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International Energy Agency

CCS: critical decade to fulfill its potential in GHG mitigation

23 October 2012

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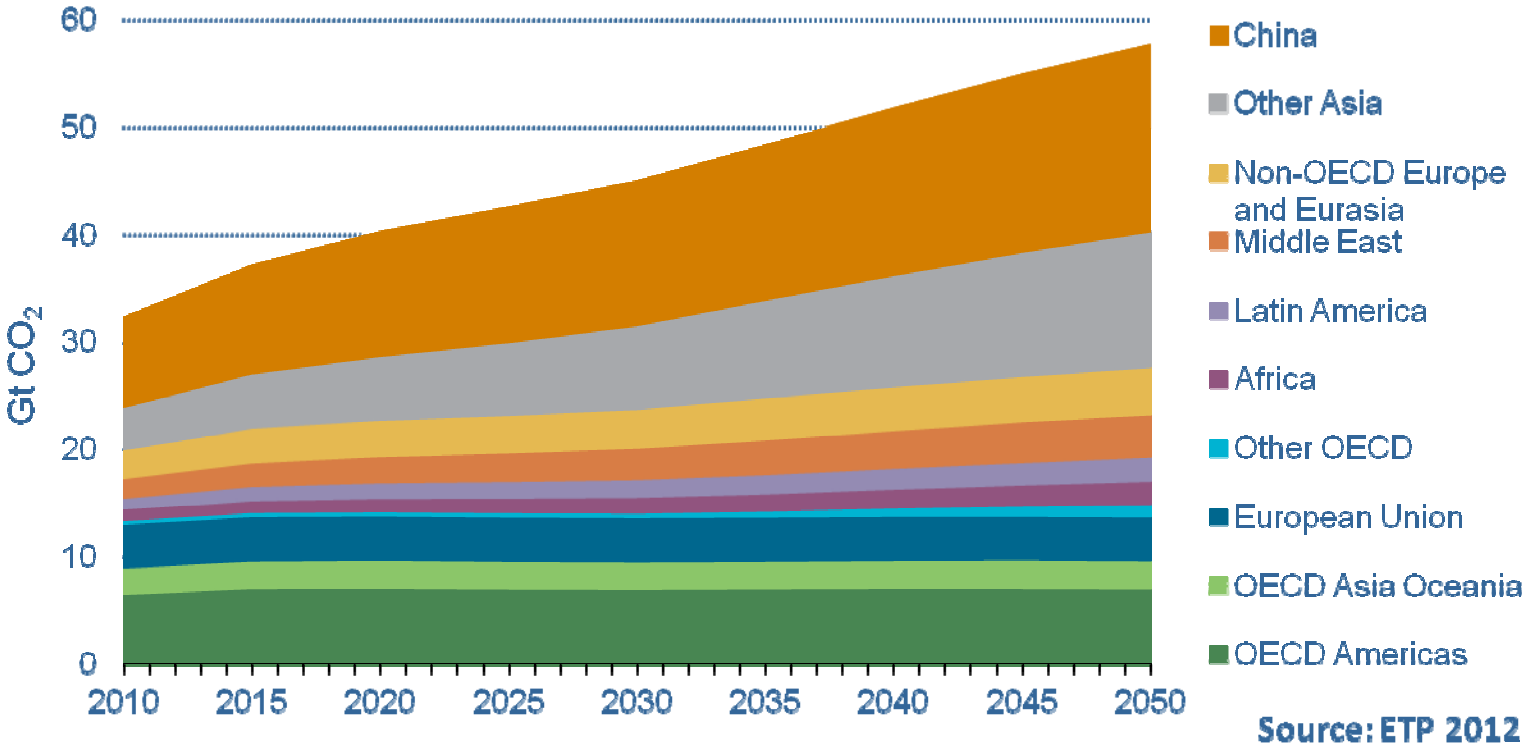
IEA CCS Unit

GLOBAL CO_2 EMISSIONS CONTINUE TO GROW - 6C Degree Scenario ("6DS")



Global energy-related CO_2 emissions have more than doubled in past 40 years, from 14Gt to 30Gt

Until very recently, emissions are driven by OECD countries

Since 2005, non-OECD countries emit more than OECD

Current CO_2 concentration in atmosphere roughly 390ppm

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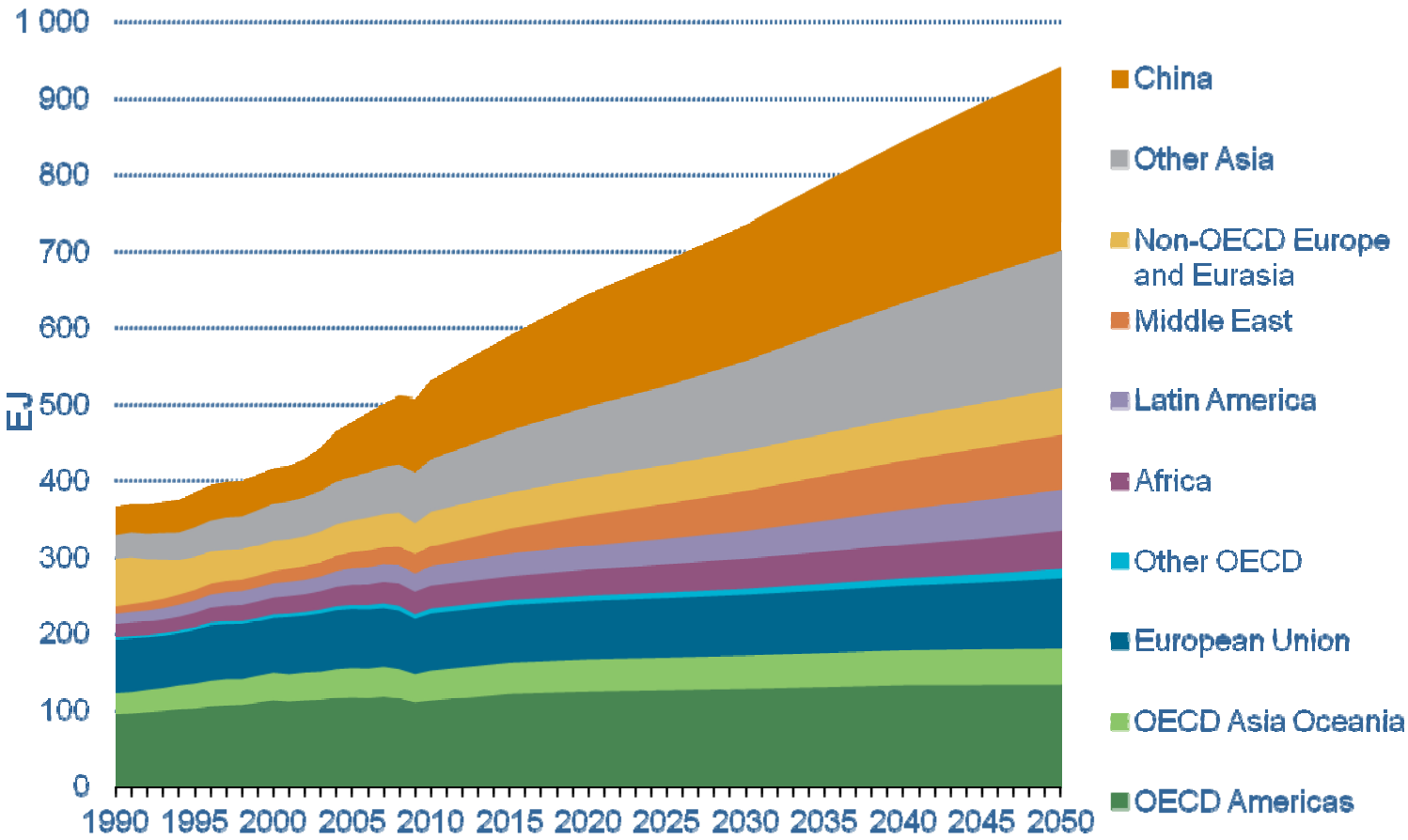
ENERGY DEMAND CONTINUES TO GROW "6 DS"



Source: ETP 2012

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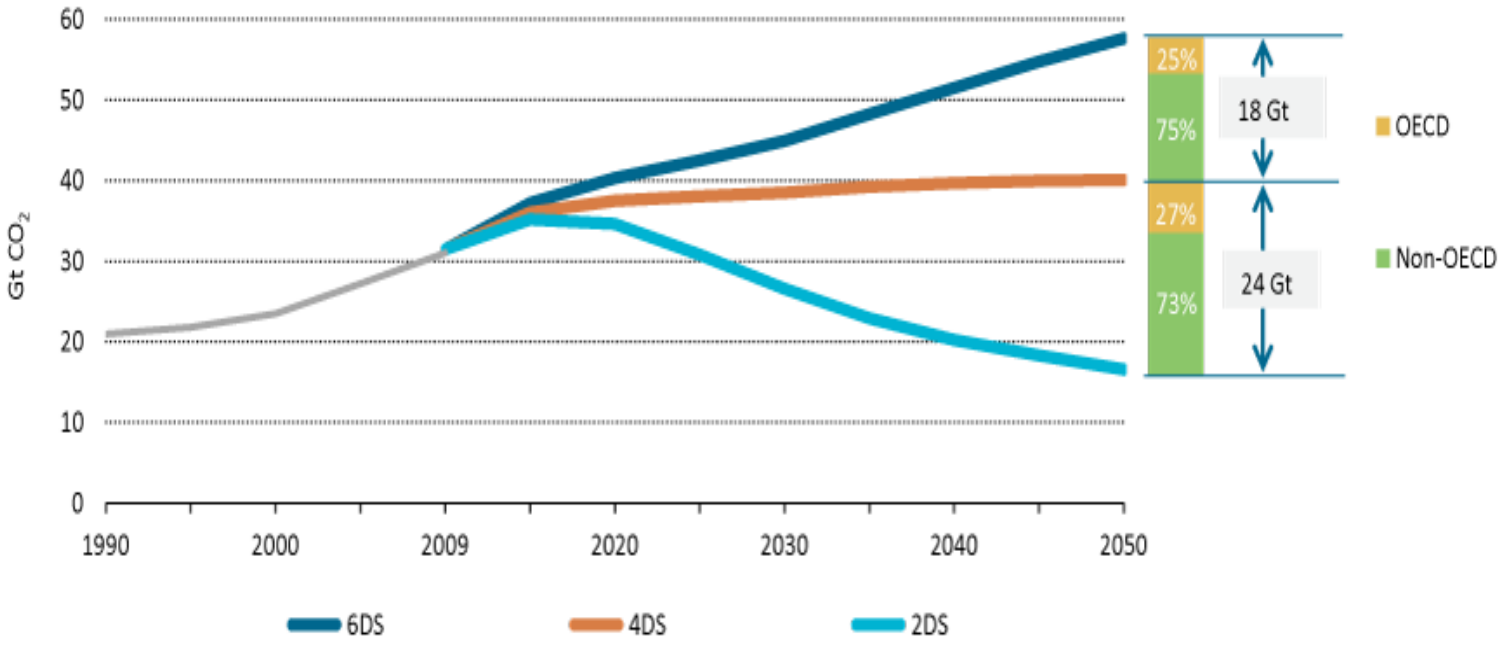
TOWARDS SUSTAINABLE FUTURE – ”2DS”

- Current policies or “6DS scenario” unsustainable
- Scientific evidence and policy ambitions now often target “450ppm scenarios” or “2DS” (50-50 chance to keep temperature increase at ≤2°C)
- Critical period NOW to establish policy and develop technology



Source: ETP 2012

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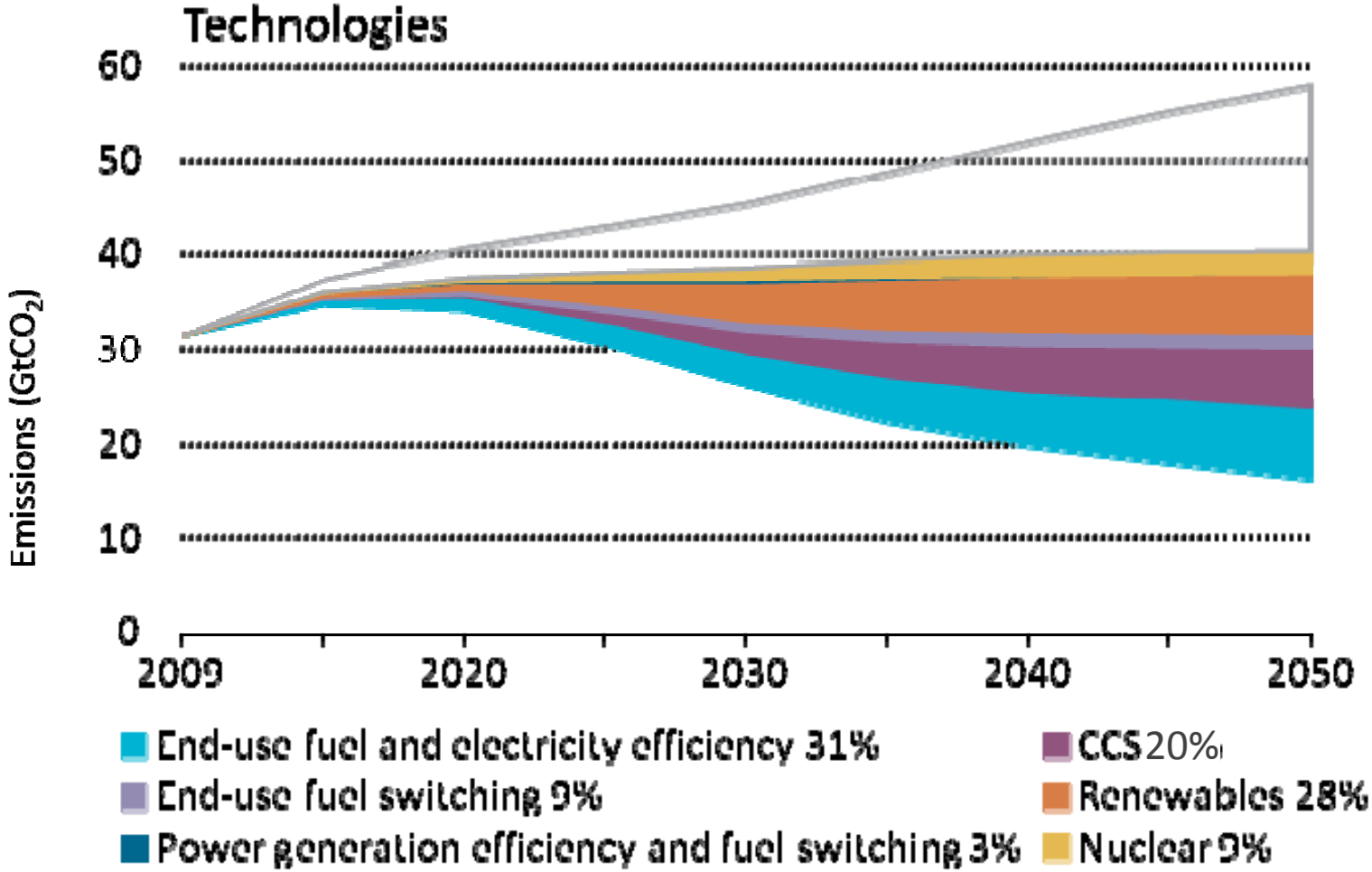
The technology portfolio includes CCS



IEA analysis assigns critical role for CCS in a least-cost pathway to reaching 450ppm scenario

Nearly 123Gt of CO_2 need to be stored through 2050

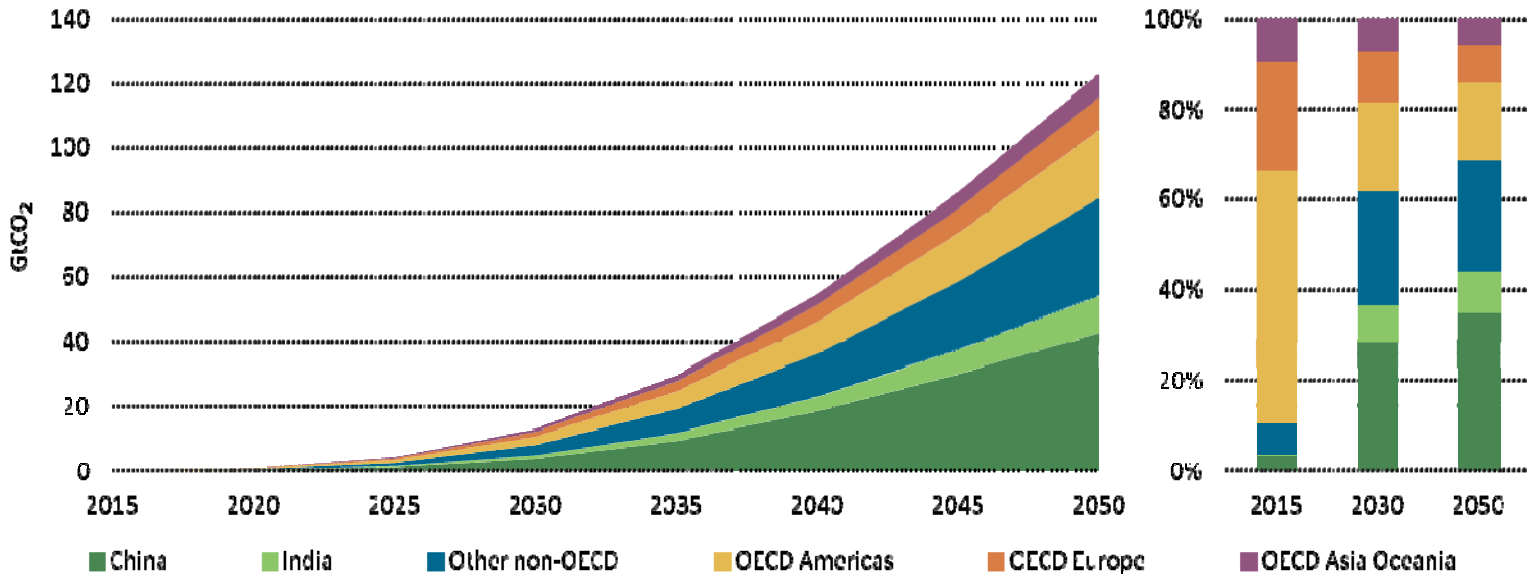
Source: ETP 2012

Слайд 5

STM1 Note that there was an error in Figure 1.9 and the numbers shown here for CCS, renewables and nuclear are the correct contributions based on correspondence with Uwe Remme.

Sean McCOY; 14.06.2012

CCS must grow rapidly around the globe



In the near term, the largest amount of CO_2 is captured in OECD countries;

By 2050, CO_2 capture in non-OECD countries dominates – 70%

Source: ETP 2012

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EMISSIONS REDUCTION POTENTIAL FOR CCS

- **Industry:** Potential to reduce CO_2 emissions by up to **4.0 Gt annually by 2050**
  - Needed: Up to **1800 projects globally** by 2050 with an investment of some **$880 Bln (USD) 2010-2050**
  - Applying CCS in high-purity sectors represents early opportunity

- **Power sector:** Potential to reduce emissions by **5.5 Gt CO2 annually by 2050**
  - Needed: **22 GW** of power generation with CCS installed in **2020**;
  - Around 60 GW of power plant will need to be retrofitted with CCS by 2050

