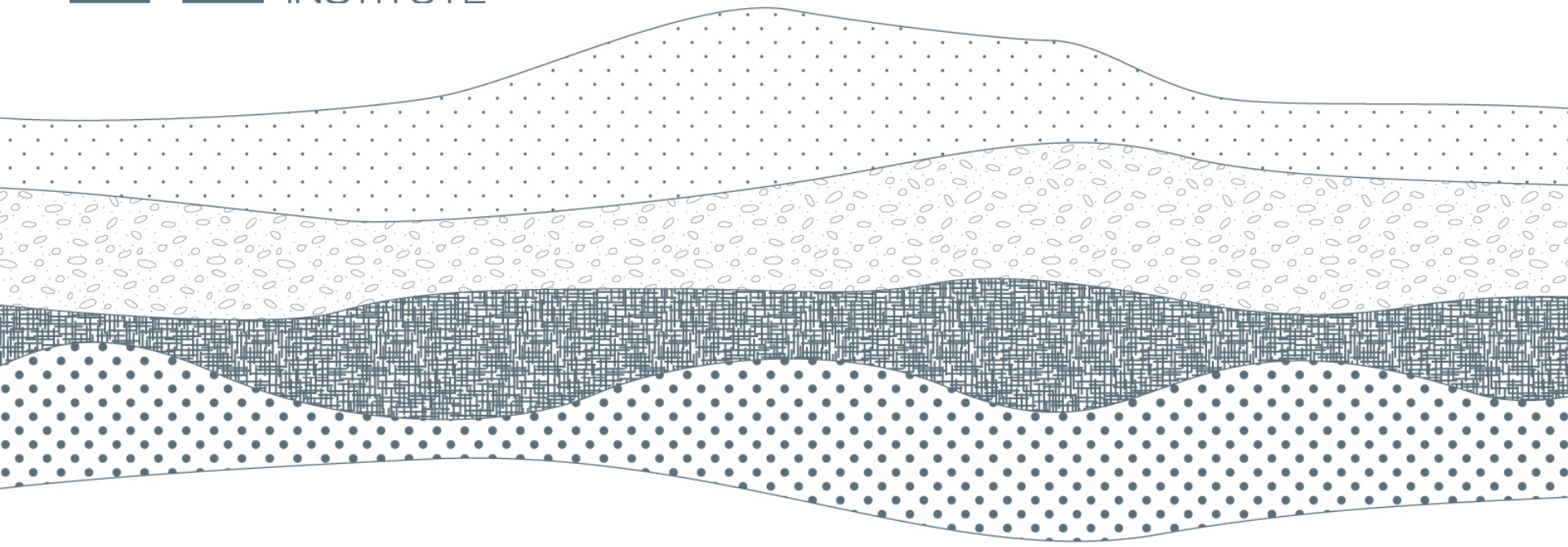


UPDATE ON CCS STORAGE PROJECTS

Holger Bietz – General Manager, Projects, Financial and Commercial

CCS Opportunities in the CCOP Region

12-14 September, Bali, Indonesia

OVERVIEW OF PRESENTATION

- Global status of CCS
- Geological storage of CO_2
- Importance of EOR
- CCS in developing countries
- Importance of knowledge sharing
- Conclusions

GLOBAL STATUS OF CCS

Climate Change backdrop (IEA WEO 2011)

- Current Policies Scenario (BAU)
  - Global temperature +6°C by 2100 (1000ppm CO_2)
- New Policies Scenario (commitments/announcements)
  - Global temperature +4°C by 2100 (650ppm CO_2)
- 450 Scenario:
  - Limit temperature increase to 2°C (450ppm CO_2)
  - A low carbon technology portfolio is required
    - Carbon Capture and Storage needs to be part of it

GLOBAL STATUS OF CCS

Important developments in 2012

- International policy developments:
  - Kyoto succession, acceptance of CCS in the CDM
- Pathways progress:
  - e.g. UK's comprehensive low carbon regime, Australia's Carbon Tax / ETS 2015
- International standards for CCS:
  - International Standards Organisation (ISO), bi-national CCS standard for Canada and the US
- Capture test facilities:
  - e.g. Mongstad (Norway), NCCC (US).

