

Challenges of CCS Full Implementation

CCS: Towards Early Implementation

EPPSA's 4th TECHNOLOGY EVENING

27th January 2010, Albert Hall Complex

Mike Farley, Doosan Power Systems
EPPSA Vice President

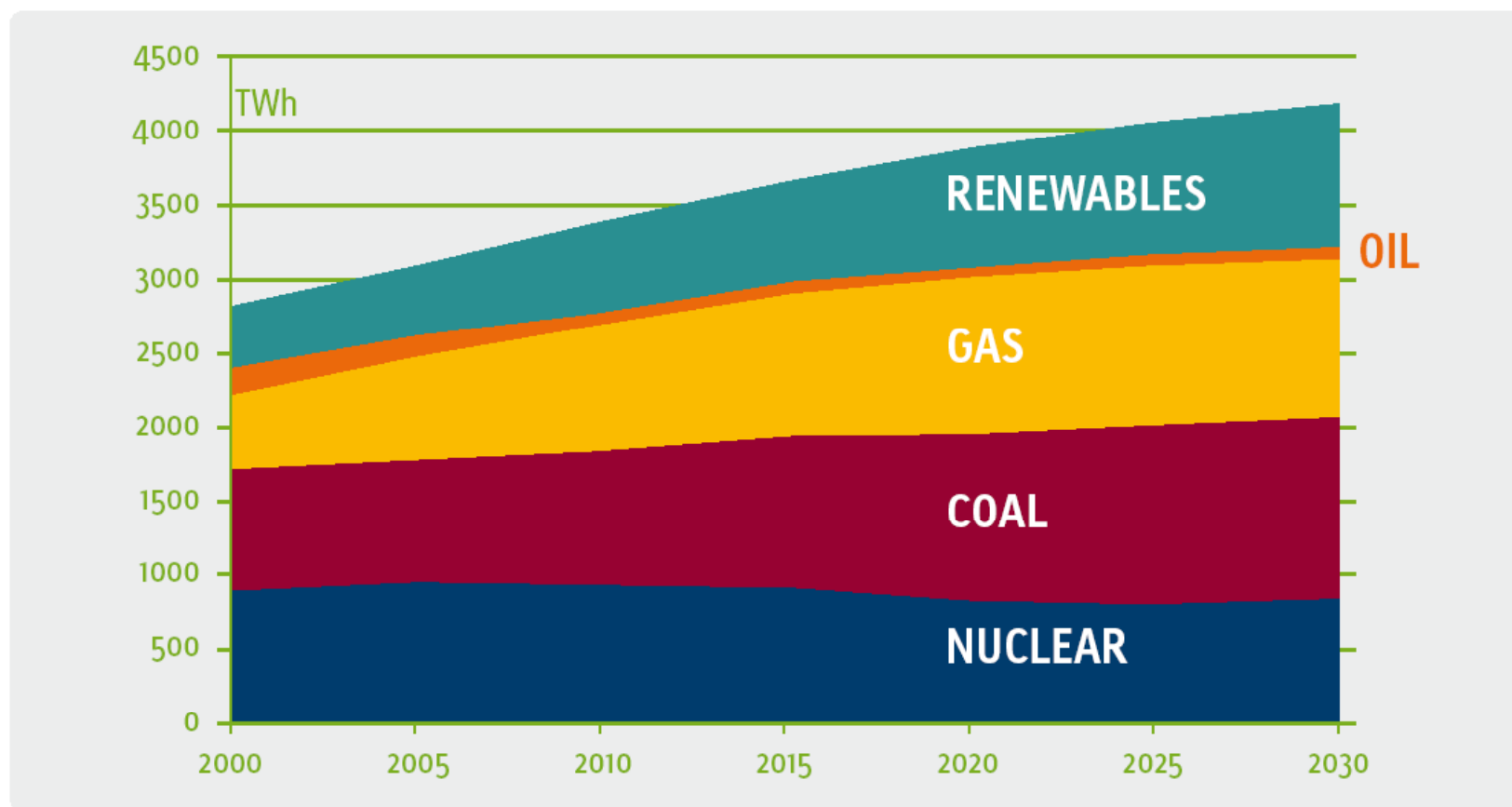
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OUTLINE:

- Power generation demand in EU27 will increase to 2030
- New fossil fuel plants are needed by 2020
- CO₂ emissions must decrease in order to meet the 2020 targets set by the EU
- To meet these targets fossil fuelled power plants need to be retrofitted or built with CO₂ capture
- In order to build power plants equipped with CO₂ capture in EU27 and continuously keep know-how and resources, commercial roll – out needs to start immediately after the first Demo projects
 - and *not* wait until 2020

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Increasing power generation in EU27 to 2030



Source: *EU-27 Energy Baseline scenario Trends to 2030 - update 2007*, DG TREN, European Commission

Note: It should be noted that the scenario chosen does not take into account the impact of the current economic crisis due to different assumptions. Sources like VGB, IEA and Eurostat foresee a decrease in the EU27 power generation demand. Nevertheless, the International Monetary Fund stated that *the global economy is recovering faster than expected*.