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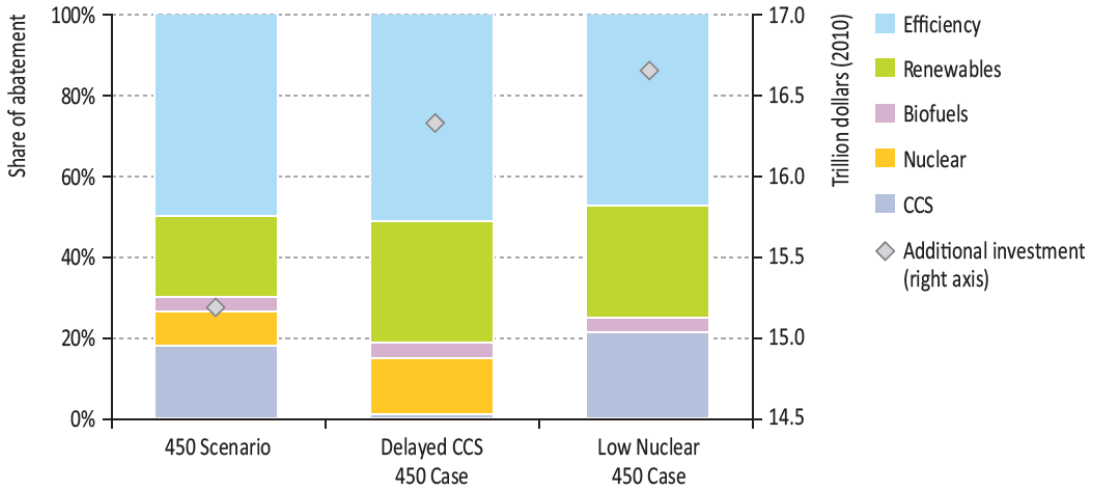
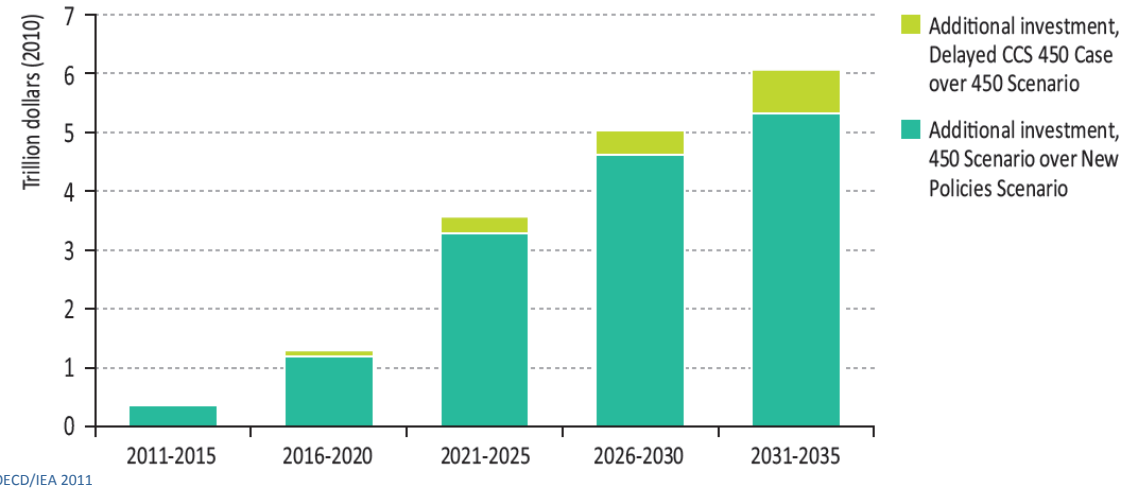
WHAT IF CCS IS DELAYED UNTIL 2030?





- Abatement shifts to renewables and nuclear
- A further energy efficiency boost seems impossible

- Significant cost increase: 1.14 trn USD additional investment

Source: IEA World Energy Outlook 2011

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CCS must be deployed **now**

2012

0
GW OF POWER GENERATION FITTED WITH CCS IN 2012

5
MT OF CO2 CAPTURED IN INDUSTRIAL APPLICATIONS IN 2012

0
POWER PLANTS FITTED WITH CCS IN 2012

4
INDUSTRIAL PROJECTS EMPLOYING CCS IN 2012

2020

16
GW OF POWER GENERATION FITTED WITH CCS IN 2020

196
MT OF CO2 CAPTURED IN INDUSTRIAL APPLICATIONS IN 2020

38
POWER PLANTS FITTED WITH CCS IN 2020

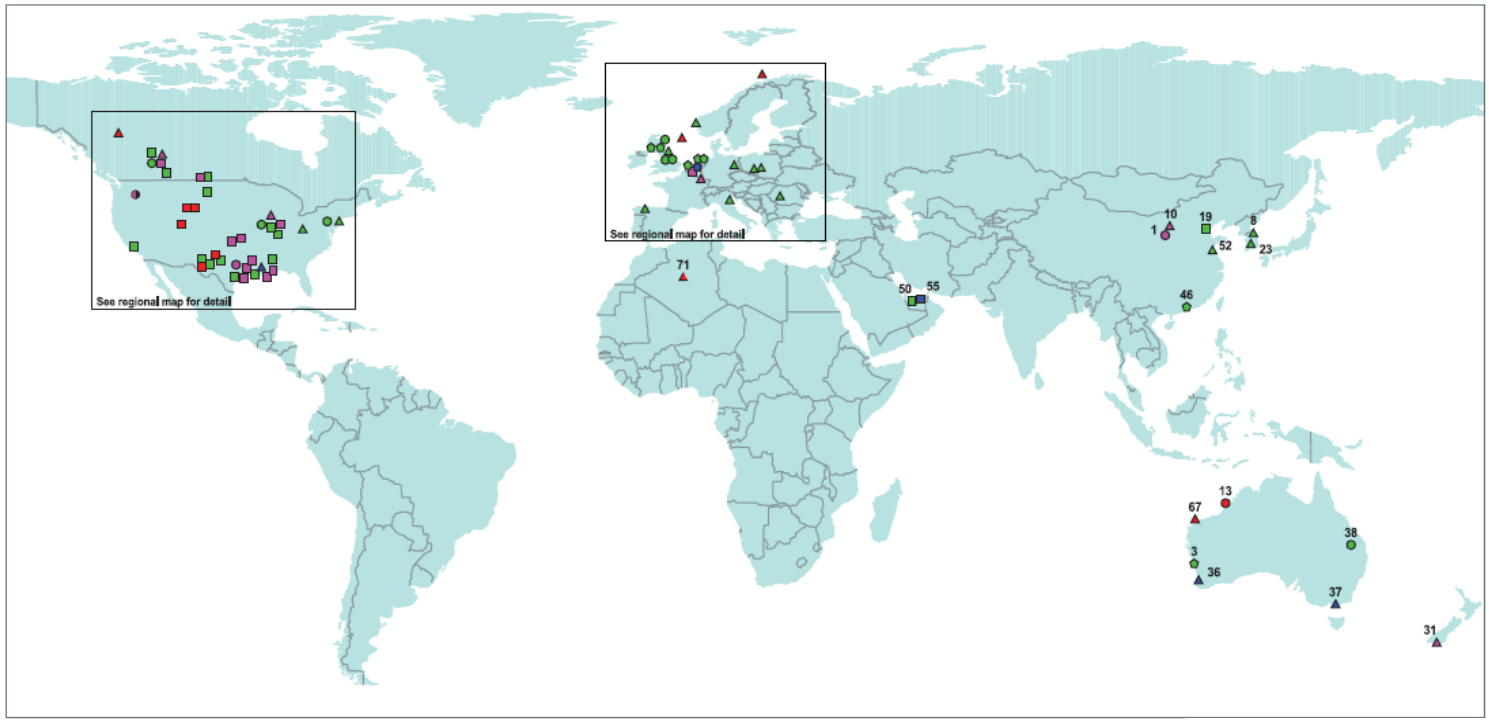
82
INDUSTRIAL PROJECTS EMPLOYING CCS IN 2020

Source: IEA Tracking Clean Energy Progress, 2012

CURRENT AND PLANNED PROJECTS

Around 75 integrated large-scale projects in various stages of development

Four large-scale integrated projects are operating today: Sleipner, Snohvit, In Salah, Weyburn



Source:

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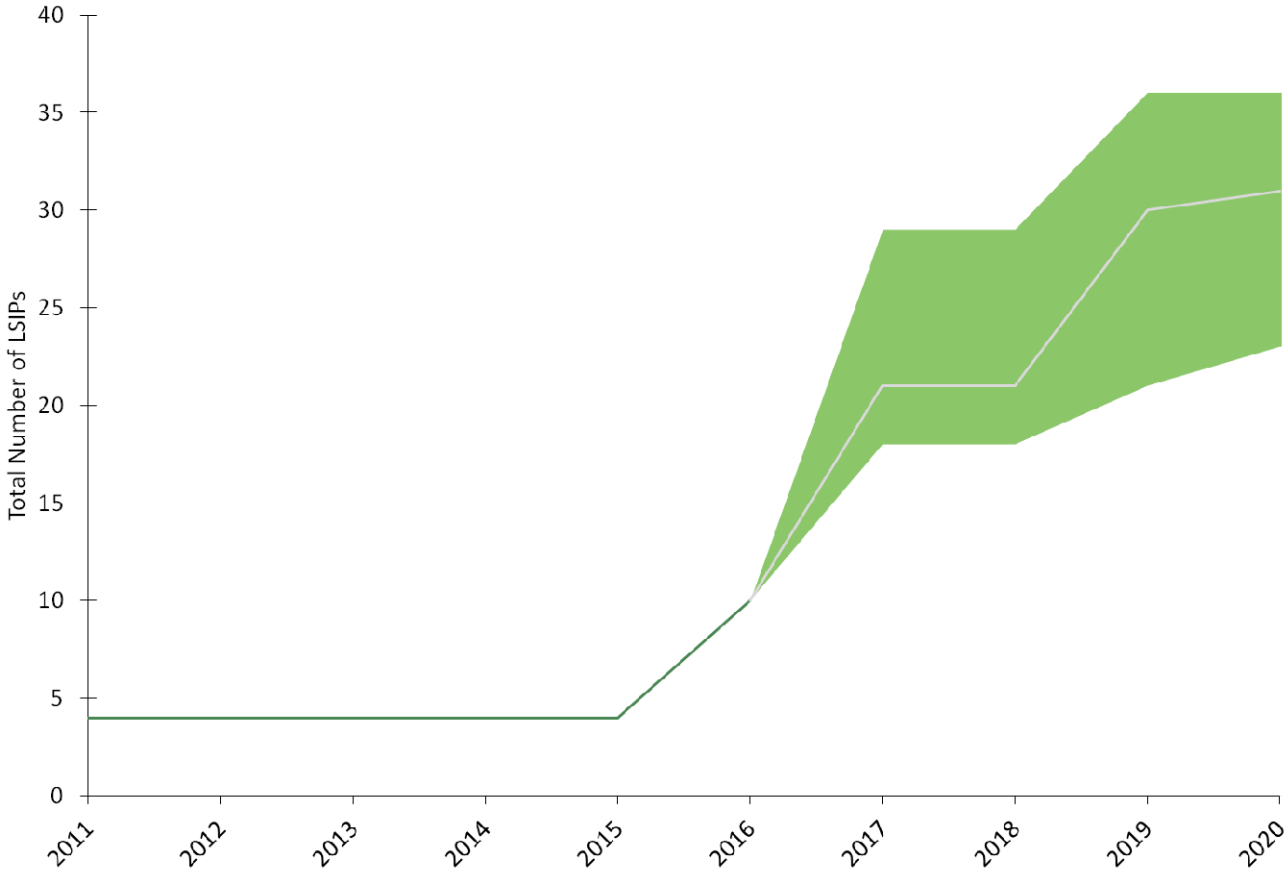
Are we on track for 2020?



