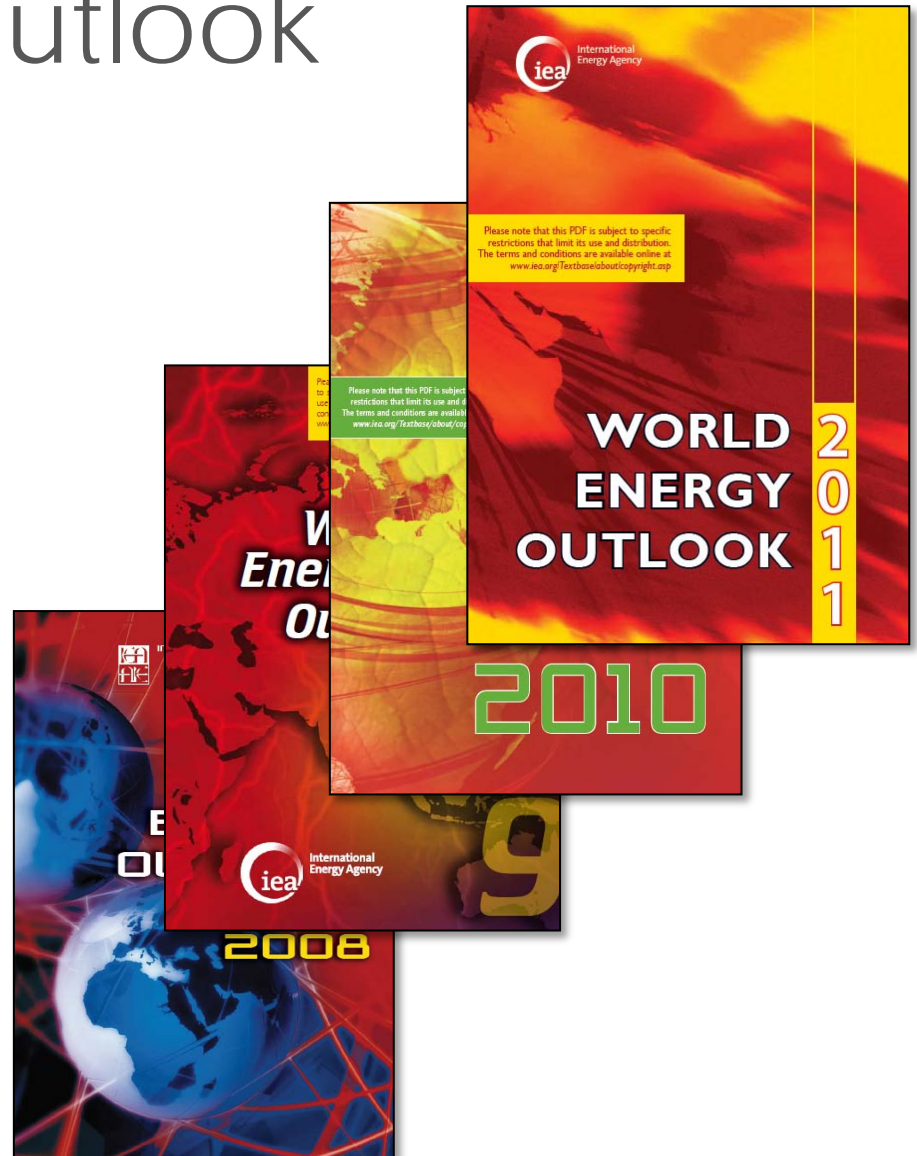
- Range of high quality publications produced over several years
- Dedicated *IEA Carbon Capture & Storage Unit* established in 2010

CCS publications on CO₂-EOR

- **2004** – Prospects for CCS:
 - Included technical and financial review of EOR potential (from literature)
 - Highlighted distributional challenges between sources and EOR sinks
 - Concluded that EOR is important early opportunity for CCS
- **2005-07** – CCS legal & regulatory issues. Limited coverage of EOR
- **2008** – CCS Key Abatement Technology:
 - Further literature reviews of EOR potential
 - Concluded that EOR may provide some limited early opportunities and support early infrastructure development
- **2009** – CCS Roadmap:
 - Becomes “blueprint” for CCS deployment worldwide. CO₂-EOR not specifically considered within analysis
- **2011** – CCS Roadmap (Industry):
 - Highlighted importance of “high purity” sources linked to EOR for early demonstration
 - Concluded that enhanced national level analysis required to better understand EOR opportunity.
- **2012** – Policy Strategy for CCS:
 - Highlighted role of “climate policy oriented EOR” compared to commercial EOR

World Energy Outlook

- IEA flagship publication providing “...*authoritative source of energy market analysis and projections....insights into trends in energy demand and supply andenergy security, environmental protection and economic development*”



WEO on CO₂-EOR

- **CO₂ EOR last considered in depth in 2008**

“Prospects for O&G production and climate change”:

- Estimated worldwide potential: 160-300 billion bbl incremental production to 2030 (7-14% of 2008 conventional reserves)
 - 80-130 bn bbl in ME region
 - 20-90 bn bbl in N Am
 - higher if greater uptake leads to lower cost (~500 bbl)
- \$22-70 barrel marginal production costs
- Base case: 9.8 Gt CO₂ stored through CO₂-EOR by 2030 (~445 MtCO₂/yr). Would equal most of CCS Roadmap estimate for deployment over period
- Carbon pricing will significantly alter cost curve for EOR (but with basic assumptions)

Broad trends in IEA analysis

- Linkages between CO₂-EOR and CCS have been historically emphasized as a critical driver for both technologies
- Assumption underpinned by broad top-down analysis based on oil production cost curve, and the role CO₂ pricing could play in changing oil production economics with CO₂
- Positive views on the role of CO₂-EOR in supporting CCS deployment as an “early opportunity” have been tempered over recent years based on the lack of new CO₂-EOR projects occurring
- Growing realisation that a better understanding of *technical*, *political* and *economic* factors necessary to calibrate estimates
- Growing realisation that an evaluation of specific and smarter policy interventions necessary to realise co-benefits of CO₂-EOR and CCS

Current work programme represents the first efforts of the IEA to undertake a comprehensive and systematic bottom-up analysis of the role of CO₂-EOR and CCS worldwide to address the knowledge gap