

# What do we know now and where next?

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ETI Strategy Manager  
Dennis Gammer

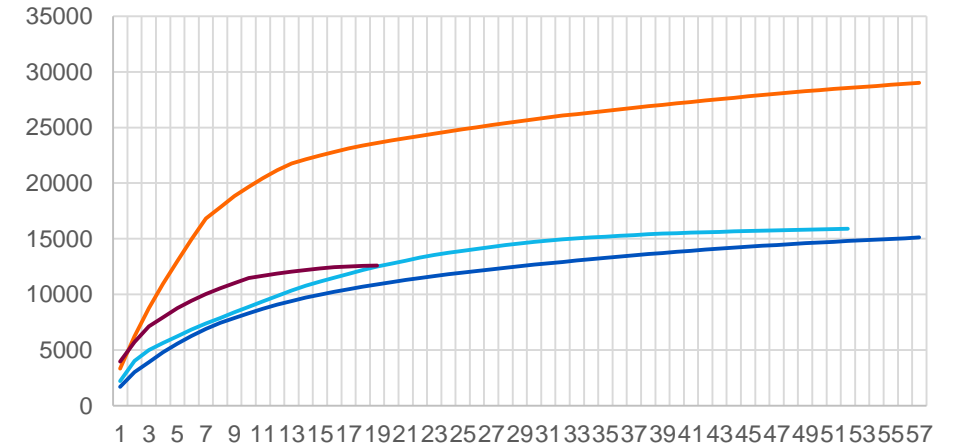




# Where to next? - CO<sub>2</sub> storage

- Complete the detailed de-risking of best stores – make them “bankable”
- Engage the O&G sector:
  - retain valuable data during decommissioning period
  - explore synergies with the hydrocarbon production industry
  - exploit UK technical and operational expertise offshore
- Continue work on increasing:
  - storage efficiencies in different store types
  - injection rates
- Focus on large scale deployment issues
- Need deployment to gain confidence in performance prediction including cost

Cumulative storage (MTs) vs No. of Stores, by type

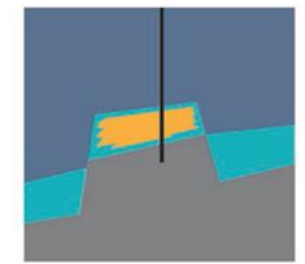
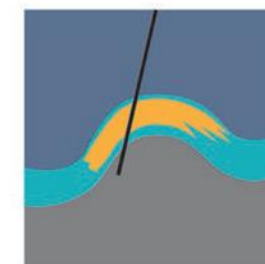
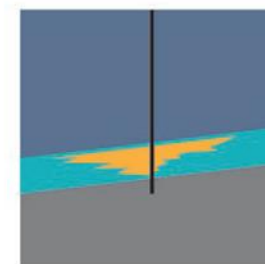


— Closed Box                      — Open with no structure  
— Open with structure          — Structural Trap

OPEN  
(<5% Eff)

TRAP  
(<20% Eff)

CLOSED BOX  
(<5% Eff)

