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Birmingham Centre for Nuclear Education and Research

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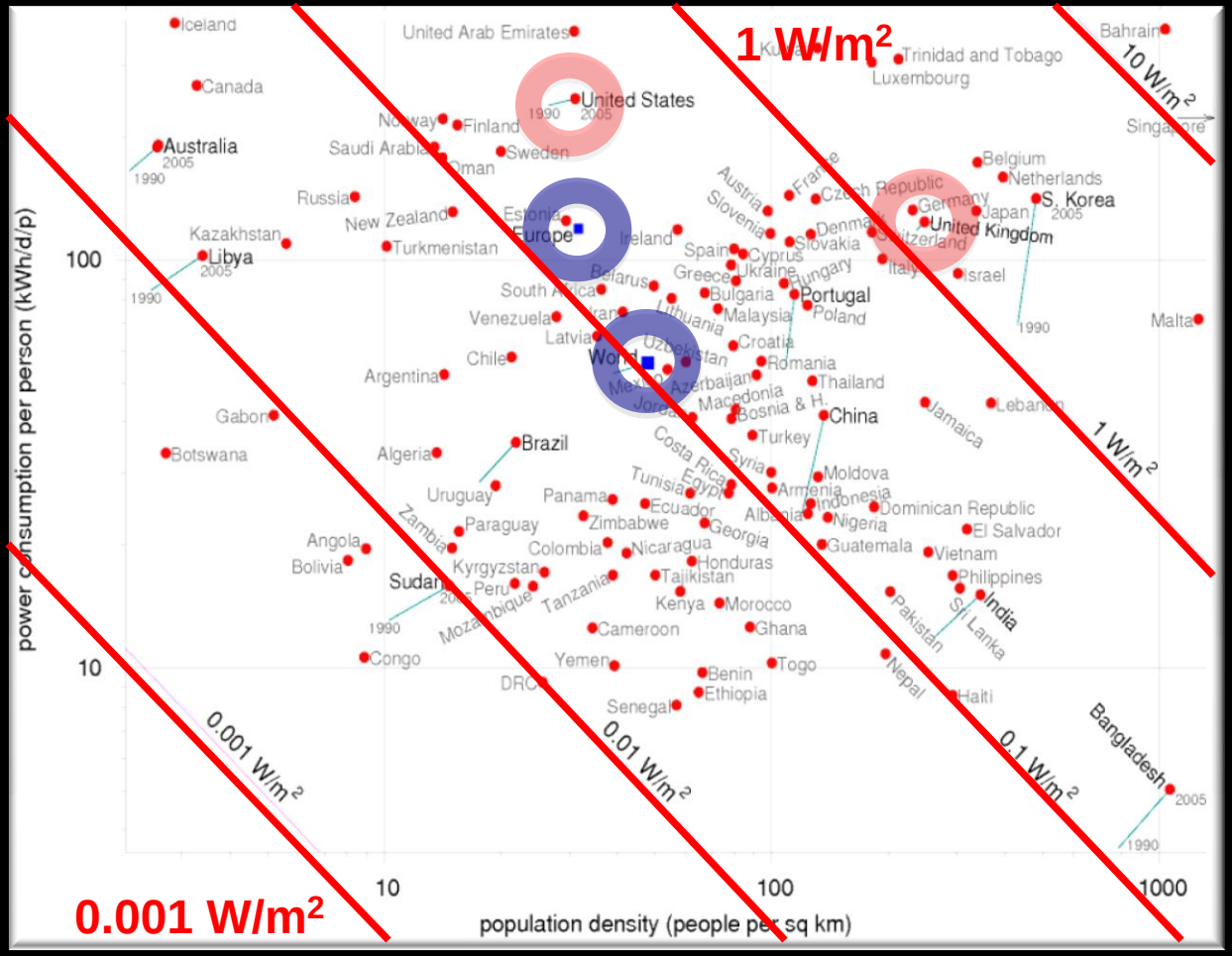
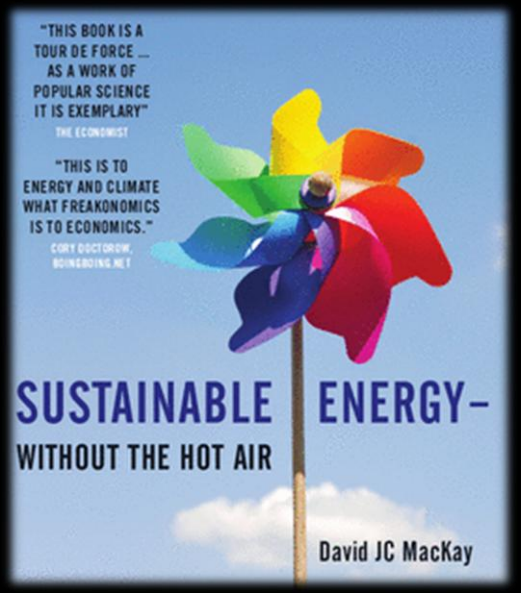
The Energy Challenge



