Energy and Power Projects with CCS
A Global Perspective

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Roundtable on the Commercial and Financial Structuring of Commercial Scale Projects with CCS

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AGENDA

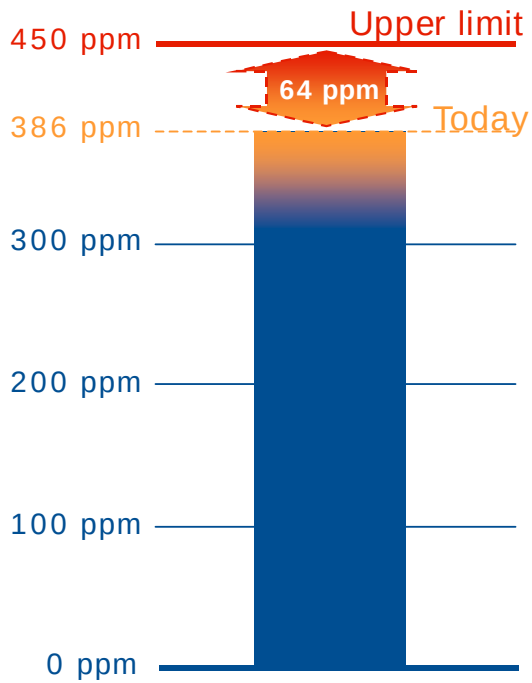
- The potential of CCS for the Energy and CO_2 challenge
- What's limiting build rate? "Laws" of energy deployment
- Lessons so far – research, development, deployment
- Copenhagen and what next?

THE ENERGY AND CO_2 CHALLENGE

ENERGY DEMAND WILL DOUBLE WHILE CO_2 IS NEARING ITS LIMIT

CO_2 CONCENTRATION IN ATMOSPHERE

Science warns of a 450 ppm upper limit



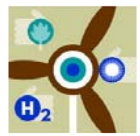
Emissions are rising at over **2 ppm** per year

MEETING DEMAND WITH LESS CO_2

The world will need ALL options it has

Energy efficiency

AND



Renewables

AND

Nuclear

AND

CO_2 Capture and Storage

AND

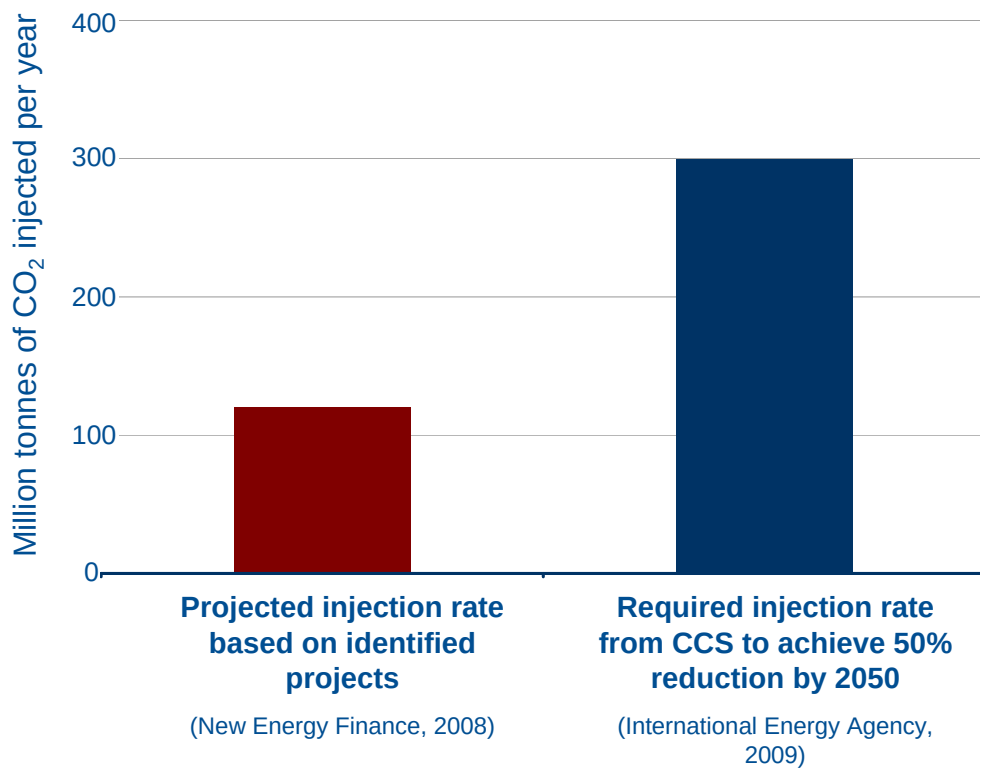
Forestry, LUC,

All five pathways are essential and will be needed **at scale** to meet energy demand this century and to limit CO_2 emissions.

GAP BETWEEN REQUIREMENT AND DEPLOYMENT

OVER 150 MILLION TONNES CO_2 GAP TO THE REQUIRED LEVEL

Annual injected rate by 2020



THE NEED TO RAMP-UP DEPLOYMENT

- Intergovernmental Panel of Climate Change (IPCC) identified CCS as having the potential to deliver up to 55% of the mitigation effort needed by the end of this century
- All identified projects estimate a total injection rate of 120 million tonnes of CO_2 sequestered annually by 2020 – far from the needed 300 million tonnes by 2020 to achieve 50% reduction by 2050
- Prompt deployment of CCS at scale is crucial to meet the energy and CO_2 challenge

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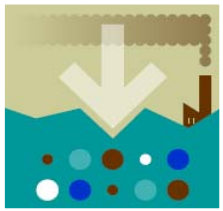


"LAWS" OF ENERGY TECHNOLOGY DEPLOYMENT

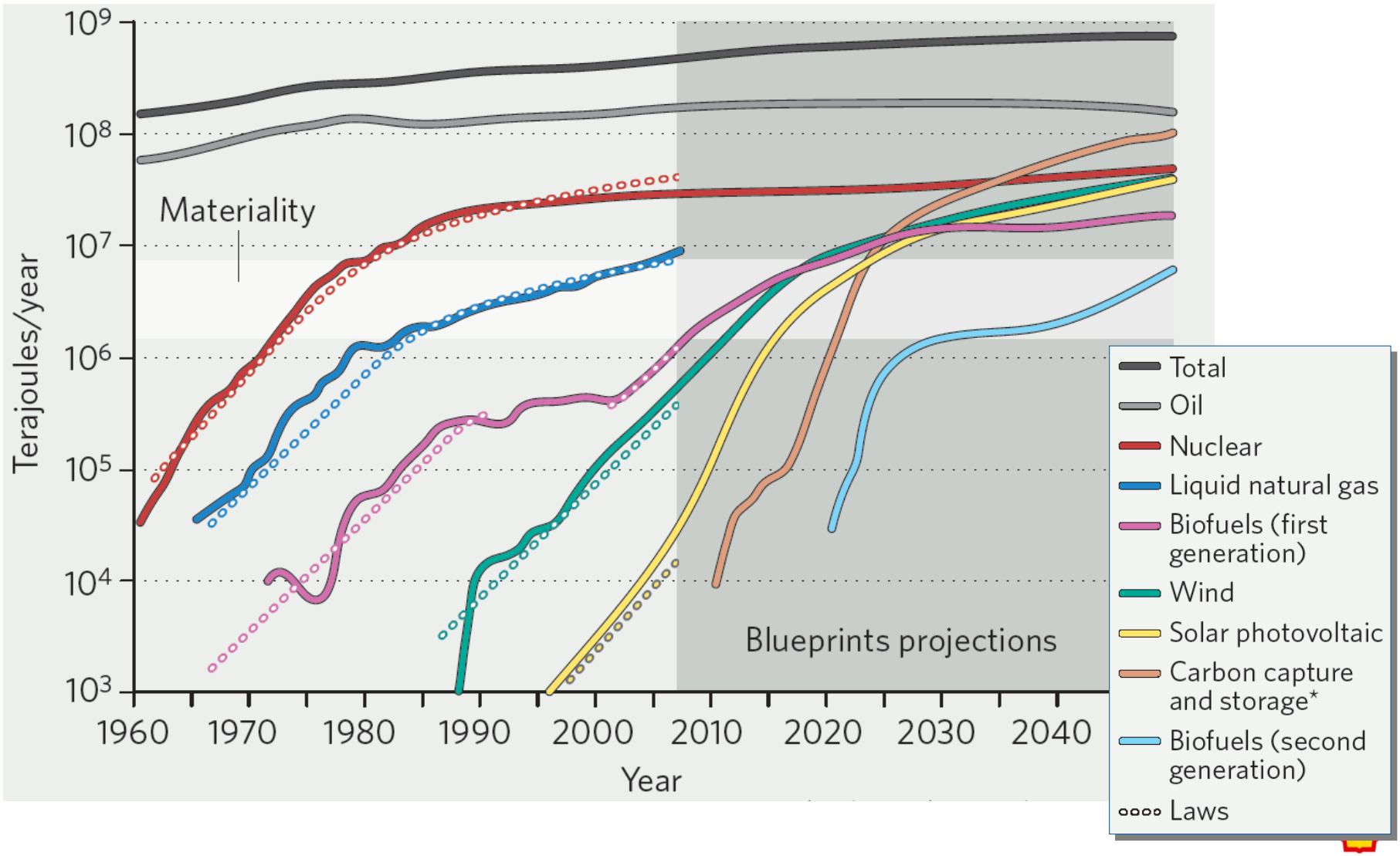
Law 1

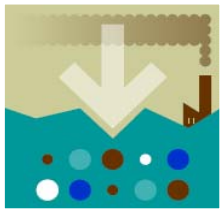
When technologies are new, they go through a few decades of exponential growth, which in the 20th Century was characterized by scale-up at a rate of one order of magnitude a