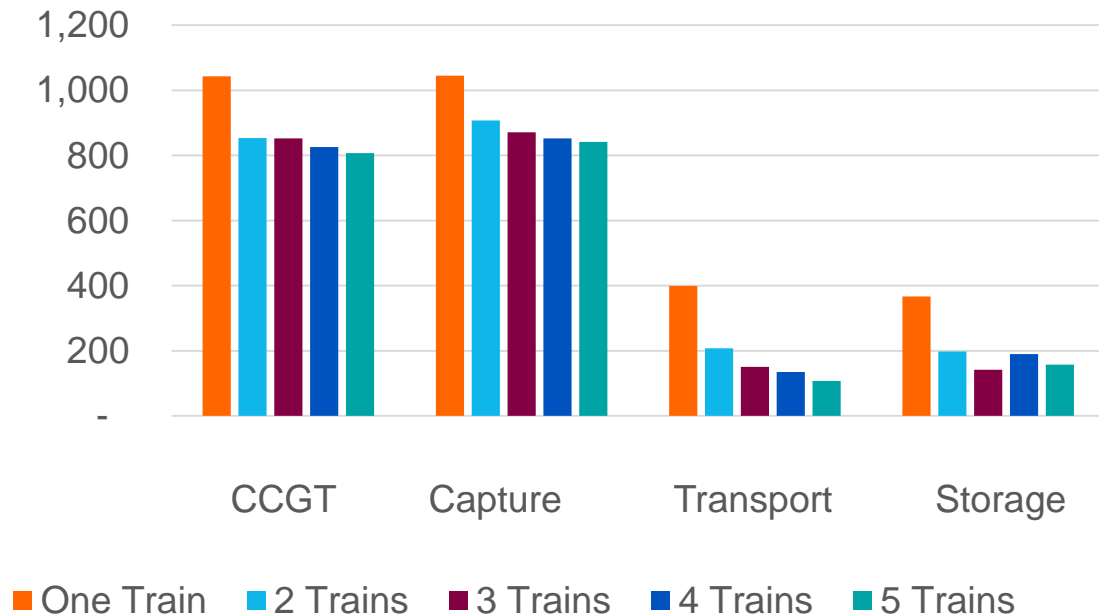




# Where are we now? – Capture

- Post Combustion Capture is the biggest component of large scale CCS cost
  - Demonstration plants running – power, steel, H<sub>2</sub>, biofuel etc.
  - Gas turbine sizes increasing
  - Gas turbine efficiency increasing
  - Energy penalty decreasing
- Good FOAK cost base for UK plant from BEIS Commercial CCS Competition and international demonstration plant
  - The ETI Thermal Power with CCS Project has used this to provide a robust estimate for large scale gas power with CCS
- Pre Combustion capital costs – less data/more spread
  - higher capital cost than post – combustion methods for power generation
  - biomass gasification (negative emissions) undergoing UK testing. ESME modelling suggests H<sub>2</sub> production from biomass for use in industrial abatement (not power) is a target application

Investment breakdown, £/kW vs. No. of Power Trains



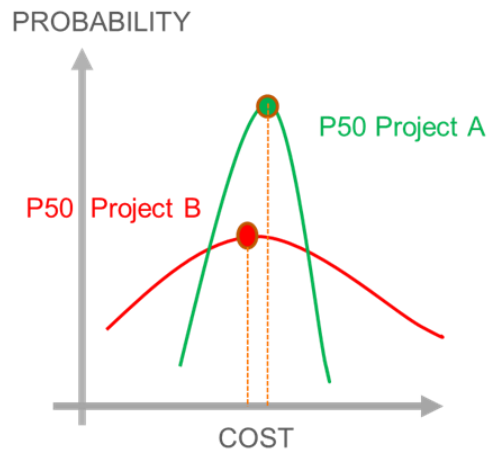
Scale matters!



