



Challenges for Practical Use and Commercialisation of CCS.

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Workshop on Practical Use and
Commercialization of CCS

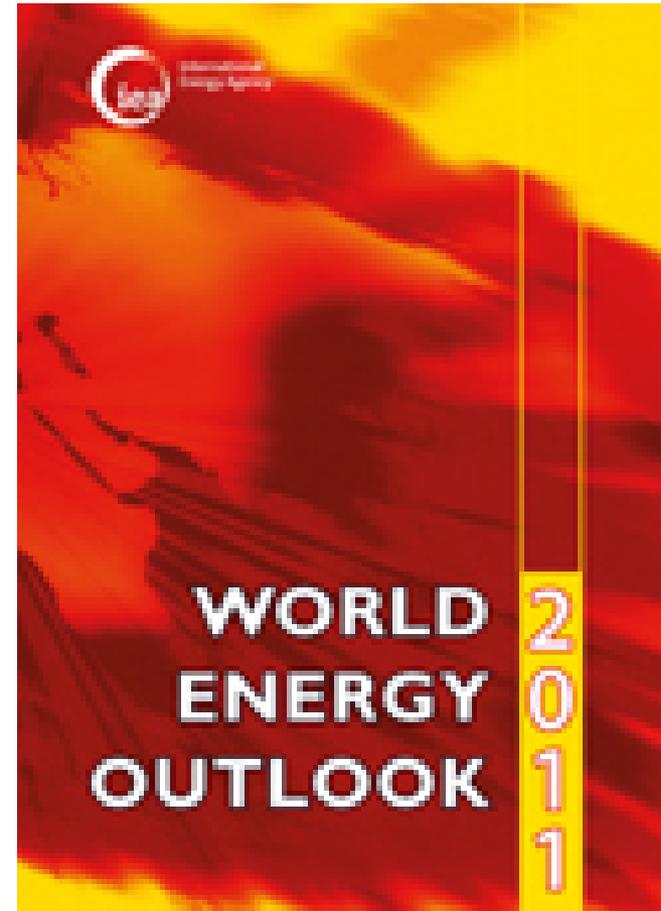
Tokyo, Japan

18th January, 2012

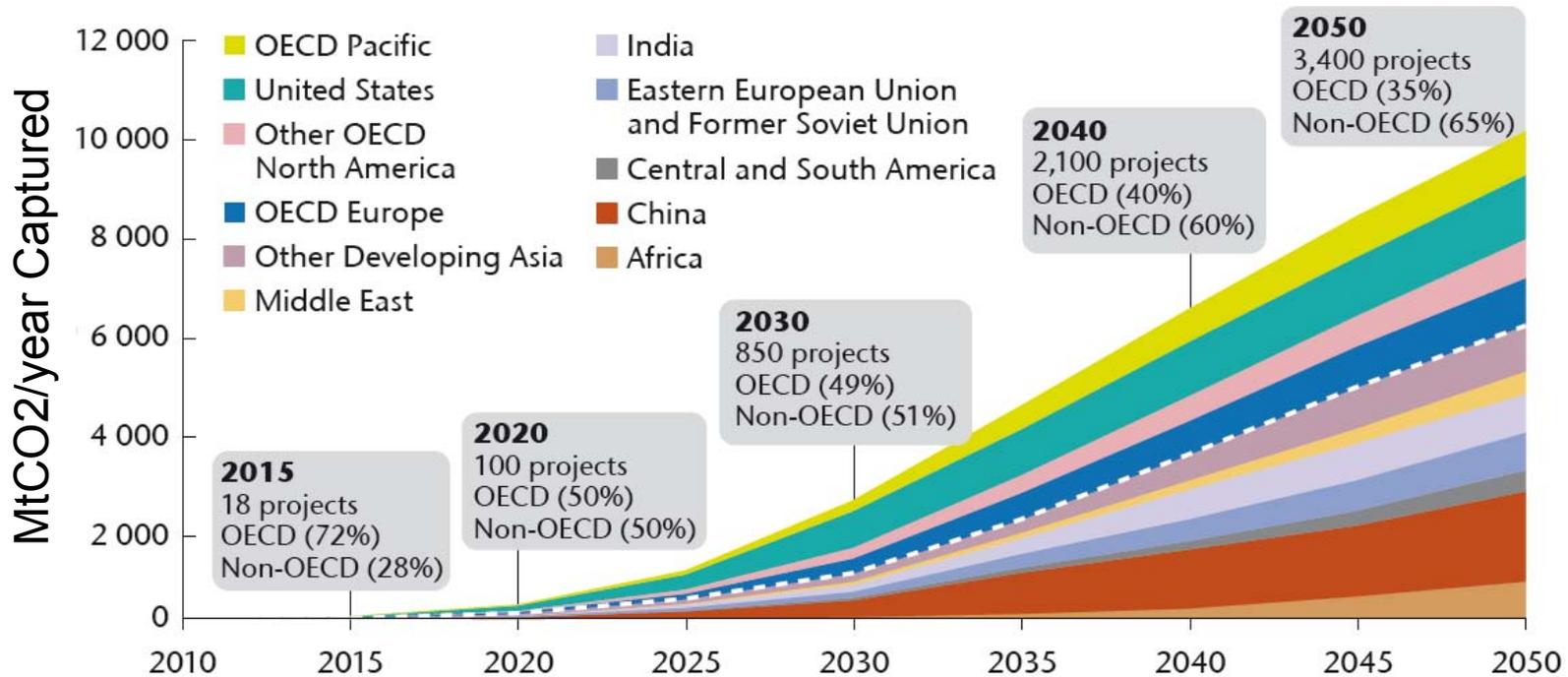
IEA ANALYSIS OF GLOBAL ENERGY TRENDS AND FUTURES



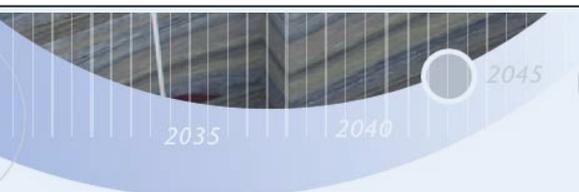
- Energy demand continues to grow: up 33% from 2012 to 2035
- Despite policy action CO2 emissions continue to grow
- Without further action by 2017, the 450 scenario will be “locked in”
- New “Golden Age” for gas
- Increased use of gas without CCS will not be enough to limit temp rise to 2C
- CCS remains a key abatement option for 450ppm scenario
- If CCS not deployed by 2020 extraordinary burden placed on other Low C technology



An ambitious growth pathway



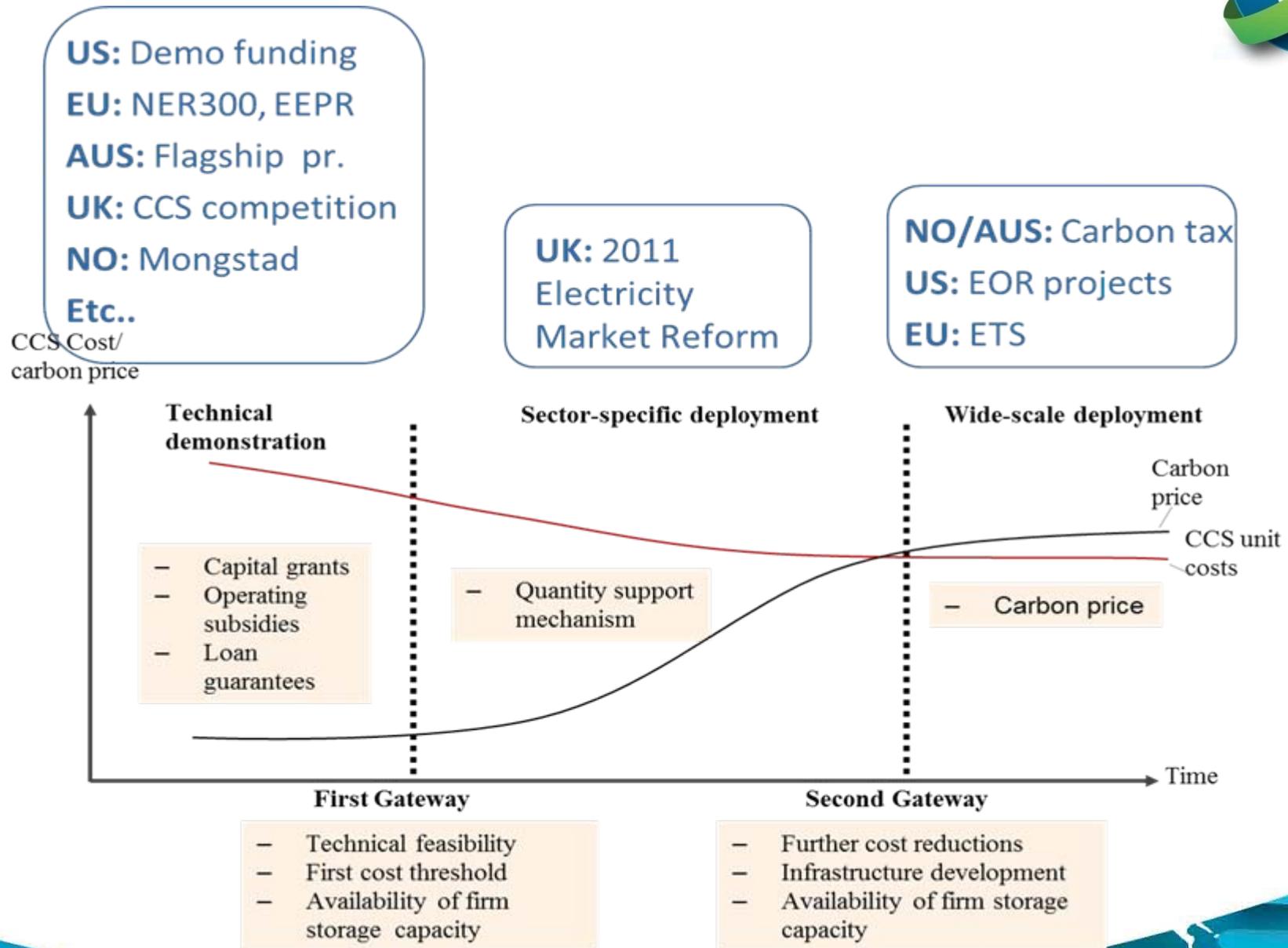
OECD regions must lead in demonstrating CCS, but the technology must quickly spread to the rest of the world



