

UKCCSRC 2015 Annual ECR Meeting

- Thinking about your future career.
- As of today, number of jobs in CCS is uncertain due to technology not yet been fully demonstrated.
- CCS requires “big” projects and financing, range of partners/disciplines.
- If technology becomes commercially proven, then tens of thousands of jobs globally.
- Programme reflects different stages of career development and both industry and academia.
 - Learning from experience
 - How ECRs careers are starting to develop

A Journey in Fuel Science that has ended in Carbon Capture

Colin Snape

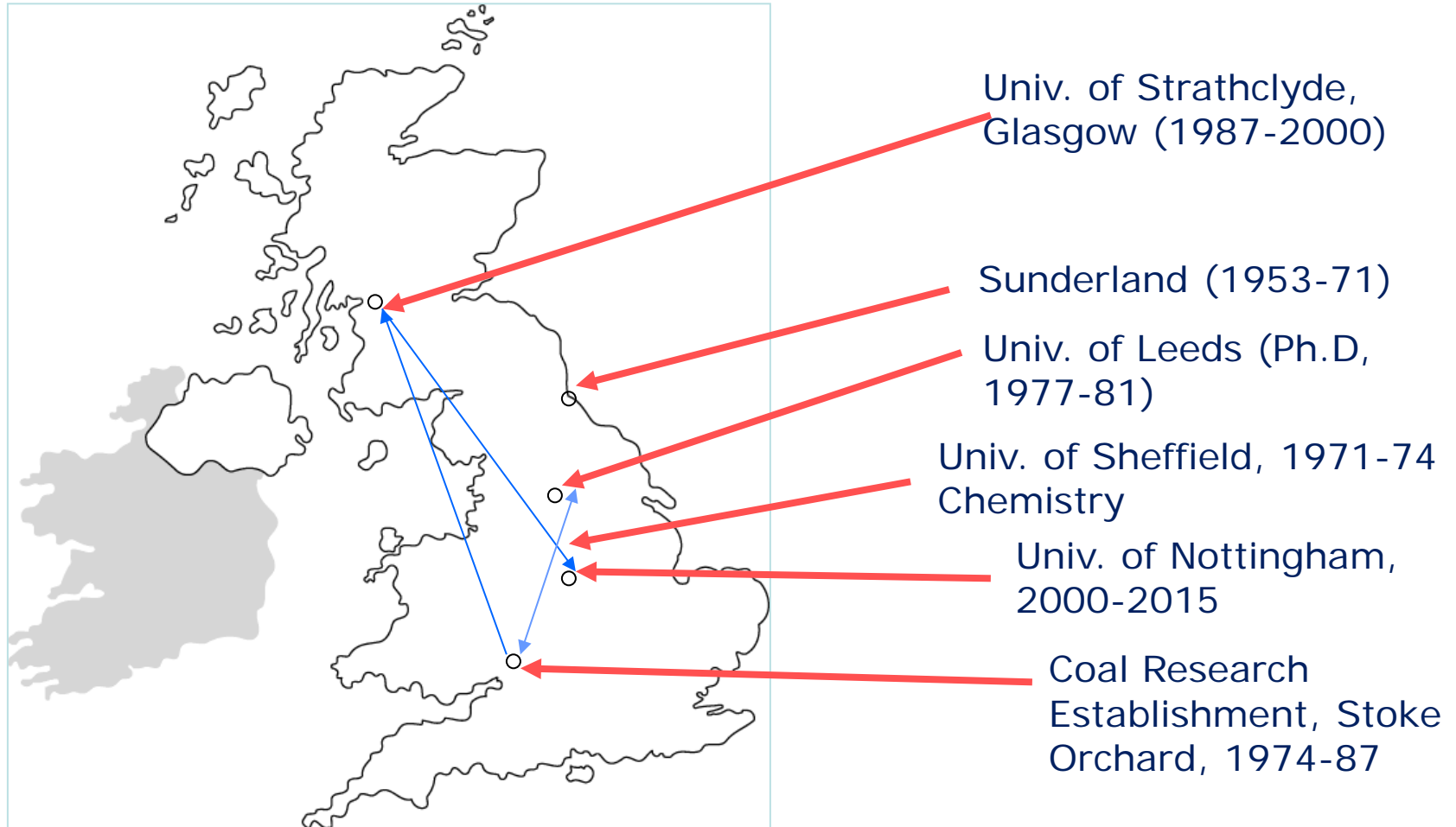
*Director of Centre for Doctoral Training in CCS and Cleaner Fossil Energy and the Engineering Doctorate Centre in Efficient Fossil Energy Technologies
Visiting Professorship for Senior International Scientists, Chinese Academy of Sciences*

University of Nottingham, Faculty of Engineering,
The Energy Technologies Building, Jubilee Campus, Triumph Road
Nottingham, NG7 2TU

- How I got to where I am today
- What key decisions have I made?
- What motivates me?
- How I've tried to adapt to change.

My Life

- only 10 years post CCS R&D



The Durham Coalfield in the 1960s



Eppleton Colliery



Easington Colliery



Hawthorn Mine
and Coking Plant



Wearmouth
colliery



“Get Carter” 1972, Horden Beach

How I got my first job -CRE

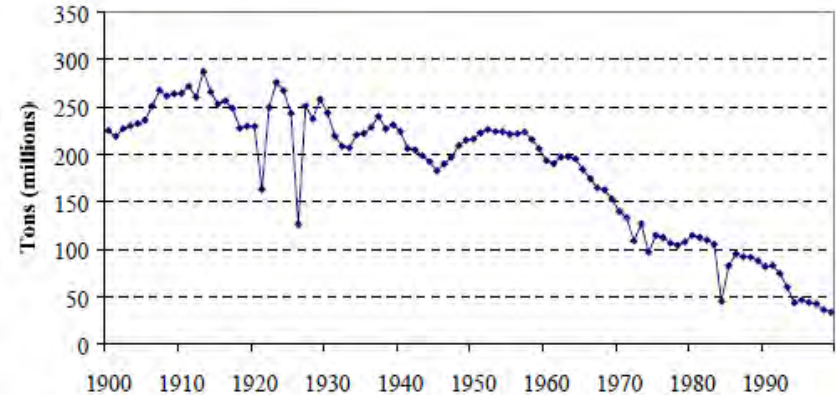
“You wont get me I’m part if the Union”
(Strawbs 1973)



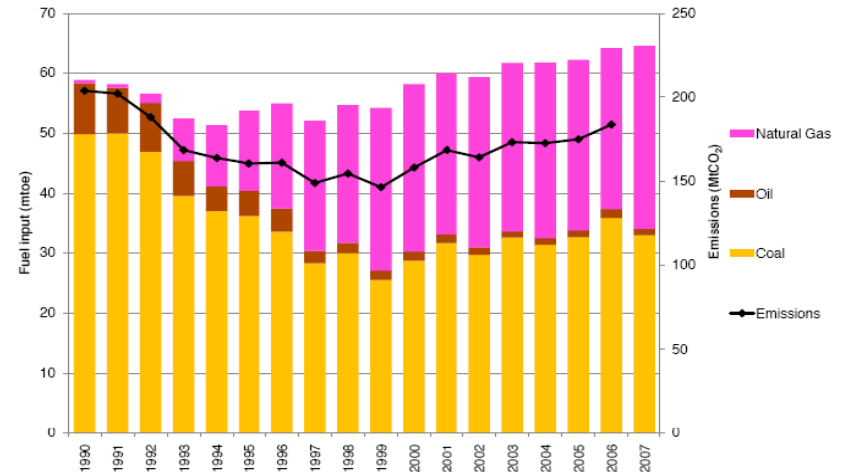
- My father was in the Durham Windermen’s Association, a separate entity within the NUM and somewhat less militant.
- Oil price rise – coal liquefaction would meet future needs.
- Chemistry, Coal characterisation, liquefaction and pyrolysis
- 30 publications by 1987, but.....

1984-85: The Beginning of the End

- Miners strike accelerated the decline of the UK coal industry.
- What do I do next?



Fuel input for electricity generation and CO₂ emissions since 1990



Why I thought I could survive in Academia

- Saw at first hand how Keith Bartle rapidly progressed up the academic ladder at Leeds, progressing from a predominately teaching role to out and out research.
 - Interacted both internally at Leeds (Alan Williams) and a wide international network
 - Projects across a broad range of topics
- Diversification is the key in identifying where your skills can be applied.



© Keith Bartle

My "Scientific Family Tree"

Prof. Keith Bartle,
Univ. of Leeds

Dr. Bill Ladner,
Coal Research Establishment

Colin Snape

Gordon Love,
Stuart Mitchell, Ian
Murray, Chris Russell,
Will Meredith, Clement
Uguna, Karl Smith

***Hydropyrolysis,
catalysis and CO₂
capture***

Rob Law, Miguel Castro Diaz,
Gordon Love, John Andresen
Mercedes Maroto-Valer
Shona Martin, Sylvia Kokenya
***Solid state NMR
Coal structure and
carbonisation***

Carole McRae,
Cheng-Gong Sun

Pollutants: PAHs

Katie Le Manquais,
Salome Farrow, Luke
Morris

***Combustion, oxy-
fuel mineral
catalysis***

University of Strathclyde, 1987-2000

- Broad research programme in fuel science, quickly diversified away from coal.
 - organic geochemistry
 - catalysis,
 - petroleum residues,
 - oil shale and biomass pyrolysis
 - sulphur speciation
- polymer degradation and plant cell-wall chemistry
- Became a Chair in 1995
- 100 journal papers
- 20 Graduated PhDs
- So why did I decide to leave?