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New fossil fuel plants (coal/gas) are needed by 2020 in order to

- ▶ meet increasing demand
- ▶ replace old plants at the end of their lifetime
- ▶ add back-up plants to balance newly installed intermittent power (solar, wind)

Coal [Period 2010-2020]

	GW	800 MW Units
New	73	91
Back-up	24	30

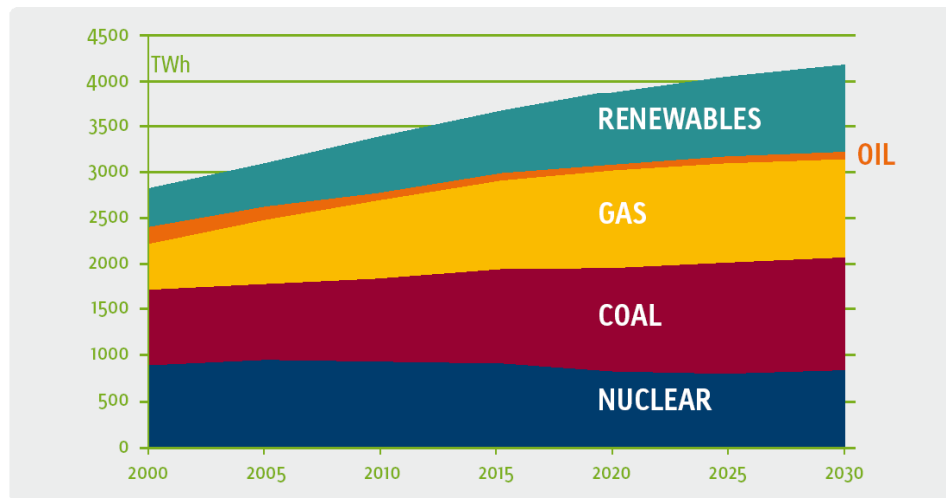
Gas [Period 2010-2020]

	GW	400 MW Units
New	74	185
Back-up	24	60

Source: *EU-27 Energy Baseline scenario Trends to 2030 - update 2007*, DG TREN, European Commission

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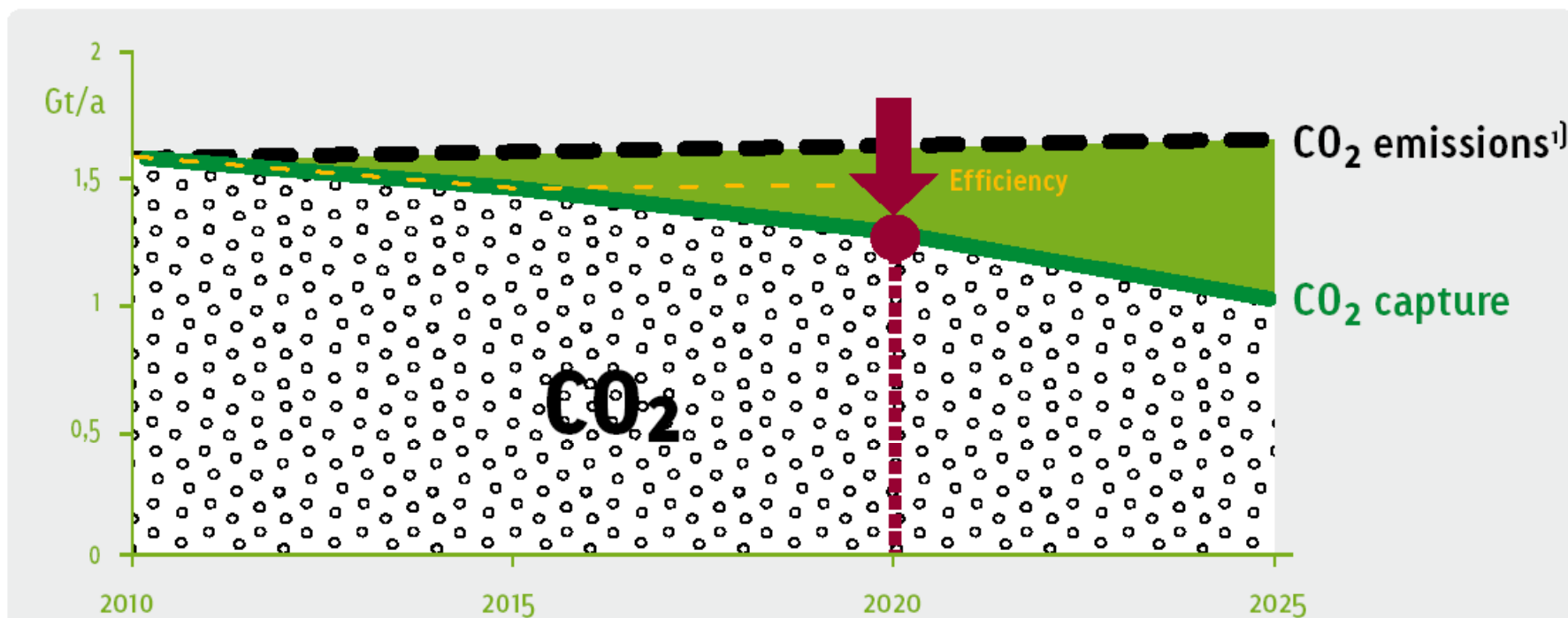
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Source: EIP-IP Energy Reference scenario Trends to 2030 – update post DG TREN, European Commission