Population density

Average power output per unit area

Wind	2-3 W/m²
Tidal	3-6 W/m²
Solar	5 W/m²
Hydro	11 W/m²



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The Pressures

DEPARTMENT OF ENERGY & CLIMATE CHANGE

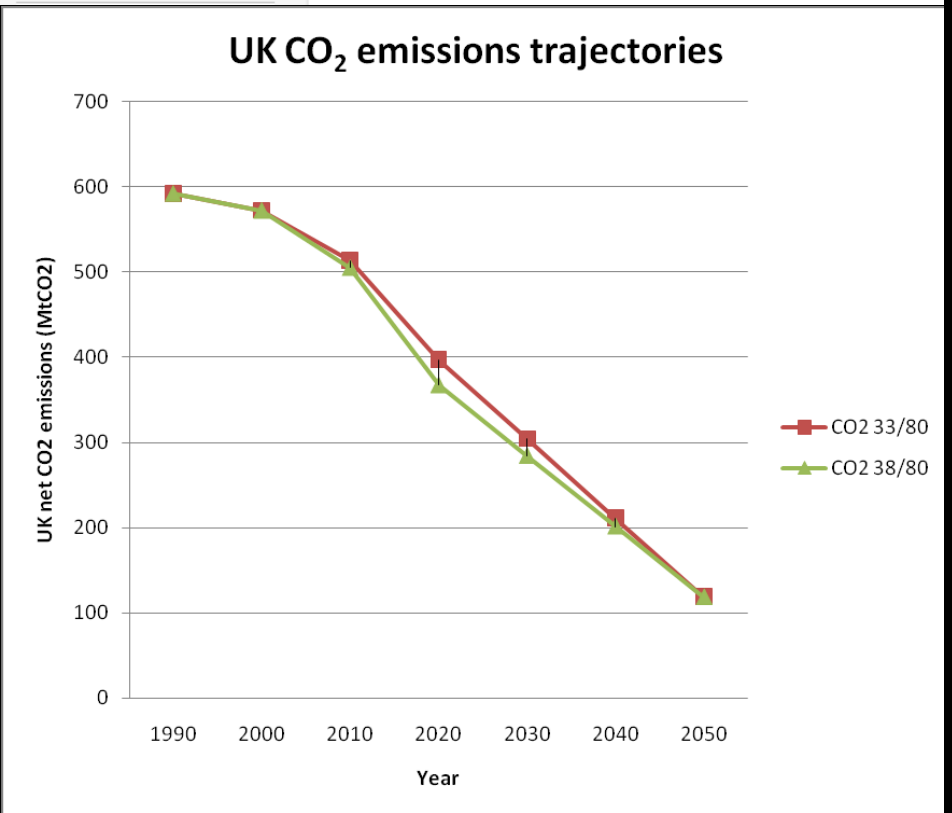
Tackling Climate Change | Cutting Emissions | Meeting Energy Demand | Funding & Support

Policy & Legislation > Climate Change Act 2008

Energy Bill 2010-2011

Energy Act 2010

CLIMATE CHANGE ACT 2008



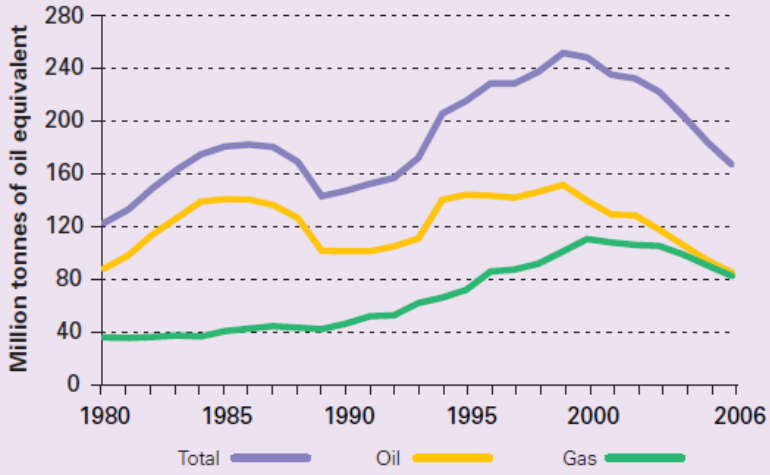
DEPARTMENT FOR BUSINESS ENTERPRISE & REGULATORY REFORM

UK ENERGY IN BRIEF JULY 2007

National Statistics A NATIONAL STATISTICS PUBLICATION

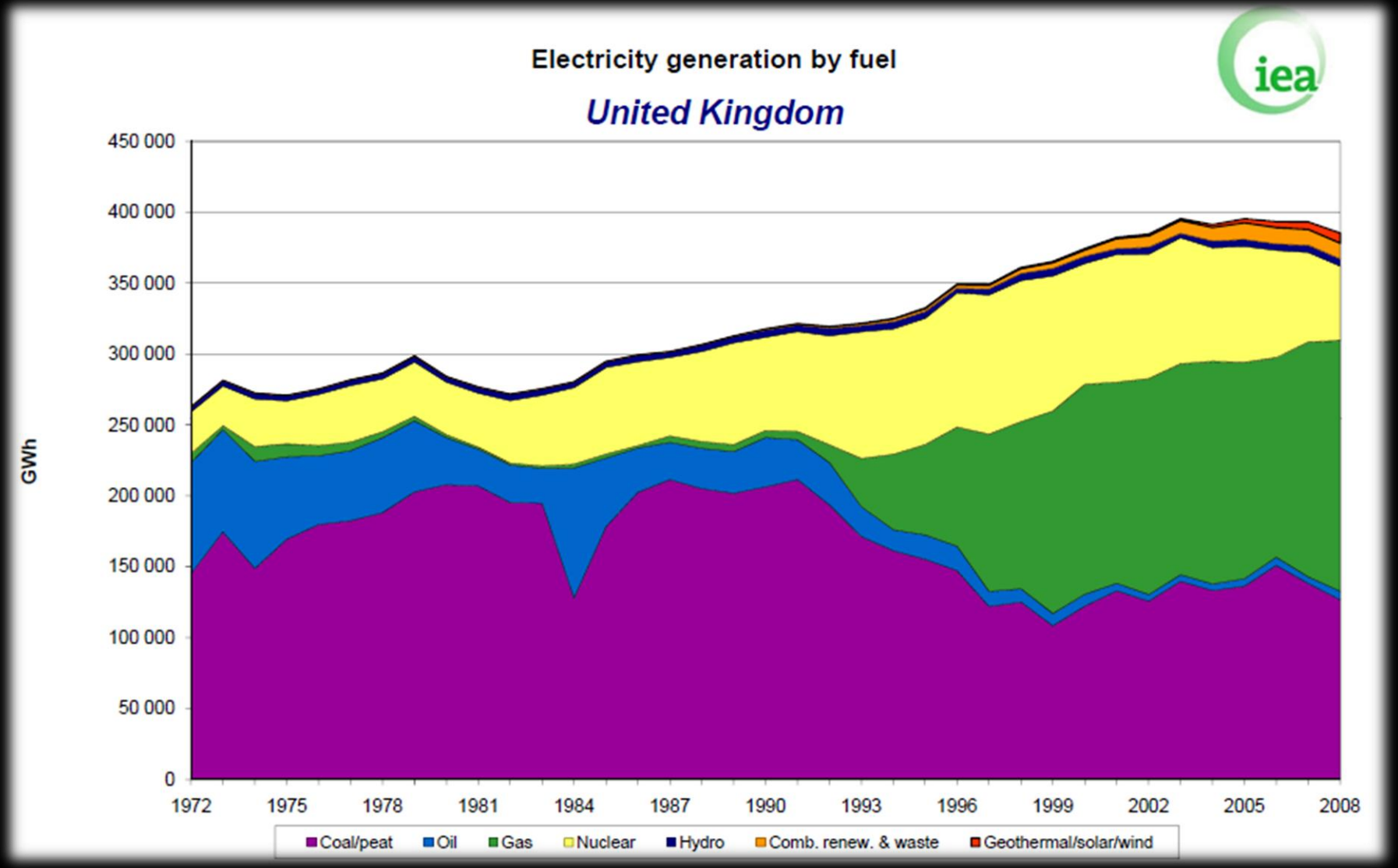
OIL AND GAS PRODUCTION

UK Continental Shelf production, 1980 to 2006



Million tonnes of oil equivalent

	1980	1990	2000	2004	2005	2006
Oil	86.9	100.1	138.3	104.5	92.9	84.0
Gas	34.8	45.5	109.3	97.5	89.2	81.6
Total	**121.7**	**145.6**	**247.6**	**202.1**	**182.1**	**165.6**



http://2050-calculator-tool.decc.gov.uk/pathways

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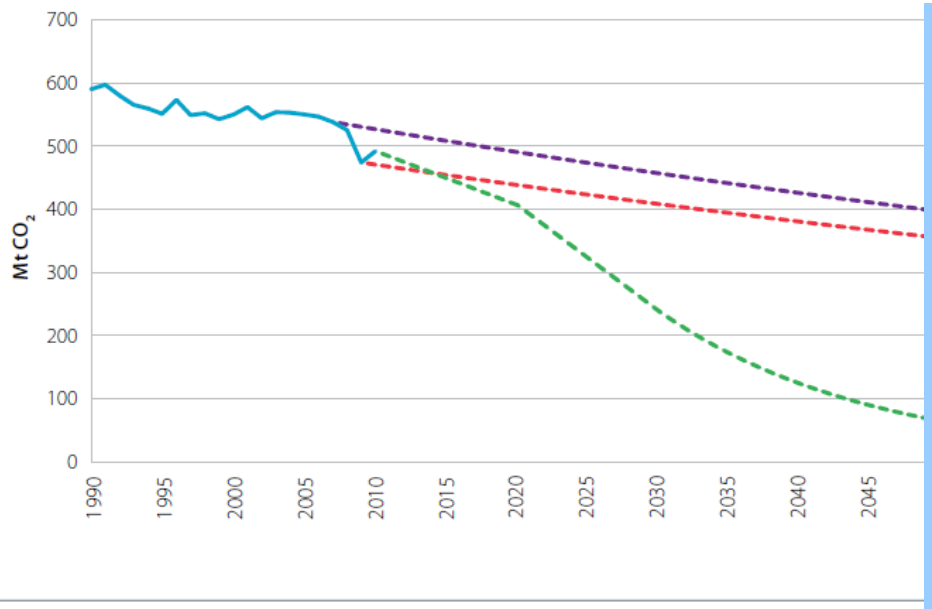
Committee on Climate Change

Independent advisors to the UK Government on tackling and preparing for climate change

Figure 3: CO_2 emissions under pre-recession trend versus required reductions (1990-2050)



Illustrative 2030 scenario. We set out an illustrative scenario in which commitments on support for offshore wind and marine through the 2020s are broadly in line with planned investment and supply chain capacity to 2020. Together with ongoing investment in onshore wind, this would result in a 2030 renewable generation share of around 40% (185 TWh). Sector decarbonisation would then require a nuclear share of around 40% and a CCS share of 15%, along with up to 10% of generation from unabated gas.

The Renewable Energy Review

May 2011

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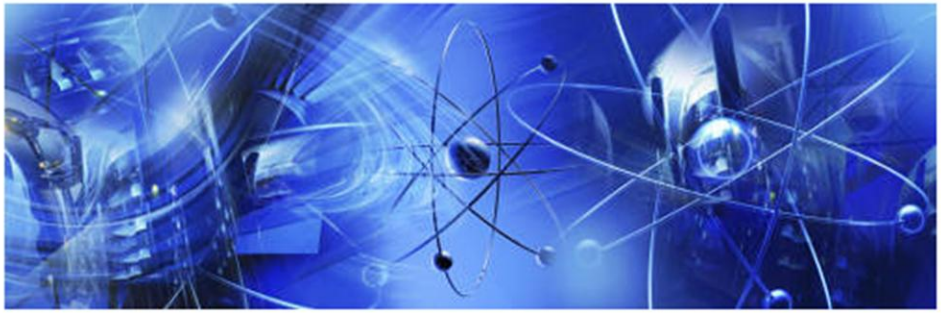

The University of Birmingham has a long and established track record in working in areas of de-commissioning, health monitoring and residual life prediction of existing nuclear power stations, dating back to the first phase of nuclear construction. Birmingham has made significant contributions in metallurgy and materials in the study of the extension of the lifetime of reactor materials; Prof. John Knott received an OBE "for services to Nuclear Safety" in recognition of his contribution to this area. Important contributions have also been made to the effects of radiation damage to nuclear materials.

The new investments in Nuclear Engineering, Waste Management and Decommissioning and the creation of the Birmingham Centre for Nuclear Education and Research are part of the University of Birmingham strategy to be one of the leading nuclear research and education institutions.

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Tel: +44 (0)121 414 3344

http://www.birmingham.ac.uk/research/activity/nuclear/index.aspx

Birmingham

Current Research Portfolio

- Nuclear Materials (reactor life extension work, materials analysis of radiation damage,….)
- Nuclear Chemistry (filters of radioactive waste products)
- Waste Storage (materials analysis, geological analysis)
- Waste assay (detector development)
- Biological solutions (bio-molecules lock up heavy metals)
- Radiation Sensors (nano-sensors)
- Robotics (manipulation + sensors)
- 3D environment simulation (submarines)
- Policy
- MC40 Cyclotron – supporting PEPT

Joint appointment (RAEng Chair)
National Nuclear Laboratory (Prof. A Worrall)

