GLOBAL CCS INSTITUTE

THE GLOBAL STATUS OF CCS

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Underground Injection Control Conference

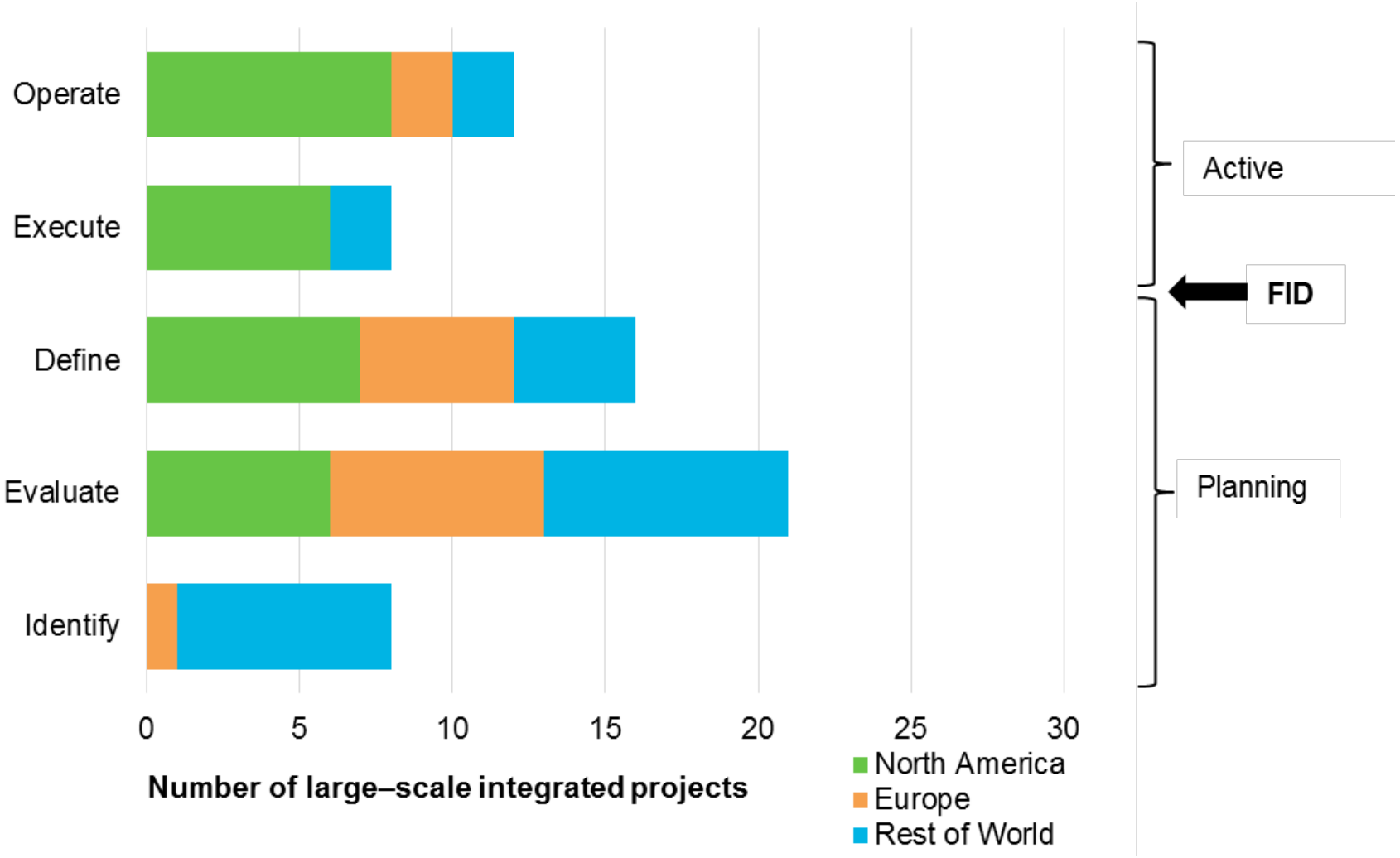
21-23 January 2014, New Orleans, LA

The Global Status of CCS: 2013

Most comprehensive source on the status of CCS – key points

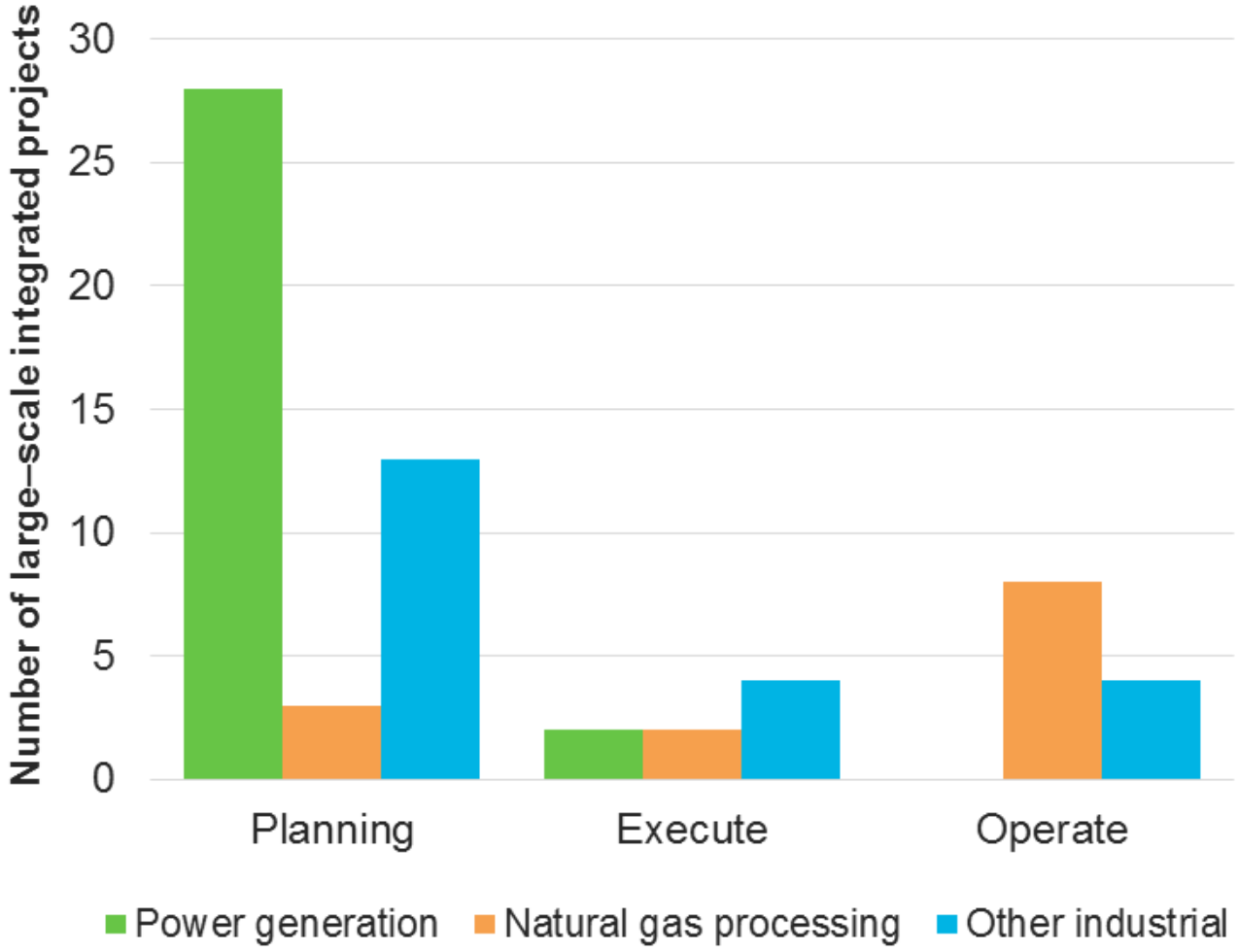
- CCS technology is a reality –over 20 projects, many benefiting from early support, now in operation or construction.
- But progress is too slow for CCS to play its full part in climate change mitigation.
- Policy and regulatory actions are vital for a momentum shift and to attract private investment.
- Robust R&D and infrastructure support are also key enablers.
- Mid-year Status Highlights out shortly

