



GLOBAL
CCS
INSTITUTE



GLOBAL STATUS OF CCS: 2014 - 2015

NEIL WILDGUST, PRINCIPAL MANAGER – GEOLOGICAL STORAGE

CMC Colloquium
April 2015



The Global CCS Institute

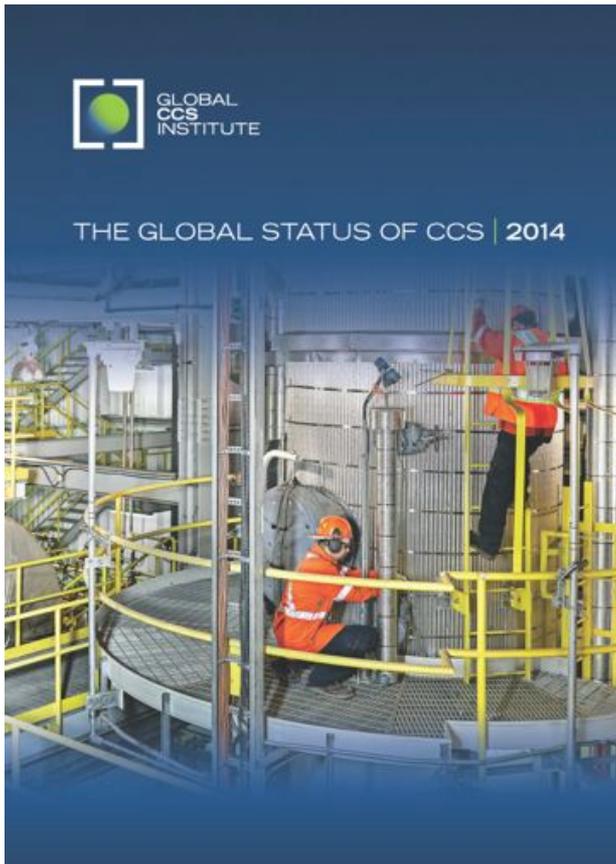


- We are an international membership organisation.
- Offices in Washington DC, Brussels, Beijing and Tokyo. Headquarters in Melbourne.
- Our diverse international membership consists of:
 - governments,
 - global corporations,
 - small companies,
 - research bodies, and
 - non-government organisations.
- Specialist expertise covers the CCS/CCUS chain.



The Global Status of CCS: 2014

The *Global Status of CCS: 2014* – Key Institute publication



- Provides a comprehensive overview of global and regional developments in large-scale CCS projects, in CCS technologies and in the policy, legal and regulatory environment.
- Introduces and links to project descriptions for around 40 lesser scale 'notable' CCS projects.
- Makes recommendations for decision makers.
- The full report is available online, including supporting resources and data



