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GLOBAL STATUS OF CCS

Deployment of Carbon Capture, Use and Storage in the Arab Region: Challenges and Opportunities – UN ESCWA Expert Workshop, Manama, Bahrain

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Cover image: Aerial view of Tomakomai CCS Demonstration Project facilities located at Tomakomai City, Hokkaido, Japan. Image provided by JCCS.



The Global CCS Institute

Our Vision for CCS:

CCS is an integral part of a low-carbon future

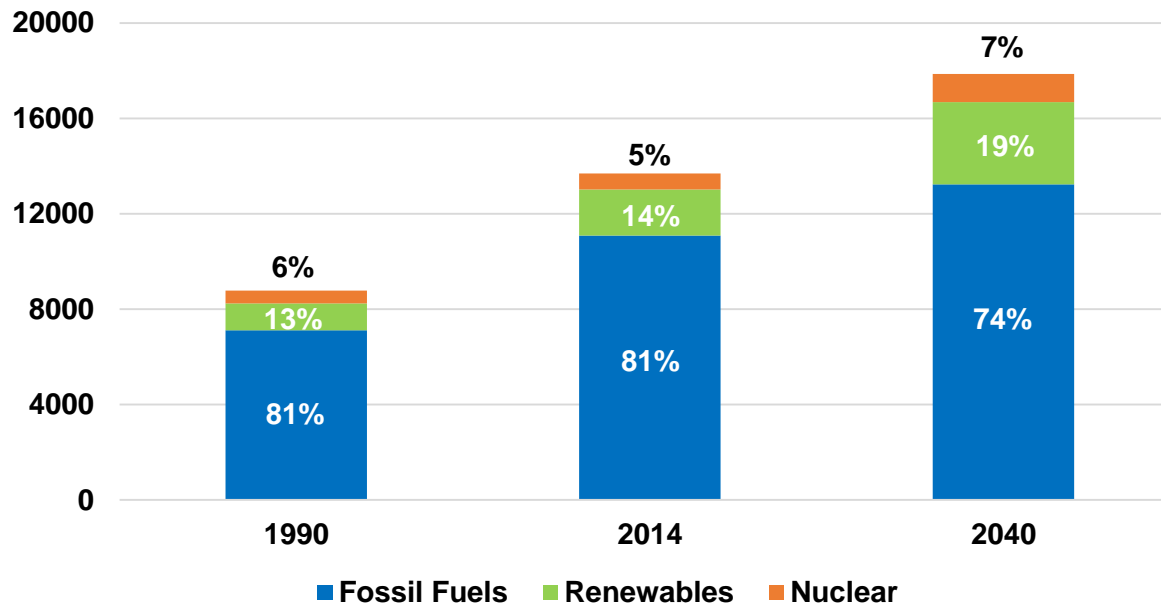


- We are an international membership organisation.
- Offices in Washington DC, Brussels, Beijing and Tokyo. Headquarters in Melbourne.
- Our diverse international membership consists of:
 - governments,
 - global corporations,
 - small companies,
 - research bodies, and
 - non-government organisations.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



Fossil fuel demand growing and reserves robust

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



Source: IEA World Energy Outlook, 2016 (New policies scenario)

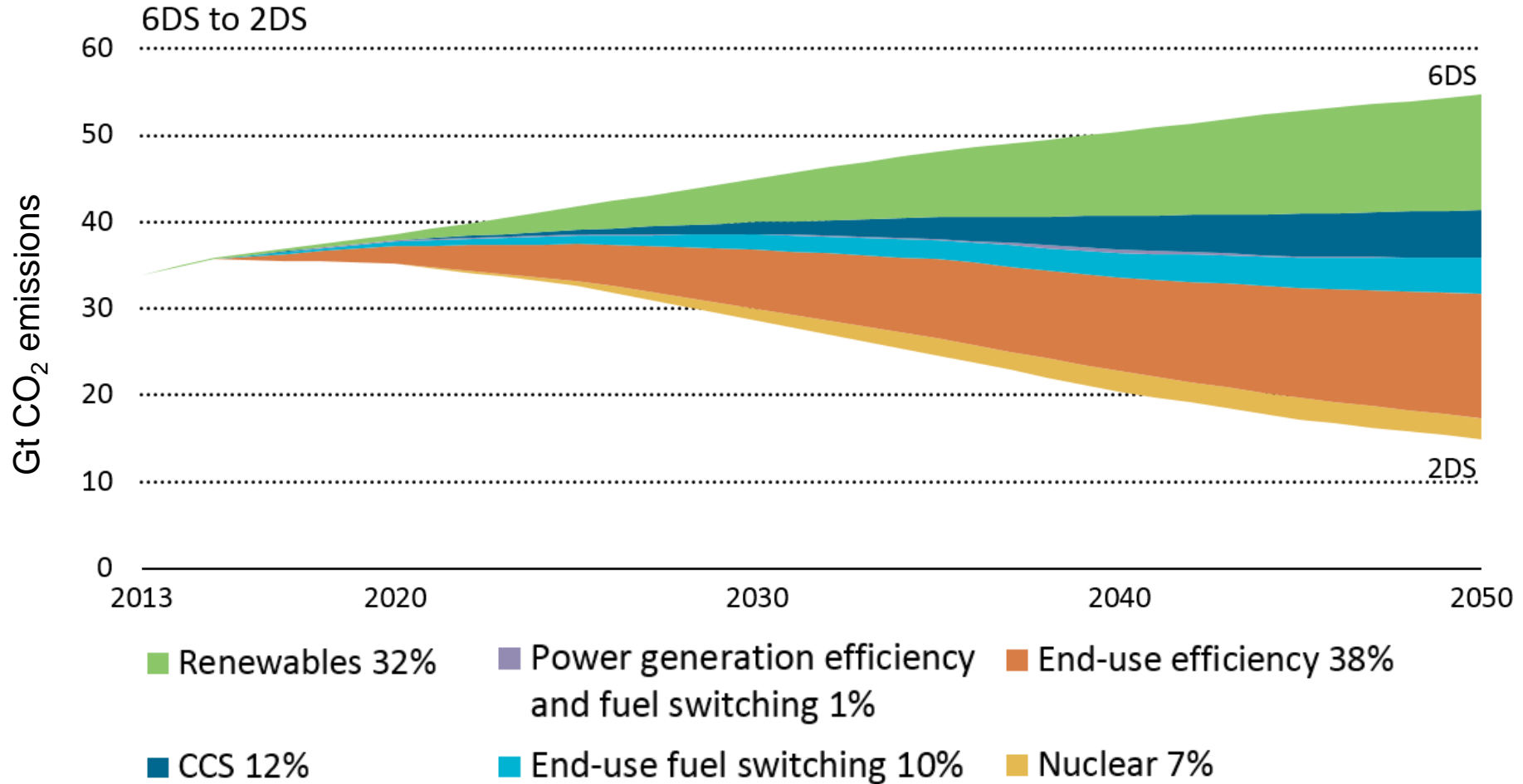
Fossil fuel proved reserves:
6 trillion barrels of oil equivalent