Skewed regional distribution needs attention



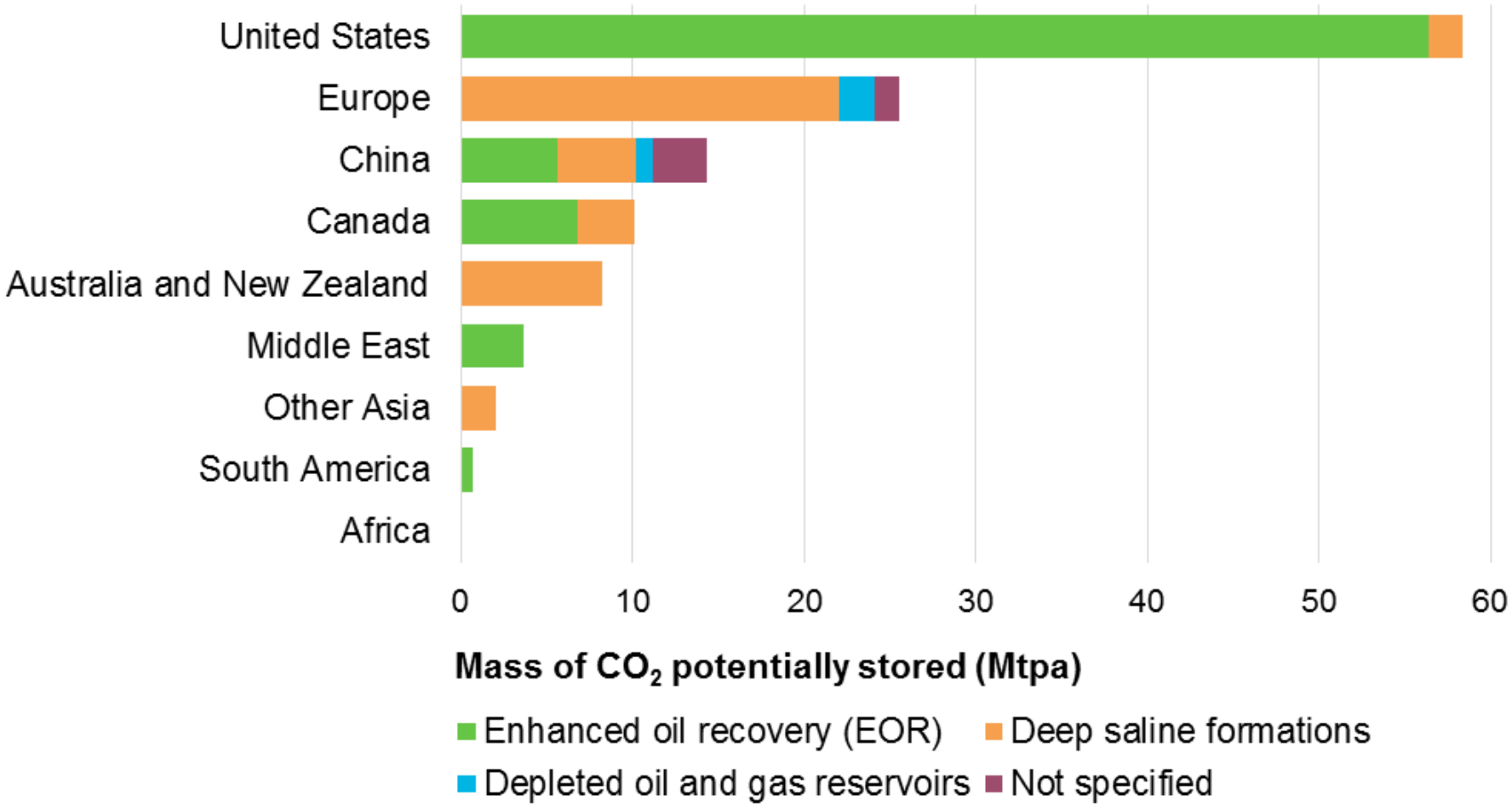
North America dominates Active projects. No new projects passed FID in Europe in over a decade. Projects in non-OECD countries critical.

