DEGREES OF CAPTURE

UNIVERSITIES, THE OIL INDUSTRY AND CLIMATE CHANGE

new economics FOUNDATION

Corporate Watch

Contents

Overview

The oil industry and Britain's universities: how many degrees of capture?

Our planet is warming up more quickly than at any time in the past 10,000 years. Within less than a century, scientists are predicting temperature rises of up to six degrees centigrade, sea-level rises of nearly a metre and climatic chaos. These changes will in turn exacerbate weather-related disasters such as drought, flooding and windstorms, and increase the risks of water-borne diseases like malaria and diarrhoea. Hundreds of millions of people will face danger, disease and destitution as a result. These projections represent a consensus among several thousand of the world's leading scientists, the Intergovernmental Panel on Climate Change.

Yet, instead of bracing themselves to help tackle one of the biggest challenges facing humanity, Britain's universities are walking hand-in-hand with a big part of the problem: the oil and gas industry. Degrees of Capture reveals how many of our top academic institutions could be brought into disrepute through their links to big oil. The report highlights:

- How universities are collaborating with an industry that continues to foster our dependence on climate destroying fossil fuels
- How this collaboration is subsidised by government
- How the oil and gas industry is happy to invest its own money in the short term pursuit of profit, but prefers the public to pay for protecting its longer term interests and ensuring our fossil fuel dependence

Degrees of Capture also reveals: a failure of academic accountability and transparency, commercial confidentiality overtaking academic freedom, researchers afraid to speak out for fear of losing funding, and the lack of a central register of research and academics interests.

Global warming is largely caused by emissions of greenhouse gases, such as carbon dioxide and methane. Yet no coherent international policy exists to tackle this problem. Scientists agree that cuts of at least 60 percent in carbon dioxide emissions, and in some areas up to 90 per cent, are needed to halt climate change. Yet the Kyoto Protocol which the world's largest polluter, the US, has refused to ratify, aimed to reduce industrialised countries' emissions by just over five percent below 1990s levels by between 2008 and 2012. Realistic new assessments suggest it will achieve cuts of only between one and two per cent. And while Kyoto addresses levels of fossil fuel consumption, it fails to address cutting production.

According to the UN's advisory group on greenhouse gases, any mean global temperature rise of more than one degree centigrade could lead to 'extensive ecosystem damage' as a result of 'rapid, unpredictable and non-linear responses'. This is scientific shorthand for runaway global warming. The EU meanwhile has set a ceiling of two degrees as the maximum permissible increase in global temperatures. Taking these figures, Greenpeace International has calculated that, in order to keep within a one degree rise, the world can only afford to burn 295 billion tons of carbon over the next century. Meanwhile, the world's economically recoverable reserves of fossil fuels currently amount to 1,000 billion tons. So, rather than looking for more fossil fuel reserves to burn, governments, companies and academics should be combining forces to phase in renewable energy technologies. In Britain, however, the opposite is happening; and this report sets out to show how.

Britain is a leading player in the global oil and gas industry not because of the size of its domestic reserves, but because of the cutting edge technology developed (and exported worldwide) to find and extract those reserves from tricky offshore fields. Britain is home to the headquarters of BP and Shell, two of the world's three largest fossil fuel companies.

These companies, along with many others in the industry, have succeeded in 'capturing' the allegiance of some of Britain's leading universities, through sponsoring new buildings, equipment, professorships and research posts. Many universities, meanwhile, operating in a climate of ever-tighter public funding, are only too eager to please big business. In return for corporate sponsorship and contracts, universities are encouraging oil companies to steer the research agenda, tailoring courses to meet corporate personnel demands and awarding high profile positions to oil executives. In May 2001, for example, BP established the BP Institute at Cambridge University with a £25 million endowment. The Institute's full-time director is one of the company's senior managers.

For its part, the government is encouraging the link between academic research and corporate profit:

- around £40 million of taxpayers' money is spent every year on furthering fossil fuel research.
- Industry contributions take this figure up to around £67 million per year of academic research projects relevant to the upstream oil and gas industry.

- Only two percent of this money is directed towards studying environmental impact – the lion's share goes towards improving the efficiency of oil and gas discovery and extraction.

Yet according to a DTI paper on renewable energy: 'Reducing our use of fossil fuels, and replacing them with non-fossil sources, will be a key part of our long-term strategy to reduce greenhouse gas emissions".

Publicly funded research and development into fossil fuel technologies is artificially distorting the energy markets in their favour, undermining progress towards renewable alternatives. As university geology or engineering departments devise ever more efficient ways of extracting oil and gas from marginal fields, they boost the technological edge and competitiveness of the companies who benefit from their expertise. This in turn helps keep fossil fuel prices low and renewable energy prices uncompetitive. The UN's Solar Energy Group on Environment and Development says that "renewable energy R&D could be adequately funded by shifting priorities for existing research".

But in Britain at least, the odds are currently stacked against that happening. For example, the publicly funded Engineering and Physical Sciences Research Council determines academic grants through a peer review college containing 12 oil or gas executives and just two renewable energy members.

This capture of the academic agenda by the oil industry aided and abetted by public research bodies is not only undermining the competitiveness of non-fossil fuels, it also runs counter to the government's policy on renewable energy and calls into question the role of universities as impartial centres of critical, intellectual enquiry and guarantors of the public good. Tens of millions of pounds of public research funding is serving to promote the profits of an industry woefully out-of-step with the challenge of our times. Is this a responsible use of taxpayers' money in the current global climate? As the world inexorably warms, the industrialised nations' dependence on oil is looking life-threatening.

Spain's pristine Galician coastline has been smeared with crude oil residue, devastating commercial fisheries and marine fauna, because of irresponsible transport. American oil-dominated ambitions in Iraq and Central Asia risk unimaginable consequences for global political stability. And, ironically, hurricanes in the Gulf of Mexico, indicative of the extreme weather events that will become more common with global warming, hampered oil production in 2002, leading BP to issue three consecutive production warnings and to experience a different kind of turbulence, this time in their share price.

The situation looks increasingly indefensible as alternative energy paths gather pace and credibility. The British government is conducting a wide-ranging energy review. It could recommend the redirection of public funds towards supporting research and development of cleaner energy alternatives. Renewables are starved of R&D funding, and without more technological advances, they are unlikely to compete with fossil fuels for many years to come. With the climate change clock ticking, delaying the introduction of renewables may prove fatal. Burning fossil fuels is demonstrably bad for the health of the planet and its people.

Funding and research which support further extraction of oil and gas are no longer in the public interest. A combination of energy efficiencies and renewable technologies offers the best hope of turning back the tide of global warming. The British government and British universities, academics, taxpayers and companies could be in the vanguard of rising to meet this new challenge. Phasing out public funding for research into fossil fuel extraction and redirecting money in favour of renewables would be the place to start.

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1. Introduction

This report examines the relationship between the oil and gas industry and the UK higher education sector, and assesses this in the context of climate change. It asks if some parts of the higher education sector have been 'captured'[a] by the industry.

The report looks in detail at how much influence oil and gas companies have over R&D priorities, and to what extent public money is supporting both the extraction of fossil fuels and the profits of carbon-intensive corporations.

Universities could play an important role in leading the debate about energy economics and developing sustainable alternatives to fossil fuels. Yet universities are engaged in research and technology development which is used by the oil and gas industry, and are the recruiting and training grounds for its future managers.

After detailing the ways in which the research and teaching agendas are influenced by oil companies, the report makes a series of recommendations to put universities onto a more sustainable path.

Louise Sales

Sculpture on wall of key oil centre the Royal School of Mines at Imperial College, London – blackened from car exhaust fumes

2. Captured!

Case studies of the oil and gas industry's university partners

The BP Institute, Cambridge University
In May 2001, the BP Institute was opened at Cambridge University. Endowed with £25 million from BP, this was the largest single donation from the oil and gas industry in the history of British academia. The BP endowment included £2 million for the new institute building, and funds the BP Professorship of Petroleum Science, four permanent lectureships, and support staff.

The Institute is, according to its website, 'designed to tap into the academic resources and make them available to meet the scientific challenges of the oil and gas industry in the future. By increasing the precision of the prediction of how oil and gas flow out of underground reservoirs and through pipes, the industry will be able to make better investments and reduce costs'[1]. To ensure the industrial relevance of the Institute's work, its full-time director, Dr Pete Smith, is a senior manager from BP.

As well as providing research for the oil and gas industry, the BP Institute offers training and postgraduate courses for oil and gas industry personnel.

Centre for Petroleum Studies, Imperial College, London
The Centre for Petroleum Studies at Imperial College (part of the University of London) carries out more research for the oil and gas industry than any other academic department in the UK. It is housed in the Royal School of Mines, one of Imperial's four original constituent colleges. The RSM was founded in 1851 to support the British coal industry, and later embraced petroleum as a core priority. The Centre now offers MSc courses in Petroleum Engineering and Petroleum Geoscience, and its 40 research staff provide expertise to meet a wide range of industry needs.[2]

The School has close links with Schlumberger, a multinational which provides technology and information services to the oil and gas industry. In January 2001, Schlumberger donated software worth US$ 7.5 million to the Centre for Petroleum Studies[3]. In September 2001, Imperial College appointed Dr Tidu Maini, Senior Vice President of SchlumbergerSema (IT division of Schlumberger), to the new post of Pro Rector of Public and Corporate Affairs[4].

In 2000, BP signed a deal whereby any division of BP worldwide could request research from Imperial[5]. Peter King, Professor of Petroleum Engineering, previously spent 17 years with BP. Enterprise Oil (which has now been taken over by Shell) sponsors the Chair of Petroleum Geology, while BP sponsors the Lecturer in Geophysics[6]. Until December 2000, Imperial's Rector (the Head of the college, equivalent to a Principal) was Sir Ron Oxburgh, a geologist and non-executive director of Shell.

The Oil and Gas Centre, Aberdeen University
Few universities have handed themselves over so completely to the oil and gas industry as Aberdeen, located in Europe's oil capital. According to the Principal, Prof Duncan Rice, 'We are genuinely committed to trying to do all we can to help [the oil and gas industry] through contract work and through consultancy and, where possible, training programmes for people who are already in the labour force of the industry or moving towards it'[7].

Aberdeen University's Oil and Gas Centre is an interdisciplinary centre, bringing together geology, economics and engineering. Founded in September 1995 with support of £100,000 from BP, the Centre's first director was Dr George Greig, seconded from BP Exploration[8]. In 1999 Aberdeen University was granted £775,000 by the Scottish Higher Education Funding Council to set up the Scottish Offshore Materials Support Facility, a centre specialising in the testing of industrial materials in conditions of high pressure and temperature such as exist in oil and gasfields[9]. Meanwhile, many academic positions are funded by the oil and gas industry, including: the Shell Chair of Production Geoscience; the BP Arco lecturer in Petrophysics; and the Exxon-Mobil lecturer in Structural Geology.

Louise Sales

Imperial College London's Royal School of Mines, home of the Centre for Petroleum Studies.

In the Department of Geology & Petroleum Geology, industry provides over two thirds of research income. The Department responds: "We return the investment most directly through innovation and research ... Indirectly we return the investment through our high quality graduates at BSc, MSc and PhD levels.[10]" An Industry Advisory Panel ensures the relevance of departmental activities.[11]

The Petroleum Economics group in the Department of Economics has worked on cost-saving initiatives for Mobil, BP and others[12]. The Professor of Economics, Alex Kemp, was appointed by Tony Blair to write the official history of North Sea oil and gas[13]. According to Prof Maxwell Irvine, former Principal of the university, 'Our engineers, geologists, economists, environmental lawyers and sociologists have played their part in the growth of Aberdeen as an international oil centre'[14].

The Institute of Petroleum Engineering, Heriot-Watt University
In 2002 Heriot-Watt University restructured into six schools and two institutes - one of these latter being the Institute of Petroleum Engineering, of which the University is very proud. The Institute boasts that "We tailor our teaching and research to the needs of the petroleum industry and place considerable importance on the maintenance of close links with the industry".[18] The Institute has won a series of awards for pioneering contributions to the oil and gas industry, research excellence and industry collaboration. With research income of £5.5 million per year, the Institute is one of the UK's highest earners per member of staff.[19]

Principal and Vice-Chancellor of the University, Prof John Archer, himself a distinguished petroleum engineer, says: 'At Heriot-Watt we have always made a virtue of the fact that over 50% of our income comes from our competitive endeavours in the market place - be it in research, in University businesses or in overseas markets.'[20]

The department was set up in 1975 'to satisfy the industry's growing requirement for professional petroleum engineers'[21]. It is now housed in the Conoco Centre for Petroleum Engineering, established in 1986 with grants from Conoco and the Universities Grants Committee[22]. In 1993, the Enterprise Oil Building was added[23]. The Institute says that 'research projects address real problems faced by companies involved in the development of oil and gas resources in the North Sea and in other oil producing provinces, throughout the world. With significant industrial support, this activity has flourished'.[24] Students in the Institute have received scholarships from Agip, Amerada Hess, Amoco, BP, British Gas, Chevron, Conoco, Deminex, Elf, Enterprise Oil, Fina, Halliburton, Landmark, Marathon, Mobil, Reservoir Management Limited, Schlumberger, Shell, Texaco, and Total.[25]

Among other courses, it offers an MSc in Subsea Engineering, whose subject matter 'reflects the increased use of subsea technology in the development of small fields in the North Sea, in deep water west of Shetland, and in deep water elsewhere in the world.'[26] The prospectus claims that almost 500 MEng graduates are now serving the international oil and gas industry[27].

The Centre for Energy, Petroleum and Mineral Law and Policy (CEPMLP), Dundee University
Policy and legal areas of the oil and gas industry are the focus of Dundee University's CEPMLP, where 'academic rigour and excellence is promoted, but combined with professional relevance and close links with the multinational companies, banks, international institutions, government agencies and law, consultancy and accountancy firms'[28]. It is the largest European institution in its field[29].

Dundee's former Principal (until 2000), Dr Ian Graham-Bryce, previously headed the environment division of Shell[30]. Many of CEPMLP's 25 academic staff and 40 honorary associates are drawn from the oil and gas industry. Assistant Director of the Centre, Armando Zamora, previously worked for Mobil Oil[31]. Peter Davies, Chief Economist of BP, is an honorary professor[32]. The centre undertakes numerous consultancies worldwide and offers seminars for the industry, sponsored by Ruhrgas, WINGAS and Total.

3. Extracting intelligence

Research and development for the oil and gas industry

Summary

- The International Petroleum Research Directory (IPRD) lists about 1000 R&D projects carried out in UK universities. While the value of such research is protected by confidentiality agreements, we can estimate that it is worth about £67m per year.
- Almost half of this research is geological – finding where new fields are and how to exploit them. Most of the other research focuses on the development of new technology and drilling techniques, which enable the industry to extract petroleum from ever more marginal, difficult and expensive areas – such as the deep ocean – or to get more oil and gas out of existing fields. Thus most R&D serves to expand fossil fuel reserves.
- Over 50% of oil and gas R&D projects in higher education institutions are fully paid for by the taxpayer, and a further 23% receive part public funding. The direct public subsidy is estimated at £36m per year. Government funding of R&D is now focused on achieving industry co-funding. This naturally favours fossil fuels over renewable energy because the fossil fuels industry is considerably larger.
- R&D for the oil and gas industry is widespread, with 54 universities listed in the IPRD. The biggest providers of oil and gas industry research are Imperial and University Colleges (London), and Heriot-Watt, Newcastle and Southampton Universities.

Background

The oil and gas industry spends an estimated US$ 2 billion per year on research and development (R&D) worldwide[33]. Of the major companies' global R&D budgets, 95% is for in-house work[34], focused on non-collaborative research or areas where definite short-term returns are expected. However, universities are attractive because their research is cheaper and companies can take advantage of their range of expertise and resources. While in-house R&D must be tightly results-focused and highly secret, R&D in academia can be more experimental and collaborative.

Oil and gas industry R&D has five main goals:

- **find new fields** as cheaply as possible, by minimising on-site work through more predictive geology and modelling.
- **extract from small or difficult fields,** since most big fields (e.g. in the North Sea) are being exploited already. Subsea technologies and floating platforms make small or deepwater fields accessible.
- **extract more hydrocarbons from existing reservoirs,** using new recovery techniques and improved instrumentation technology.
- **reduce costs of extraction**, through better drilling techniques and seismic mapping.
- **improve safety and environmental performance,** to meet tighter regulations and improve image.

The first four aims either lower the industry's production costs or increase supplies of oil and gas (which in turn lowers the price of oil). Thus R&D improves the industry's competitive position relative to alternatives such as renewable energy – a cause for serious concern given the threat of climate change (Chapter 6).

Research projects

Oil and gas companies and universities we contacted for information on research and development for the oil and gas industry were often reluctant to cooperate, many of them citing commercial confidentiality. So we decided to use research directories. Our primary source of data for this chapter is the Centre for Marine and Petroleum Technology's (CMPT) *International Petroleum Research Directory (IPRD, 1997)*[35]. While somewhat dated, the IPRD is superior to alternative sources. As it is a directory for industry, it is in departments' interests to be listed, for advertising reasons.

The CMPT (now ITF) ceased publication of the directory in 1998. We interviewed some of the largest oil and gas research institutions to determine how the picture may have changed. Both University College London and Southampton University said that their level of oil and gas research has not significantly changed over the last few years, while Imperial College London said it had increased. The editor of the IPRD also said that it had not substantially changed, but if anything it has increased.[36] Quantitatively, we use the 1997 IPRD data mainly to examine the relative balance of subject areas of research, and the relative importance of various institutions, and also to obtain a lower-limit estimate for the total quantity and value of oil and gas R&D in UK universities.

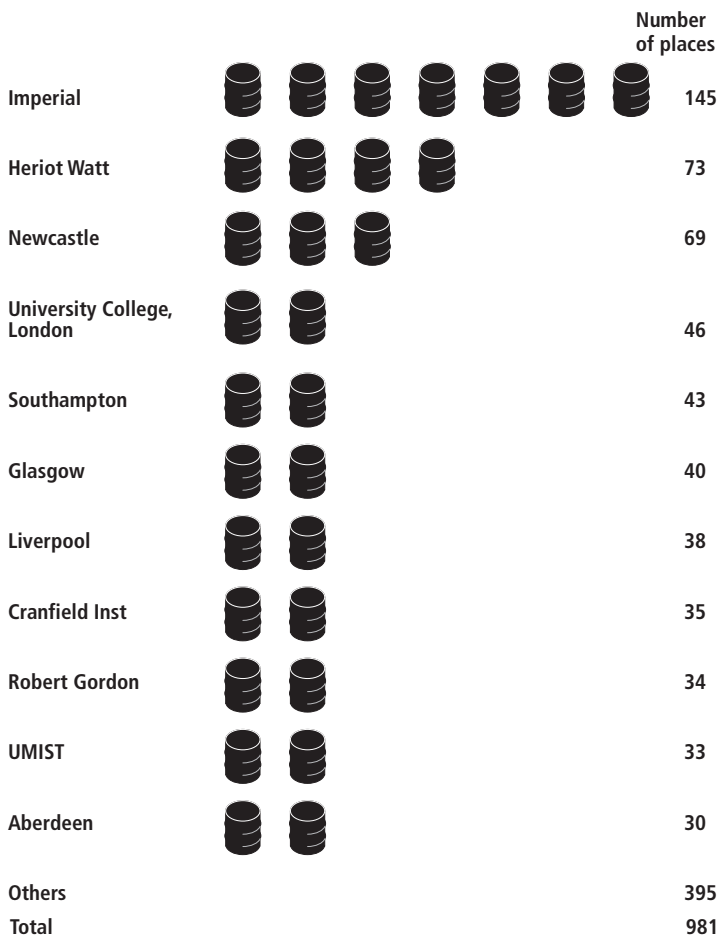
The IPRD lists 981 research projects carried out in UK universities relevant to the upstream oil and gas industry, costing roughly £67 million per year. These can be categorised as follows[37]:

	Number of projects	Av. project cost per year (£k)	Est. total expenditure (£k)
Production geology	254	90	18,500
Drilling/well technology	206	185	11,200
Offshore structures	169	63	10,600
Exploration geology	71	40	10,200
Geophysics	69	111	6,300
Flow/pipelines	60	52	3,100
Recovery/processing	57	38	2,600
Environment	34	44	1,500
Safety	32	46	1,500
Other/miscellaneous	29	50	1,500
ALL PROJECTS	-	**70**	**67,000**

The greatest area of research is geological – finding new fields and examining how to exploit them. Meanwhile, projects focusing on environmental impact and safety, prominent in company public relations, account for less than 7% of all research. Clearly the vast majority of research is geared towards increasing the supply of oil and gas or reducing the costs of its extraction – neither of which will help in the struggle to prevent dangerous climate change.

These projects were carried out in 54 universities. Just 11 institutions carried out 586 projects (60% of the total):

Leading oil and gas research institutions



This high concentration in a few institutions suggests that some departments are becoming dependent on the oil and gas industry.

Over a third of the projects (342) were carried out in Geology departments, another third (370) in various engineering-type disciplines (including materials and marine science), about 20% (201) in specialist minerals, energy or petroleum departments, and 7% (72) in chemistry-related subjects.

Who pays?

In the later stages of technology development, companies keep their work to themselves to maintain competitive advantage. By far the greatest corporate sponsors of academic R&D in the oil and gas sector are BP, Shell, and BG (formerly British Gas). According to the *Guardian*, Shell spends £3.6 million a year in universities[39]. The Industry Technology Facilitator (ITF), formed by the government in 2000, provides a funding channel for many projects. ITF works on behalf of its 16 member companies in the upstream oil and gas industry. Heriot-Watt, Robert Gordon and Aberdeen universities are represented on ITF's Technical Advisory Committee.

In the early stages, research is more speculative, so companies tend to collaborate more, as work generally benefits them all. It is also in these stages that public money is used to fund research, as companies see less direct advantage to themselves. It is interesting that the oil and gas industry desires proprietary control of research and development that it can directly benefit from, but still expects public subsidy to secure its longer-term future.

Indeed, the biggest share of university R&D for the oil and gas industry is paid for by the taxpayer. 52% of the research projects are publicly funded, while a further 23% are jointly private/public funded – the public contribution thus amounting to £ 40 million per year.[40]

In 1999-2000, the **Department of Trade and Industry** (DTI) alone spent £2 million on offshore oil and gas R&D[41], shared between companies and universities.

The biggest sources are the Engineering and Physical Sciences Research Council (EPSRC) and the Natural Environment Research Council (NERC), which account for two thirds of publicly-funded oil and gas-related research.

In 1998, the **Engineering and Physical Sciences Research Council** (EPSRC) launched a new programme in Offshore Oil and Gas with an initial budget of £2 million per year for three years[42]. The research contains 'large elements which lie at the high-risk end of the innovation supply chain where new creative, fundamental and applied research could have a significant impact'. In other words, EPSRC funds speculative research which could lead to major breakthroughs, but which companies will not fund because it does not lead directly to market advantage. Key topics covered were better detection of hydrocarbons, cost reduction in deep water drilling, and elimination of surface facilities for deep water and marginal field developments. Currently EPSRC's website lists 70 projects under Oil and Gas research, at 29 different universities adding up to £ 8.8 million of support[43]. The publishers of the IPRD commented that 'the topic of oil and gas is all pervasive encompassing virtually all the areas of academic research within EPSRC'[44].

While EPSRC focuses on engineering, the **Natural Environment Research Council** (NERC) is the major funder of geological research. NERC's programme on Rock Fluid Systems has a budget of £2.5 million over five years, supporting research at 14 universities. NERC is contributing £4.5 million to 'Ocean Margins' – a five year multidisciplinary programme helping industry overcome extraction challenges. The programme's steering committee is chaired by Dr E Cullen of Amerada Hess[45]. NERC's Hydrocarbon Reservoirs Programme, completed in 2000, aimed to develop 'new science and technologies for the exploration, evaluation, description and monitoring of hydrocarbon reservoirs which can be exploited by service companies both in the UK and in export markets[46]. The current value of the programme is £8.4 million, provided by government and industry on a 50:50 basis. Of NERC's science budget in 1999-2000, 46% went into the science areas of 'earth' and 'marine'[47], both of which have substantial oil and gas-related components.

The government's **Health and Safety Executive** (HSE) funds the vast majority of safety research for the offshore oil and gas industry, and from 2000-01 spent £848,000 on research in universities[48]. The majority of HSE's R&D funding goes to private sector institutions (total research expenditure in 2000-01 was £4.07 million[49]).

The **European Commission** (EC) funded at least 40 of the petroleum research projects listed in the IPRD[50]. According to the journal *Euroil*, 'many of the projects which receive funding from the European Union are aimed at unlocking oil and gas reserves which, without leading edge technology, would remain unexploited'[51]. The fifth framework programme (1998-2002) had, by April 2001, given Euro 95.8 million to oil and gas research in Europe[52].

4. Investing in intellectual capital

Recruitment and training for the oil and gas industry

Summary

- While R&D provides an 'intellectual income' to oil companies, they also need to possess their own intelligence. Universities provide companies with training and skilled recruits – both of which constitute 'intellectual capital' invested in the companies.
- Recent years have seen course curricula increasingly tailored to meet the needs of industry. Some degree courses now entirely specialise in oil and gas. Often areas of study are set in consultation with industry representatives. The Institute of Petroleum recommends 13 undergraduate and 42 postgraduate courses at 21 universities. Many universities also provide training services to existing industry personnel – including short courses, distance learning and whole degrees.
- While oil and gas companies are prepared to invest where there is an immediate opportunity for profit, they expect the government (through universities) to subsidise personnel training for their longer-term future.
- In 1998 the oil industry recruited 795 graduates from 105 universities. Of these, 362 (46%) came from just four institutions – Robert Gordon, Aberdeen, Imperial College (London) and Heriot-Watt universities.

Background

For oil and gas companies, universities are fertile recruiting grounds – an important reason for companies to maintain close relationships with the higher education sector. London is home to two of the world's three mega-oil and gas companies (BP and Shell), making the UK a major driver of the global oil and gas industry. The majority of managers are British (or in Shell's case, British and Dutch) and many attended UK universities.

Oil and gas companies not only expect universities to help promote the industry to their students, they even expect universities to carry out initial training of future staff.

According to the Chief Executive Officer of US oil company Conoco, 'Conoco is not in the business of providing 'graduate education' to new hires. Companies that depend on sophisticated technologies, work processes and communications systems as their lifeblood require new employees who can contribute from day one'[53].

By limiting training costs, companies can shed staff without losing investment – in effect by passing the cost of the investment on to the public purse. Limited recruitment since the early 1980s threatens a skills shortage as ageing workers retire. So the industry is interested in new training but doesn't want to incur the costs. Essentially, oil and gas companies, like in the case of research and development, want to control investment that brings them short-term profits, but expect the government to pay for investment which secures their industry's long-term survival.

Influence over course content

Many geology (and some engineering) degrees include modules on petroleum geology or engineering. There are a number of courses available which specialise entirely in skills relevant to the oil industry – most of which are at the postgraduate level. The Institute of Petroleum, the professional body for the UK industry, recommends 13 specialist undergraduate degrees and 42 specialist post-graduate degrees, at 20 different universities.[54]

Course curricula are often decided in consultation with industry – a trend encouraged by PILOT, the government/oil and gas industry competitiveness taskforce[55]. According to the Principal of Robert Gordon University, 'The University is proud that its courses are highly responsive to the demands of employers – our staff do not just sit down and wait to hear news of new developments in the oil and gas industry, they actively go out and meet employers to determine their education and training requirements. Industry input does not stop at initial course content; the University ensures that these courses are kept up-to-date and fully in-line with the industry's requirements by consulting a Course Advisory Board containing representatives from major drilling companies and asset managers within the oil and gas sector'[56].

At Aberdeen University, the MSc in Petroleum Geology has an Industry Liaison Forum, and an Industry Advisory Panel. Local oil companies also provide data and help with student projects.

Training for industry personnel

As well as training its future recruits, many universities also help develop the skills of the industry's existing workforce, through short courses, diplomas, modular masters courses, distance and internet learning packages. Universities are sometimes contracted by companies to train their staff, and the Institute of Petroleum lists 16 universities as providing such training.[57] Esso, for example, has a long-term contract with London Business School (part of the University of London) for provision of the Graduate Development Programme for all new graduate staff. Training comprises 30 working days in the recruits' first 3 years. It covers 9 modules including finance, strategy planning, IT, marketing[58]. Robert Gordon University's commercial subsidiary Univation Ltd has provided tailor-made courses to Russian drilling managers, to Korean Gas Corporation and to Shell Nigeria, amongst others[59].

The British Council manages the Petroleum Education and Training Alliance (PETA), which coordinates training internationally. Some universities are members of PETA, including Robert Gordon and Dundee.

Scottish Knowledge – jointly owned by 12 universities, eight further education colleges and 24 companies – also markets UK training capabilities abroad in all industrial sectors. It has a multi-million pound contract to provide online education for 10,000 Shell employees.[60] It runs the United Arab Emirates Petroleum Institute (a £12 million contract)[61], and supplies distance learning to Malaysia's Institut Technologi Mara and oil company Petronas[62].

Graduate recruitment

For students leaving university in 1998, the Higher Education Statistics Agency lists 795 graduates going into careers in oil and gas companies or oil field service companies.[63] A further 150 graduates went into jobs in geological consultancies, many of them petroleum-related.

The majority of graduates (348) joined as engineers. 268 of these students (34% of oil and gas recruits) went on to take potentially leading roles in the industry (engineers, scientists, management and finance / professional staff in multinational oil and gas companies).

Of the 795 graduates who in 1998 took up careers in oil and gas companies or oil field service companies, 362 (45.5%) came from just four institutions.[64] In general, these are the same universities which provide R&D for the industry:

- Robert Gordon (145),
- Aberdeen (78),
- Imperial College (77) and
- Heriot-Watt (62).

In terms of departments, 285 (36%) of the 795 graduates entering the industry in 1998 came from just 13 departments, all sited at Aberdeen, Heriot-Watt, Robert Gordon and Imperial. Key departments included:

- Geology/Earth Sciences (115),
- Mechanical Engineering (112),
- Chemistry/Chemical & Production Engineering (90) and
- Business And Management Studies/Marketing/Communications/Media (89).

Attracting students to apply for jobs

Over recent years, the UK oil and gas industry has made a major effort to attract high-quality graduates, with help from academia and government. According to the Principal of Aberdeen University: 'one of the issues we have got to think about is how the energy industry can make itself attractive to potentially highly skilled graduates from the universities'.[65]

In this effort it has been supported and subsidised by the government. In 2001 PILOT – the joint government / oil industry competitiveness taskforce – began three years of work to develop an improved graduate recruitment strategy, largely involving greater coordination of the industry effort and better communication with students to promote jobs in the sector[66].

Much depends on students' perceptions of companies. According to the trade journal *Lloyds List Energy Day*, 'Oil companies must make integrated university visits and supply brand-building advertising at universities'[67]. Companies build their brands through, for example, sponsoring and attaching their names to new buildings, lecture series and academic posts.

Favourite recruiting grounds are those universities which carry out substantial amounts of industry R&D, since this develops skills in areas relevant to the oil and gas industry. There may be a branding effect, but more important are the personal and institutional connections which allow company recruitment posters to be placed in departments' corridors. Careers advice given by university staff to students is also important and is encouraged by companies. For example, Esso provides

Credit: UKOOA / DTI

Energy Minister Brian Wilson and Jenny Costelloe (Graduate Attraction Manager at oil trade association UKOOA) launch a mobile careers fair to promote careers in the oil and gas industry on a tour of 21 universities from January to May 2003

fellowships to academics, and develops ongoing relationships with them. In 1996, one of these was awarded to David Faraday at Surrey University, who had previously arranged industrial placements for his students with Esso[68].

Companies also develop relationships with individual students, through sandwich courses (four-year courses, where the third year is spent working for a company), expenses-paid site visits, business courses for final year students during vacations and placements (temporary work in a company, usually during vacations). For example, Shell awards about 60 'premium' placements each year for UK students[69]. All university applicants for Esso's exploration division must attend an eight-week work experience programme. Some of the attendees will be invited for interview[70].

Sponsorship of students (whereby a company pays the student's fees and provides some living expenses and other benefits, in return for the student working for the company during vacations) is quite common at the postgraduate level, and is usually on the basis of employment by that company afterwards.

5. Mechanisms of capture

Building the company-university relationship

Summary

- The oil industry has captured major parts of the UK higher education infrastructure, by gaining influence at the departmental, university and government levels.
- At the departmental level, staff are seconded between companies and academia; companies fund academic positions; many academics come from careers in the industry; and companies participate in departmental advisory boards. The university departments with the closest personal connections are often those which provide the industry with the most R&D, training and recruits.
- Oil companies commonly provide higher education institutions with donations – of buildings, equipment or cash. With ever more limited public funding, few universities can afford not to accept. In return, the companies gain influence over research priorities and course curricula, and also make their branding visible to students who are looking for careers.
- Many of the most oil industry-committed universities are (or have been) led by former oilmen – including Imperial College, and Heriot-Watt, Dundee, Exeter and Hull Universities. Vice Chancellors and Principals play an important role in influencing the culture of the institution. A university's values are well reflected in its choices of to whom to award honorary degrees – and oil industry managers are common recipients.
- The relationship between the petroleum industry and higher education is also maintained at the government level, with the industry well represented on a number of policy-making bodies, on the Foresight Panels which dictate research priorities, and on the grant awarding boards of the Research Councils EPSRC and NERC. For example, Robin Nicholson, a non-executive director of BP, is a member of the Council for Science and Technology, which advises ministers on science issues; Richard Hardman, Vice President of Exploration for Amerada Hess, is a member of the Council of NERC.

Background

As the previous chapters have shown, oil and gas companies extract several resources from universities: most importantly, R&D, recruits and training. Companies must maintain good relationships with universities, so that the industry is considered favourably when research priorities are set and its profile remains attractive to potential recruits. In this chapter we examine how the oil and gas industry keeps universities serving its interests, at three levels: departments, universities and government policy. Clearly these overlap – university top management plays a major role in the biggest corporate deals, while some university principals are influential at policy level.

Unfortunately, there are no registers of corporate donations or personal connections. Major awards may be announced in university reports or the media. But lack of centralised reporting makes it difficult to document the full extent of industry/academic connections. The examples below are therefore gathered in somewhat ad hoc fashion, and should not be taken as comprehensive.

Department level

It is at the department level that oil and gas companies' relationships with universities have the most direct impact on students and academics, for it is here that research, teaching and advice to students and staff are executed and strategies decided. A positive relationship with a university department can enable the company to access training, research or consultancy services. Often companies seek something in return for their donation. Universities which enjoy donations from or personal connections with industry are usually the same institutions which provide research and recruits for the industry.

i) Personal connections

At the individual level, companies' personal connections with academics give companies not just influence over research and teaching, but also a direct link to students. This may simply involve sticking careers posters up in corridors, or may extend to advising students on careers. Personal connections are maintained via secondment, company-funded academic positions, industry personnel moving into academia, and advisory roles.

Personal connections are closest when a company employee is seconded to work in academia. For example, the first director of Aberdeen University's Oil and Gas Institute in 1995 was Dr George Greig, manager of northern pipelines in BP Exploration. The new BP Institute at Cambridge University appointed as its director Dr Pete Smith, seconded from BP, where he had worked for 19 years, 'in order to forge links with the oil industry'[71].

TCS (formerly the Teaching Company Scheme) is a government programme to support and encourage secondment between academia and industry. For example, it funded the secondment of Dr Ken Hutcheson of Heriot-Watt University to Edinburgh Petroleum Services (EPS) to develop software to assess how much oil or gas is in a well. Following the placement, Shell made a £ 200,000 order to EPS. This prompted EPS Managing Director Laurence Ormerod to admit: 'That one sale was undoubtedly helped by the work we were doing with TCS'[72].

Personal relationships also develop through funding of academic positions by companies (Table 5.1). Academics often have to dedicate some of their time to the companies' concerns as consultants.

Industry personnel may transfer to careers in academia, thereby linking their prior employers with university staff and infusing departments with their corporate philosophy. For example:

- Alain Gringarten, after 25 years in the oilfield service industry, became Chair of Petroleum Engineering and director of the Centre for Petroleum Studies at Imperial College, London[88];

- Graeme Simpson, previously Business Opportunities Group Manager with Esso Exploration and Petroleum UK, became the Schlumberger Chair of Energy Industry Management at Aberdeen University[89]; and

Table 5.1 Some oil and gas industry-funded academic positions

Aberdeen	Geology and Petroleum Geology	Schlumberger Chair of Energy Industry Management[73], Brunei Shell Petroleum Senior Lecturer, Shell Chair of Production Geoscience[74], BP Arco lecturer in Petrophysics, Mobil Lecturer in Production Geoscience, Exxon-Mobil lecturer in Structural Geology, ENI Agip lecturer in Petroleum Geology, Shell UK lecturer in Sedimentary Geology, Conoco Lecturer in Petroleum Geology. Research fellows sponsored by Mobil and Norsk Hydro[75].
Cambridge	BP Institute Chemistry	BP Professor of Petroleum Science[76], BP Professor of Organic Chemistry[77].
Dundee	Centre for Energy, Petroleum and Mineral Law and Policy	BP Professor of Petroleum Policy[78].
Edinburgh	Chemical Engineering	Elf UK lectureship in Safety Engineering[79].
Imperial	Chemistry	BP Professor of Inorganic Chemistry[80].
Imperial	Earth Resources Engineering	Elf Senior Lecturer[81], BP Lecturer in Geophysics, Enterprise Oil Chair of Petroleum Geology[82].
Leeds	Earth Sciences	Shell UK Lecturer in Geophysics[83].
Oxford		BP Professor of Information Engineering[84].
Robert Gordon	Offshore Management Centre	Texaco research fellow[85].
Royal Holloway College, London	Geology	BP Professor of Structural Geology[86].
University College, London	Mechanical Engineering	Shell Professor of Mechanical Engineering[87].

- Chris Marsden, formerly Head of Community Affairs at BP, was founding director of the Corporate Citizenship Unit at the University of Warwick Business School from 1996-99. He is now Senior Visiting Fellow at the Unit[90].

Many departments invite industry input through advisory boards. For example, Aberdeen's Department of Geology and Petroleum Geology has a Production Geoscience Advisory Board, a Department-Industry Forum and an Industry Advisory Panel. Robert Gordon University has an Industrial Advisory Board, with members from leading companies in the industry. Birmingham University's chemical engineering senior advisory group was co-chaired by Keith Taylor, the former chair and chief executive of Esso UK[91].

ii) Donations

The most visible manifestations of corporate/university partnership are donations of buildings, facilities or cash (Table 5.2). Donations help companies to build brand-image and to promote themselves to students as potential employers.

With pressures on funding, departmental managers want to encourage future donations and partnerships, and will consider this when deciding on the direction research should take and which courses should be offered. Donations thus reward decision-makers within university departments for their past and expected future partnership.More subtly, industry can influence the department's philosophy: industrial

Table 5.2 Some oil and gas company donations to academic departments

Aberdeen	BP provided £100,000 of start-up funding for the Oil and Gas Institute[92], Conoco Natural History Centre[93], Music unit part-funded by Elf Enterprise[94]
Cambridge	BP Institute for Multiphase Flow[95] (£19.5m donation in 1998, increased to £25m in 1999)[96], BP contributed £1m to the BP Laser Laboratory[97], Shell Department of Chemical Engineering – £1.5m (£20m in today's money) donation in late 1940s[98].
Edinburgh	Shell UK donated £25,000 to the University's Centenary scholarship fund in 1994[99].
Heriot-Watt	Conoco Centre for Petroleum Engineering, established 1986[100], