



GLOBAL
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GLOBAL CCS INSTITUTE TECHNICAL FOCUS 2015

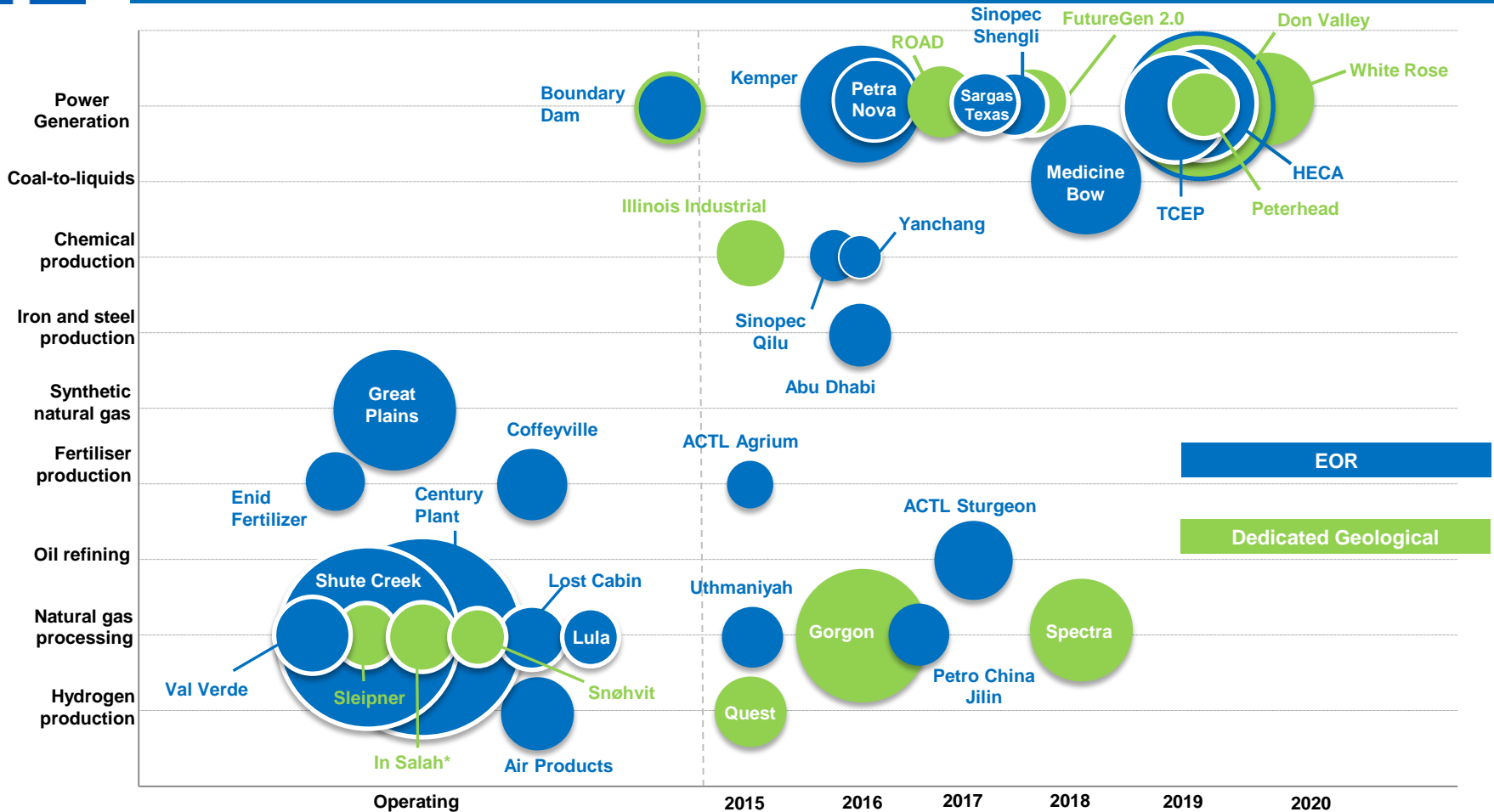
NEIL WILDGUST

PRINCIPAL MANAGER – GEOLOGICAL STORAGE

CSLF Technical Group Meeting
June 2015



Actual and expected operation dates for projects in operation, construction and advanced planning



○ = 1Mtpa of CO₂ (areas of circle are proportional to capacity)

* Injection currently suspended

2014-2015 is a watershed period for CCS – it is a reality in the power sector and additional project approvals are anticipated