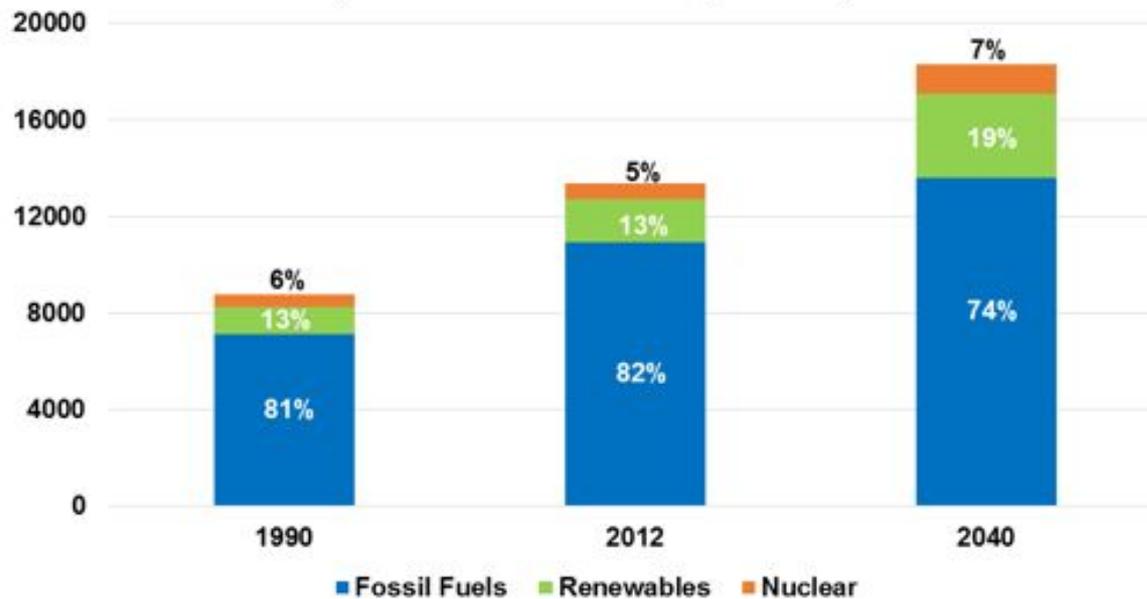
Climate Change – Geoscience Perspective

- Atmospheric CO₂ at 400ppm level – last observed 3 million years ago
- Research continues to link past climate variations and greenhouse gas concentrations
 - Ice core records
 - Deep ocean sediments
- Geoscience position statements:
 - http://www.geosociety.org/positions/pos10_climate.pdf
 - <http://www.geolsoc.org.uk/climaterecord>
- Ocean acidification



Fossil fuel demand growing and reserves robust

Primary energy demand by fuel source:
(million tonnes of oil equivalent)