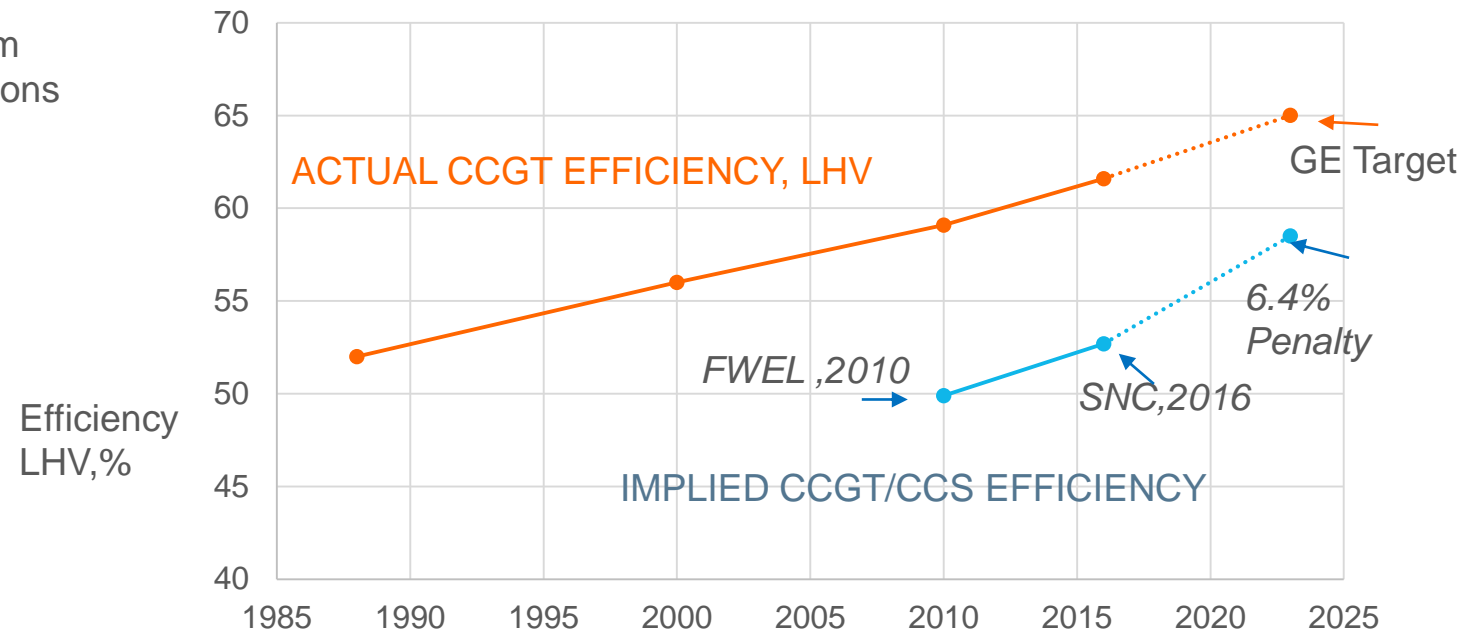
# Where to next? - Capture

- There is no standout “ready to deploy” alternative to amine/solvent technology that justifies the risk
- Focus on higher capture rates
- Considerable expenditure is required to introduce innovative pre-combustion and post combustion technologies. Large scale testing of capture from biomass firing is key to realising negative emissions

Commercially proven CCGT & amine platforms will raise the bar for new technologies

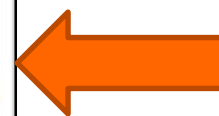
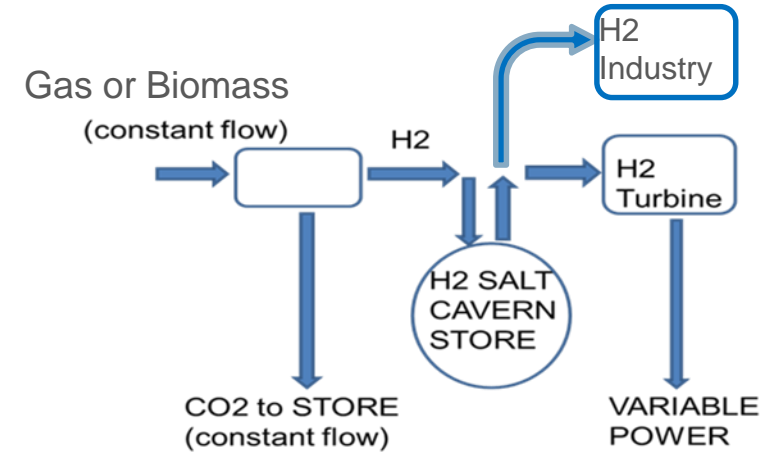
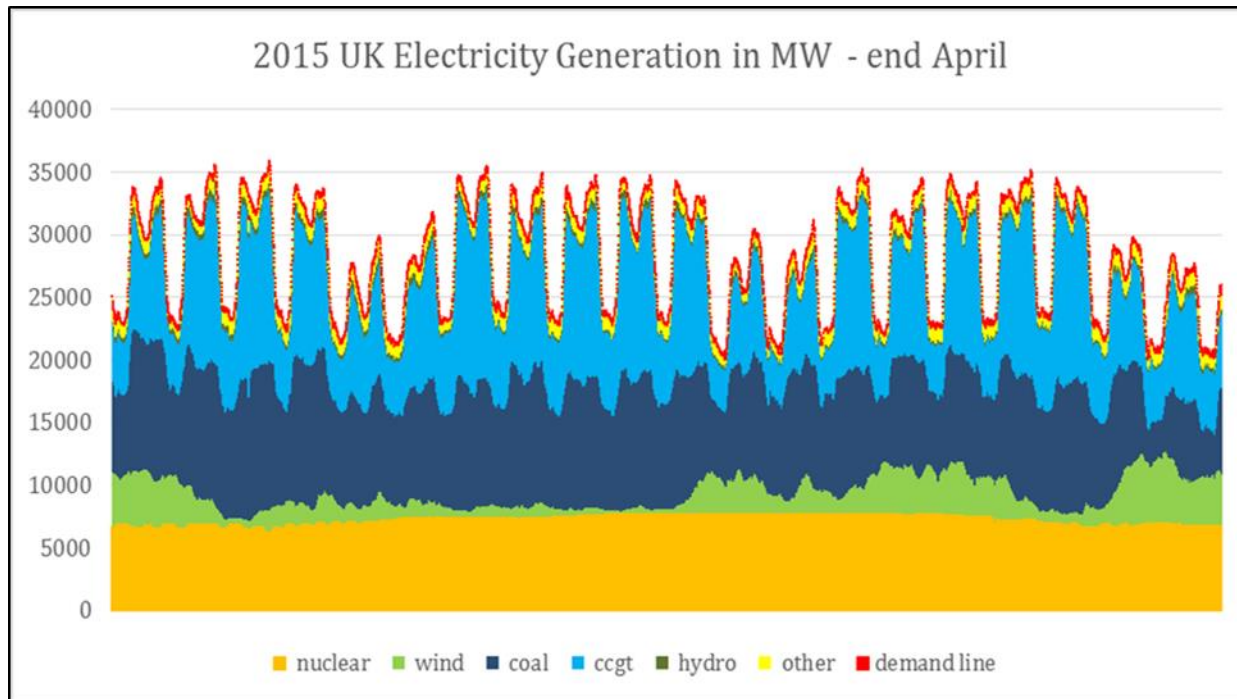