Technology Roadmap

Carbon capture and storage

Need to Incentivise CCS

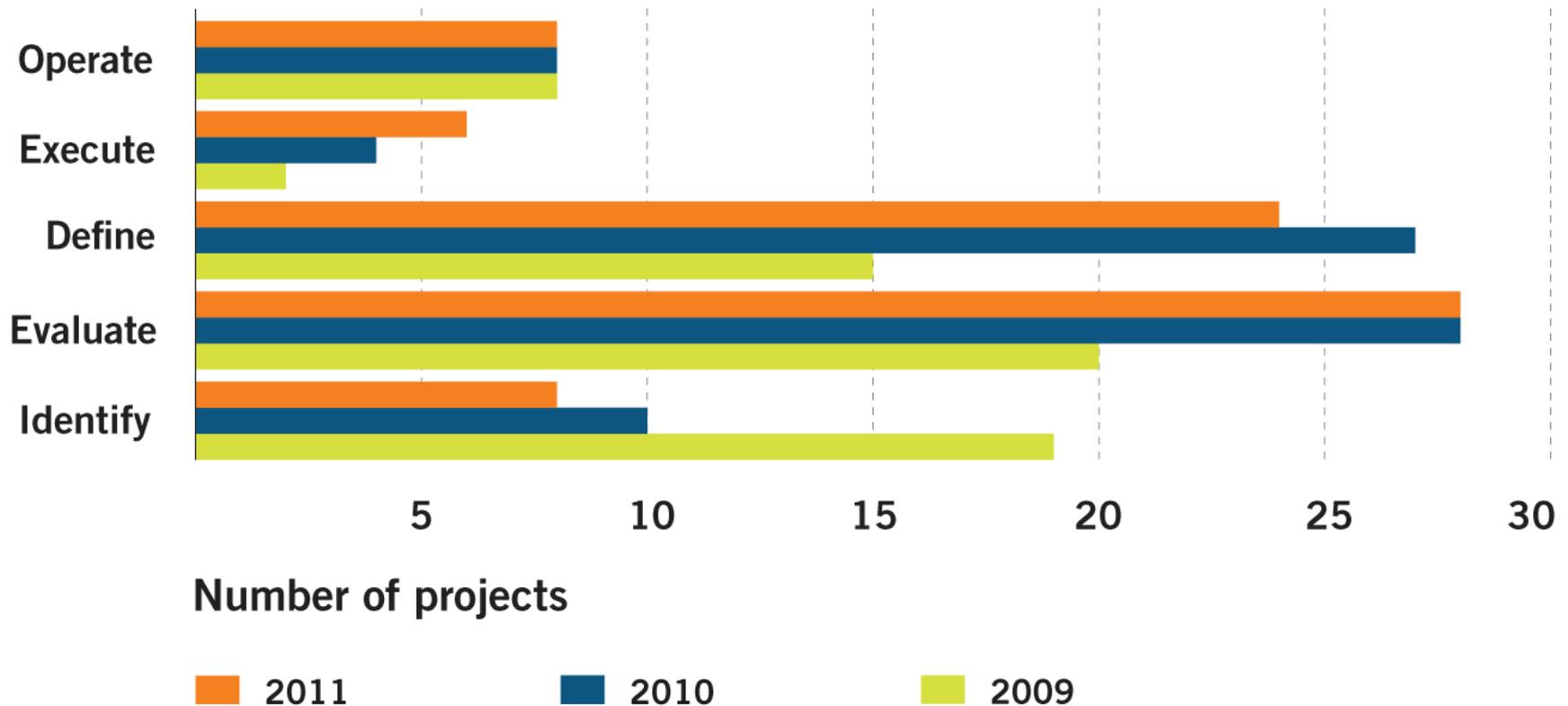


UNFCCC Developments



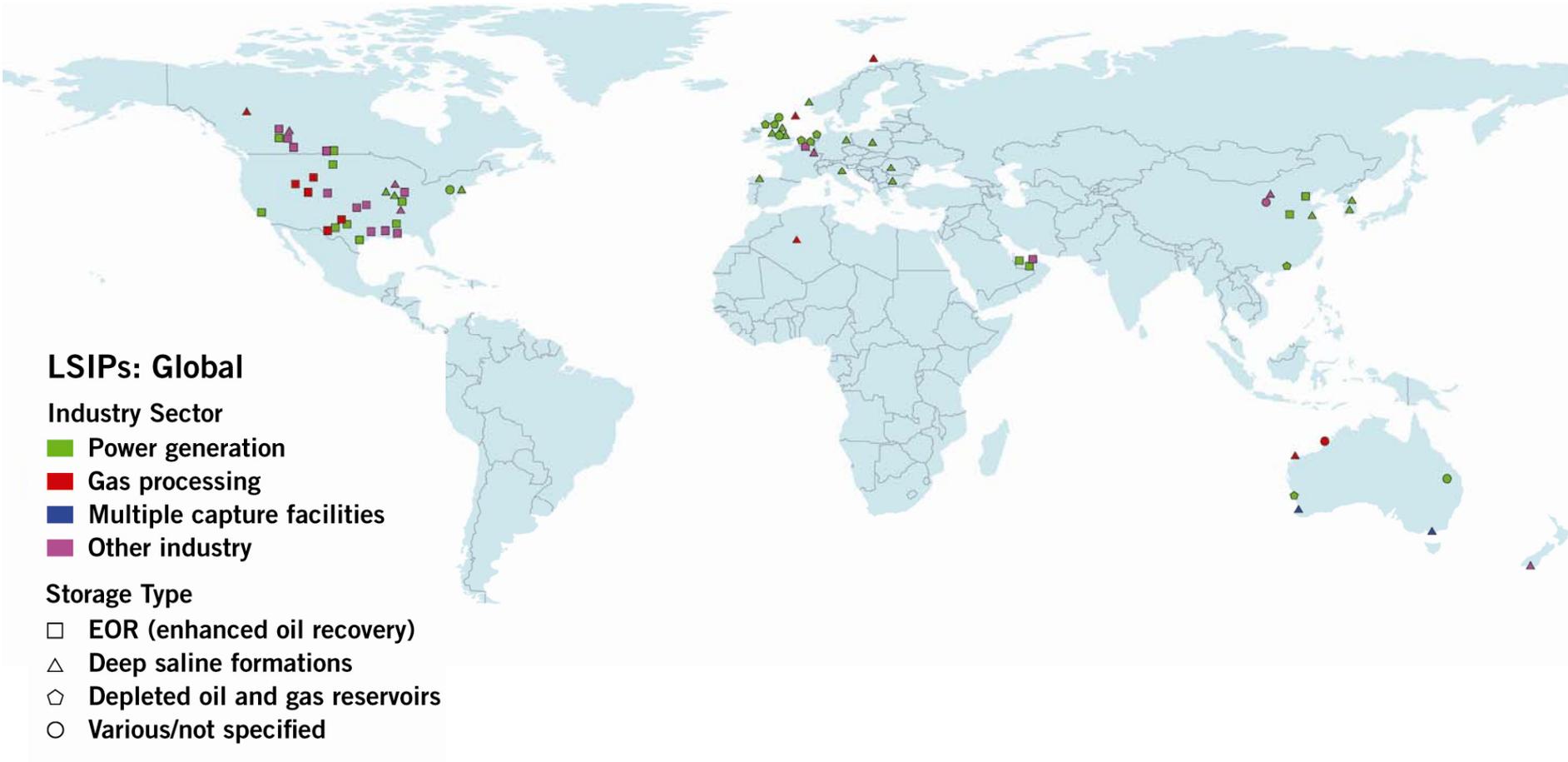
- COP17 Durban
 - Finally the Modalities and Procedures were agreed to allow CCS in the CDM
 - Help support CCS deployment in Developing Countries
 - A roadmap to a legally binding agreement that includes all countries taking on emissions targets, to be agreed by 2015 and implemented from 2020
 - A second commitment period for the Kyoto Protocol will be agreed by the end of 2012.
 - The Green Climate Fund was agreed which will fund developing countries for both mitigation and adaptation activities.