GLOBAL STATUS OF CCS

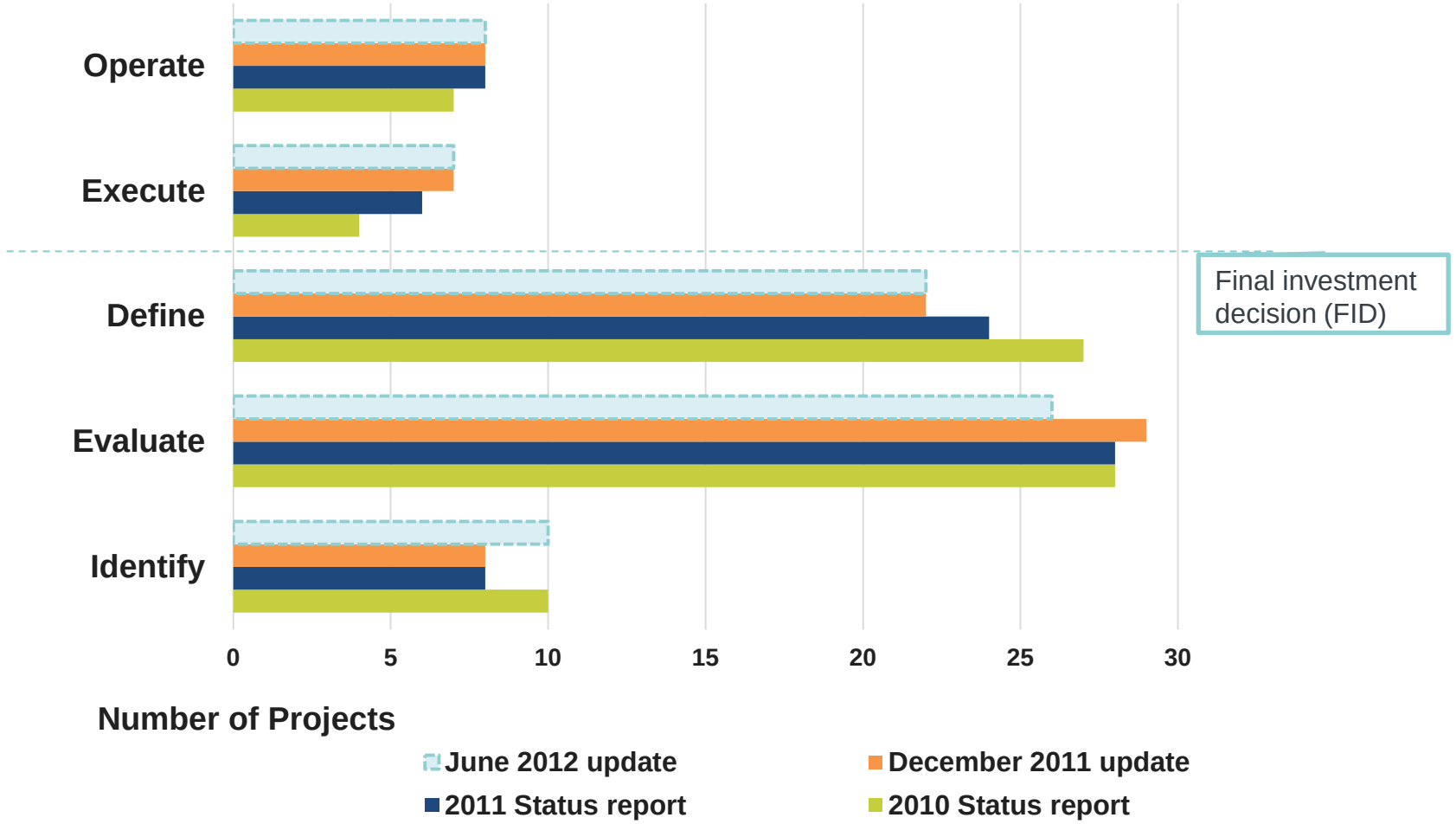
Monitoring of large-scale integrated projects

Project definition:

- integrated;
- ≥ 0.8 Mtpa CO_2 for coal-based power plants;
- ≥ 0.4 Mtpa for industrial plants; and
- anthropogenic CO_2, storage monitored.