Reserves to production ratio:
~75 years

Source: BP Statistical Review of World Energy 2016



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

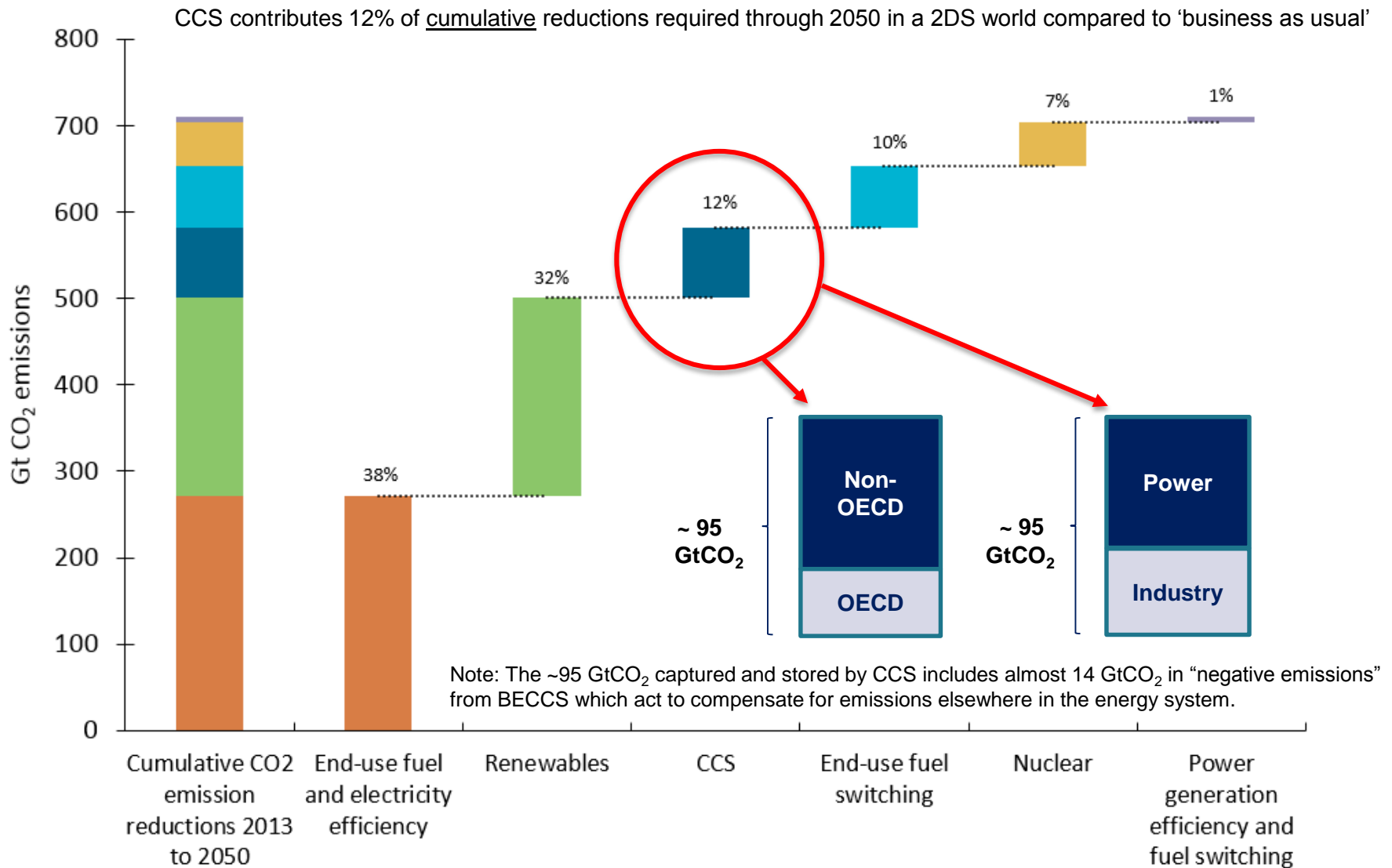


A transformation in how we generate and use energy is needed

Source: IEA Energy Technology Perspectives (2016)

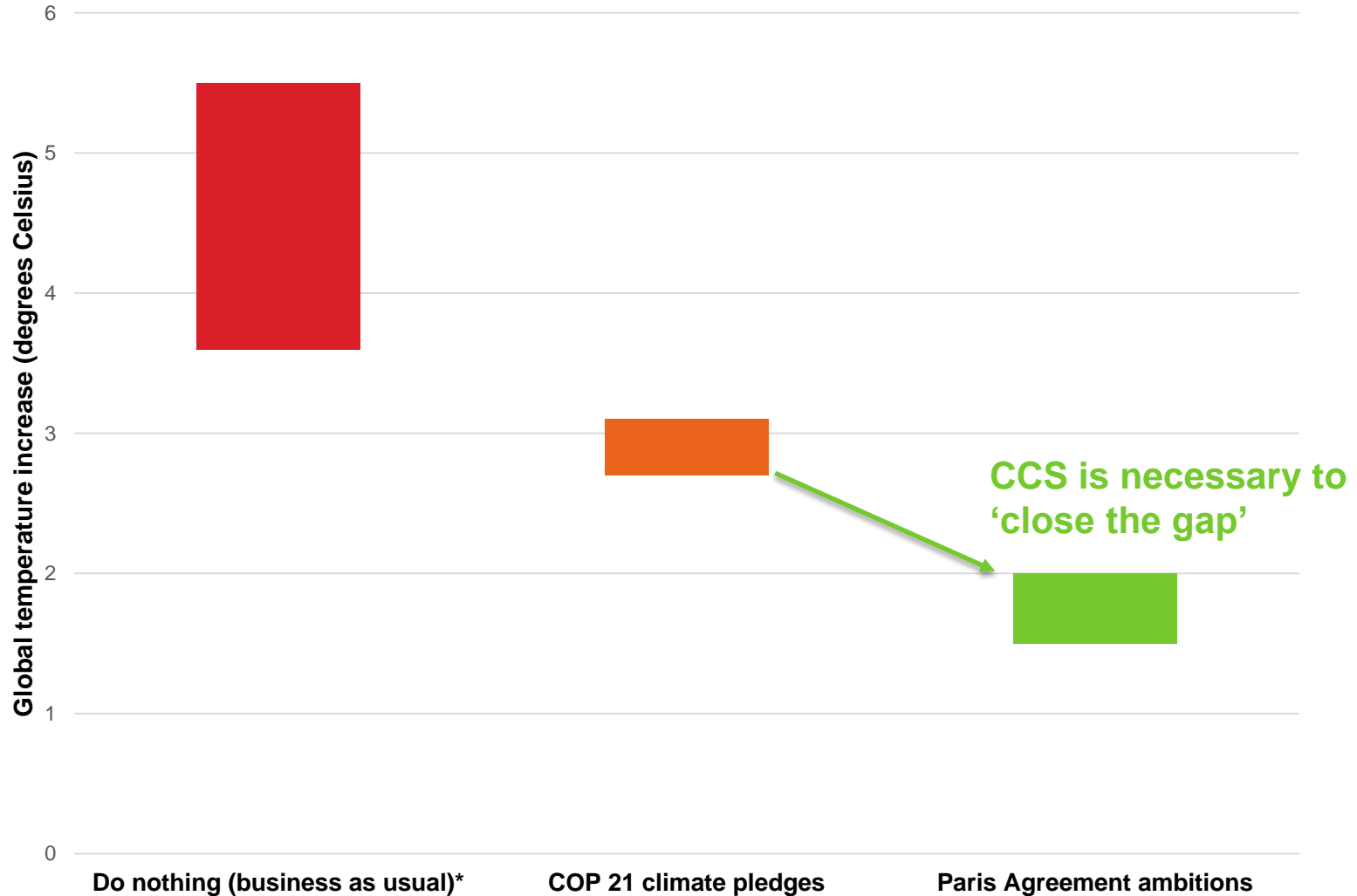


CCS is critical in a portfolio of low-carbon technologies





CCS is essential to meet Paris Agreement ambitions



*Absence of efforts to stabilise the atmospheric concentration of greenhouse gases.



A significant task within one generation

Global Status of CCS January 2017

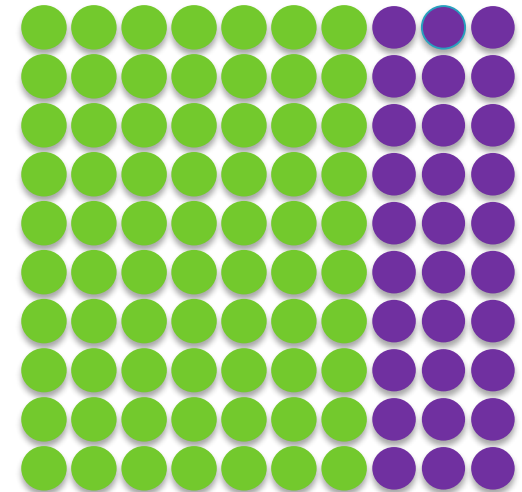
38 large-scale CCS facilities - combined CO₂ capture capacity of approximately 70 Mtpa*:

- 21 facilities in operation or construction (**40.3 Mtpa**)
- 6 facilities in advanced planning (8.4 Mtpa)
- 11 facilities in earlier stages of planning (21.1 Mtpa)

40 Mtpa



Almost 4,000 Mtpa of CO₂ captured and stored by 2040
(IEA 2DS Scenario)**



● Non-OECD ● OECD

*Mtpa = million tonnes per annum

**Source: IEA, 2016. *Energy Technology Perspectives: Towards Sustainable Urban Energy Systems*. Paris. OECD/IEA.



Large-scale CCS facilities by region or country – January 2017

	Early planning	Advanced planning	Construction	Operation	Total
North America	1	1	4	11	17
China	5	3	-	-	8
Europe	2	1	-	2	5
Gulf Cooperation Council	-	-	-	2	2
Rest of World*	3	1	1	1	6
Total	11	6	5	16	38

** Includes facilities in Australia, Brazil and South Korea.*

North America dominates – four of the five facilities in construction soon to be operational, China has most facilities in planning, facility pipeline needs replenishment



16 large-scale facilities are operational; more to come

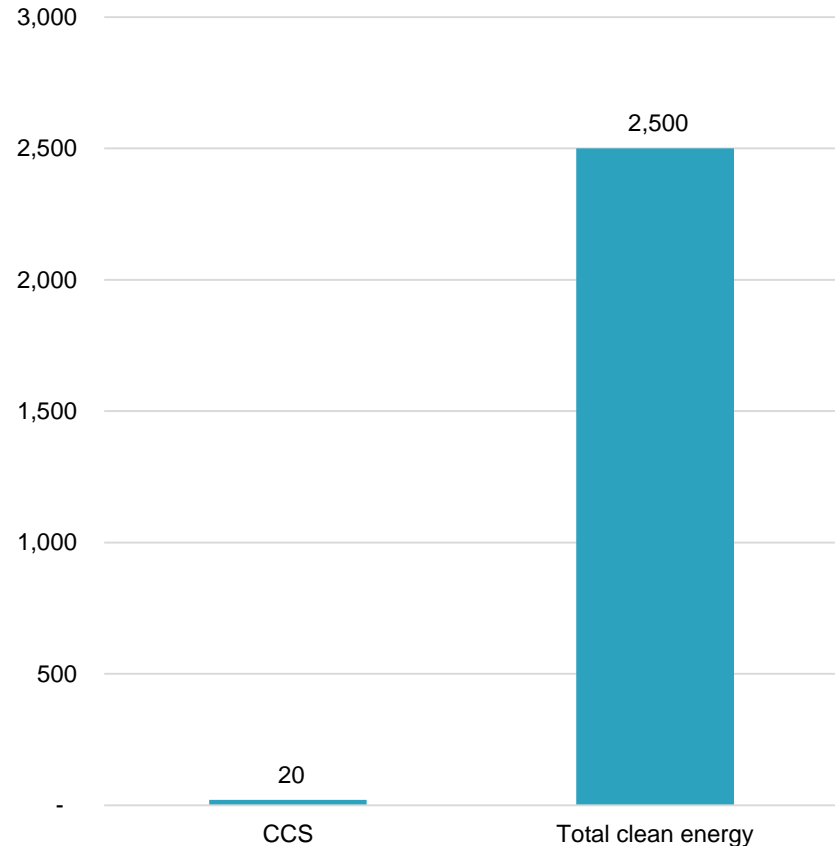




Strong policy drives investment – CCS must be afforded ‘policy parity’

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






USD billion since 2006



Data source: IEA 2015 “Tracking Clean Energy Progress”. Bloomberg New Energy Finance “Clean Energy Investment By the Numbers – End of Year 2015” fact pack.



