

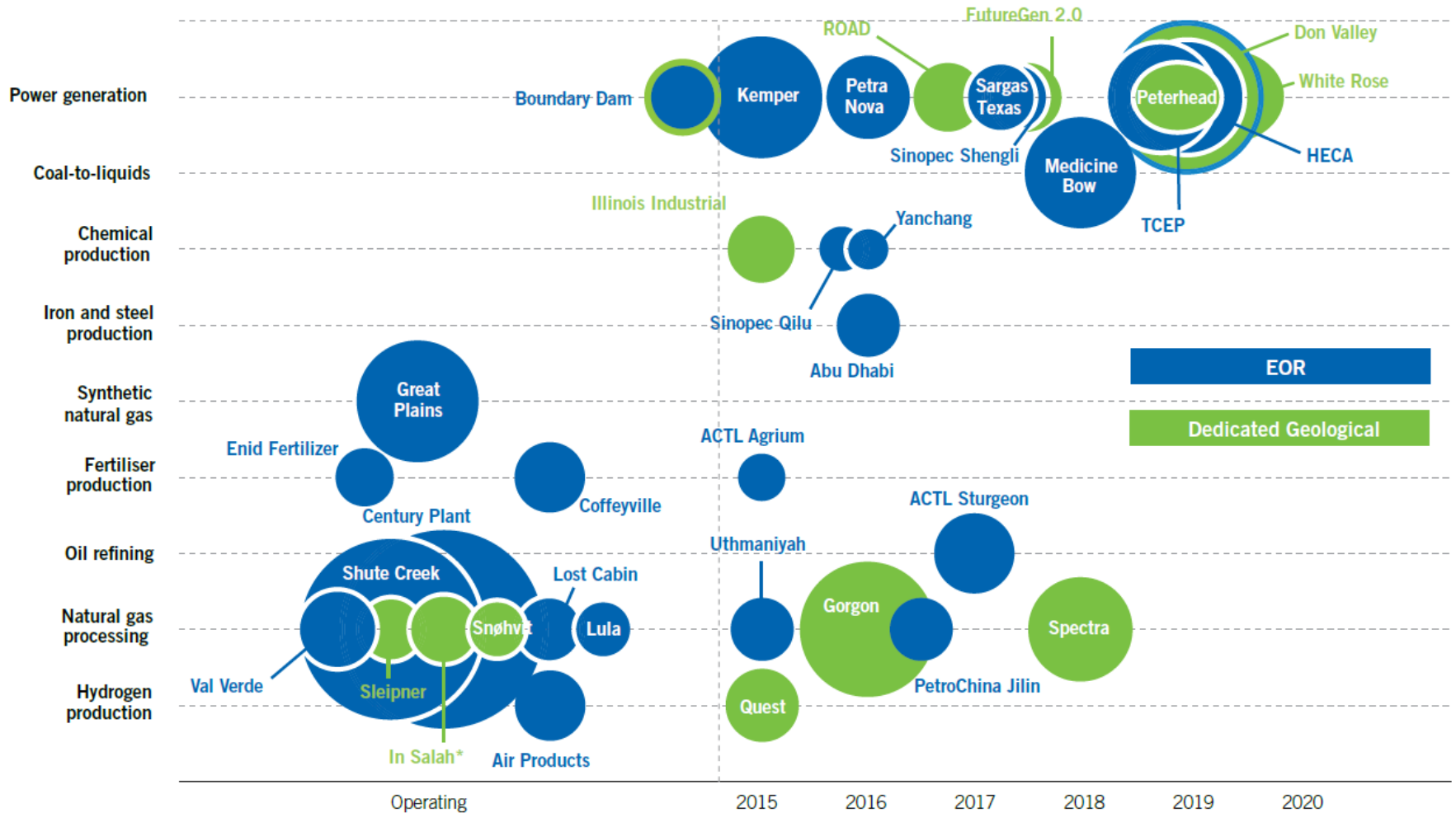
Opening and State of play - CCS



Dr. Nils A. Røkke – Director NORDICCS

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Project status globally



EOR
Dedicated Geological

○ = 1Mtpa of CO₂ (area of circles proportional to capacity)

Source: GCCSI 2014

* Injection currently suspended

North America- CCS Projects - Power Sector

Boundary Dam 3, Canada



NRG Parish, Texas, USA



- Refit of existing coal fired unit
- Operational for 1 year
- CanSolv amine based PCC technology
- 110MWe
- 95% capture
- CO₂ sold for EOR

- Refit of existing coal fired unit
- Operational in late 2016
- MHI amine based PCC technology
- 250 MW slip stream, 1.6 MTPY
- 90% capture
- CO₂ sold for EOR


North America CCS Projects - Power Sector

- Kemper County Project, Mississippi, USA
 - Novel TRIG IGCC Technology
 - 524 MW lignite fired – new build
 - 65% of total emissions captured, ~3 MTPY
 - Due on stream late 2016



European (re)recognition of CCS as key

- Energy Union has 4 +2 priorities in the R&I pillar



The banner features the European Commission logo on the left, the text "2015 - Energy union – R&I pillar" in the center, and a graphic of a globe with energy lines on the right. Below the globe is the text "Towards an #EnergyUnion".