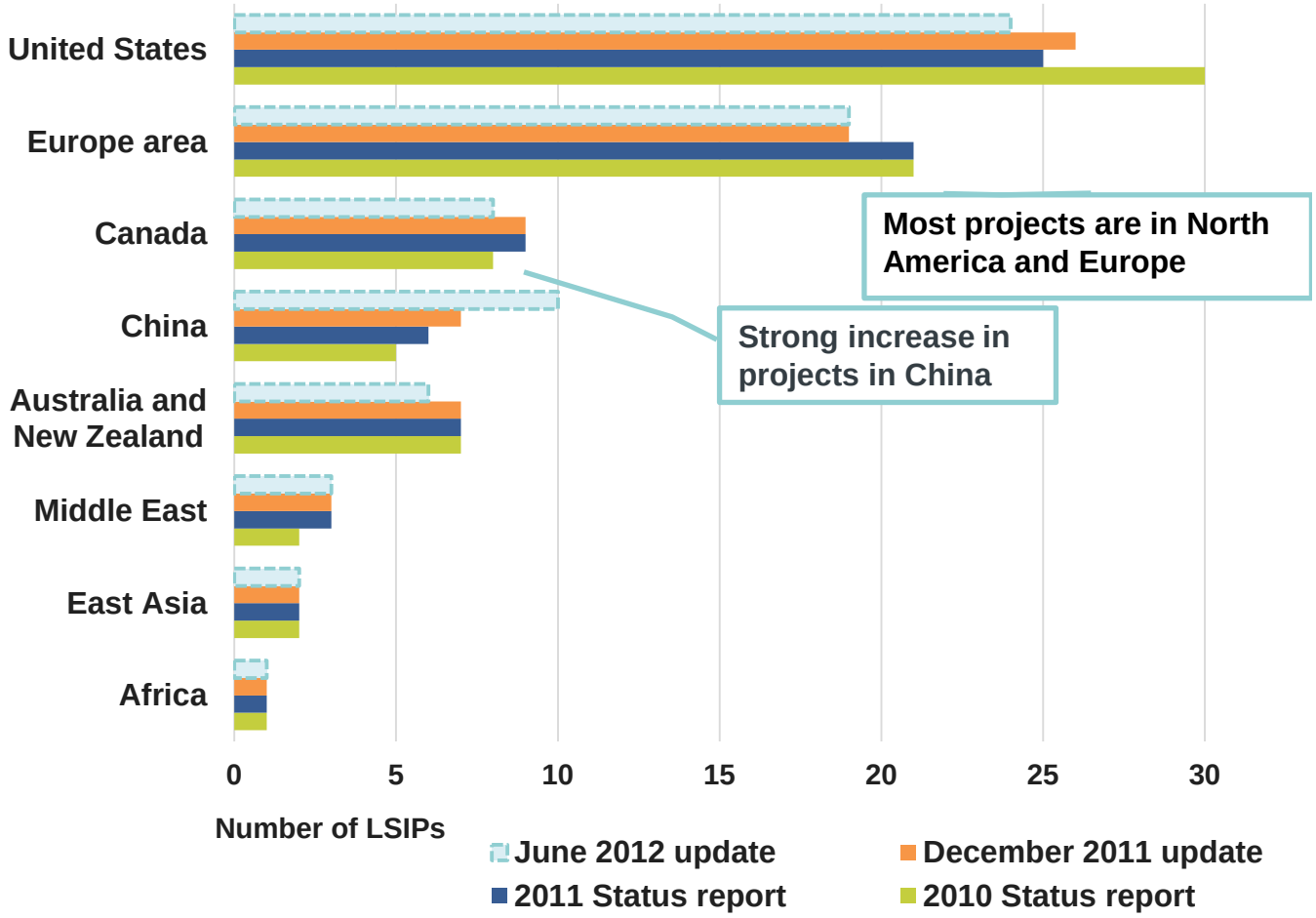
GLOBAL STATUS OF CCS

Large-scale integrated projects progress slowly



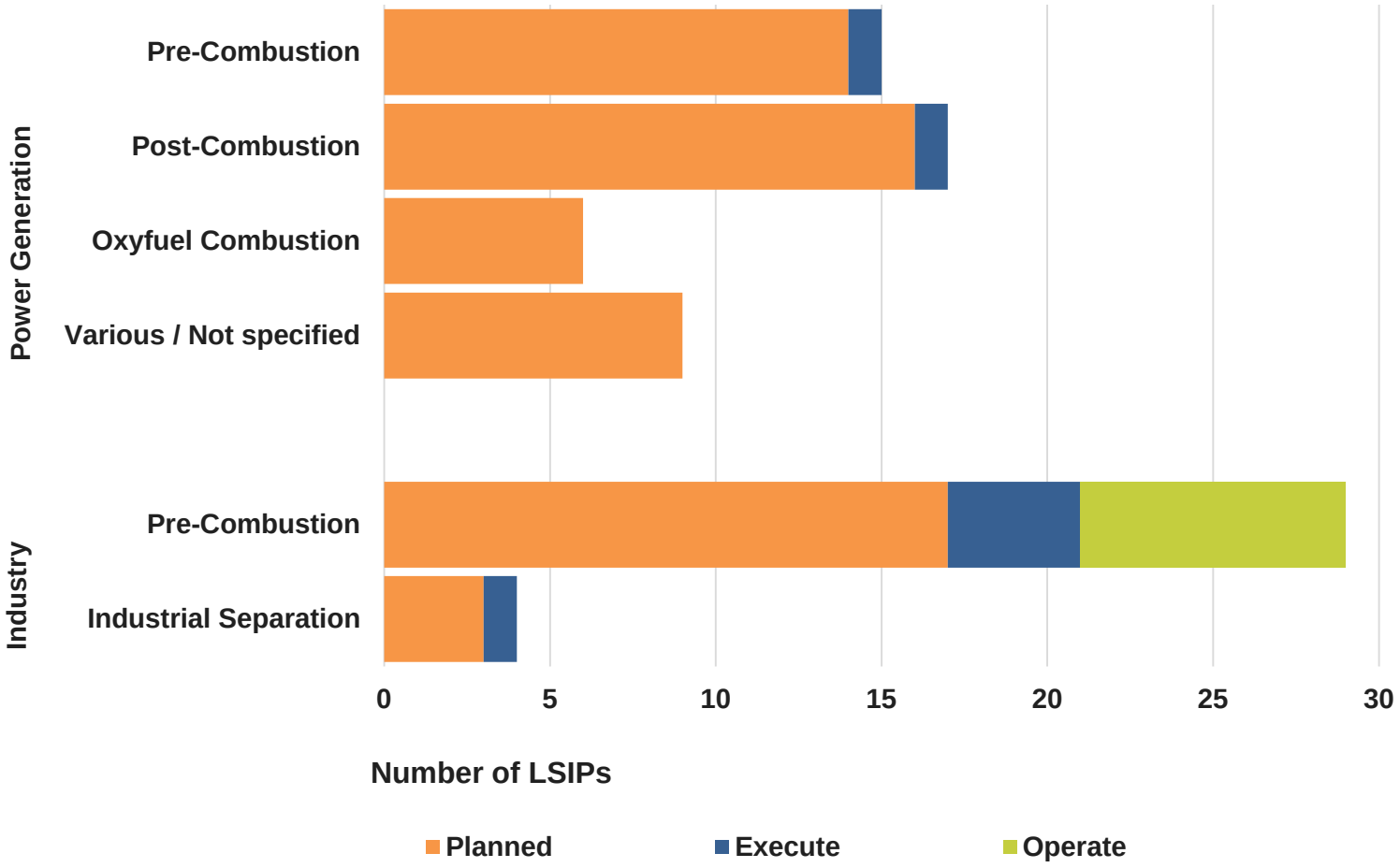
GLOBAL STATUS OF CCS