decade (corresponding to 26% annual growth). Exponential growth proceeds until the energy source becomes 'material' - typically around 1% of world energy.

Law 2

After 'materiality', growth changes to linear as the technology settles at a market share. These deployment curves are remarkably similar across different technologies.

“LAWS” OF ENERGY TECHNOLOGY DEPLOYMENT





WHAT DOES THIS MEAN?

- Fossil fuels will remain dominant until at least the middle of the century.
- Therefore we need CCS.
- There are physical limits to the rate at which new energy technologies can be deployed.
- Therefore structured government intervention is needed to drive technology change.
- *We need policies and incentives targeted specifically at CCS to accelerate deployment – and these need to change as the technology moves along the deployment curve*

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GOVERNMENT SUPPORT FOR CCS

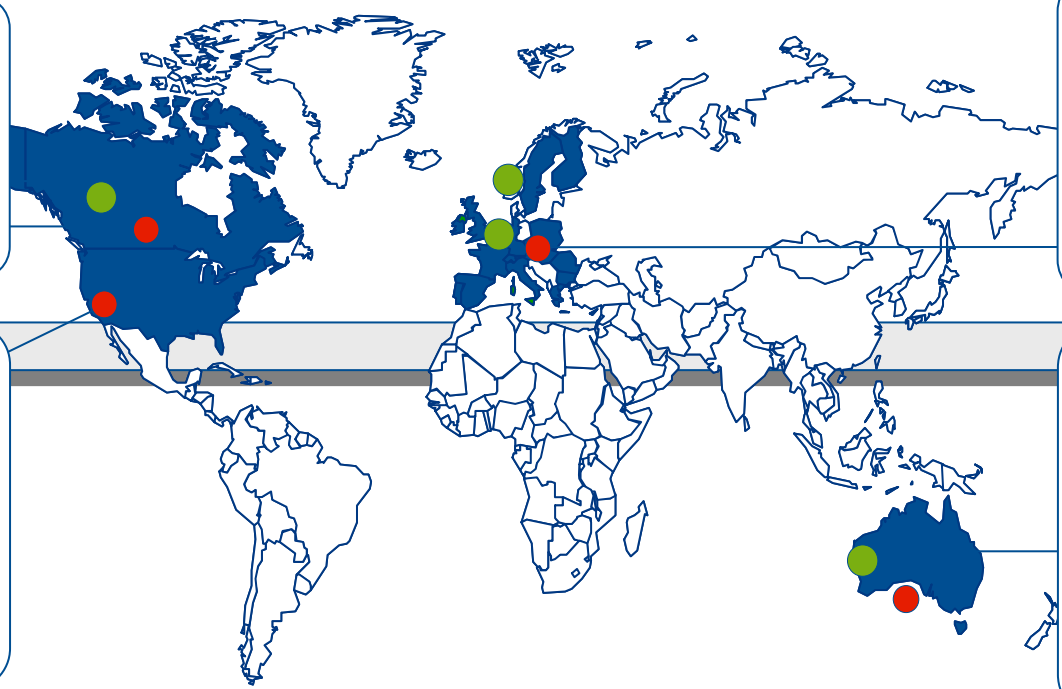
EXAMPLE OF GOVERNMENT SUPPORT FOR CCS DEPLOYMENT