## CCGT LHV efficiency vs year

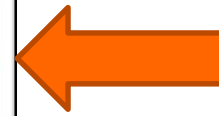




# Changes in the market and role - power



Load following area, eventually more MWh than in baseload area. 100+ starts per annum. Best configured with a “store”. Hydrogen – use also in industry, heat, transport, could be from biomass, coal, renewables. Needs technology update.



Baseload area left by coal, increasingly penetrated by wind through to 2030/40 . Natural area for gas turbines with post combustion capture to compete with nuclear - £63- £93/MWh LCOE, depending on gas cost

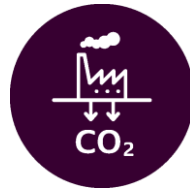


# The case for CCS deployment

- Major international demonstrations are in operation for several applications.
- The cost, flexibility and performance promise makes it highly valued in climate change mitigation and energy system models.
- The UK has excellent infrastructure, expertise and assets for CCS and will require clean dispatchable power and heat, complementing its renewables, and achieving deeper decarbonisation across sectors.
- Scale and risk profile, and the potential to expand are important attributes for projects to deliver success.
- Deployment is the primary driver of cost reduction, and is more impactful than currently envisaged technology improvements







# CCS Programme Legacy

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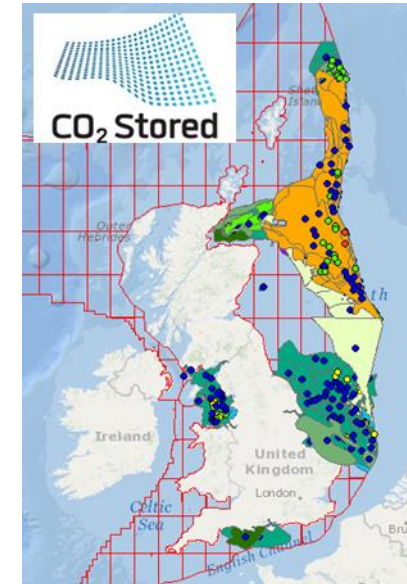
ETI Programme Manager  
Andrew Green

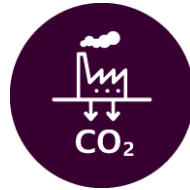




# ETI CCS Programme – the Legacy

- Energy Systems Catapult Strategic Analysis Function will continue the ETI's energy system analysis work and 'flying the flag' for CCS
- CCS Knowledge Zone – wherever possible CCS reports are or will be made publically available
- CO2Stored – advanced discussions under way to assure continued access, support and development of this national asset
- The Clean Gas Project
  - Development of a large scale gas with CCS project in the UK
  - Early stage development completed by the ETI
  - Transferred to OGCI Climate Investments, with access to critical ETI background knowledge
  - Announced as one of their three initial projects





# Thank You

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Speak to our specialists in the Carbon Capture and Storage  
exhibition area for more details