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Birmingham

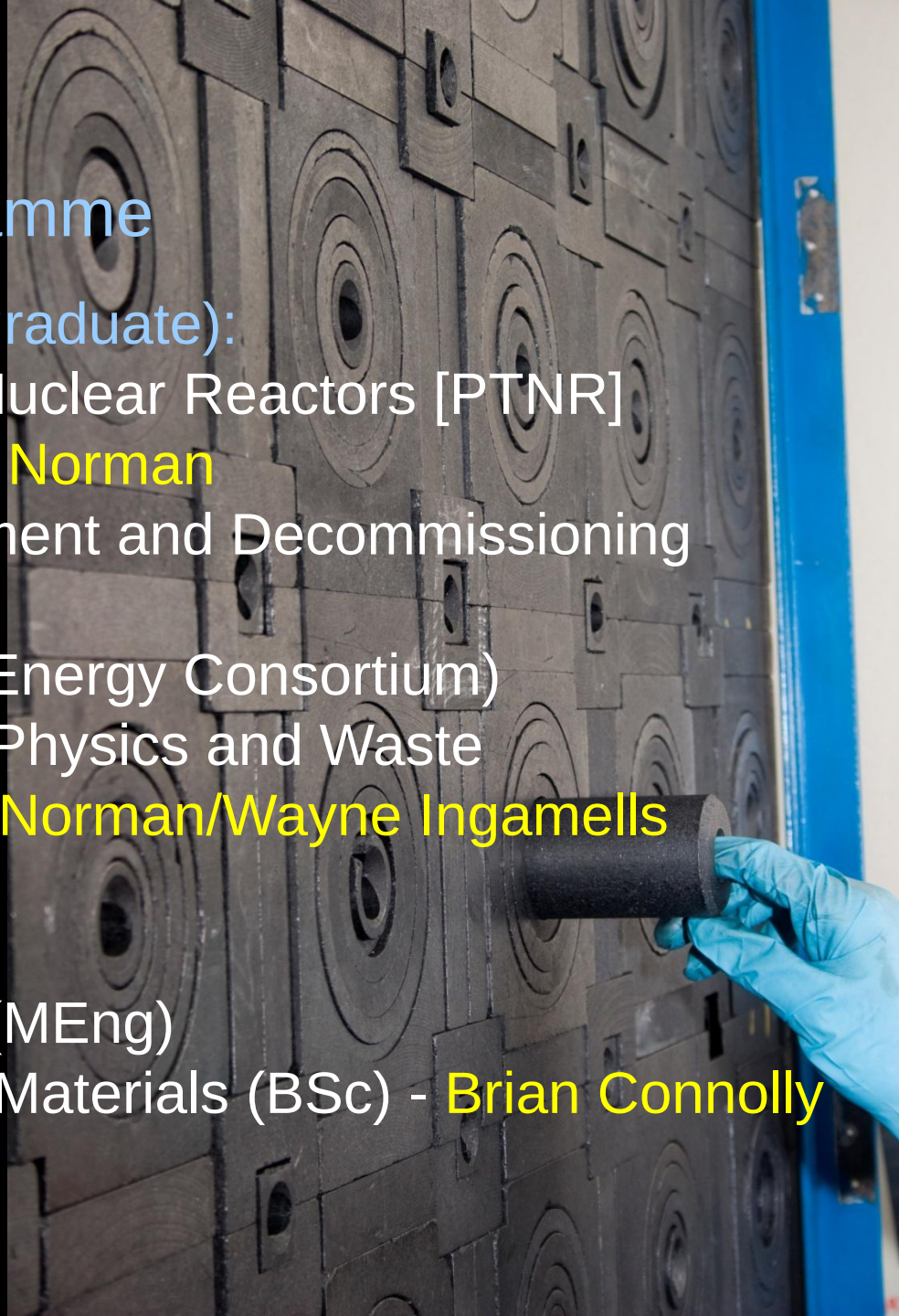
Nuclear Education Programme

Masters Level Courses (Postgraduate):

- Physics and Technology of Nuclear Reactors [PTNR] (30-40 students/year) – Paul Norman
- Radioactive Waste Management and Decommissioning (MSc in 2012) – Jo Renshaw
- NTEC (Nuclear Technology Energy Consortium) Birmingham delivers Reactor Physics and Waste Management modules – Paul Norman/Wayne Ingamells

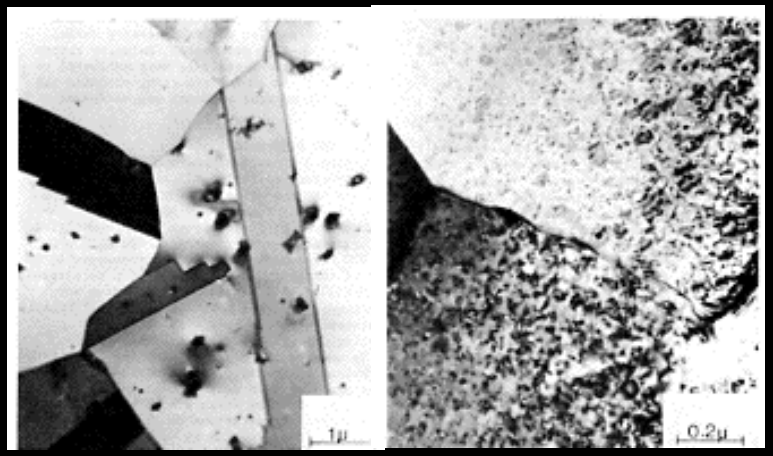
Undergraduate

- 4 year Nuclear Engineering (MEng)
- 3 year Nuclear Science and Materials (BSc) - Brian Connolly