NO

Not enough plants are in the development pipeline to meet the 2DS goal today

Source: GCCSI LSIP Database and IEA Analysis

The main challenges for CCS deployment

- **Lack of strong policy drivers** that would put a high-enough cost (=value!) to emitting CO2.
- **Lack of incentives and supporting policies**. Since 2008, USD 21-24bn have been committed by various governments for first CCS projects, out of which only USD 14 bn have been allocated.
- **Poor image and lack of public acceptance** is an issue, BUT, this is not uniform across the globe.
- Setting and implementing **legal and regulatory frameworks**.
- Lacking understanding of **CO2 storage**.
- **High cost of technology, especially capture**.
  - between 55-80 USD / t to capture CO2 from power plants
  - 30 USD /t in gas processing
  - Between 30 and 150 USD/t in industry
  - 5-10 USD/t for transport and storage

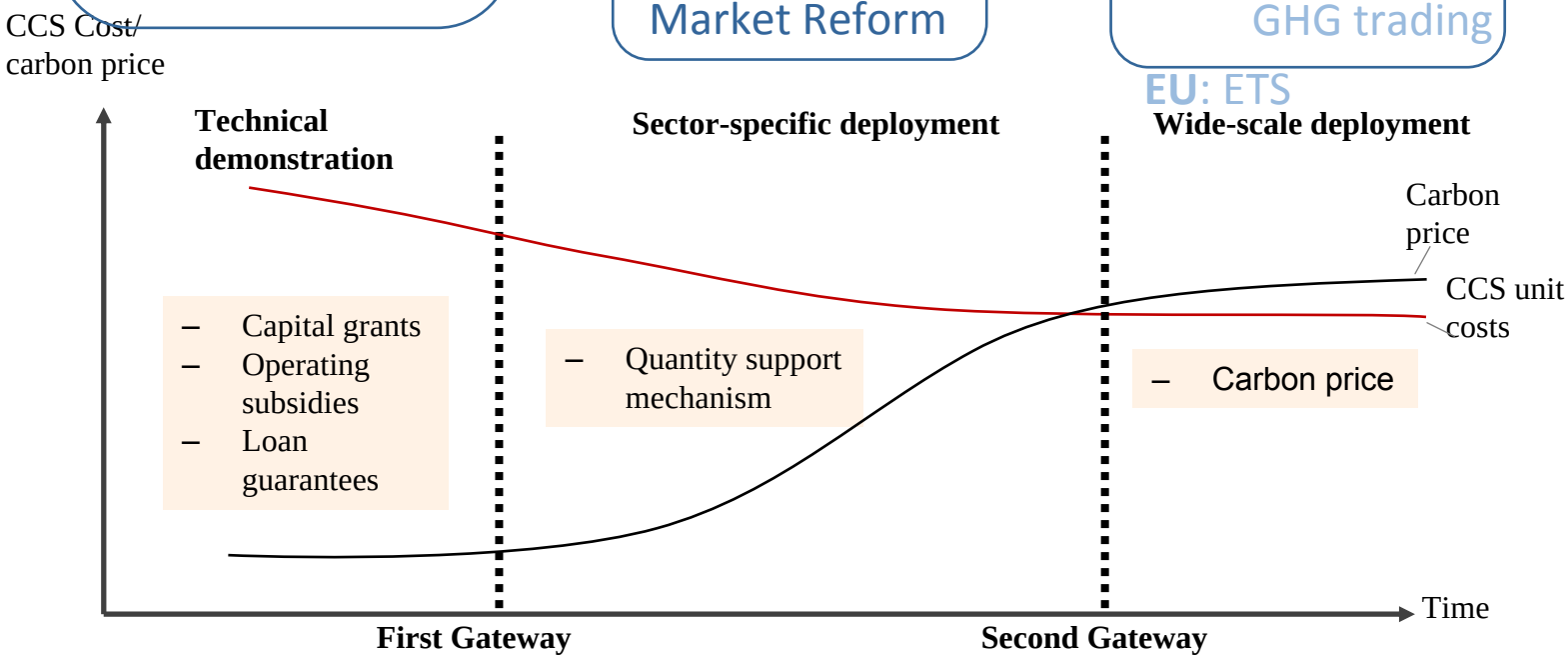
POLICY ARCHITECTURE AND GATEWAYS

US: Demo funding
EU: NER300, EEPR
AUS: Flagship pr.
UK: CCS competition
NO: Carbon tax and R&D funding