Fossil fuel proved reserves:
6 trillion barrels of oil equivalent

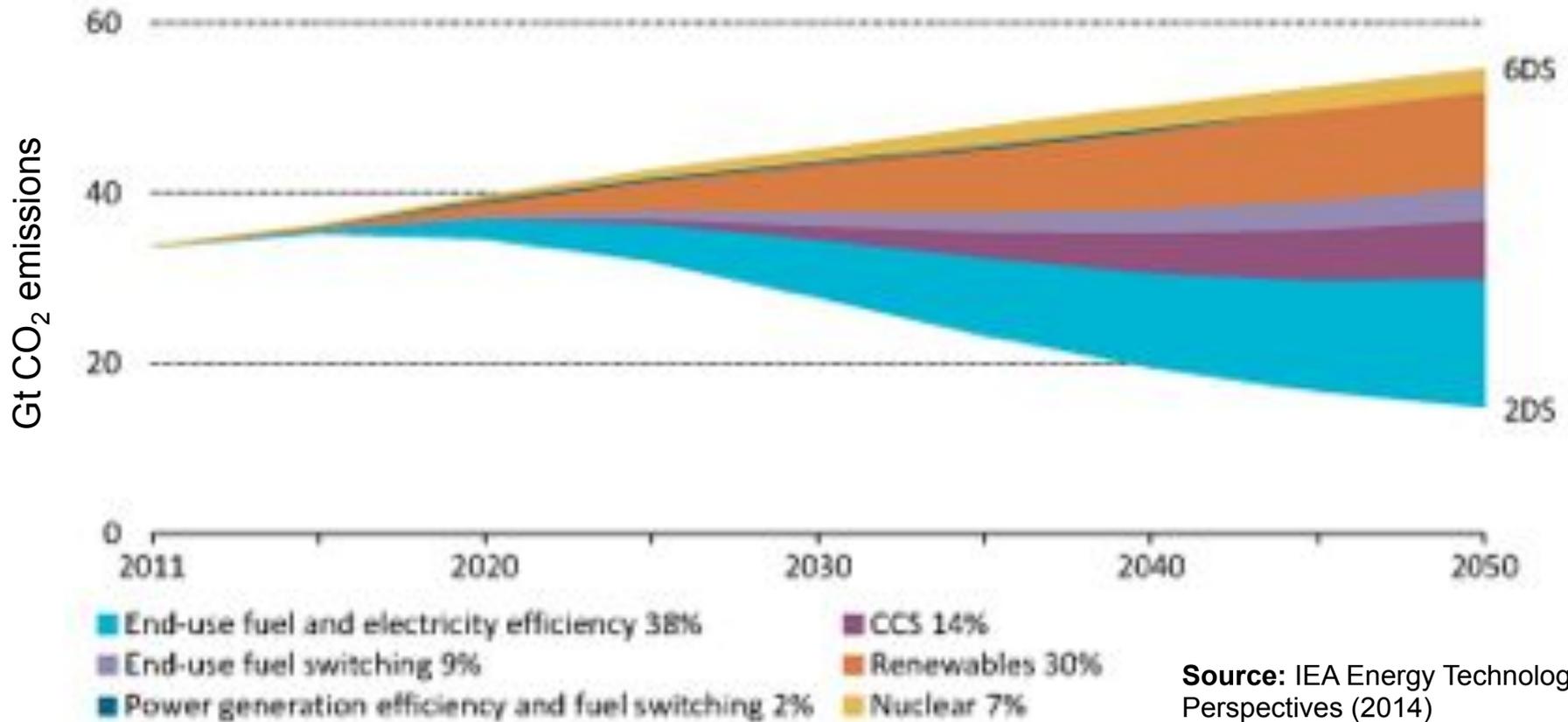
Reserves to production ratio:
~75 years

Source: IEA World Energy Outlook, 2014 (New policies scenario)

Source: BP Statistical Review of World Energy 2014



CCS is a vital element of a low-carbon energy future



A transformation in how we generate and use energy is needed



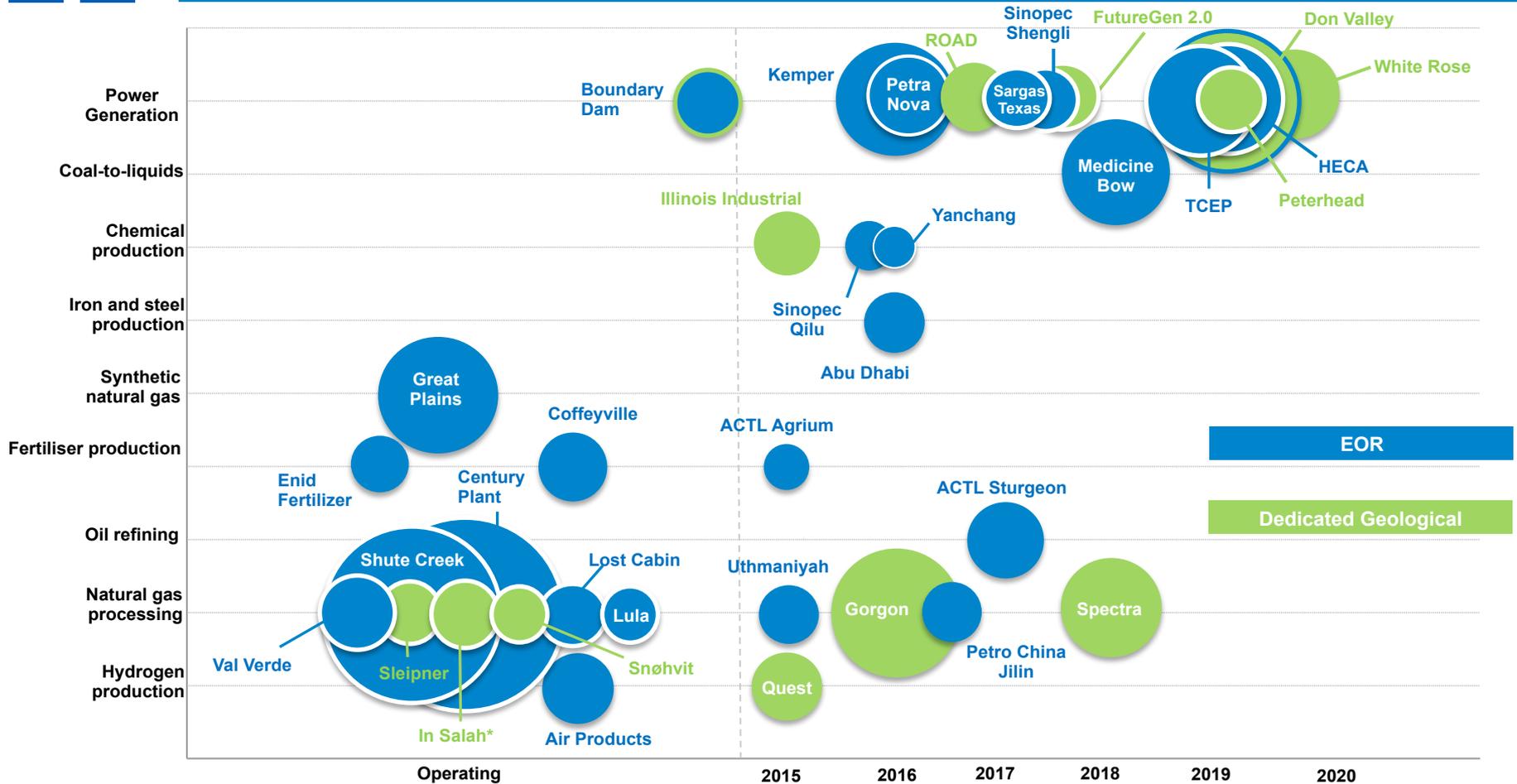
Large-scale CCS projects by region or country