Four core priorities:

- World leader in **RES**, together with energy storage;
- **Consumer** – smart grids, smart home appliances, smart cities, and home automation systems;
- **Efficient energy systems**
- More **sustainable transport systems** – innovation for increase energy efficiency and reduce greenhouse gas emissions.

Two additional research priorities:

- A forward-looking approach to **CCS** and **CCU** for the power and industrial sectors
- **Nuclear energy** – the use of the highest standards of safety, security, waste management and non-proliferation; technological leadership to be maintained

European (re)recognition of CCS as key

- Set Plan has 10 actions and CCS is one of them

Driving ambition in carbon capture storage and use deployment

9. Step up research and innovation activities on the application of carbon capture and storage (CCS) and the commercial viability of carbon capture and use (CCU):

Enhanced efforts by Member States, in the implementation of large-scale integrated chain CCS demonstration projects in both power and industrial sectors, are necessary to gain experience, bring down costs and demonstrate safe and reliable underground storage of CO₂.

At the EU level, apart from the support planned under Horizon 2020, future CCS projects may be able to benefit from the proposed Innovation Fund to support highly innovative, low-carbon first-of-a-kind projects; and the Modernisation Fund, to support modernisation of energy systems in 10 lower-income Member States.

Research and innovation should support carbon and energy intensive industries to explore the feasibility of CCS, focusing primarily on sectors with high-purity sources of CO₂ to minimise capture costs. CCU options, such as transforming CO₂ into fuels, chemicals and material, could further improve the economic case for CCS.



Table 1: Global public spending on low-carbon energy RD&D (latest year)

	\$ billion		As % of total public spending on R&D
Renewables:			
Solar and wind	3.2		
Vehicles (incl. hydrogen)	1.7		
Storage and transmission	1.0		
Total		5.9	1.8%
Bioenergy		1.3	
Nuclear fission		4.2	
Energy efficiency		2.1	
Carbon capture and storage		1.3	

	\$ billion p.a.
Govt R&D expenditure (OECD):	
Total	333
On renewables	6
Subsidies:	
to renewables	101
to fossil fuel	544
Official development aid (OECD)	127
Promised public and private payments by rich countries to developing countries for climate change mitigation	100

Status of CCS in Europe - UK

United Kingdom

- UK Competition £1billion capital funding set aside by Treasury
- FEED now studies underway
 - Peterhead Gas Fired CCS Power Plant
 - White Rose, Oxy fired CCS power plant
- Final Investment Decision end of 2015
- UK Gov. will announce decision in early 2016



- <https://www.gov.uk/guidance/uk-carbon-capture-and-storage-government-funding-and-support>

J.Gale - IEAGHG

Status of CCS in Europe - Norway

- Two commercial scale CCS project operating
 - Sleipner (1996) & Snøhvit (2007) – 1.7 MTPY total
- Technology Centre Mongstad (TCM) operational since 2012 – PCC tech's
- Mongstad full scale CCS project cancelled in 2014 , target full scale by 2020
- Gassnova – three industrial CCS projects under consideration – decision in 2016 expected

~400kt/yr



NORCEM BREVIK
(Cement)

~500kt/yr



YARA
PORSGRUNN
(Fertilizers)

~400kt/yr



Klemetsrud –
Waste incinerator

Status of CCS in Europe – The Netherlands

- ROAD project
 - E.On and ENGIE
 - 1.1 MTPY
 - Coal with PCC- Offshore storage TAQA
 - Linked to utilisation and transport network



- Rumours are:
 - That funding shortfall is being bridged
 - The project team is being reassembled
 - The H2020 Co-fund for large scale demo may go ahead
 - There might be an announcement to go ahead in mid 2016

Summary

- CCS is gaining momentum
 - Several more plants will be operational by 2020 (2-4 more in Europe?)
- No regret option for key industrial processes (steel, cement)
- BioCCS needed according to IPCC – calls for urgency
- EU acknowledges CCS as key for deep decarbonisation
- R&I actions are maintained at EU level and in countries that see CCS as important for security of supply, competitiveness and contributing to greenhouse gas reductions
- NORDICCS is paving the road for CCS in the Nordics!