Long-term policy architecture can enhance credibility and effectiveness

UK: 2011 Electricity Market Reform

NO: Carbon tax
AUS: Carbon tax and GHG trading
EU: ETS



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STM2

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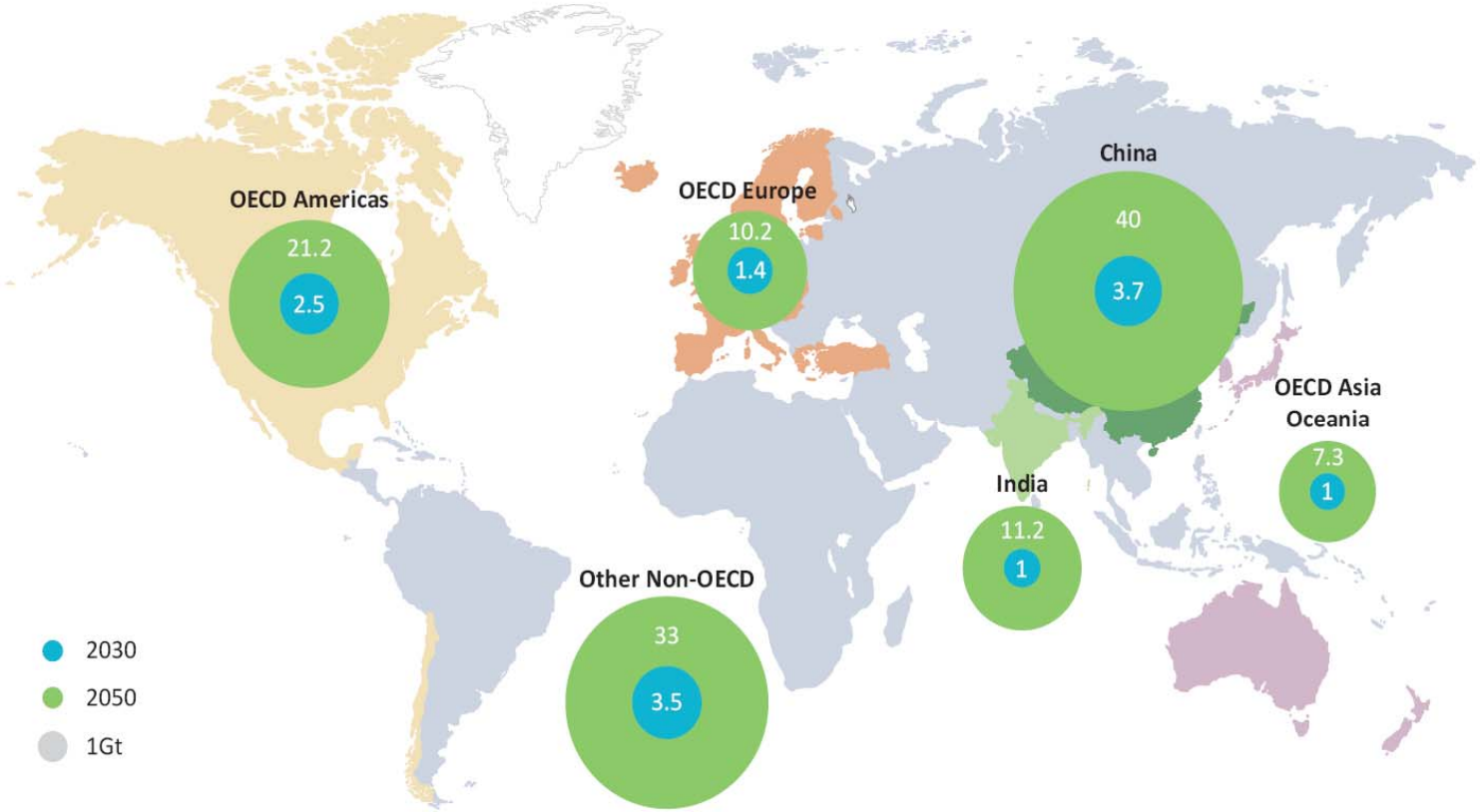
Where is CO_2 storage needed?



Note: Mass captured shown in $GtCO_2$

Source: ETP 2012

Between 2015 and 2050, 123 Gt of CO_2 are captured that need to be transported to suitable sites and stored safely and effectively. Storage sites will need to be developed all around the world.

STM2 Note that this does not show the amounts stored in these regions, but the amount captured. Since there is capacity in most regions of the world and transport between regions is an added cost, it is reasonable to expect that much of the captured CO2 will stay in these regions.
Sean McCOY; 12.06.2012

*CCS remains a critically important technology, and **concerted policy action is necessary**:*

- Countries to **assess the role of CCS** in their energy futures;
- Government **funding and incentive policies for CCS**;
- Government and industry efforts to **demonstrate CCS** at a commercial scale;
- Enabling **legal and regulatory frameworks** for both demonstration and deployment of CCS;
- Enhanced efforts on **storage capacity estimates**;
- Increased emphasis on **CO_2 transport and storage infrastructure**;
- **Engaging the public** at both policy and project levels to ensure transparency.

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Thank-you!

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