	Early planning	Advanced planning	Construction	Operation	Total
Americas	5	6	6	10	27
China	7	4	-	-	11
Europe	2	4	-	2	8
Gulf Cooperation Council	-	-	2	-	2
Rest of World	4	-	1	1	6
Total	18	14	9	13	54

North America, China and UK (with 5) have the most projects



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

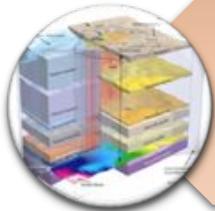
IEAGHG Weyburn-Midale CO₂ Monitoring & Storage Project (WMP) 2000 to 2012



Commercial EOR operations in Weyburn and Midale oilfields utilise anthropogenic CO₂



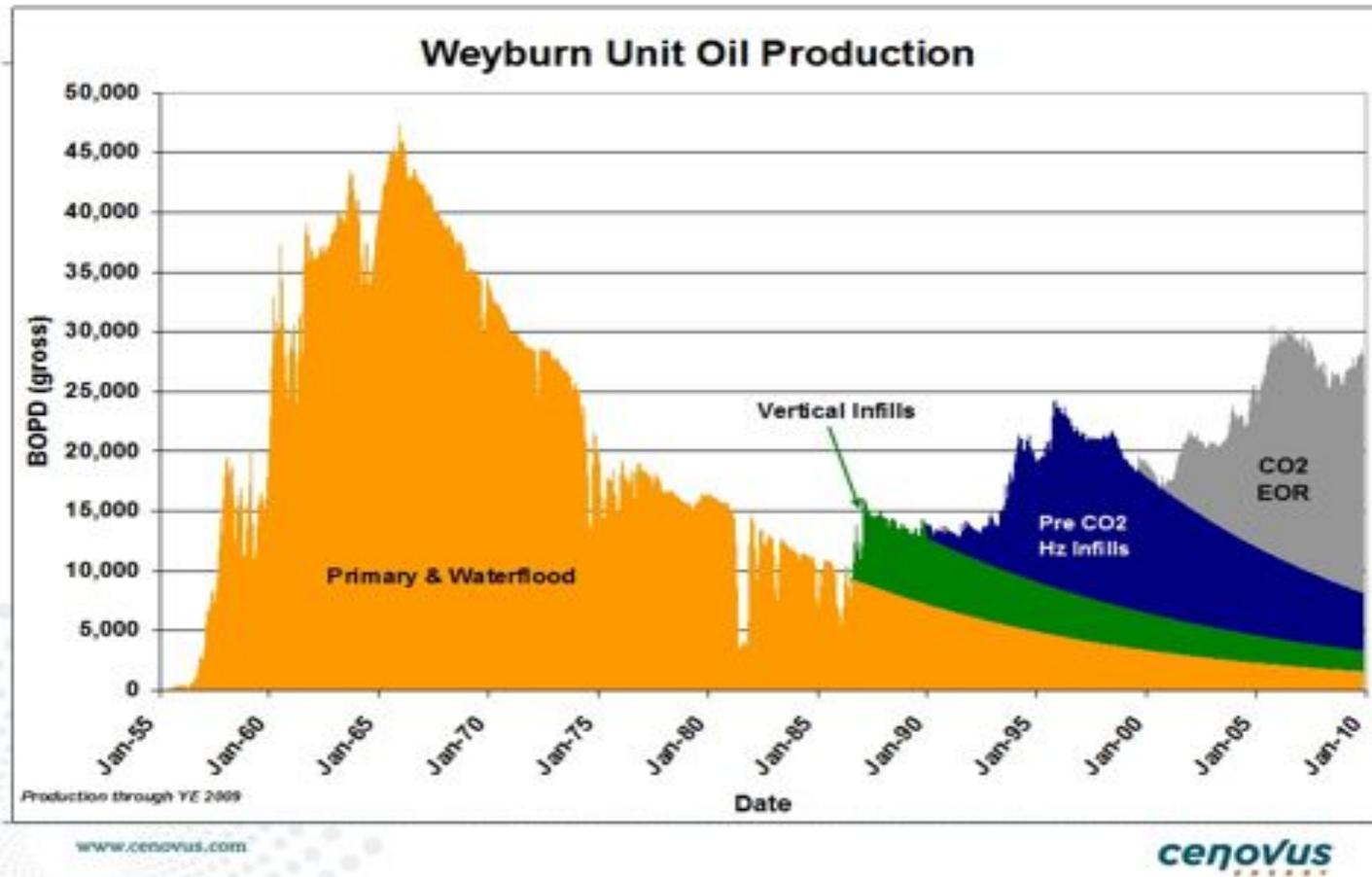
Over 25Mt of CO₂ injected and stored since 2000