Note: It should be noted that the scenario trends data are based on the impact of the current economic crisis and do not reflect any changes in the EU power generation demand. However, the International Energy Agency (IEA) stated that the global economy is recovering faster than expected.

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CO₂ emissions must decrease to meet 2020 targets



To meet the 2020 targets 50 % of new plants have to be equipped with CO₂ capture in the period of 2015-2020

¹⁾ Source: *EU-27 Energy Baseline scenario Trends to 2030 - update 2007*, DG TREN, European Commission

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How many power plants need to be equipped with CO₂ capture?

Target 2020 [Period 2015-2020]

Fuel	GW	Units
Coal	24	30 ^{800 MW each}
Gas	25	63 ^{400 MW each}

Potential 2025 [Period 2020-2025]

Fuel	GW	Units
Coal	52	65 ^{800 MW each}
Gas	48	120 ^{400 MW each}

- ▶ CCS technologies will contribute more to a reduction of greenhouse gas emissions than a switch to renewables²⁾
- ▶ Efficiency improvement in BAT³⁾ power plants vs. European average compensates for the energy penalty of CCS
- ▶ Industry is addressing full CO₂ chain, from capture to storage

149 GW of coal and gas power plants equipped with CO₂ capture need to be built between 2015 and 2025 compared to 131,5 GW of coal and gas power plants built between 2000 and 2010

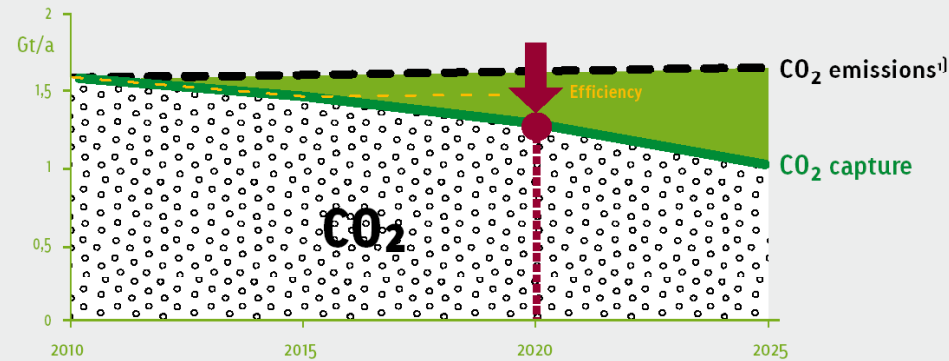
²⁾ Source: International Energy Agency, World Energy Outlook 2009

³⁾ Best Available Techniques, as defined in the IPPC / IED

Source: *EU-27 Energy Baseline scenario Trends to 2030 - update 2007*, DG TREN, European Commission

