



# IGCC – Current Projects and Technology Status

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13 April 2011

## Current Operating IGCC Plants (Coal Feedstock)

	Net Output	Gasifier	Gas Turbine	Commercial Operating Date
Buggenum (Netherlands)	253 MW	Shell	Siemens V94.2 (SGT5-2000E)	1993
Wabash (USA)	262 MW	ConocoPhillips	GE 7FA	1995
Vresova (Czech Rep.)	398 MW	Lurgi (26 off)	GE 9E (2 off)	1995
Polk (USA)	250 MW	GE	GE 7FA	1996
Puertollano (Spain)	330 MW	Uhde	Siemens V94.3	1997
Nakoso (Japan)	250 MW	MHI	MHI M701DA	2007
<b>Total</b>	<b>1,743 MW</b>			

Source: [www.gasification.org](http://www.gasification.org) and other public websites.

## IGCC – Current Projects

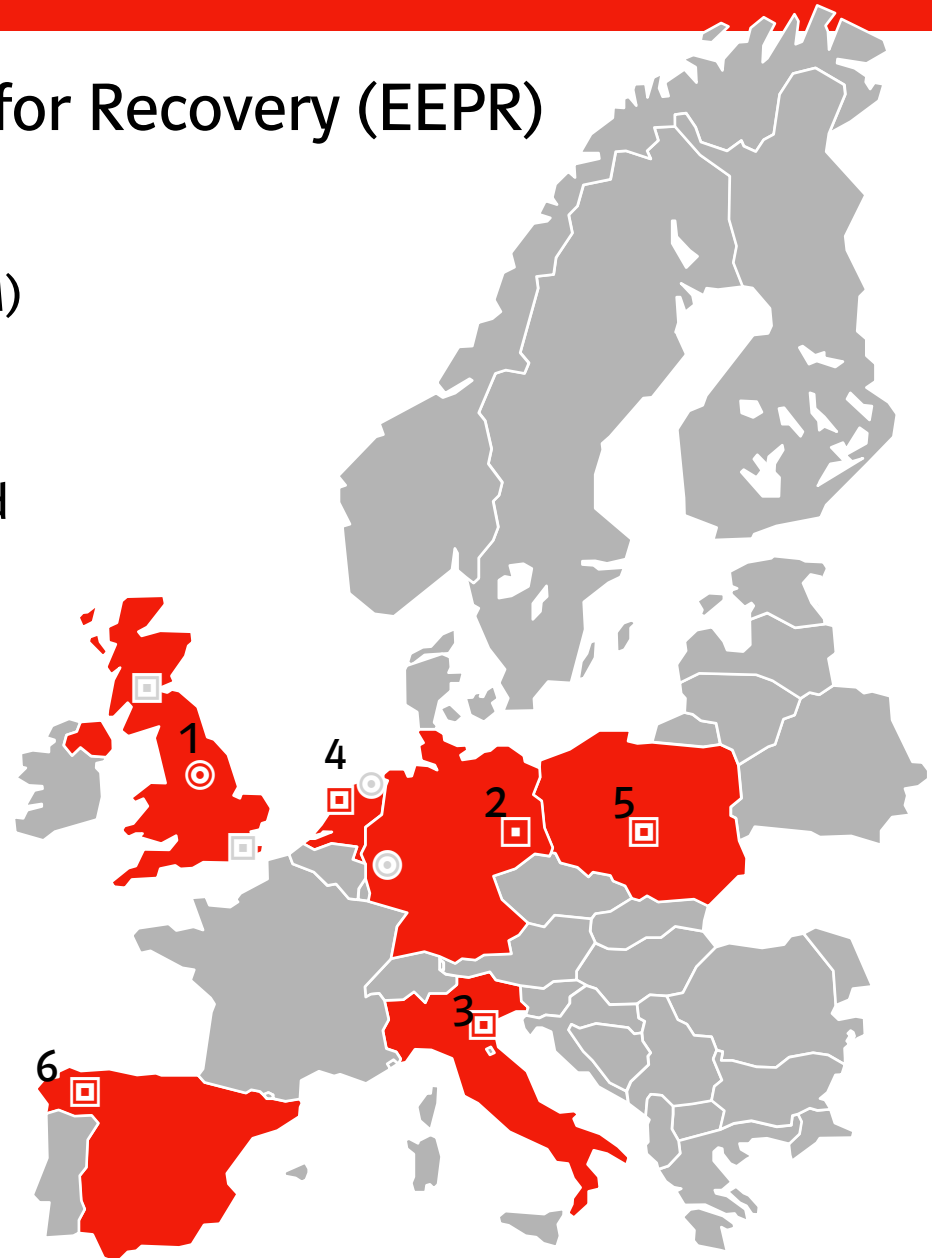
Only three showing any significant progress:

- Edwardsport (Duke Energy), Indiana, USA
  - \$2.9B (\$4,700/kW) – 618 MW
  - COD 2012
- Kemper County (Mississippi Power), Mississippi, USA
  - \$2.2B (\$3,800/kW) – 582 MW (with 65% CO<sub>2</sub> capture)
  - COD 2014
- GreenGen, Tianjin, China
  - \$1B (\$4,000/kW) – 250 MW
  - COD 2011

## European Energy Programme for Recovery (EEPR)

- €180M to each project (except Porto Tolle, which has €100M)
- "Rules"
  - >80% CO<sub>2</sub> capture
  - Transport and store underground
  - 250 MW<sub>e</sub> or greater
  - Knowledge share
- Reserves in grey

- 1 - Hatfield (IGCC) - Powerfuel
- 2 - Jaenschwalde (Oxy-Fuel) - Vattenfall
- 3 - Porto Tolle (Post-Comb) - Enel
- 4 - Maasvlakte (Post-Comb) - E.ON
- 5 - Belchatow (Post-Comb) - PGE EBSA
- 6 - Compostilla (Post-Comb) - Endesa



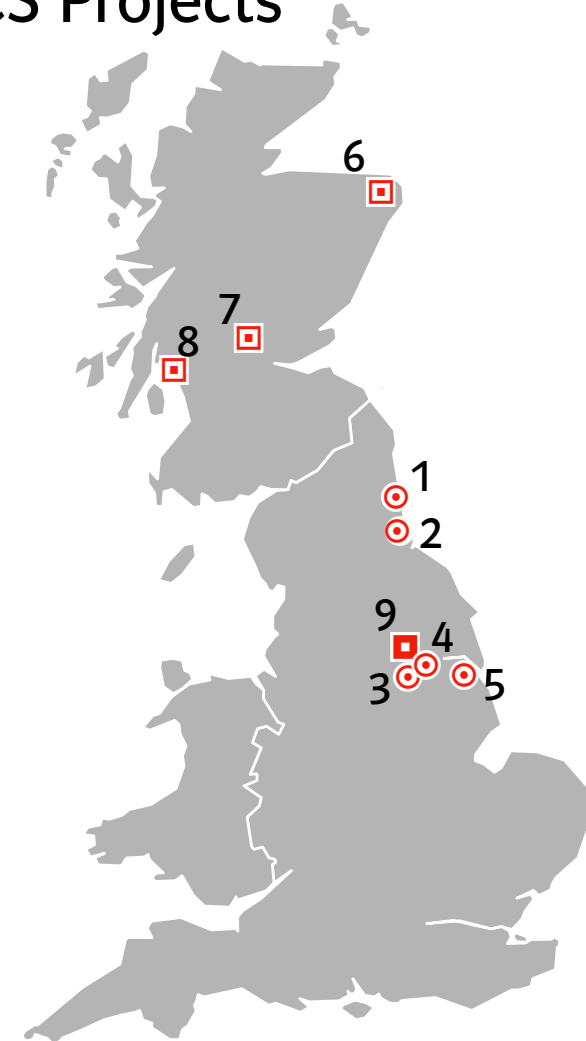
## New Entrants' Reserve (NER300)

- 300M CO<sub>2</sub> credits from NER to be made available to CCS and Renewable installations.
- Total value unknown
  - Depends on price of a CO<sub>2</sub> credit
  - Depends on split between CCS and Renewables
  - €3B for CCS may not be unreasonable guess.
- Up to eight CCS plants to be demonstrated by end of 2020 (more possibly at a later date, subject to funding being available).
  - Announcements made at end of 2011 and end of 2013
  - 50% of CAPEX paid up front
- Shortlist of projects to be announced end-2010.
- 250 MW minimum, to be in service by 2015. 85% CO<sub>2</sub> capture.

## New Entrants' Reserve (NER300) – UK CCS Projects

- Partial list released
- This slide represents author's best guess
- All three main CCS routes shown
  - Five pre-combustion capture
  - Three post-combustion capture
  - One oxy-fired plant