WMP has used these sites to study technical aspects of CO₂ geological storage



Oil Production: Weyburn Field



SUPPORTED BY:



WHY USE OIL FIELDS TO STORE CO₂?

- Well-developed technique for injecting and handling large volumes of CO₂, with over 40 years of experience.
- CO₂ is incidentally stored through enhanced oil recovery (EOR) operations.
- Much of the infrastructure is already in place.
- Costs of storage (e.g., new infrastructure, monitoring, etc.) can be offset by income from EOR.



Courtesy EERC

EOR IS STORAGE!

- Existing EOR operations are already incidentally storing CO₂.
- Almost every ton of CO₂ purchased is eventually stored.
- Oil produced with CO₂ EOR is “greener” than conventionally produced oil.



Regional analysis – North America

- Has well over half the large-scale projects in operation or under construction.
- Home to all three of the world's large-scale CCS power projects in operation or under construction.
- CO₂-EOR providing significant business case support.
- Policy actions and incentives to drive CCS deployment must complement regulatory action on emissions standards.
- US DOE supports an extensive R&D program into CCS technologies.
- Brazil and Mexico advancing CCS/CCUS programs.



Regional analysis – Asia Pacific

- China follows the US as the most active country in CCS/CCUS.
- The world's largest dedicated geological storage project – the Gorgon Carbon Dioxide Injection Project in Australia – is planned to be operational in 2016.
- Japan and Korea have CCS activities at pilot and demonstration scale:
 - Japan – the Tomakomai and Osaki CoolGen projects are in construction
 - Korea – KEPCO is testing advanced capture technologies
- A key focus is increasing knowledge of storage potential in the region.
- Legal and regulatory advances are required in some jurisdictions to provide greater certainty to project proponents.



Regional analysis – Europe

- CCS ambition at start of the decade has not been realised.
- Recognition of CCS in the October 2014 European Council conclusions is a positive sign of support.
- CCS projects in the UK are progressing and policy makers are developing mechanisms to support CCS in the power and industrial sectors.
- European projects in planning are important contributors to a global portfolio – all are in the power sector and plan to use offshore geological storage.
- The Dutch ROAD project is critical for CCS in mainland Europe.



Regional analysis – Gulf Cooperation Council (GCC)

- GCC countries are at an early stage of CCS/CCUS deployment.
- Saudi Arabia and the United Arab Emirates (UAE) have significant projects.
- The UAE hosts the world's first CCS/CCUS project in the iron and steel sector.
- The focus of CCS/CCUS activity in the region is two-fold:
 - validate large-scale projects under local conditions
 - support for R&D activities
- Confidence from these programs is a key driver for longer-term deployment.



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.



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.



Policy and regulatory support is vital

- Achieving climate goals without CCS would incur substantial additional costs - or not be possible.
- Current large-scale CCS project activity is supported by public funding programs established towards the end of the last decade.
- Looking forward, a strong policy, legal and regulatory environment will incentivise and provide predictability for investors in CCS projects.
- Action is needed now if we are to deliver projects in the next decade
- The new international climate agreement under development will be an important foundation stone.
- Regional and national policy settings should be technology neutral to ensure that CCS is not disadvantaged relative to other technological solutions.

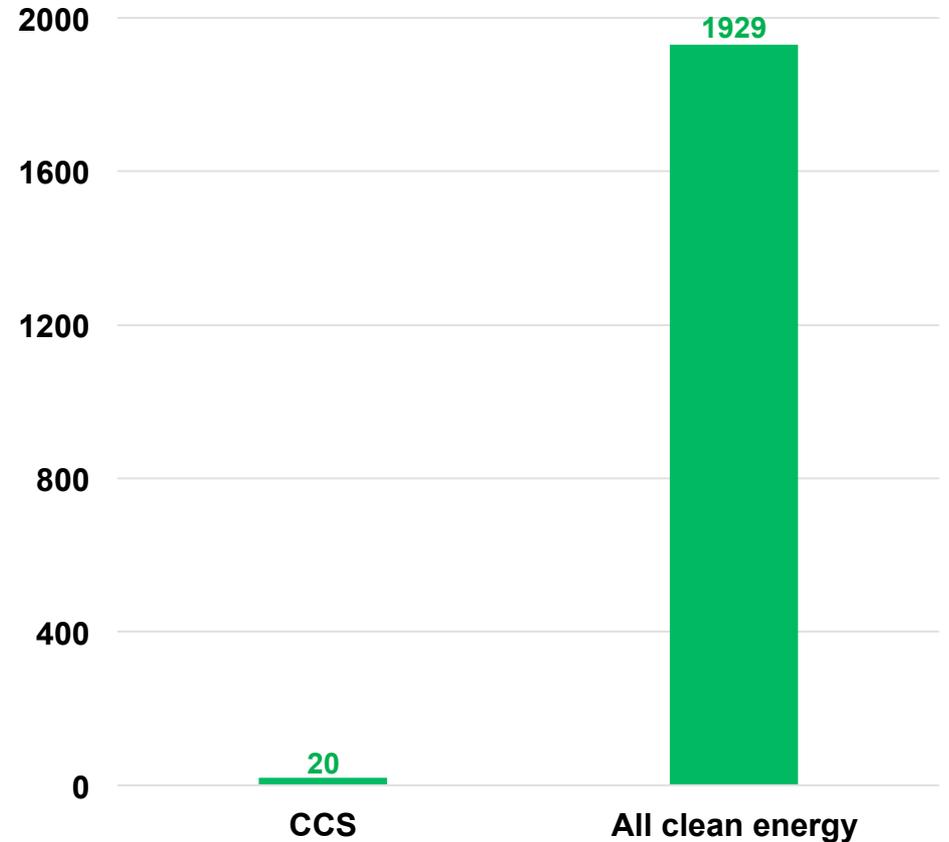


Strong policy drives investment

- Scale of renewables investment is instructive
- CCS has not enjoyed commensurate policy support
- EOR has provided impetus in North America
- Policy parity is essential
- How do we get CCS onto a similar curve?

Clean energy investment between 2004-2013

USD billion



Data source: Bloomberg New Energy Finance as shown in IEA presentation “*Carbon Capture and Storage: Perspectives from the International Energy Agency*”, presented at National CCS week in Australia, September 2014.