Measured progress of large-scale integrated Projects SINCE 2009



Source: Global CCS Institute, Global Status of CCS, 2011

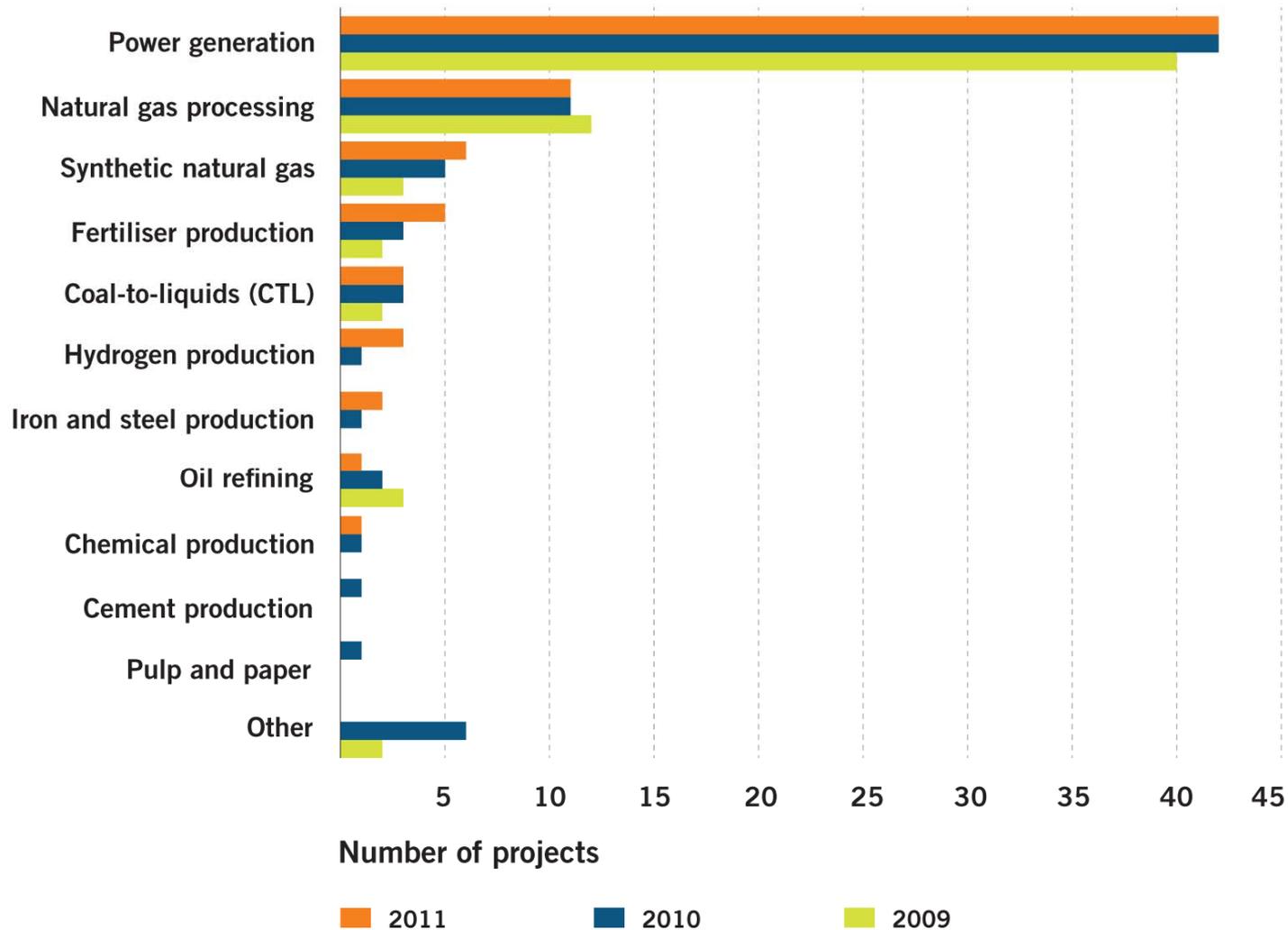
Global Spread of Projects



Source: Global CCS Institute, Global Status of CCS, 2011

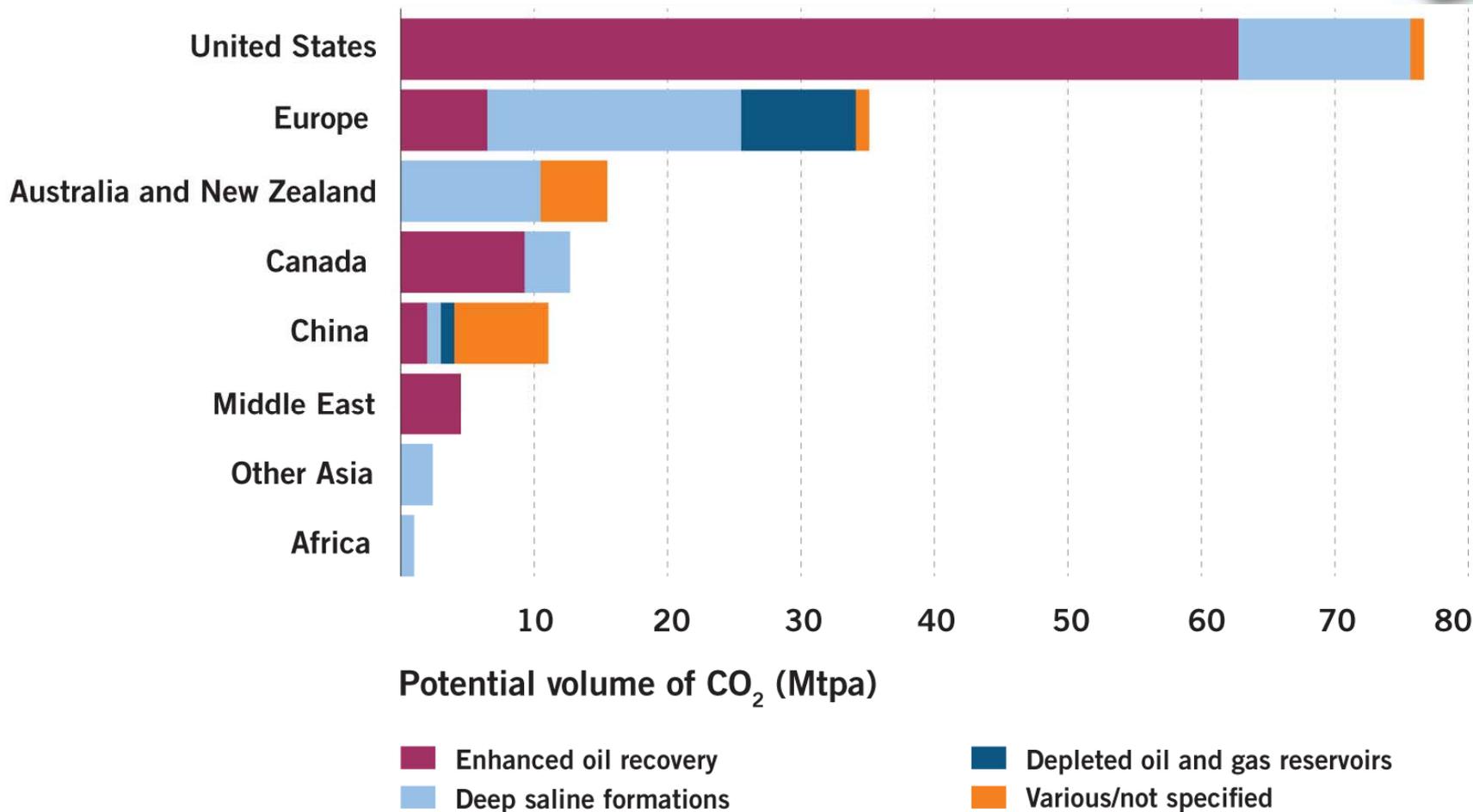


Concentration on power generation



Source: Global CCS Institute, Global Status of CCS, 2011

Regional bias towards storage selection



Source: Global CCS Institute, Global Status of CCS, 2011



Key messages

- CCS projects are found in a number of applications (often when carbon capture is already part of the industrial process and where already well explored storage locations are available).
- Two power projects are now under construction with the aid of government funding and EOR revenue.
- A number of projects have indicated they could be in a position to decide on a financial investment decision within ~12 months but ‘tying a ribbon’ around the business case is time consuming and difficult.
- **Storage assessments in deep saline formations can have long lead times – needs to be carefully integrated with capture planning.**

Source: Global CCS Institute, Global Status of CCS, 2011

Why have some projects failed?



- Regulatory uncertainty – still the case in some jurisdictions
 - EC CCS Directive Approved in 2009
 - Only one country to date has implemented EC Directive into National Law
 - UK
 - Germany will only regulate for demonstration plants
 - USA
 - USAEPA adapted existing UIC programme for CO₂ injection in 2011
 - New Class VI wells programme
 - http://water.epa.gov/type/groundwater/uic/wells_sequestration.cfm
 - Operators trying to circumvent process for CO₂-EOR operations which use Class II well programme

Why have some projects failed?



- Economic/Investor uncertainty
 - No stable price for Carbon under EU ETS
 - Need \$50/t but current price under €10/t
 - In contrast price for CO₂ for EOR stimulating take up in USA/Canada
 - Economic woes in many countries affecting viability of projects
 - Global market economics mean it more cost effective for operators to invest in more dynamic markets
 - Brazil, Mexico, Turkey, Indonesia etc.,

Are we giving ourselves a chance?



- Are funding targets too tight to allow successful project delivery?
 - Feedback from ZeroGen project in Australia