CANADA

- Alberta provides C$2 billion for CCS projects
- Government funding of C$250 million for the development CCS

UNITED STATES

- Department of Energy to invest up to $1.3 billion in CCS ($290 million in projects through 2009 and $1.01 billion subsequent years)



EUROPEAN UNION

- Recognizes CCS under EU Emissions Trading Scheme
- Provide 300 million CO_2 allowances for CO_2 stored

AUSTRALIA

- Enabling regulations for CCS are in place
- A$ 100 million support to Global CCS Institute

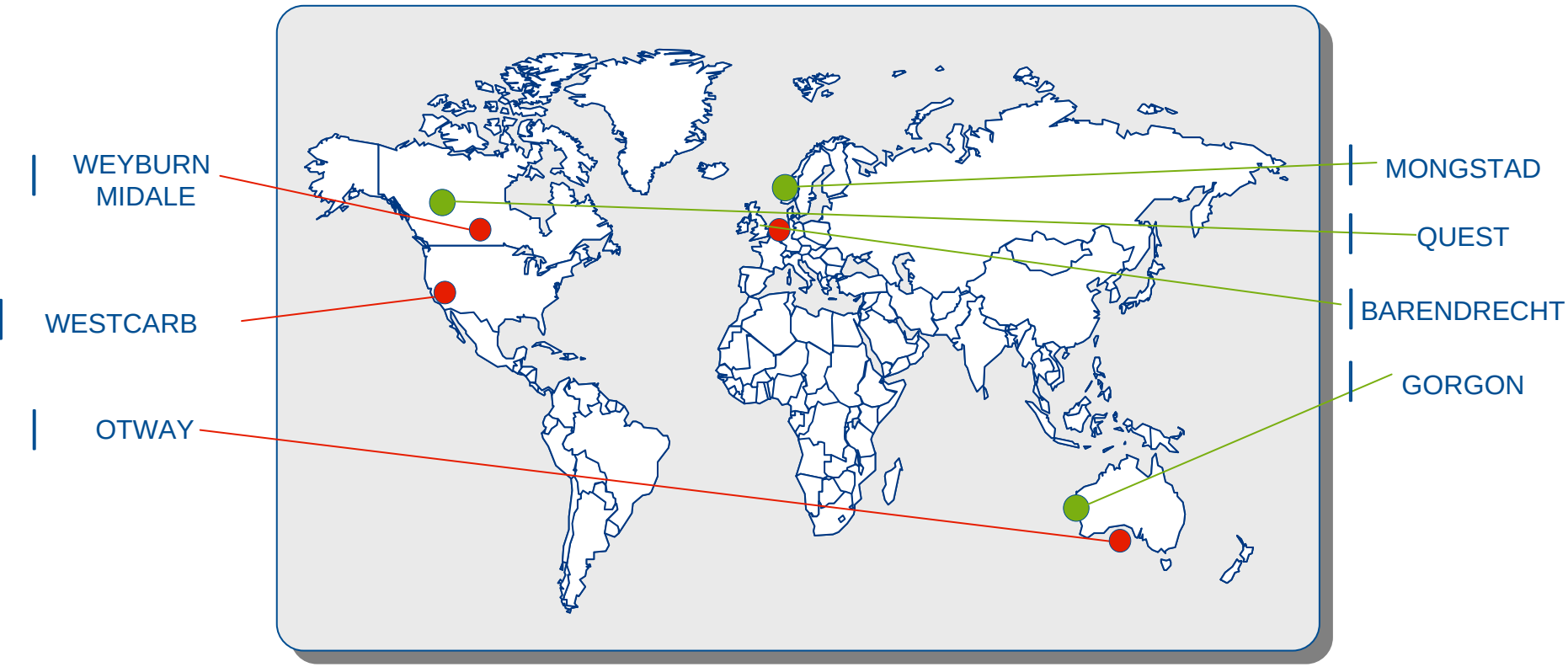
Demonstration / research projects

Industrial scale (>100 KTPA) projects under development

EXAMPLE: SHELL INVOLVEMENT IN PROJECTS

DEMONSTRATION AND INDUSTRIAL PROJECTS

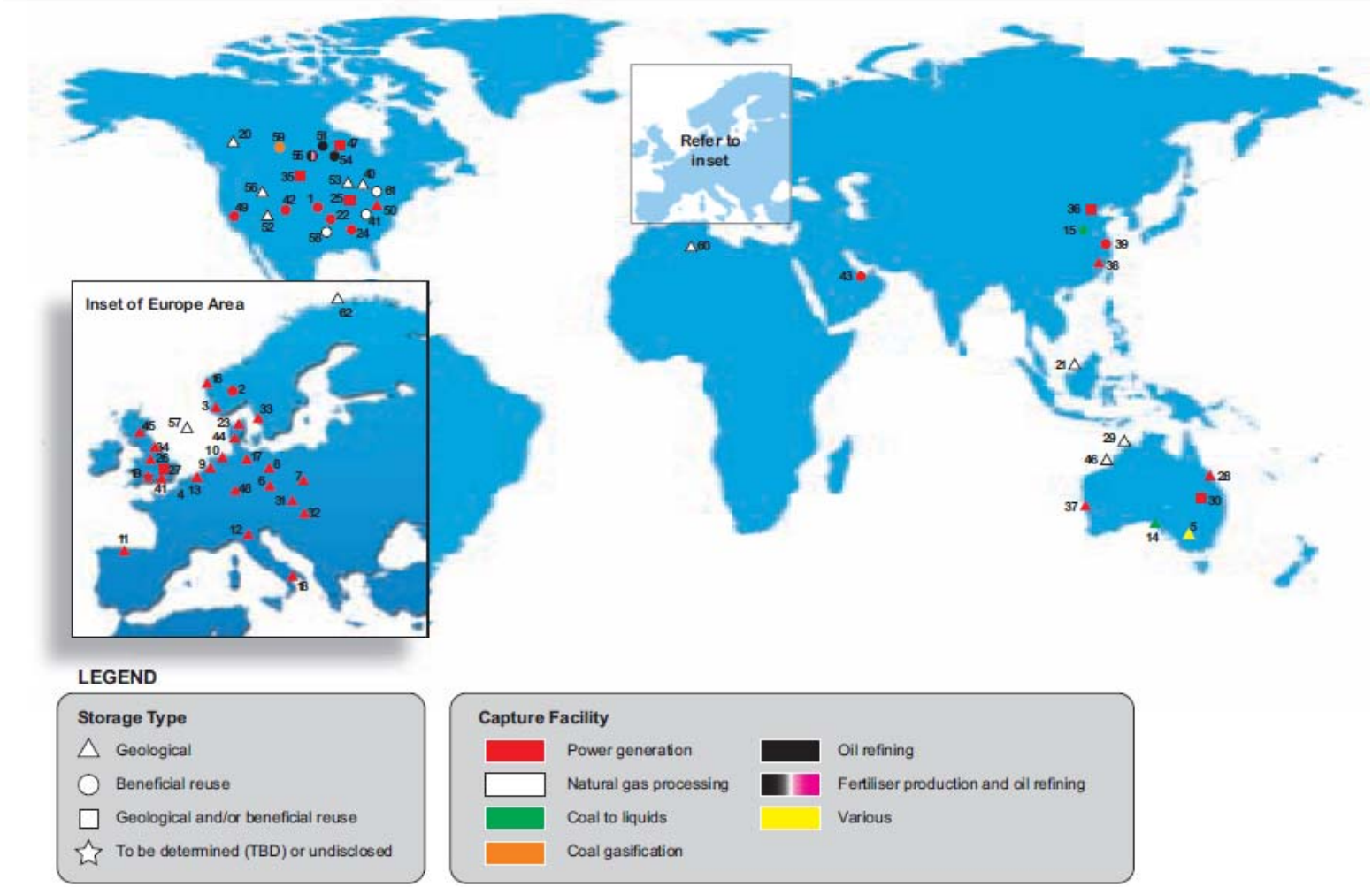
Shell is also a member of multiple CCS research partnerships