Distribution of projects



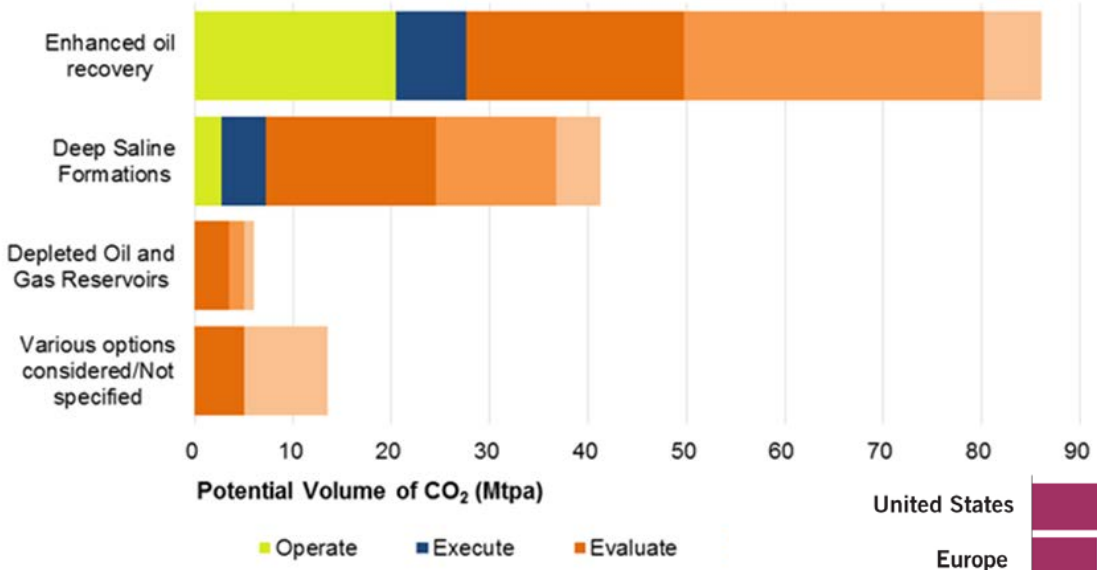
GLOBAL STATUS OF CCS

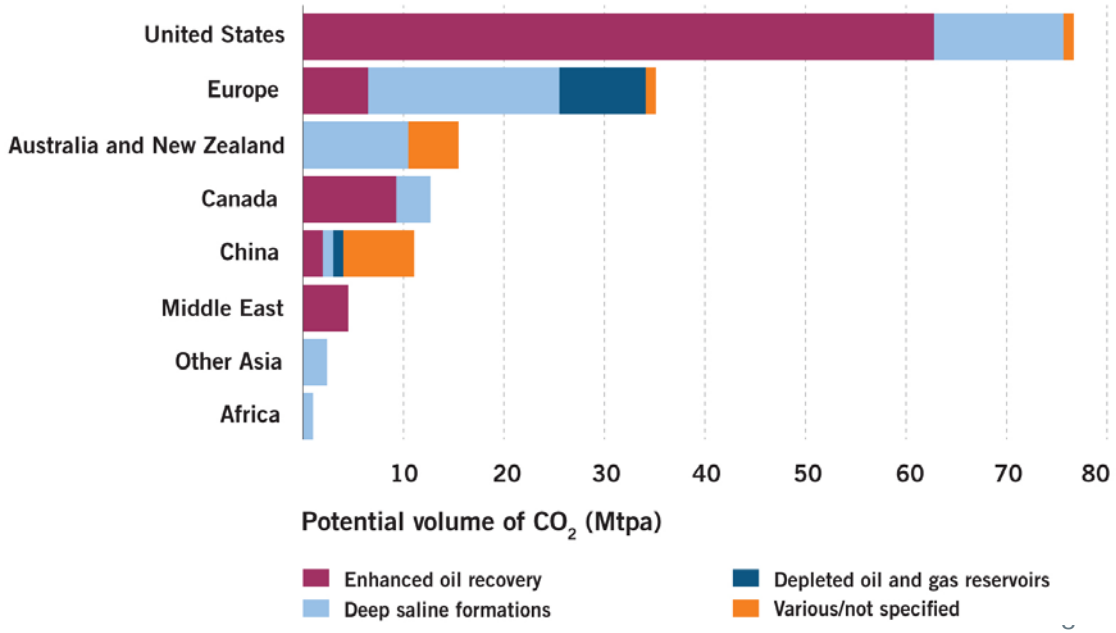
Distribution of capture technologies



GLOBAL STATUS OF CCS