 - To meet Government targets for funding had to following three planning tracks in parallel
 - Storage path failed due to lack of suitable storage resource
 - Whole project failed
 - **Advice:**
 - **Stagger planning**
 - **Start storage exploration early**
 - Upfront cost with high risk
 - Longer project leads times (6-12 years)
 - But overall decreased project risk
 - **Keep a second option - added cost burden**



UK FEED Results

Longannet – Goldeneye Field

- Mature gas field coming to end of life
- Operator/owner: Shell
- Repressurised by water drive
- Operational experience and full data sets
- Confident that can inject and store CO₂.
- Monitoring/Abandonment plans built around full QRA

Kingsnorth – Hewett Field

- Mature gas field – pressure depleted
- Operators: ENI and Tulco
- E.ON had to acquire field data
- E.ON still don't have a complete data set
- Monitoring plan incomplete
- No abandonment plan



UK FEED Summary

- Capture plant design – in relative terms was easy
- Pipeline
 - A lot of issues with routing and design but these could be overcome
- Storage reservoir
 - Even in a mature oil and gas basin like North Sea the storage reservoir can throw up issues and uncertainty

http://www.decc.gov.uk/en/content/cms/emissions/ccs/demo_prog/feed/feed.aspx

CCS not winning public hearts and minds



- Latest Euro barometer survey (364, May 2011). Some key results
 - Only one in ten (10%) said they had heard of CCS and knew what it was
 - In the 6 countries where there is a major EU co-financed CCS project, 88% had not heard of the project
 - 85% would be worried about CCS technology if an underground storage site for CO₂ were to be located within 5km of their home.
 - Respondents liked renewables but least popular were nuclear and coal as energy sources

http://ec.europa.eu/public_opinion/archives/eb/eb74/eb74_publ_en.pdf

Public acceptability



- Two notable project disappointments in Europe
 - Barendrecht, Netherlands
 - On shore depleted gas field project
 - Stopped by public opinion
 - Dutch government then revised policy to only store off shore
 - Schwarzepumpe, Germany
 - On shore storage project
 - Local resistance to storage and transportation
 - Use of CO₂ in Ketzin project abandoned
 - Opposition grown in German state legislatures
 - Led to Vattenfall stopping Janswalde demonstration project