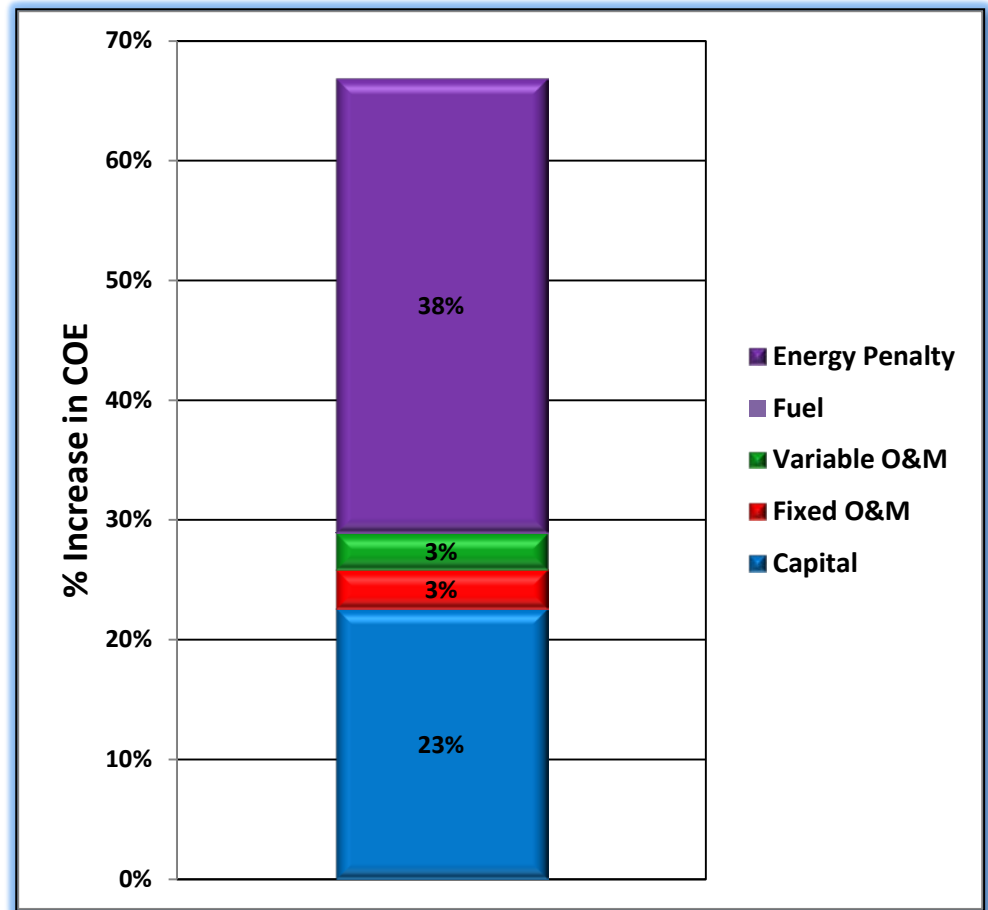
CO2 capture – focus on cost

- First generation projects will deliver important lessons.
- Continued R&D activities – on materials, processes and equipment – will help drive down costs.
- Collaboration crucial to achieve cost and performance goals.
- Next-generation technologies ready for the 2020-2025 timeframe.



Institute's Upcoming Capture Focus

- Cost reduction
 - 2nd Generation Technologies
 - Transformational Technologies
- Water Use





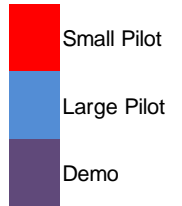
2nd Generation Technologies

- Current wave of projects moved into operation and construction
- What's next?
- Examine R&D pilot projects globally
 - Development timelines
 - Energy impacts
 - Capital cost impacts
- Included as part of 2015 Global Status Report



Current DOE 2nd Generation Pilot Development

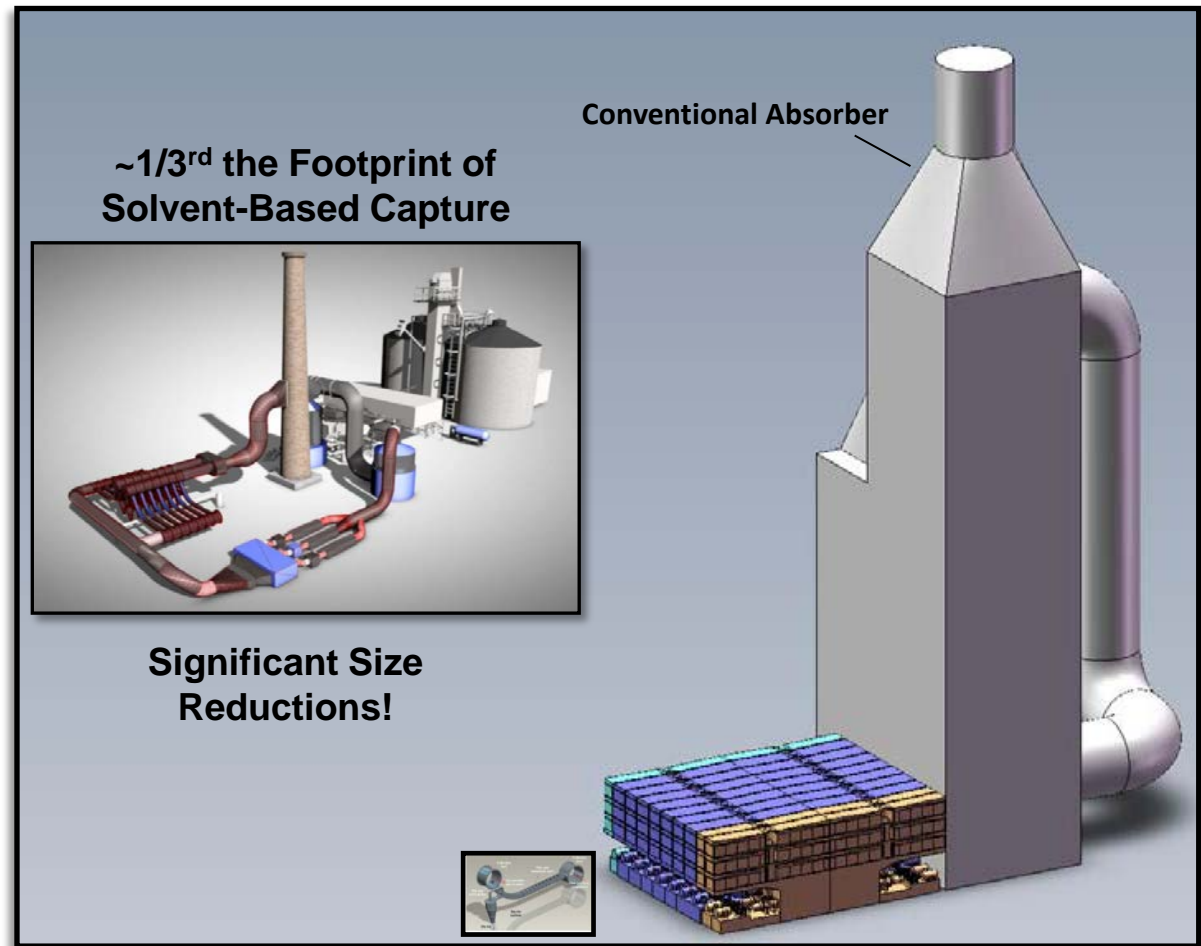
Performer	Project Focus	Benefits	Scale	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY	FY
				14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Solvents																				
Neumann Systems Group	Nozzle-Based Solvent Delivery	Modular; Solvent Agnostic	0.5 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
Linde	Advanced Amine/ Heat Integration	Single Process Train	1 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
University of Kentucky	2-Stage Regeneration	High Pressure Regeneration	0.7 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
Southern Company	Heat Integration/ Exchange	Thermal Management	25 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
General Electric	Silicone Solvent	Enhanced Energetics	1 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
ION Engineering	Non-Aqueous Solvent/ Amine Mixture	Enhanced Energetics	0.7 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
Sorbents																				
ADA-ES	Amine-Based Sorbent	Process Design	1 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
TDA	Alkalized Alumina Sorbent	Process Cycle	1 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
SRI	Carbon-Based Sorbent	Attrition Resistance	1 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
Membranes																				
MTR	Spiral-wound Membrane	Process Design	1 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
GTI	Solvent Contactor	Process Intensification	1 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
Oxygen-Fired																				
Aerojet Rocketdyne	Oxy-PFBC	Latent Heat Recovery	1 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	
Alstom	Limestone Chemical Looping Combustion	Inexpensive O ₂ Carrier	1 MWe	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	





Transformational Technologies

- Targets
- Approaches
 - Materials
 - Equipment
 - Processes
- Summaries of selected development efforts
- Fact sheets or topical reports





Capture and Water Use

- Literature estimates show 60 – 90% increase in water consumption
 - 5 – 10 years old
 - Based on simple design
- Refresh water use estimates
 - Updated design
 - Process integration
- Base on estimates from ROAD and other projects
- Topical Report



CO2 storage – focus on timing

- EOR providing support to current wave of CCS projects.
- Global deployment will require significant geological storage.
- 2°C scenario requires over 2Gt annual storage by 2030, over 7Gt by 2050.
- Greenfields sites can take up to 10 years to assess to FID standard.
- Currently, industry has no incentive to undertake storage exploration.



2014 Status Report – Risk Focus

- Storage section prepared with DNV
- Described how existing technology allows secure geological storage
- Extensive experience from dedicated projects and industrial analogues
- Storage regulations need to be proportionate to risk



Storage Resources

- 2015 Global Status report
 - Global review of storage resource assessments
 - Emphasis on more refined (practical/matched) resources
 - Adequate resources exist to allow commercial deployment
- Long term goal and WBCSD initiative
- Further regional and global assessments worthwhile.....but this is not a barrier to deployment



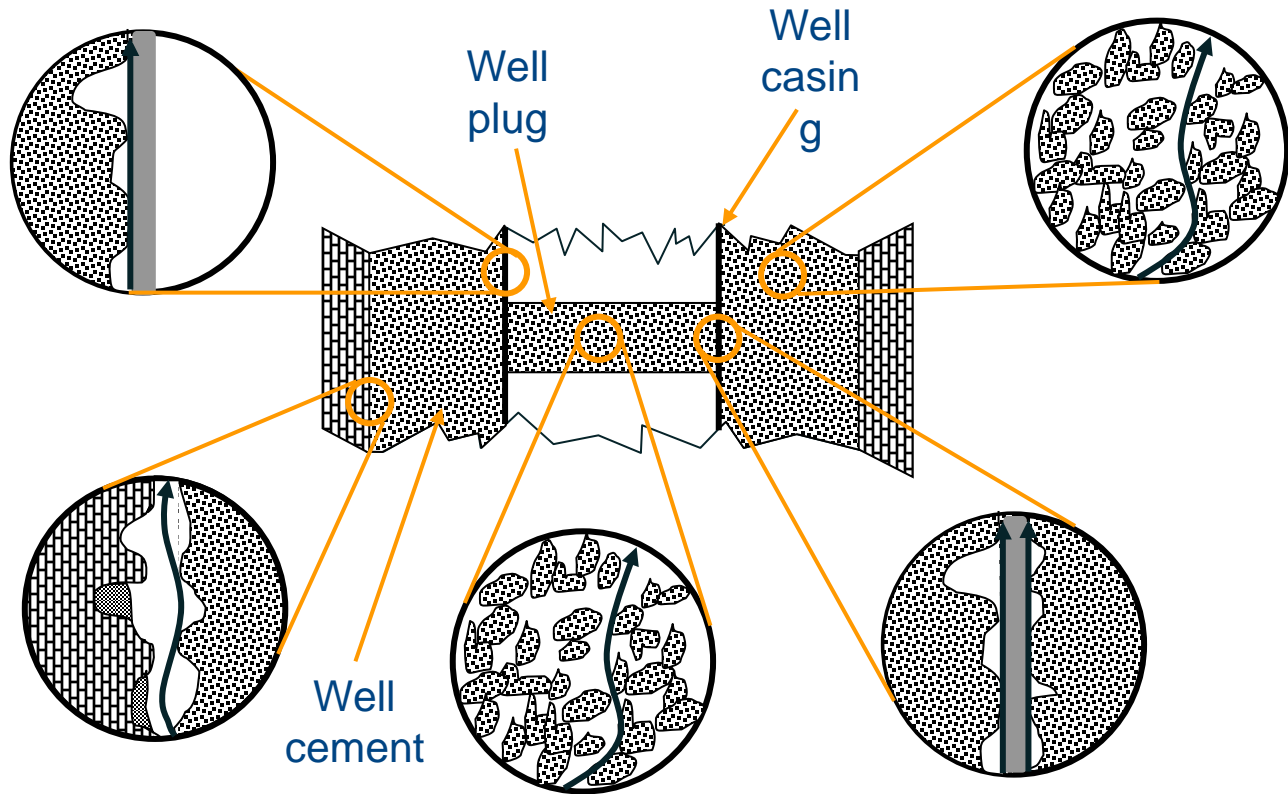
REGIONAL STORAGE FOCUS

- Asia-Pacific
 - CCOP CCS mapping program
 - CSLF offshore task force
 - Global storage readiness report
- Europe-Africa-Middle East
 - ZEP storage and transport
 - Brine extraction/'EWR'
- Americas
 - Knowledge networks
 - ISO support
 - CO₂-EOR and storage









Wellbore Integrity Network

Schlumberger
Carbon Services



LEGEND

-  Cement
-  Formation
-  Drilling mud
-  Well casing
-  Open casing
-  Migrating CO₂

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