Projects by storage type





GLOBAL STATUS OF CCS

Challenges for large-scale integrated projects

- Carbon pricing
- Project size & CCS technology costs
- Development risks
- Legal frameworks
- World economy
- CCS acceptance

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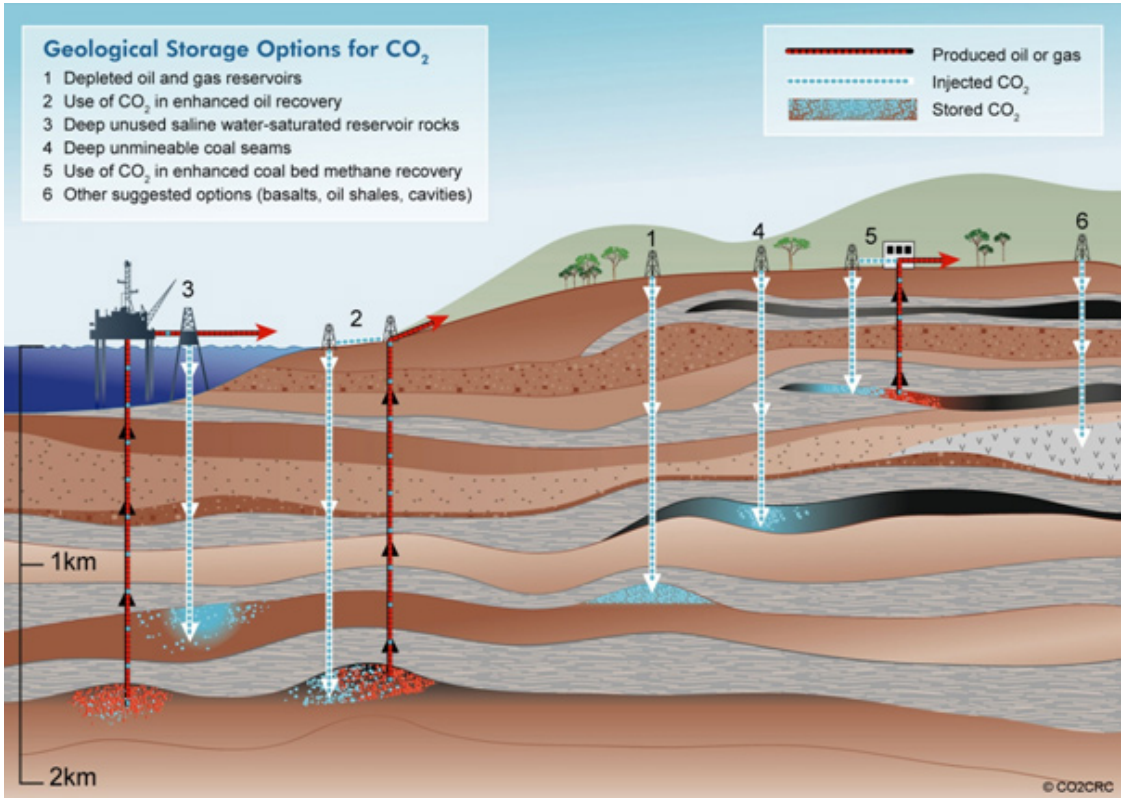
GEOLOGICAL STORAGE OF CO_2