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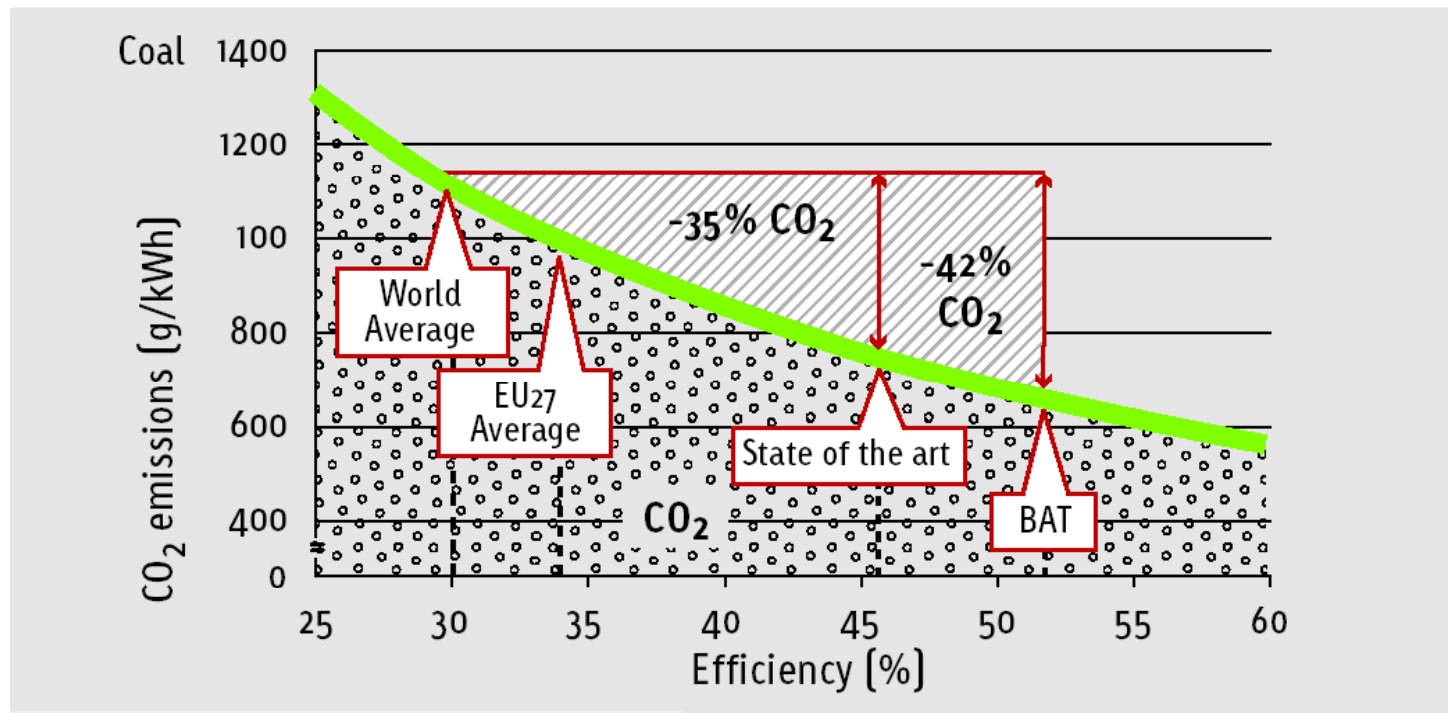
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1) Source: EU-27 Energy Baseline scenario Trends to 2020 - update 2007, DG TRIN, European Commission
2) Source: International Energy Agency, World Energy Outlook 2004
3) Best Available Techniques, as defined in the IPPC / IED

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CO₂ avoidance through efficiency increase



Potential 2020 for η increase

- + 5% [basepoints]
- results in 10% less CO₂ emissions

BAT¹⁾ coal fired power plant 2020

- $\eta \rightarrow 52\%$
- adding CO₂ capture $\eta \rightarrow = 45\%$

Best efficiency:
the basis to make CO₂ capture feasible and save fuel

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CO₂ avoidance through efficiency increase