Materials Characterisation

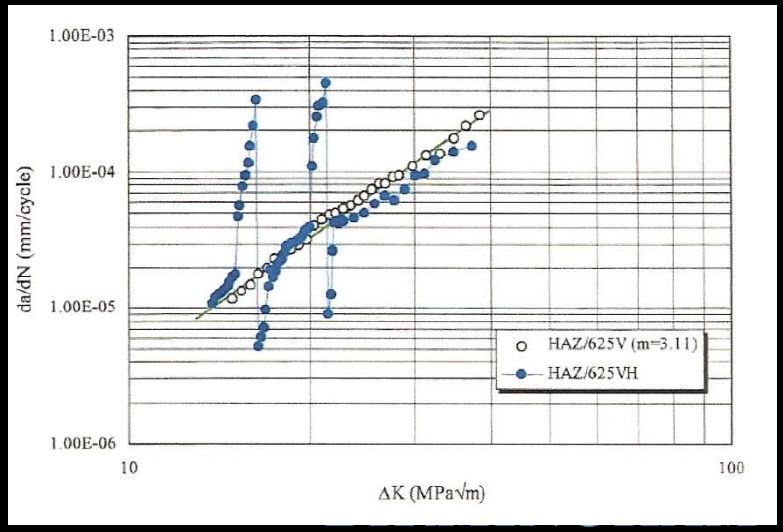
Microstructural Characterisation : Irradiated Material



before irradiation

after irradiation

High Temperature Fracture and Fatigue of 316L – main material of the European Fast Reactor



Aqueous Corrosion Issues in Nuclear Waste Storage

synchrotron tomography and fast radiography to measure the rate of pit growth in stainless steels

Intermediate level waste storage

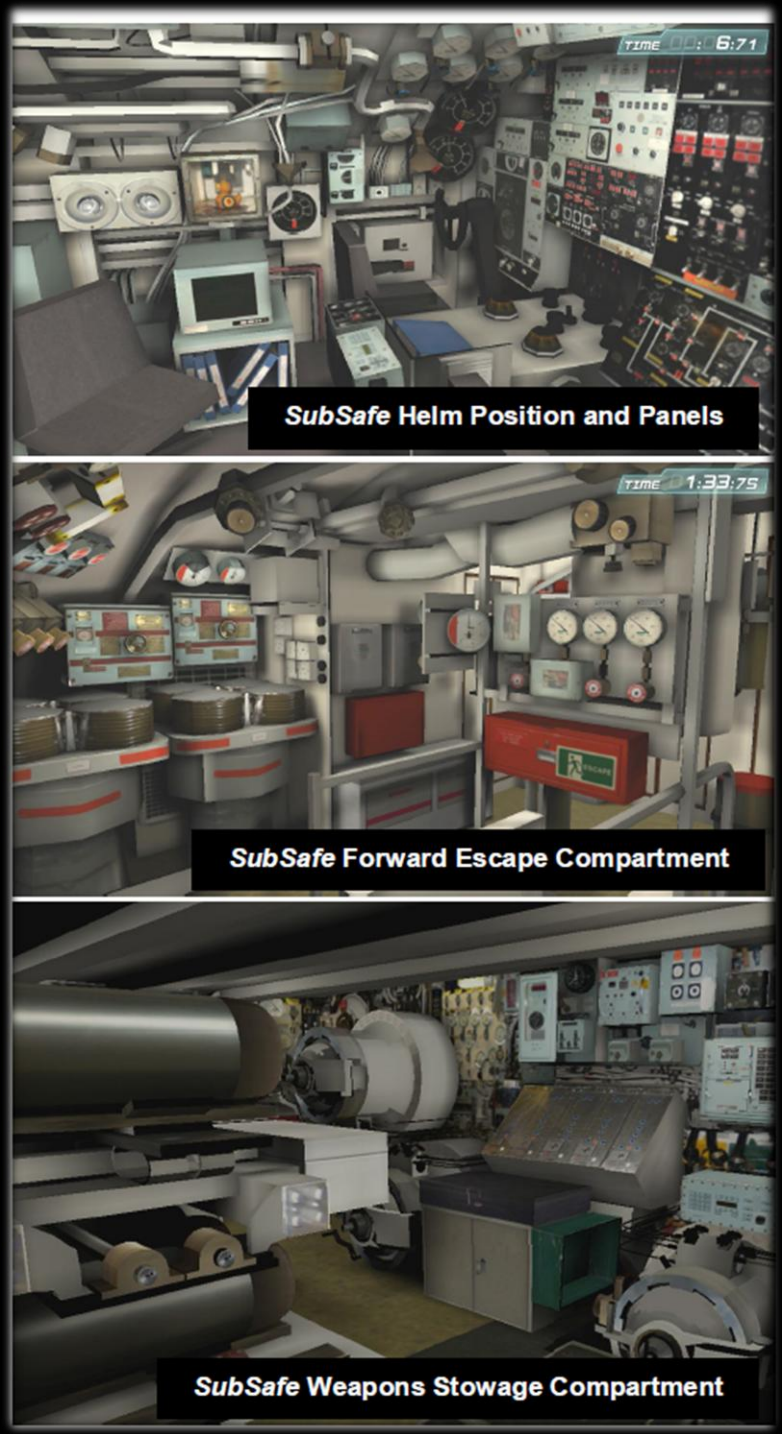
Robotics and 3D visualisation

Projects:

Robotics in Decommissioning

3D visualisation

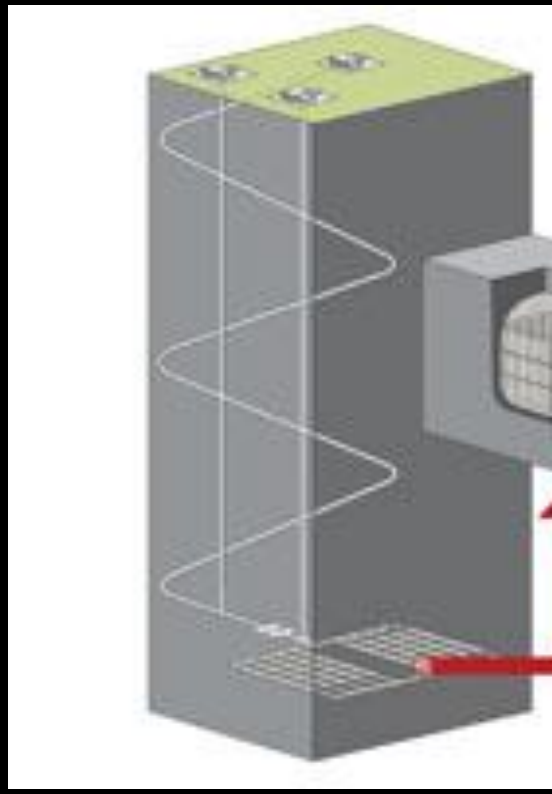
e.g. Training in nuclear submarines



Geosphere characterisation

Past work

- Stochastic analysis of radionuclide migration through clay sequences
- Geosphere characterisation for performance assessment of repository host rocks
- Paleohydrogeological assessment of the geosphere
- Extraction of hydrogeological data during repository shaft sinking
- Impact of hydromechanical processes on radionuclide migration to the biosphere from a repository
- Microbial interactions with radionuclides



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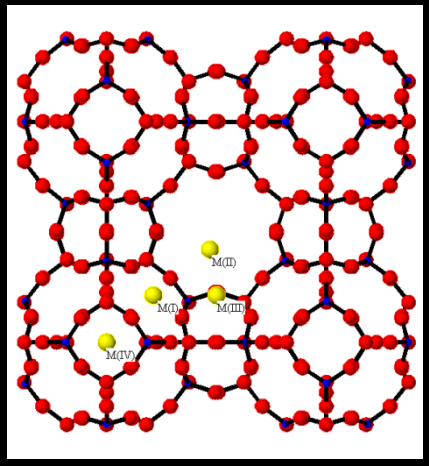
Chemical Filters

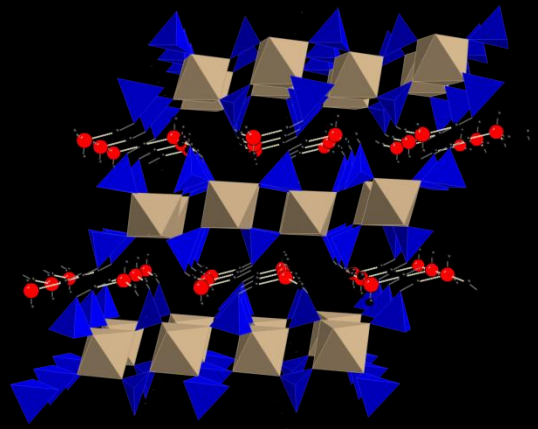
- *Materials Preparation and modification*
  Predominantly porous solids (aluminosilicate zeolites, layered transition metal phosphates, aluminophosphates, silicotitanates) useful as ion exchangers and catalysts
  Hydrothermal, ceramic, ion-exchange, HIP

- *Structural Characterisation*
  Powder diffraction and crystallography
  synchrotron X-ray studies (NSLS, ESRF, APS, DLS, SRS)
  Neutron diffraction (ISIS, ILL)
  High pressure and variable temperature diffraction studies
  Pressure-induced amorphisation
  Total scattering and pair distribution function analysis