Power generation - some progress but needs help



Almost all Active projects are in areas where CO_2 is already removed or produced at high concentrations in the production process. In power and energy-intensive industries, momentum beyond the planning stage is sluggish and must be accelerated. No Power – CCS Projects operational at this time.

EOR continues to drive development



Existing market and policy conditions have generally not been enough to advance CCS deployment; CCS is progressing fastest where opportunities for additional revenue are strongest.

Action to progress the business case for CCS: policy

- 70 per cent of respondents to the Institute's projects survey indicate policy uncertainty is a major risk.
- Pipeline of projects could shrink further, placing climate change targets at risk.
- Need to implement sustained policy support / incentives and market based mechanisms ensuring CCS is not disadvantaged vis-à-vis other low carbon options.
- Short term support needed for first mover projects, especially in power and energy-intensive industry sectors, to demonstrate CCS at scale.

Action to progress the business case for CCS: regulatory

- Some important legal and regulatory progress made at Fed and state levels; however, several key issues persist:
  - Post-closure stewardship and cross-border movement of CO_2.
  - GHG accounting for CO_2 - EOR storage must be clarified.
  - Regulatory uncertainties must be resolved to reduce project risks and attract investment

Action to progress the business case for CCS: R&D support and collaboration

- Current CCS demonstration projects are vital for ‘learning curve’ benefits – but can only take us so far.
- Much can be learnt from large pilot projects testing advanced technologies.
- Globally collaborative R&D most cost effective.
- Connecting pipeline of new technology with ‘learning by doing’ serves multiple aims - reduces costs and strengthens investor and stakeholder confidence.

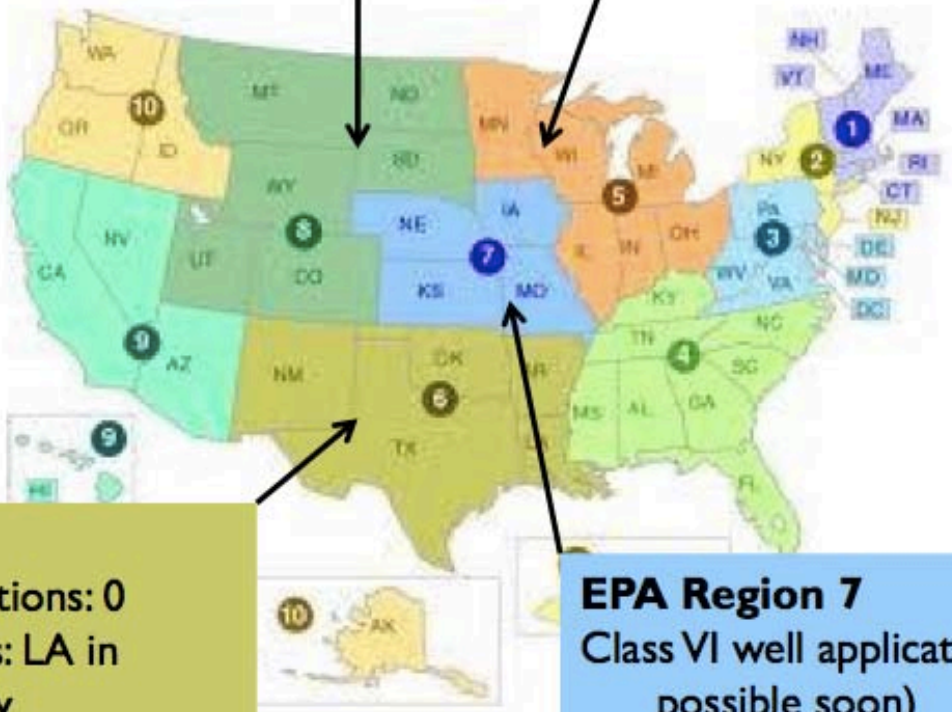
Action to progress the business case for CCS: storage

- While CO_2 - EOR is very important, there is also a need to focus on maturing deep saline storage sites.
- Full characterisation of greenfield sites can take 5-10 years or more.
- Currently limited incentives for industry to undertake costly exploration programs.
- Advance plans for storage site selection to create pathway.

Status of Class VI (Saline Storage) applications & primacy

EPA Region 8
Class VI well applications: 0 (1 possible soon)
Primacy applications: ND in process; MT, WY likely

EPA Region 5
Class VI well applications: 4 (2 more expected soon)
Primacy applications: None



EPA Region 6
Class VI well applications: 0
Primacy applications: LA in process; TX likely

EPA Region 7
Class VI well applications: 0 (1 possible soon)
Primacy applications: KS likely

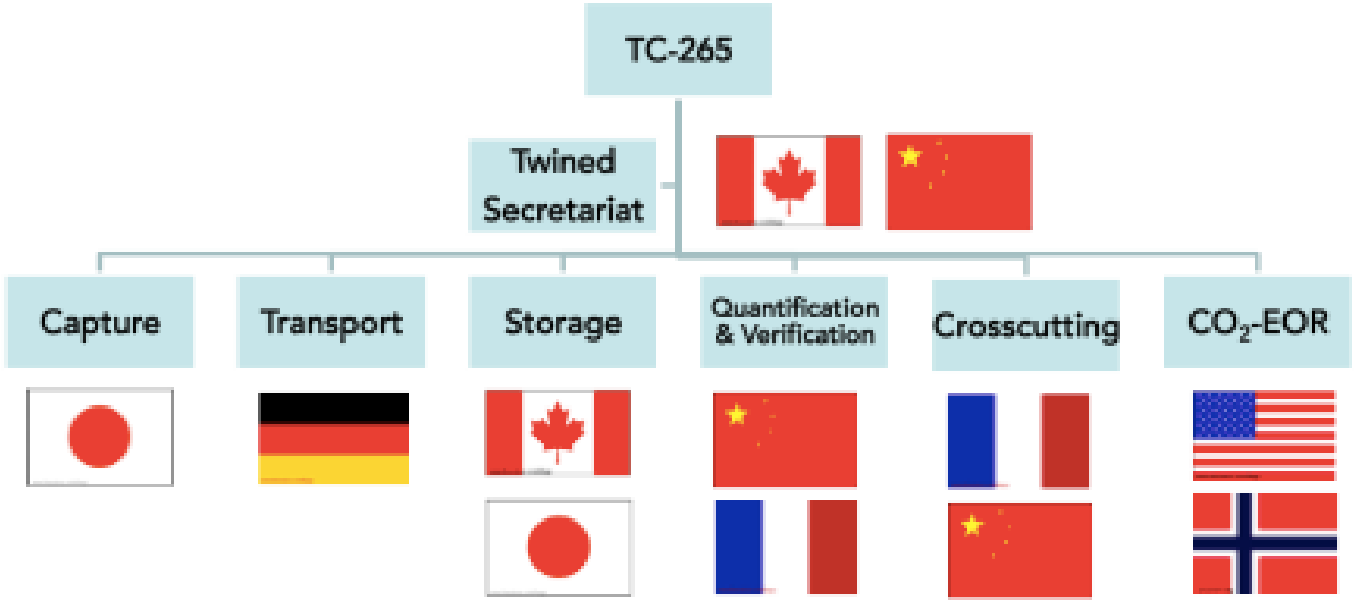
Class II & Class VI

Class VI Plans for Permit Application:

- Area of Review (AOR) & Corrective Action
- Testing & Monitoring
- Injection Well Plugging
- Post Injection Site Case and Site Closure
- Emergency & Remedial Response

Rule Requirement	Class II	Class VI
Area of Review (AoR)	0.25 mi	Computational modeling of plume and pressure front; must be revaluated max 5 yrs.
Evaluation of AoR	Define zone of "endangering influence"	Comprehensive geologic study, identifying confining zone, identification of faults, fracture zones.
Geologic Review	Confining zone must separate injection zone from USDW & must be free of faults & fractures	Must have Suitable geologic system with a confining zone free of transmissive faults.
Legacy Wells	Review reasonably available well data	Identify & take corrective action on all wells at risk of leakage.
Mechanical Integrity Tests	Every 5 years	Every year, casing inspection log or temperature log; continuous annular pressure.
Baseline Monitoring	None	USDW/ groundwater, subsurface injection zone.
CO2 Testing & Monitoring	None.	Groundwater monitoring; tracking plume and pressure front.
Well Construction	Cased and cemented to prevent movment of fluids into USDW & Designed for life expectancy of well	Must be prevent movement of fluids into or between USDWs compatible with CO2 injectate for life of project.
Well Evaluation	Wireline logs through drinking water (USDW) zones and confining zone.	Wireline logs, including CEL.
Injection Pressure	Pressure shall not exceed frac pressure.	Must not Exceed 90% of frac pressure
Injection Monitoring	Injection rate, pressure, nature of injectate.	Injection rate, pressure, nature of injectate. Must maintain a pressure on the annulus. Alarms, downhole shut off.
Reporting	Annual	Semi Annual
Emergency Response	Must report in 24 hours.	Cease injection; carry out pre-approved remedial response plan. Report 24 hrs.
Plugging	Well plugging must be acceptable to Director	Injection well plugging plan
Post Injection Site Care/Financial Responsibility	None	Closure / monitoring plume and pressure front. 50 year presumption