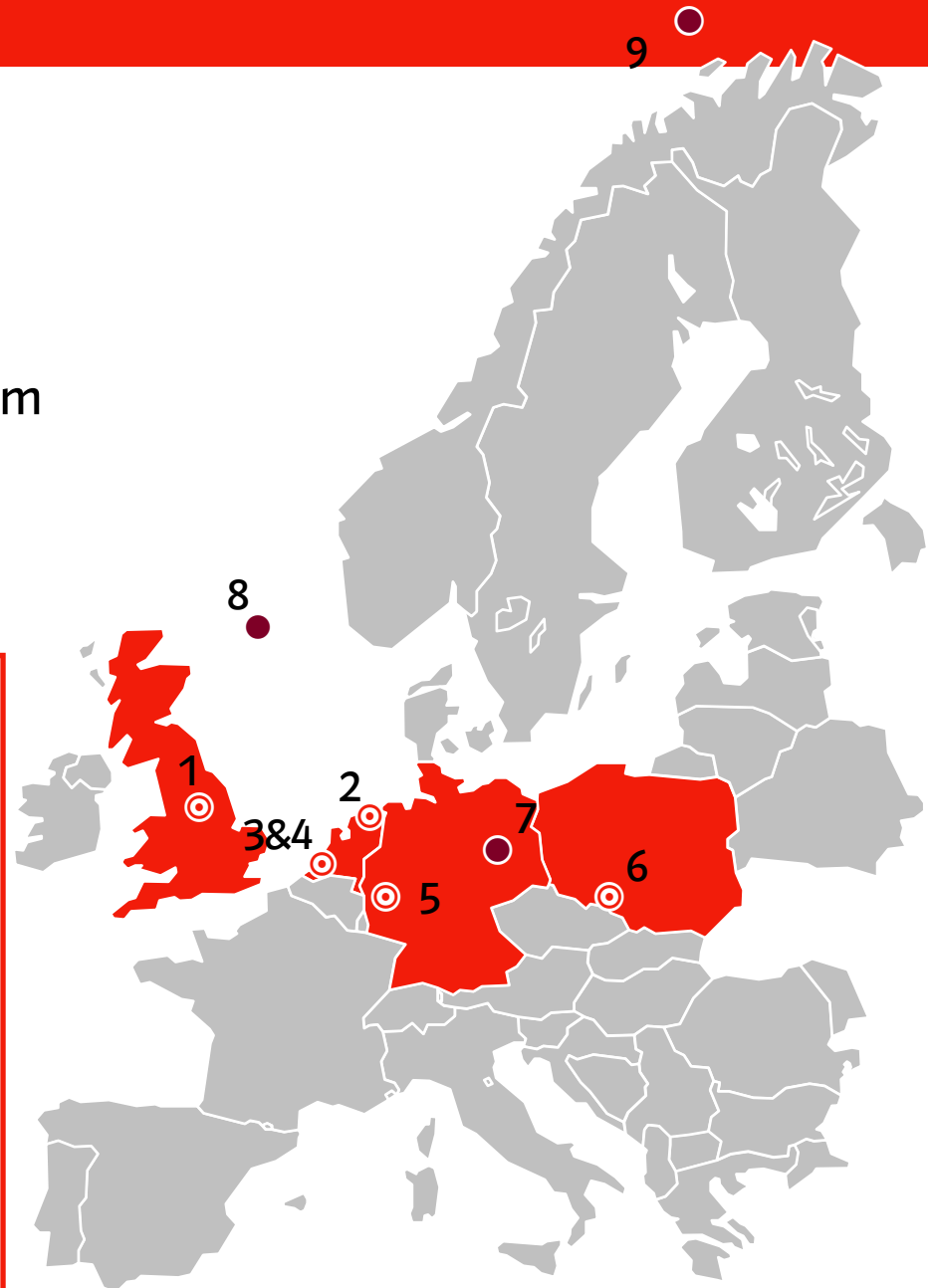
- ⊙ 1 – Blyth (Pre) – Progressive Energy
- ⊙ 2 – Teesside (Pre) – Progressive Energy
- ⊙ 3 – Hatfield (Pre) - Powerfuel
- ⊙ 4 – Endex (Pre/Gas) - Powerfuel
- ⊙ 5 – Killingholme (Pre) – C.GEN
- ▣ 6 – Peterhead (Post/Gas) – SSE/Shell (Retrofit)
- ▣ 7 – Longannet (Post) – Scottish Power (Retrofit)
- ▣ 8 – Hunterston (Post) – Ayrshire Power
- ▣ 9 – Drax (Oxy) – Drax Power/Alstom



## European IGCC Projects

- None has final sanction
- Uncertainty over storage holding them back?
  - Highlights importance of storage sites shown on map

- ⊙ 1 - Hatfield (IGCC) - Powerfuel - Phase 1 (CCGT)
- ⊙ 2 - Magnum (Nuon/Vattenfall) - Phase 1 (CCGT)
- ⊙ 3 - Rotterdam (Essent) - Postponed
- ⊙ 4 - Rotterdam (C.GEN) - Polygen (S/U 2015) - In feasibility
- ⊙ 5 - Hürth (RWE) - 450 MW IGCC - Postponed
- ⊙ 6 - Kedzierzyn (ZAK/PKE) - Polygen (S/U 2015?) - Unknown
- 7 - Ketzin (EU Project) - CO<sub>2</sub> injection into aquifer
- 8 - Sleipner (Statoil) - CO<sub>2</sub> injection into gas field
- 9 - Snøhvit (Statoil) - CO<sub>2</sub> injection into gas field



## Technology Updates

- Many types of gasifier available
  - ConocoPhillips, GE, MHI, KBR, Shell, Siemens, TPRI.
  - These are either proven, or starting to enter service.
  - Other novel designs being developed, but are not yet commercially available.
- Warm gas clean up
  - Potential efficiency and CAPEX benefit
- Gas turbine technology
  - H-class turbines – now available for natural gas
  - 60% CCGT efficiency, cf. 55% for older F-class GTs.



## Summary

- Costs are still very high
  - Only makes sense if carbon is restricted
  - However, then IGCC with CCS could be competitive.
- Technology slowly moving forward to drive costs down.
- Many projects moving forward slowly/not at all
  - Uncertainty over future for coal and CCS
  - Financial constraints