No storage = no CCS project

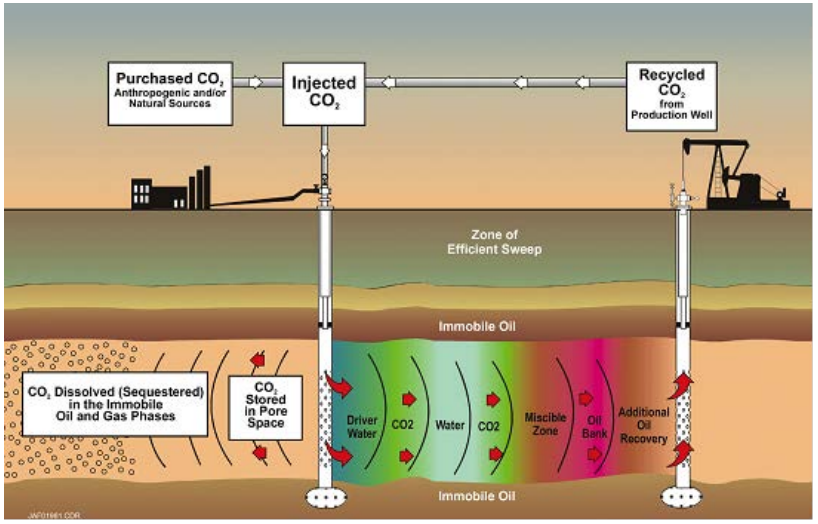
- No short-cut to characterisation
- Early and costly ($6-20/t CO_2)
- Site specific
- Perceived risks
- Common infrastructure?



IMPORTANCE OF CO_2 EOR

Development benefits & commercial bridge

- Most anthropogenic CO_2 currently being geologically stored is associated with CO_2 EOR.
- Technical and scientific knowledge.
- Important commercial driver.
- CO_2 EOR must demonstrate that the storage of injected anthropogenic CO_2 is permanent through MMV.
- Regulations and policy are required to transition from CO_2 EOR to CCS.