Public Concerns

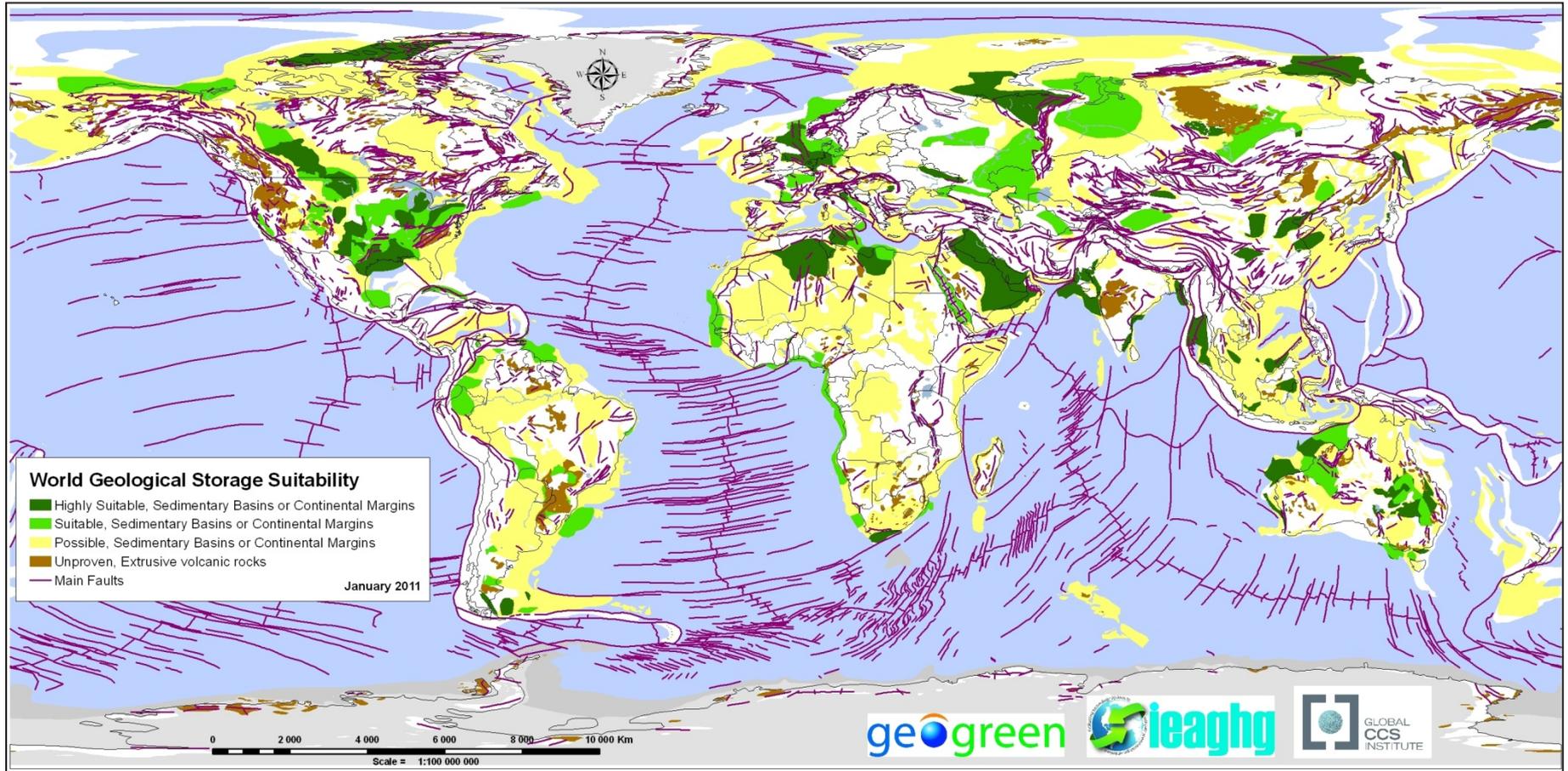
- Primarily around storage site
 - Safety
 - What happens if it leaks?
- A lot of misinformation on web
- Underlying lack of trust in industry/Government
- Failure to address issues early open
 - Need to engage local groups early

Storage Resource Gap Analysis for Policymakers

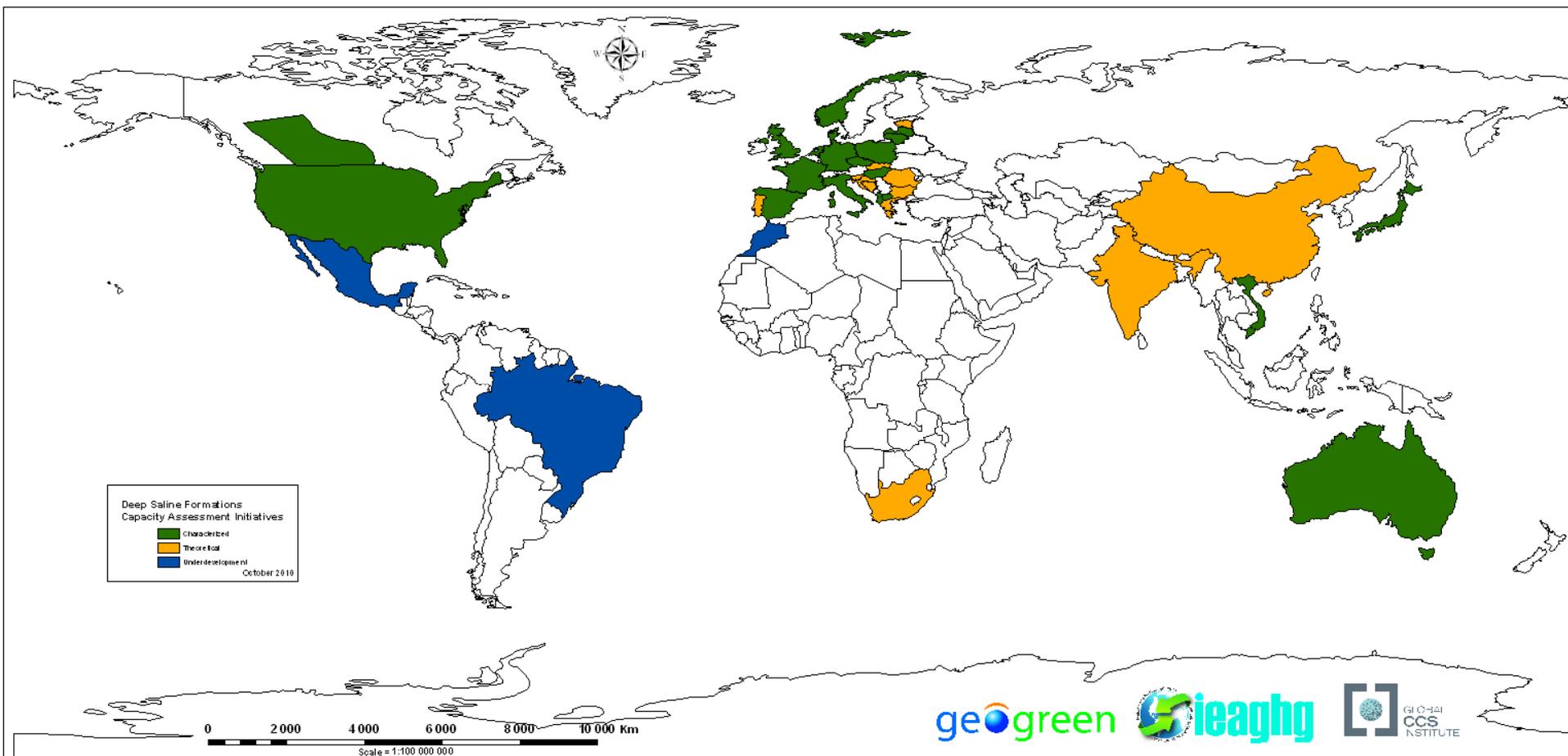


- **IEAGHG/GCCSI study**
- Aim of study:
 - Alert policymakers to the scale, cost and timing of the storage resource assessment, required to enable deployment of commercial-scale CCS projects by 2020: 20 projects envisaged by G8 Leaders, and 100 projects in IEA CCS Roadmap

Suitability Map



Capacity assessment initiatives



Costs

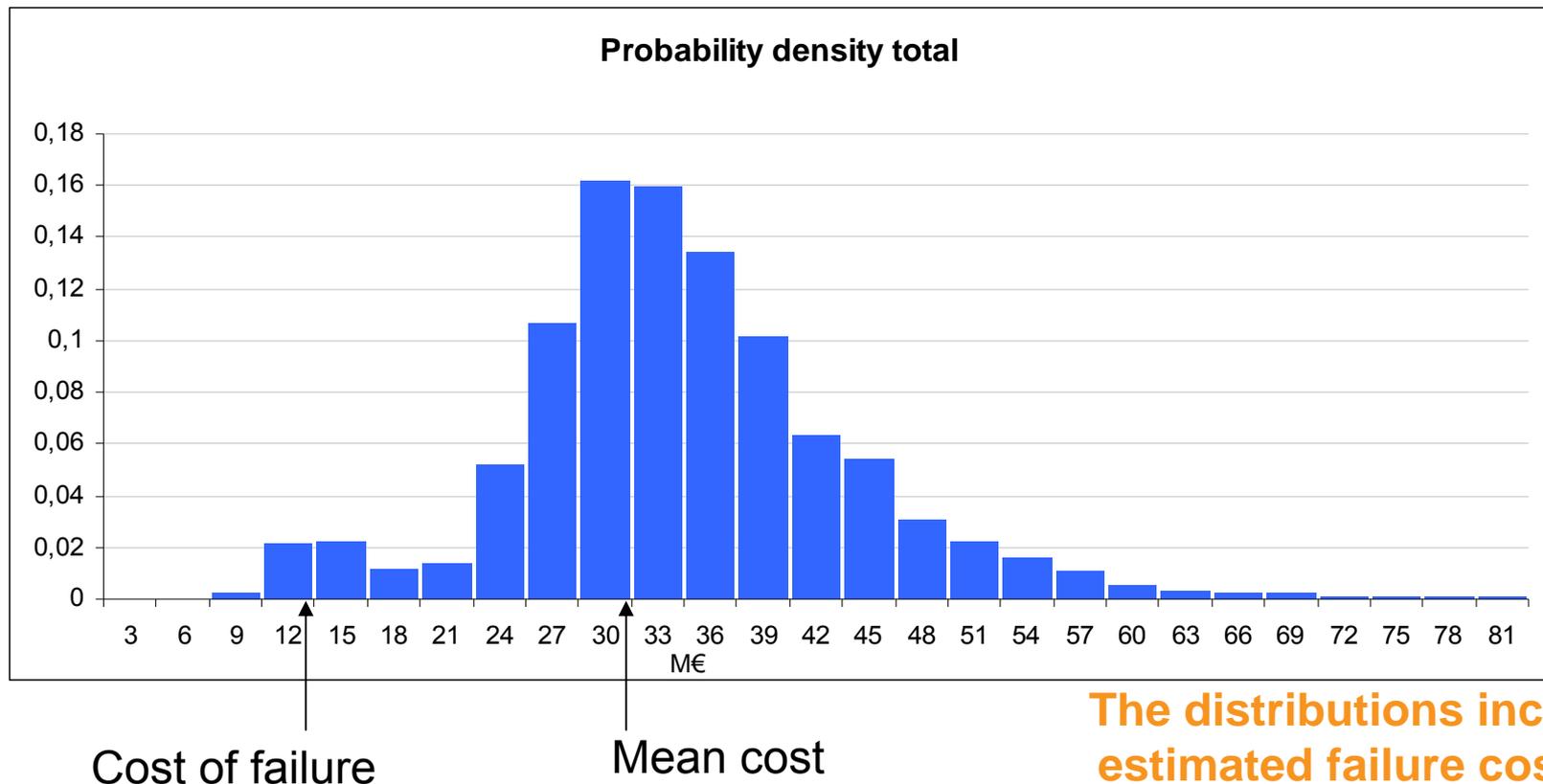


- Cost models were considered for onshore and offshore storage options both in Deep Saline Formations and Depleted Oil and Gas Fields
- Take account of failed storage sites
- Numerous possibilities for each site to reach a successful path
- Cost models included an assessment of the economic uncertainties of project bankability