CCS Legal and Regulatory Indicator results

COUNTRY		TOTAL SCORE (out of a possible 87)
BAND A: CCS-specific laws or existing laws that are applicable across most parts of the CCS project cycle (5 countries)		Average score: 65
	Australia	67.0
	Canada	65.5
	United Kingdom	65.0
	United States	64.0
	Denmark	62.0
BAND B: CCS-specific laws or existing laws that are applicable across parts of the CCS project cycle (27 countries)		Average score: 47
BAND C: Very few CCS-specific or existing laws that are applicable across parts of the CCS project cycle (21 countries scored)		Average score: 26



Regional analysis – Gulf Cooperation Council (GCC)

- GCC countries are at an early stage of CCS deployment
- Saudi Arabia is home to the region's first operational large-scale CCS project
- The UAE hosts the world's first CCS project in the iron and steel sector
- The focus of CCS 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



Regional analysis – Europe

- CCS ambition at start of the decade has not been realized, however Europe continues to make a significant contribution to CCS development
 - 20 years of successful CO₂ storage with Norway's Sleipner CO₂ Storage Project
 - The initiation of the Norwegian full-chain CCS concept definition studies
 - The Dutch ROAD Project remains a significant project in mainland Europe
 - The Teesside Collective Project could be a key demonstrator of Industrial CCS in Europe
- The UK has affirmed its continued commitment to CCS and a new CCS strategy is expected from the UK Government
 - Some excellent knowledge sharing resources and research have emerged from UK FEED projects and from independent bodies in the past year recommending possible delivery mechanisms for CCS
- Ongoing reform to the EU-ETS and activities under the Strategic Energy Technology (SET) Plan process offer platforms for longer term CCS deployment
- The development of CCS 'Hub and Cluster' opportunities are a key area of interest in the region



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 (which are under legal challenge in the US)
- US DOE supports an extensive R&D program into CCS technologies
- Brazil and Mexico advancing CCS/CCUS programs



Regional analysis – Asia Pacific

- China has eight large-scale CCS projects in various stages of planning, and several demonstration and pilot-scale projects in operation
 - The Yanchang Integrated Carbon Capture and Storage Demonstration Project is expected to make a final investment decision in the near future
- The world's largest dedicated geological storage project – the Gorgon Carbon Dioxide Injection Project in Australia – is expected to be operational in 2017
- Japan and Korea have CCS activities at pilot and demonstration scale:
 - Japan – the Tomakomai CCS Demonstration Project began operations in April 2016, carbon capture at the Mikawa power plant is planned for ~2020, and the Osaki CoolGen Project is progressing through construction and commissioning
 - 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



Global CCS status – a recap to guide future action

- CCS is indispensable in a least-cost approach to global decarbonisation
- Opportunities for cost reductions are being identified
- The task is enormous – the urgency of CCS deployment is only increasing
- Deployment is not a technology challenge
- Supporting CCS in industrial applications and non-OECD countries is very important
- Policies that spur investment are the missing pieces in the jigsaw



A plan of action for CCS – completing the jigsaw

- 'Policy parity' must be provided to CCS
 - Provision of equitable level of consideration, recognition and support alongside other low-carbon technologies
- For CCS, this means policies specifically tailored to the technology and its lifecycle stage, including:
 - Providing predictable and enduring policy arrangements
 - Implementing effective and cost-efficient CCS law and regulation
 - Incentivising early storage site identification and characterisation
 - Re-doubling R&D efforts to reduce costs and increase efficiency
 - Encourage efficient development of hub and cluster arrangements



How the Institute may assist

- Services provided to Institute Members:
 - Core membership offering
 - Regionally focused activities and service provision
 - In-house expertise across the full CCS chain
 - Advocacy and promotion
 - Networking opportunities – regional and international
 - Representation in key international fora (e.g. UNFCCC, ISO)
- Provision of targeted research and consultancy:
 - Discrete topic-specific research programmes
 - Assistance with development of national CCS strategies
 - Education and community outreach activities

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