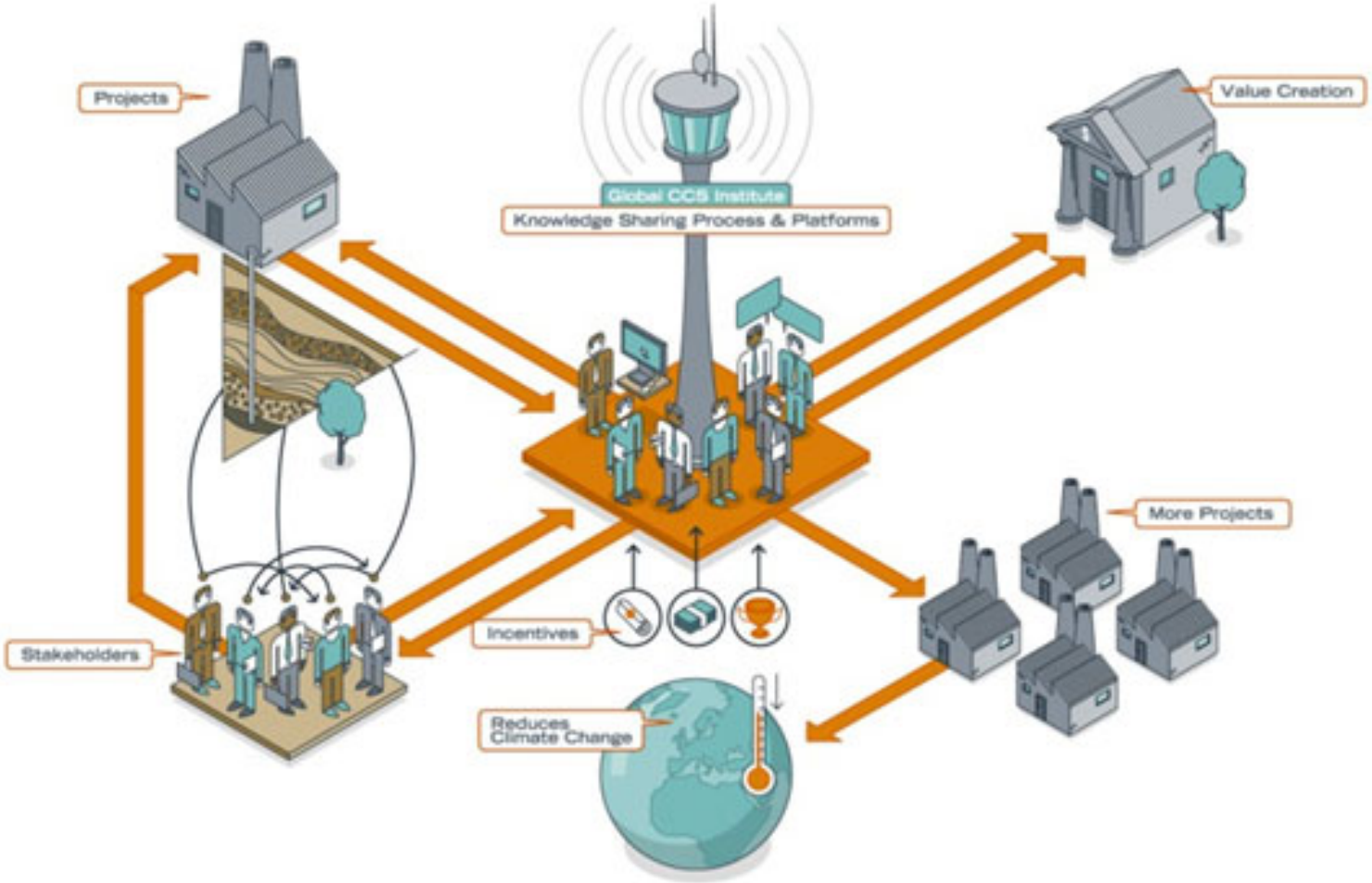
CCS IN DEVELOPING COUNTRIES

15 large-scale integrated CCS projects in Asia

- Emissions from non-OECD countries projected to increase by more than 85 per cent by 2035.
- IEA analysis indicates that 50-60 per cent of CCS deployment will need to occur in non-OECD countries.
- Preparing for CCS today yields benefits over ‘wait and see’ approach:
  - Access to future funds;
  - Basis for CDM projects; and
  - Commercial opportunities.
- Preparatory work includes:
  - Assessment of geological storage capacities;
  - Policy settings (e.g. roadmaps, pathways, legal & regulatory);
  - Capacities development .

IMPORTANCE OF KNOWLEDGE SHARING

Reduces CCS development costs and timelines, improves public awareness, accelerates technology uptake and emission reduction – IP to be maintained.



IMPORTANCE OF KNOWLEDGE SHARING

Strategic objectives of the Global CCS Institute

AUTHORITATIVE KNOWLEDGE SHARING

- Producing, gathering and sharing information, experiences and lessons learnt by connecting people and networks.
- Value-add research and analysis; optimise CCS knowledge management.

FACT-BASED, INFLUENTIAL ADVOCACY

- Advocate for CCS as one of the options required to reduce greenhouse gas emissions, both from power generation and industrial sources.
- Enhance stakeholder engagement and form and maintain partnerships and networks to build CCS standing and information exchange.

STRENGTHENED CAPACITY FOR CCS IMPLEMENTATION

- Support development and implementation of CCS policy and regulatory frameworks; contribute to international CCS standards setting.
- Provide advice, risk assessment, community engagement and compliance services and support for CCS projects.

CONCLUSIONS

Progress and challenges

- Large-scale integrated CCS projects around the world encounter challenges and progress is slow;
- Projects move in particular forward when carbon capture is part of the industrial process and where well-explored storage reservoirs are available;
- There are no shortcuts to characterisation of storage reservoirs;
- CO2-EOR can provide development benefits and a commercial bridge to CCS;
- Developing countries can benefit from CCS preparatory work today;
- Knowledge sharing is highly valuable for young CCS industry;
- CCS projects need adequate policy support to proceed and demonstrate and exploit the potential of the technology.

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