- Demonstration / research projects
- Industrial scale (>100 KTPA) projects under development

GLOBAL OVERVIEW OF PROJECTS

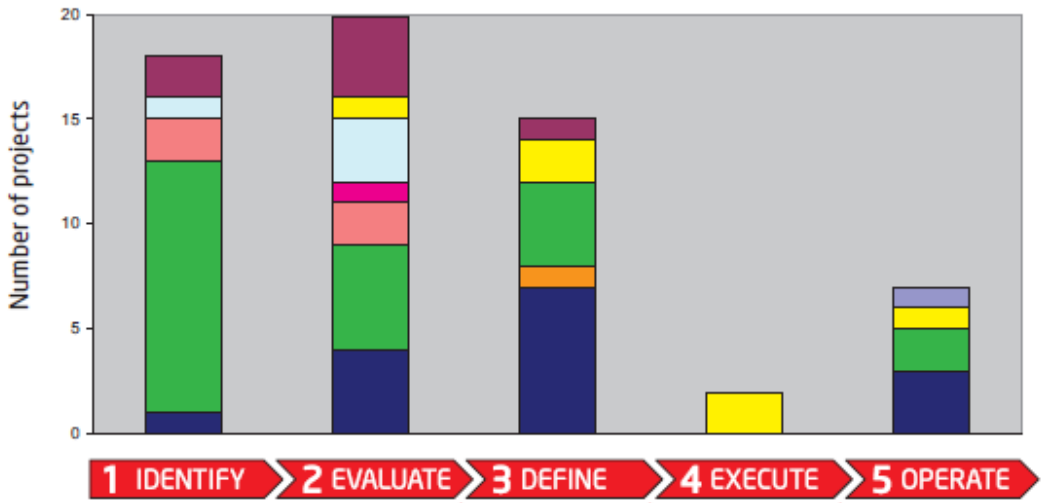
GLOBAL OVERVIEW – CCS PROJECT PORTFOLIO



Source – GCCSI; Strategic Analysis of the Global Status of Carbon Capture and Storage

PROJECTS FUNNEL

GLOBAL OVERVIEW – CCS MATURATION FUNNEL



Region						Total
Africa					1	1
Australia and New Zealand	2	4	1			7
Canada		1	2	2	1	6
China	1	3				4
East Asia (ex. Japan)		1				1
Eastern Europe	2	2				4
Europe Area	12	5	4		2	23
Middle East			1			1
USA	1	4	7		3	15
TOTAL	18	20	15	2	7	62

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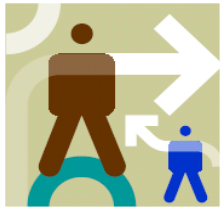


COPENHAGEN

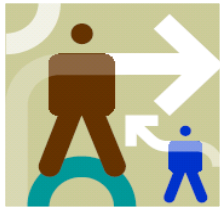
- The Copenhagen Accord is an opportunity

- An opportunity to ensure that CCS is recognised by the **new Technology Mechanism** and that CCS deployment can benefit through its use

- An opportunity to highlight the need for a new tradable Carbon Storage Unit, verifying stored CO_2 (storage certification process)

- An opportunity ensure that CCS is fully recognised in the **new Green Climate Fund** and can draw on it to assist in the implementation of new projects in developing countries

- *Actors need to articulate a shared vision on the need for a CO2 market and components of international policy and incentives.*



WHAT NEXT?

• **Urgency –** Speed is vital if demo projects are to be operational by 2015.

• **Knowledge sharing -** Policy makers and industry need to share at regional level to progress the technical understanding of CCS.

• **Public acceptance** – We need to join together to further understanding and acceptance.

•**Infrastructure** - Demonstration is key but we need to look now at how infrastructure is to be set up (plant clusters, pipelines, hub stations sinks) and how it is to planned and operated.