

Fossil Fuels and Climate Change: Themes in RAE and REF

We have been concerned to understand the substance and trajectory of the University's engagement with research around fossil fuels and climate change. I was asked to look at RAE and REF documents in a range of disciplines (Geosciences, Engineering, Politics and International Relations, and Sociology) and have reviewed the 'environment' documents (which provide inter alia a descriptions of major areas of activity and achievement) for the 2001, 2008 and 2014 RAEs/REF. There are plenty of caveats – the documents for each exercise were produced to different templates, and the University presented its research to the various exercises in different ways (four submissions in 2001 to what in 2008 and 2014 was a single General Engineering submission; two submissions in 2001 and 2008 to what in 2014 was a single submission in Earth Systems and Environmental Sciences).

Nonetheless, the following broad themes can be identified:

2001

Engineering: In 2001 coal was identified as a research theme in both Chemical and Civil Engineering, but does not figure in later submissions. There was in 2001 a strong emphasis in Electrical and Electronic Engineering and in Mechanical Engineering on renewable energy (wind, hydro, wave/tidal, and their embedding in energy transmission systems), described in Mech Eng as providing 'development-oriented solutions in order to improve quality of life and enhance the environment'.

Geosciences: The 2001 document in Earth Sciences is very short on detail but highlights a concern with the 'sustainable economic exploitation of resources and ... the monitoring and remediation of the Earth's environment'. Geography is also less than illuminating, but points to 'environmental modelling and monitoring' and 'modelling of air pollution and climatic change' as areas of emphasis (in the section on engagement with research users), as well as collaboration with Shell on 'cost-path analysis for submarine pipeline networks'.

Politics/IR: No systematic emphasis on fossil fuel or climate change issues, excepting individuals working on Green parties, Chinese energy policy strategy and green political theory/environmental rights. Later Politics/IR submissions show a similar pattern: a few individuals working separately on relevant issues, but no sense of critical mass or strategic priority.

Sociology: Nothing but a fleeting mention of 'clean technologies' under the Science, Technology and Society theme.

2008

Engineering: now a single General Engineering submission. Two of five 'strategic research priorities are relevant: 'Infrastructure and Environment' and 'Energy Systems'. The former has a very strong emphasis on water, including hydro, but also pollution (and its mitigation). The latter identifies a 'world challenge' in 'reducing the drivers of climate change while maintaining energy supply'. The focus is on wind, hydro and marine and their conversion to network delivery. There are a number of spinouts and industry collaborations.

Geosciences: the 2008 submission to Earth and Environmental Sciences has a central emphasis throughout on the modelling and mitigation of climate change, with some direct impact on the third and fourth IPCC reports claimed. The Global Change group explores climate change in atmosphere, oceans, biosphere and surface; much use of the term 'anthropogenic'. Hegerl's work on tree ring and ice core analysis (communicated as co-author to IPCC #4) concluded that 'it is likely that there has been a substantial anthropogenic contribution to surface temperature increases in every continent except Antarctica since the middle of the 20th century'. The Centre for the Study of Environmental Change and Sustainability is noted as a new grouping, though with relatively little activity at this stage. The other grouping – Earth Subsurface Science – reveals the developing momentum around carbon capture and storage. It also – in part through the same researchers – focuses on work on enhancing the economic viability of oil reserves and the exploitation of hydrocarbons. There is some sense of two sides of a coin: 'We will generate knowledge of the physical, chemical, structural, hydraulic, and transport processes

operating in the Earth's subsurface, and apply the results into practical applications that address societal needs, including resource exploitation, environmental protection, and amelioration of threats arising from natural processes'. The 2008 submission to Geography and Environmental Studies presents a major focus on climate change in the Physical Geography group with emphases on environmental modelling and monitoring and human/environment interactions especially around ice sheets, sea levels and forests as carbon sinks.

Politics/IR: much as in 2001. A few individuals working in relevant fields, but no sense of priority or strategy.

Sociology: Even less than in 2001.

2014

The 2014 templates left much less room than in 2008 for describing research at length.

Engineering: Two main relevant fields: Infrastructure and Environment, with a focus on the engineering mitigation strategies of climate change as applied to water flows and natural disasters; and Energy and Resource Management. The latter encompasses 'all aspects of the energy cycle: from resource exploration and exploitation, diversification of efficient production, and the development of materials and technologies to reduce and mitigate the effect of CO₂ emissions'. So there is emphasis on petroleum engineering including recovery from carbonate reservoirs and 'chemically enhanced oil recovery processes', CCS, wave and solar renewables and renewables and power distribution networks.

Geosciences: Research embraces 'equality and vulnerability. development and sustainability, climate and environmental change, energy, food and water security, mitigation of anthropogenic environmental change, natural resources, waste management, and natural disasters.' Fossil fuels and climate change are central emphases in all three research institutes: Global Change; Earth and Planetary Science; and Geography and the Lived Environment. Global Change has leading edge work in measurement and modelling of change in atmosphere, biosphere, cryosphere, land surface and oceans. Earth and Planetary Science has a sub-theme on Geological Resources and Waste Storage, with 'research methods and strategies to locate, characterise and monitor: geological reservoirs of resources such as oil, gas, water and geothermal heat; sites for geological storage of waste; and transport and fate of pollutants.' Geography and the Lived Environment has a sub-theme Environment and Society which 'focuses upon environment-society relationships, including assessment of the consequences of environmental change for human livelihoods, and analysis of past human-environment interactions.'

Politics/IR: only the emphasis on environmental theory/ethics remains.

Sociology: for the first time defines 'Sociology of Energy' as a main theme, bringing in some expertise from Politics/IR and generating some level of critical mass around a major project (on district heating schemes) and new appointments.