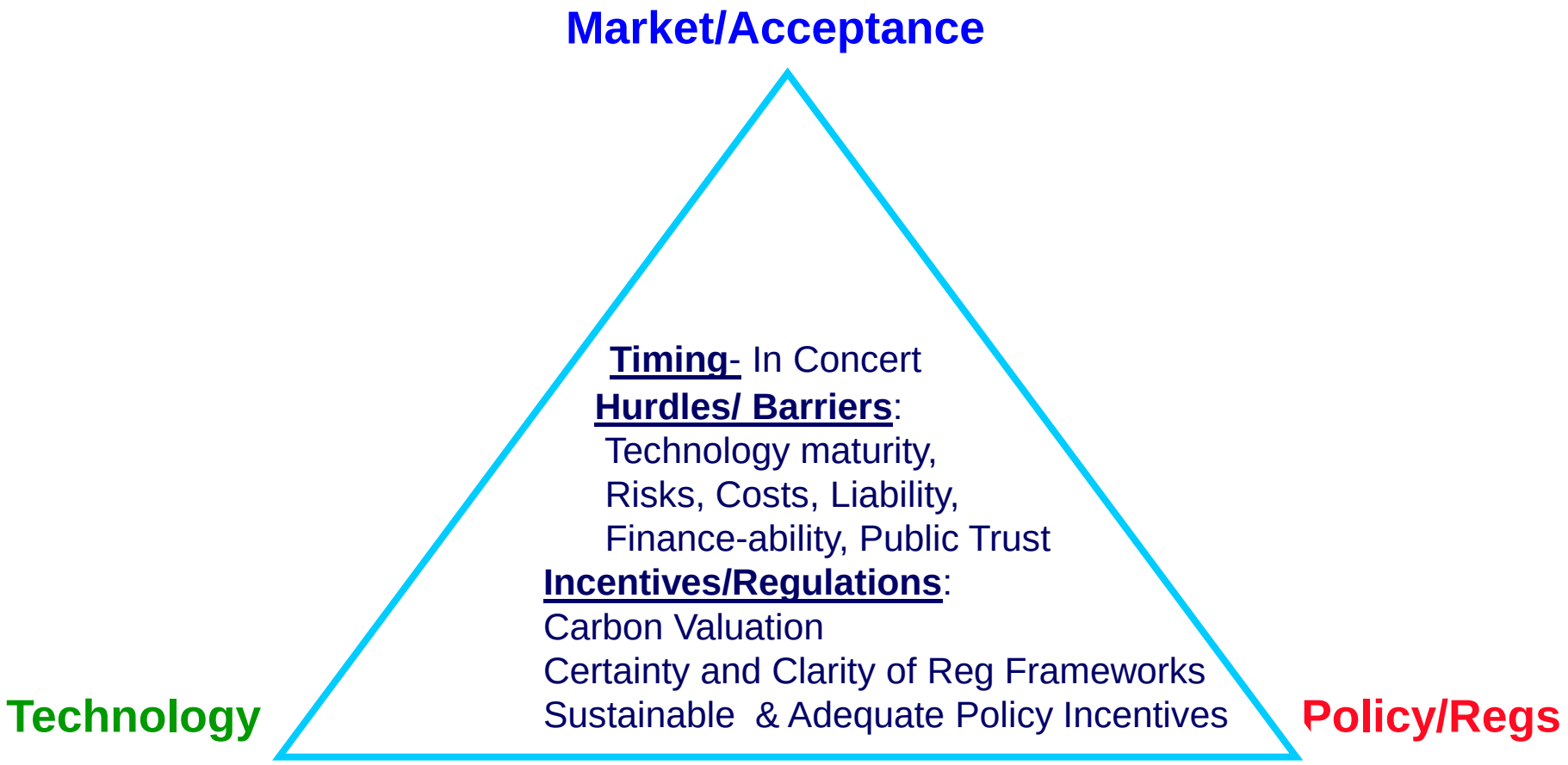
Standards and regulations: ISO TC 265 – CCS



- Can support / simplify technical regulations development and application
- World's first formally recognized CCS standard –**Z-742-12 Geological Storage of Carbon Dioxide**
- International Standards Organization – 31000, 17024, 14064, 14065
  - International Performance Assessment Centre for Geologic Storage of CO_2 – Seed document
  - Canadian Standards Association - ISO Secretariat, standards developer
  - Bi-national agreement between USA & Canada

S. Carpenter, ARI

Technology/Market/Policy Dynamics – Essential For Viable Business Case



Technology-Market-Policy/Regulatory Dynamics

Key Principle – Timing and working in concert

- **Technology**- R&D & demonstrations to show CCS/CCUS works at scale and competitive as a low carbon technology
- **Markets** – CCS Business Case including broad acceptance and confidence
- **Policy/Regulatory**- Sustainable and sufficient policy incentives and regulatory certainty within workable timetable and flexibility to encourage investment

Sound Standards and Best Practices – are key

Keep big picture in mind– CCS needed for climate and energy security in a GLOBAL low carbon future.

Actions needed

- Encouraging progress with >20 projects in operation and construction but need to address decline in project pipeline and speed of implementation.

Recommendations:

- Short term support / policy actions to help demonstration projects proceed and to build confidence, especially in power and energy-intensive industries.
- Above all, action on long-term climate change mitigation commitments is key to the deployment of CCS technology.
- Must tackle regulatory, policy and storage issues.
- Robust R&D on advanced, low-cost capture technology.
- Need to act now to ensure CCS can play its full role.