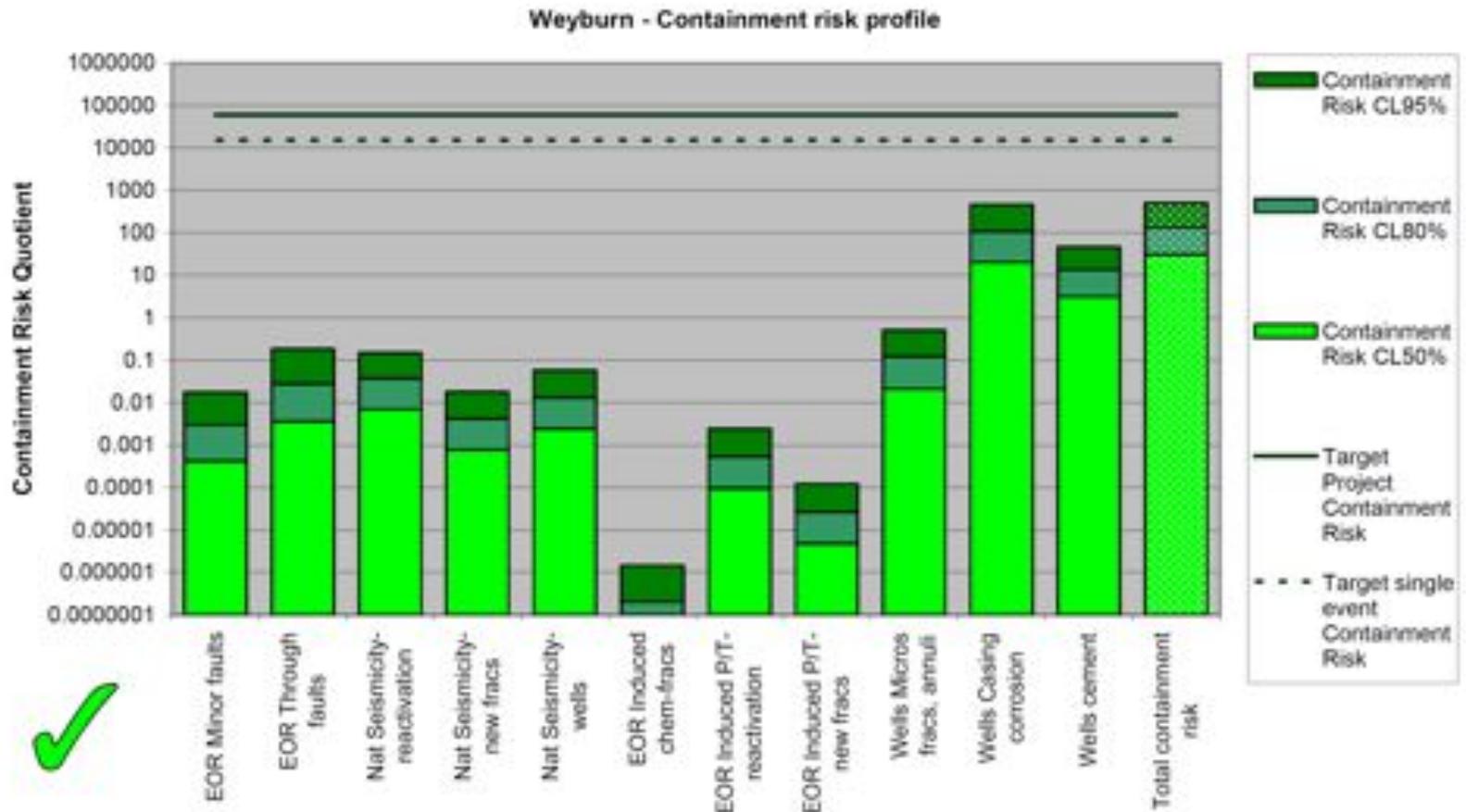
Recommendations for decision makers

- Near-term policy support critical to move advanced projects into construction.
- Strong, sustainable emission reduction policies that give investors confidence to invest in CCS are needed for longer-term deployment. These policies must be technology neutral.
- Programs that encourage the exploration of significant storage resources are needed to give storage certainty and support timely deployment.
- Substantial emissions reductions are required in non-OECD countries - focused effort is required to increase project activity in these economies.
- CCS is the only technology that can achieve large reductions in CO₂ emissions from industries such as iron and steel and cement. Urgent attention must be given to policies that incentivise deployment of CCS in such industries.

WMP Containment Risk Profile

The storage will retain most of the CO₂ injected

Containment risk assessment



No further work would be required to demonstrate containment acceptability.



Our call to action for 2015

It is time to move the agenda forward:

- CCS in the power sector is now a reality
- We now have double the number of projects in operation and construction around the world than at the start of the decade.
- Next wave of CCS projects need decisions now
- We must all take today's messages and promote CCS
- Challenge is not technology – it is policy and support
- CCS community must build on recent successes

**OUR CALL TO ACTION IS TO
ACCELERATE CCS AROUND THE WORLD**

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