Zeolite

typical formula $Na_{12}[Al_{12}Si_{12}O_{24}]\cdot 24\ H_2O$



Layered Metal Phosphate

$Zr(HPO_4)_2]\cdot H_2O$

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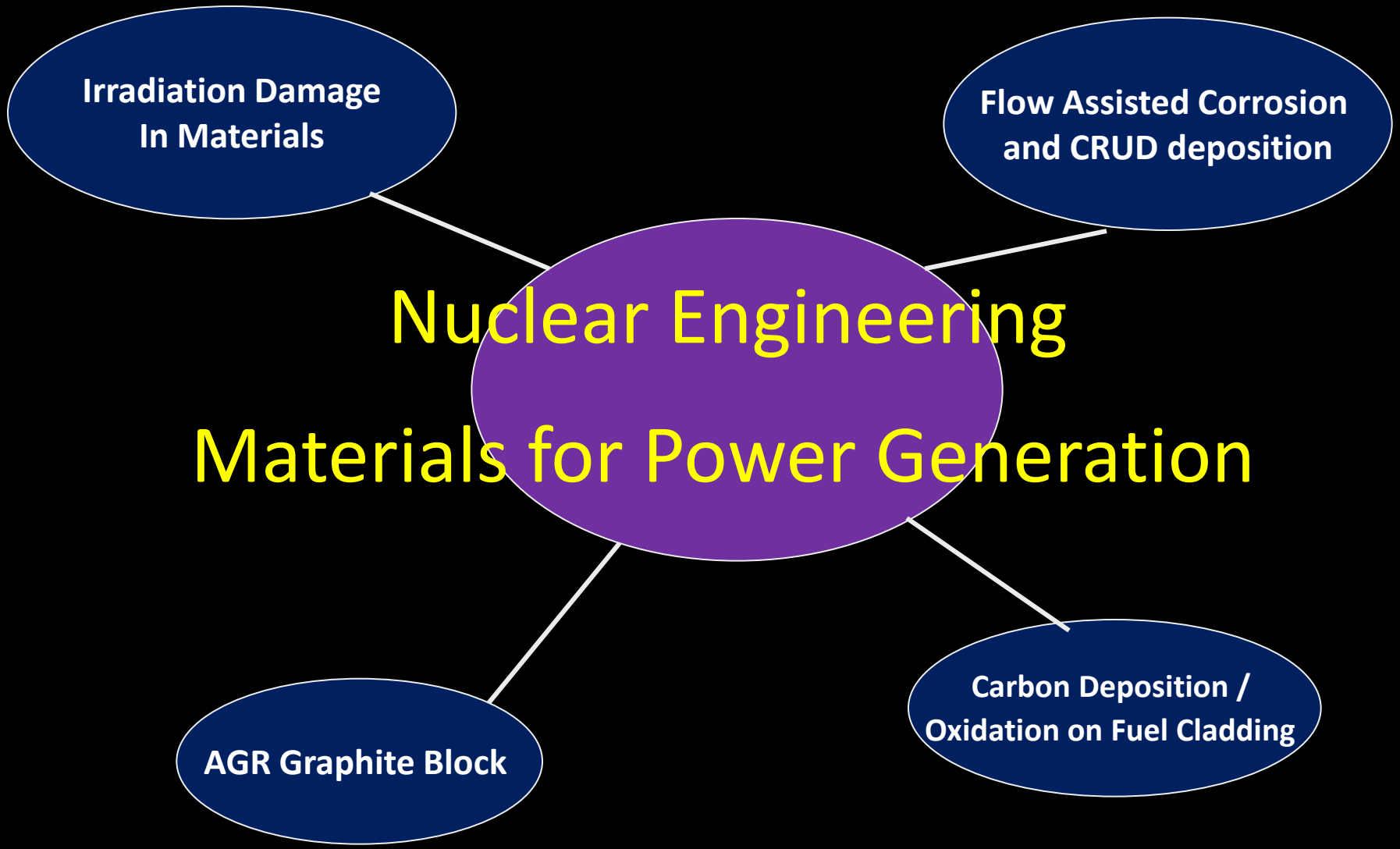
Future Investments



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SCANDITRONIX

Birmingham Policy Commission: Nuclear Power: What is the Future?

Chair: Lord Hunt (Ex DECC)
Prof. Andrew Worrall (National Nuclear Laboratory)
Simon Webster (EU Director of Fission)
Richard Rankin (Idaho National Lab, US)
Stephen Tindale (Ex Greenpeace, Climate and Energy Consultant)

Internal:-
Prof. Lynne Macaskie (Bioscience)
Dr. Paul Norman (Nuclear Reactors)
Dr. John Walls (Social Geography)
Dr. David Weaver (Nuclear Reactors/Industry)
Prof. Richard Green (Energy Economics)
Dr. David Boardman (Civil Engineering, Energy)
Brigid Jones (Energy)
Prof. Martin Freer (Nuclear Science)

Debate: Lib-Dem conference Sept. 2011

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