Carbon Capture and Storage: What role for R&D in delivering cost-competitive CCS projects in the UK in the 2020s

15th October 2015, London **ACADEMIC PRIORITIES FOR CAPTURE** RESEARCH **Karen N Finney** Energy 2050 University of Sheffield









Research Focuses & Challenges

- Focus on two main areas:
 - advanced capture
 - future fuels (in priority order)
 - ~ gas-CCS attractive option but under funded
 - ~ bio-CCS resource/supply chain uncertainty
 - ~ coal-CCS questionable future?
- Key challenges in these fields:
 - cost reductions
 - alignment with government policy







Research Focuses & Challenges ADVANCED CAPTURE

- Power plant–capture plant integration/grid interaction
 - flexible capture strategies for dynamic operation (e.g. load-following, peaking, intermittent, transient, etc.)
 - whole systems simulations and modelling (virtual reality) taking into account transport (and storage)
- Development of low-cost, fuel-specific solvents to maximise capture efficiency and minimise reboiler duty
- Technology retrofitting into existing plants vs. capture ready new-builds (current, next and future generation capabilities)
- Optimise regeneration (minimise energy penalty for costeffective operating regimes)
- Minimisation of emissions

Public perception: safety and emissions (e.g. nitrosamines)
 OUKCCS



Research Focuses & Challenges

GAS	BIOMASS	COAL
 cost reductions fundamental research on advanced turbine cycles, e.g. humidification, EGR, S-EGR, etc. high pressure/high temperature GTs oxy-firing membrane applications 	 cost reductions air and oxy-firing fuel flexibility resource availability utilisation issues (slagging, fouling, corrosion, solvent degradation, etc.) 	 cost reductions air and oxy-firing fuel flexibility – use of brown coal? public image and pressure (perception and understanding)

development for pilot-scale demonstration and technology validation for larger-scale deployment at a commercial level





Current Research Activities

- SELECT [EPSRC EP/M001482/1]
 - selective exhaust gas recirculation for capture from gas turbines
- Gas-FACTS [EPSRC EP/J020788/1]
 - future advanced capture technology options for gas
- Bio-CAP [UKCCSRC UKCCSRC-C1-40]
 - air and oxy-firing of biomass (and coal) with CO₂ capture
- New UK Fuels [EPSRC EP/M015351/1]
 - opening new fuels for conventional UK generation that are both lowcost and low-carbon
- Future Conventional Power [EPSRC EP/K02115X/1]
 - development and evaluation of sustainable technologies for flexible operation of conventional power plants



plus additional research grants on a range of other themes