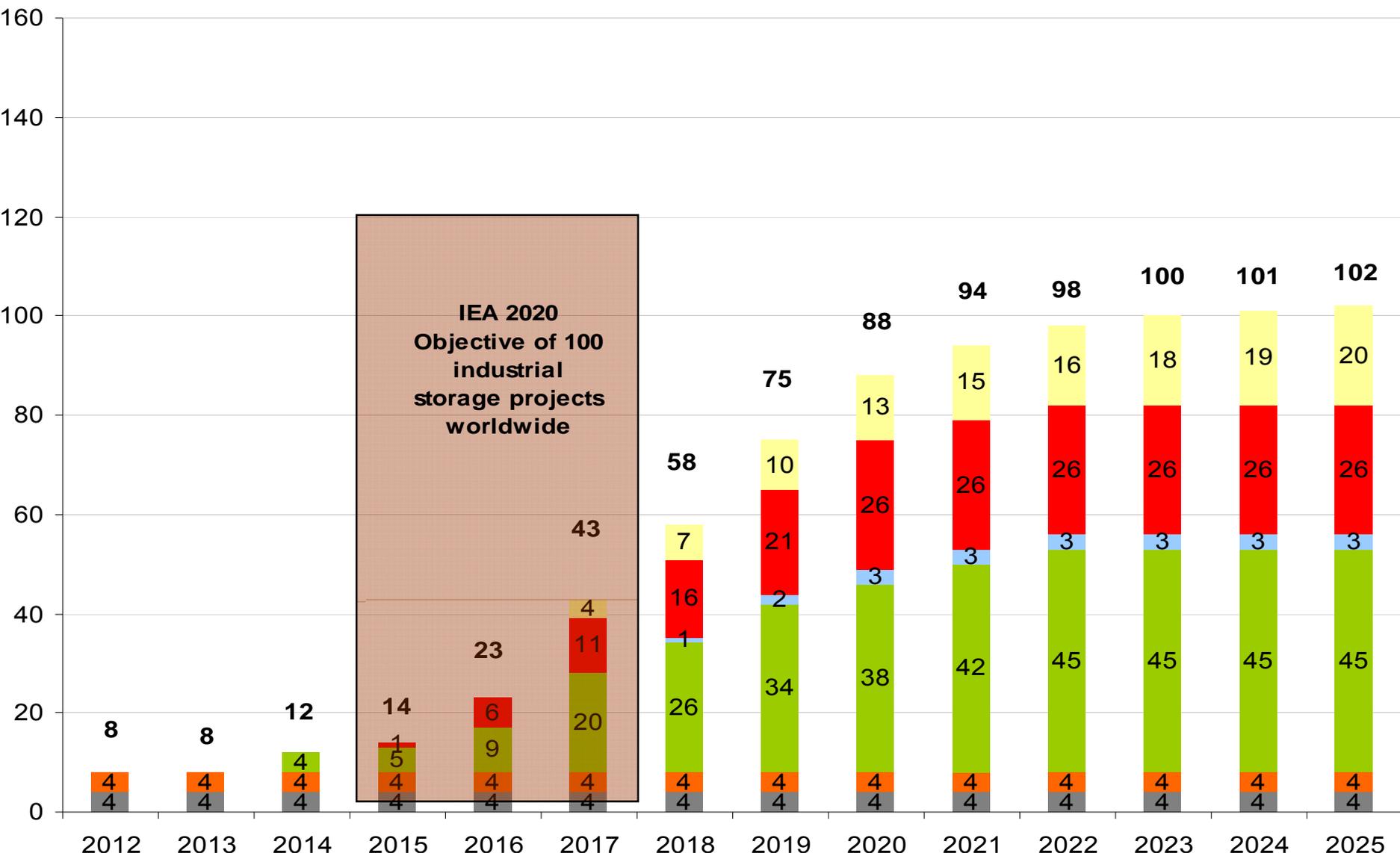
DSF European project cost



Total cost distribution for onshore bankability for an intensely explored area



The distributions includes estimated failure costs of data acquisition, wells...



- Existing projects non EOR
- Existing projects EOR
- Candidates for Bankability 2015-2017
- Additional stand-by candidates for Bankability 2016-2018
- Potential EOR contribution
- Proposed additional candidates for Bankability 2018-2022

Summary



- The storage resource issue is a primary issue that needs to be resolved
- To ensure CCS projects go ahead we need:
 - More up front investment on stage resource assessment
 - Longer project lead times
- Only if Governments recognise this issue can we make significant progress on CCS deployment globally.

<http://www.globalccsinstitute.com/publications/global-storage-resources-gap-analysis-policy-makers>

What does this mean for Japan?



- Need a Government lead programme with strong financial support from outset
- Complex geology in a tectonically active region
 - Storage offshore can be advantage
 - Utilising aquifers which are less geologically well known
- Need an extensive site characterisation programme based around key basins for demonstration projects.

What Could Japan do?



- Detailed characterisation of appropriate offshore geology, first
- Then begin stakeholder engagement
- Build up knowledge base to develop geological models to assess:
 - Site integrity issues
- Then undertake detailed risk assessment programmes
- Build up a QRA based monitoring plan
- Undertake test injections to assess injectivity issues and calibrate models and test monitoring plan

What will this achieve?



- Upfront investment on geological resource characterisation has potential to save money down stream
 - Must be prepared to lose investment
- Build a dataset to use to interact with stakeholders and build confidence
- Reduces risk and uncertainty before main project commences.
- Provides confidence for investment in a demonstration project

GHGT-11



- Call for papers now open
- <http://www.ghgt.info/index.php/Content-GHGT11/ghgt-11-submit-paper.html>
- Deadline for abstract submission: 10th Feb 2012

GHGT-11

18th – 22nd November 2012

Kyoto, Japan.

www.ghgt.info





ありがとうございます。
お会いできる事を楽しみにしています。

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