EU Average Net Efficiencies for electricity generation

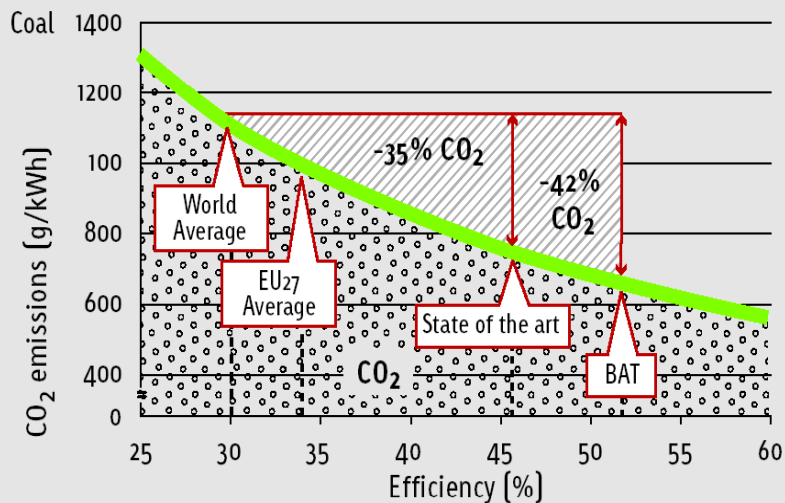
(not adjusted for CHP)	2000	2005	2010	2015	2020
Solids	0.32	0.31	0.34	0.37	0.41
Oil	0.29	0.29	0.37	0.38	0.42
Natural Gas	0.34	0.39	0.46	0.49	0.50
Derived Gas	0.25	0.28	0.41	0.41	0.42
Biomass	0.19	0.23	0.29	0.33	0.34
Overall Efficiency	0.31	0.33	0.38	0.41	0.43

Source: EU-27 Energy Baseline scenario Trends to 2030 – update 2007, DG TREN, European Commission
1) Best Available Techniques, as defined in the IPPC/IED

Source: *EU-27 Energy Baseline scenario Trends to 2030 – update 2007*, DG TREN, European Commission

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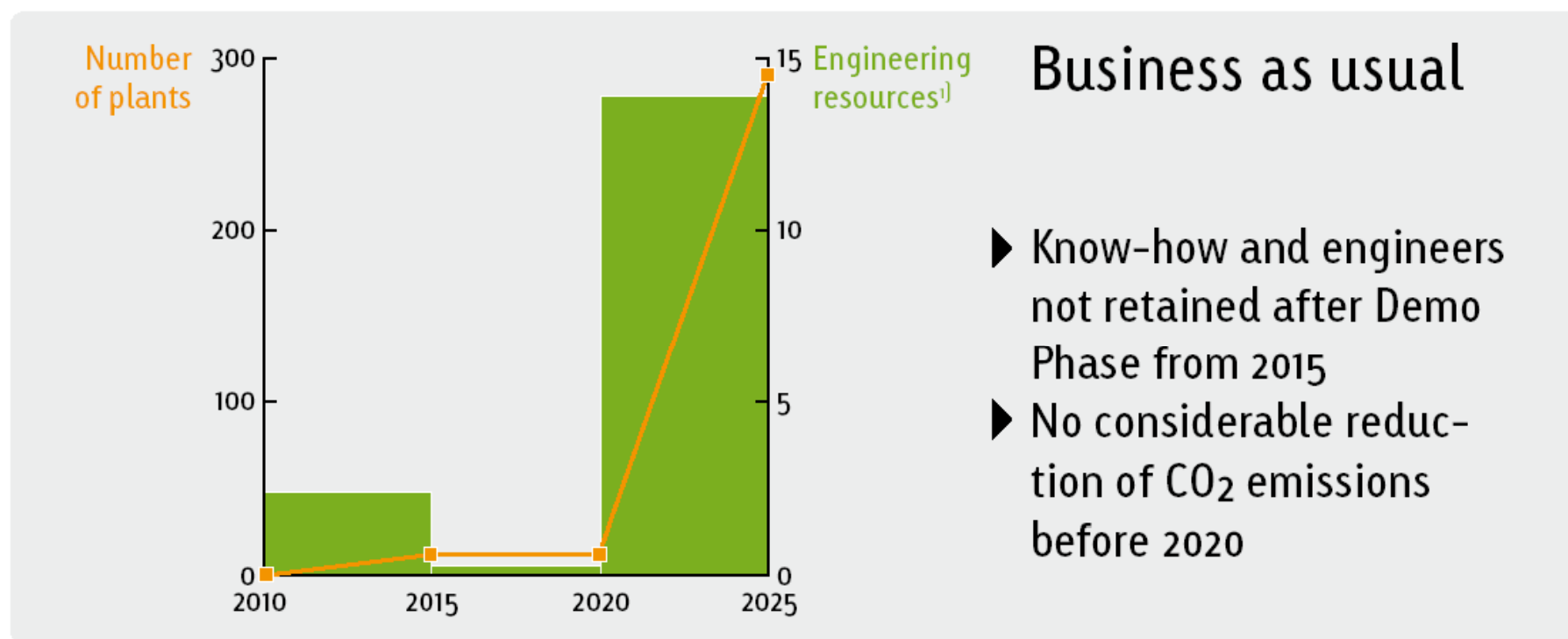
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Source: EUCO Energy Review scenario trends to 2020 - update 2007, DG-TRER, European Commission
1) Best Available Technology, as defined in the BREF, 2002

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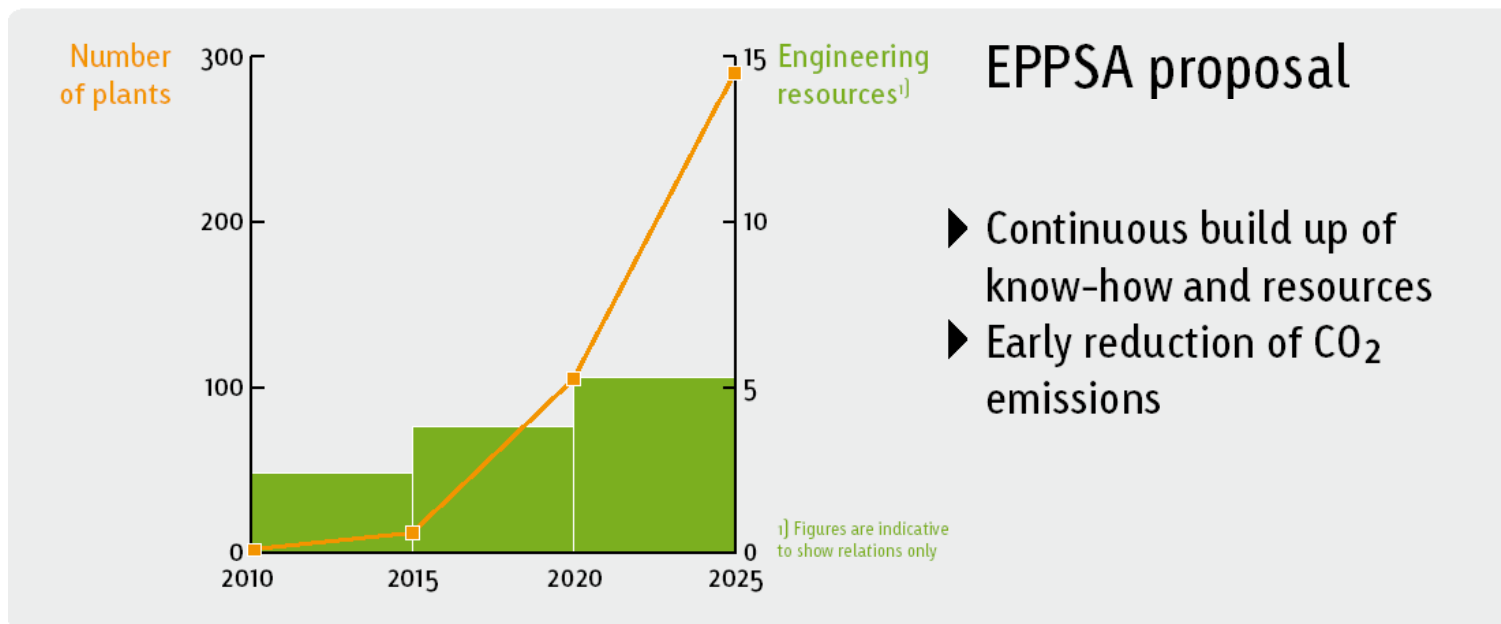
Engineering resources to build CO₂ capture plants in EU27



¹⁾ Figures for engineering resources are indicative to show relations only

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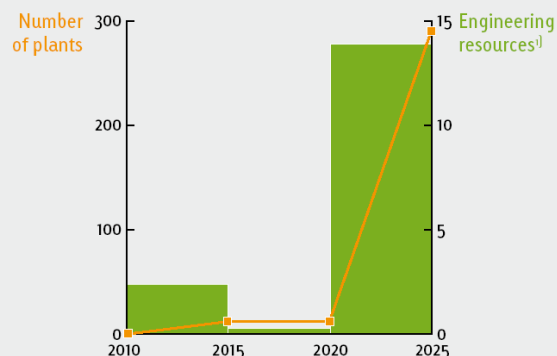
Engineering resources to build CO₂ capture plants in EU27



Commercialisation has to start following demo projects without any delay to maintain skills, obtain full benefit from Demos and accelerate deployment.

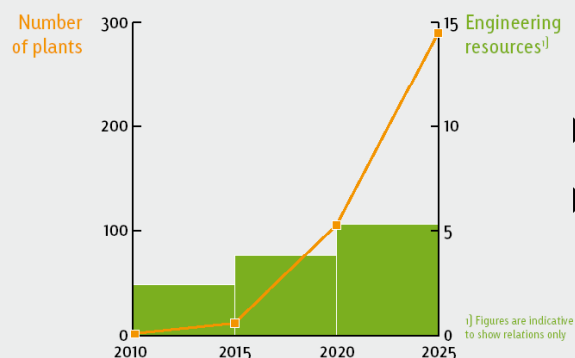
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Engineering resources to build CO₂ capture plants in EU27



Business as usual

- ▶ Know-how and engineers not retained after Demo Phase from 2015
- ▶ No considerable reduction of CO₂ emissions before 2020



EPPSA proposal

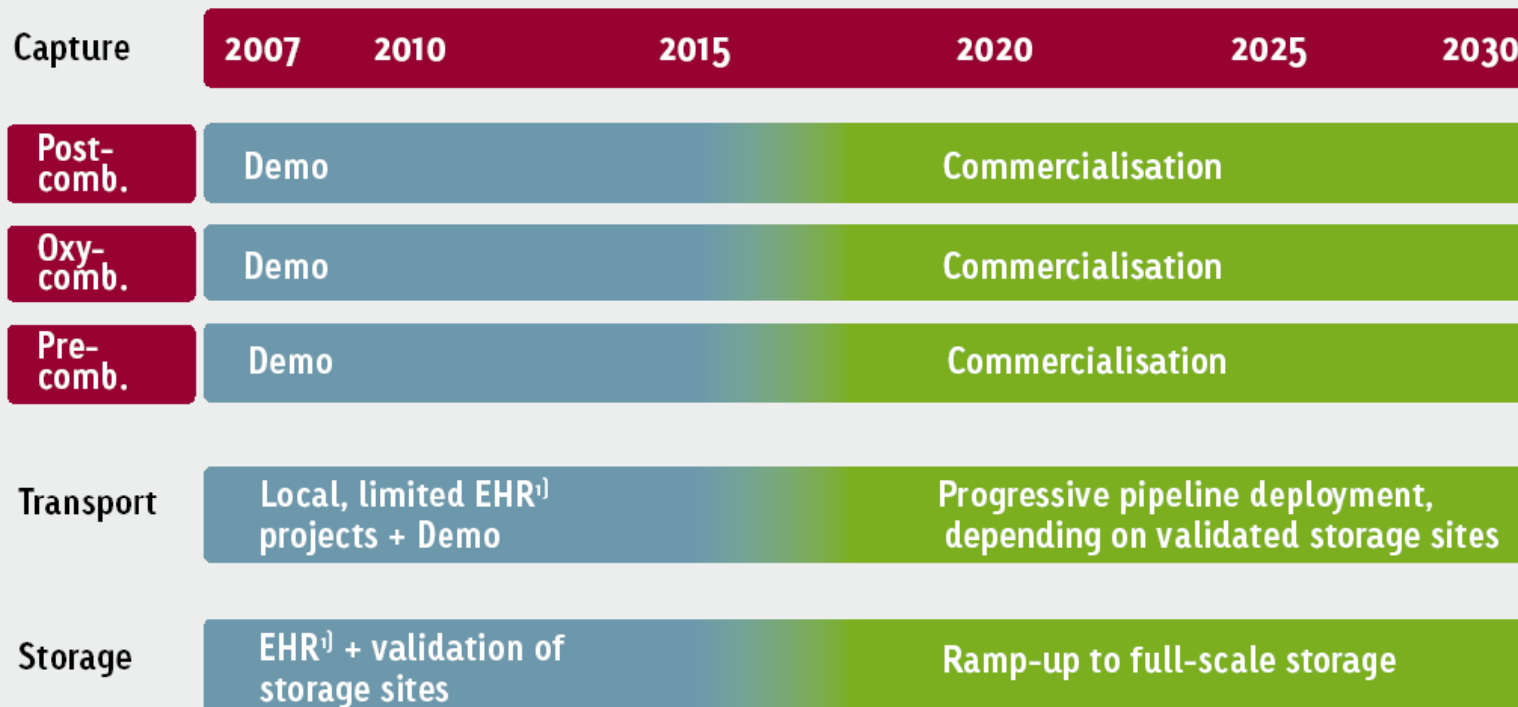
- ▶ Continuous build up of know-how and resources
- ▶ Early reduction of CO₂ emissions

Commercialisation has to start following demo projects without any delay to maintain skills, obtain full benefit from Demos and accelerate deployment.

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Fast implementation of CCS Demos is needed to gain operational experiences and optimise processes

▶ The Plan: CCS Roadmap



¹⁾ Enhanced hydrocarbon recovery

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Speeding up the implementation by

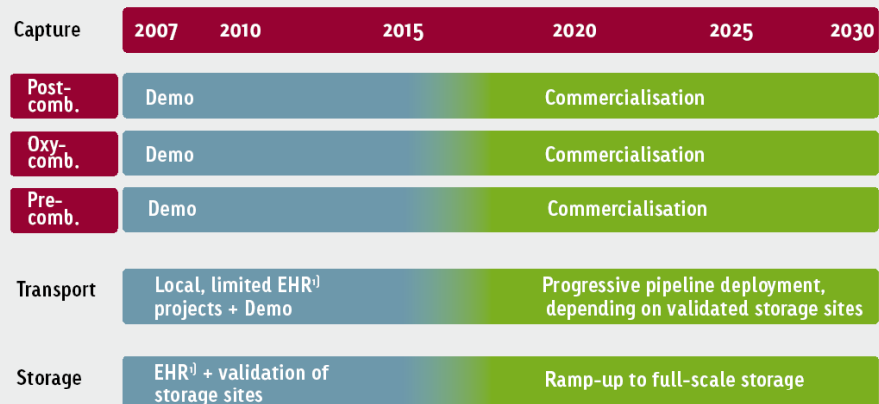
- ▶ public support
- ▶ political support
- ▶ approval procedure
- ▶ transport and storage infrastructures
- ▶ funding of demo plants

and a strategy for early deployment

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▶ The Plan: CCS Roadmap



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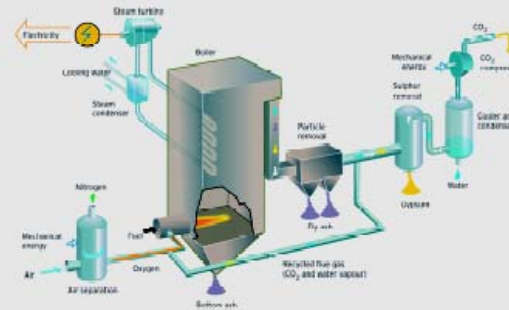
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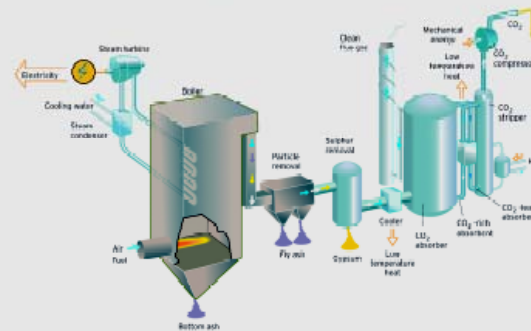
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CO₂ Capture Processes

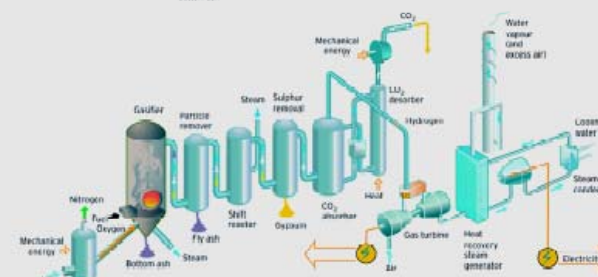
Oxyfuel Combustion
(O₂/CO₂ recycle)



Post Combustion
(absorption process)



Pre Combustion
(decarbonisation)



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Summary:

- Electricity demand in EU27 will increase to 2030 and beyond
- New fossil fuel plants are needed by 2020
- CO₂ emissions from these plants must be cut in order to meet the 2020 targets set by the EU
- To meet these targets fossil fuelled power plants need to be retrofitted or built with CO₂ capture
- In order to build power plants equipped with CO₂ capture in EU27 and meet climate targets, we need to retain know-how and resources:
 - Early initiation of 10 –12 demos is essential
 - Commercial roll – out needs to start immediately after the first Demo projects and *not* wait until 2020

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