University of Nottingham, 2000-2015



- Opportunity to establish a major internationally leading research grouping in fossil energy and carbon abatement technologies.
- My move coincided with John Patrick moving from Loughborough.
- Changing emphasis in academia where you ideally need to be part of a large research grouping.
- Current research programme encompasses:
 - Adsorbents for CO₂ capture , oxyfuel
 - High capacity Hg adsorbents
 - Hydropyrolysis in oil exploration, environmental black carbon.
 - Coking phenomena
 - Biomass/ heavy oil conversion.
- Now over 300 journal papers, 10 patents
- Since 2008, Director of CDTs.
- Coordinated energy research at Nottingham, 2004-2014
- Never been Head of Department!

Current EPSRC Engineering Doctorate Centre in Efficient Power from Fossil Energy and Carbon Capture Technologies (2009-2013 intakes)

New Industrial Doctorate Centre in CCS and Cleaner Fossil Energy (2014-2018 intakes)

The Centres are essential to the UK for producing the highly trained personnel for implementing cleaner fossil energy technologies and CCS.

- £9M EPSRC and £5M industry funding.
- Only Doctoral Training Centre in Energy highlighted in the 2010 RCUK Energy review as being “world class”.
- International summer schools – India and China.
- Ningbo campus, implementing EngD model, extensive involvement of Chinese industry.



The Advanced Skills Gap

Conventional Power Gap



Over 40 years old and being forced to retire by emissions legislation



- Commonality between our ageing coal-fired power stations and the R&D work force in the power sector!
- How do we develop and bring on new leaders quickly with the drive to more efficient fossil energy and the UK being in the vanguard for global CCS deployment?
- What is the most appropriate form of PhD training to do this?

CO₂ Capture

The Research Team: 2004-2015

- Nottingham Academic Colleagues:
 - Hao Liu (fluidised bed testing), Chenggong Sun (Carbons), Trevor Drage (adsorbent prep.)
- Nottingham Research Fellows:
 - Wenbin Zhang, Hui Deng, Nannan Sun, Lee Stevens, Salome Farrow
- Nottingham PhD students:
 - Karl Smith, Jamie Blackman, Jingjing Liu, Xin Liu, Yuan Sun.
- UK Collaborators
 - Joe Wood, Birmingham, Xiao Guo, University College London
- International:
 - Chinese Academy of Sciences, Institute of Coal Chemistry and Shanghai Advanced Research Institute, Yuhan Sun, Wei Wei, Kaixi Li
 - CSIC Spain, INCAR, Fernando Rubiera and Cova Pevida
 - Korean Institute of Energy (KIER)
- Industry: PQ Corporation, CPL, Doosan, E,ON, Parsons Brinckerhoff

Acknowledge Sponsors – Carbon Capture

EPSRC

China project: EP/G063176/1: Innovative Adsorbent Materials and Processes for Integrated Carbon Capture and Multi-pollutant Control for Fossil Fuel Power Generation, £952k). (UCL and Chinese Academy of Sciences - CAS)

China project: EP/I010955/: The Next Generation of Activated Carbon Adsorbents for the Pre-Combustion Capture of CO₂, £694k (UCL, Birmingham and CAS).

EPSRC – E.ON Partnership, STEPCAP, Step Change Adsorbents for CO₂ Capture (Liverpool, UCL and Birmingham) , £1.2M(2009-2013)

EP/J020745/1: Effective Adsorbents for Establishing Solids Looping as a Next Generation NG PCC Technology (1 Aug 2012 – 31 Jan 2016), £756k

EP/L020777/1:) CO₂ Post-Combustion Capture Using Amine Impregnated Synthetic Zeolites (2014 – 2016) With Polish partners, £192k

EU/UK Government

Carbon Trust: Developing Effective Adsorbent Technology for the Capture of CO₂ in Fossil Fuel-Fired Power Plant, £180k (2003-2007).

BERR/Bti: Optimisation of CO₂ Separation and H₂ Combustion for near Zero Emission Power Plant, £189k (2006-2008).

Research Fund for Coal & Steel Contract: Assessment of Options for CO₂ capture and geological sequestration £129k, (2004-2007).

International

ICUK Proof of Concept award, Development and sub-pilot demonstration of an innovative carbon capture adsorbent technology based on a hydrothermal process £70k (01.06.08-31.05.09).

KIER, pilot-scale demonstration of adsorbents (2015-2018)

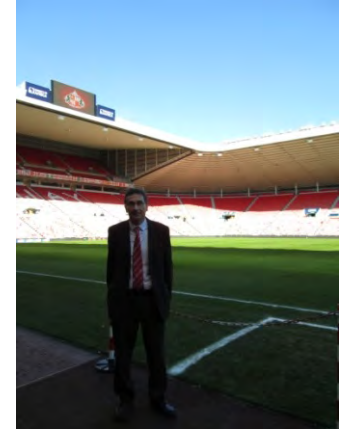
What else could I have done....



Wearmouth Colliery, 1992



Stadium of Light 1997



- I'm not the only Professor Snape but I've been around longer (since 1995). First Harry Potter novel, 1997 (The Philosopher's Stone)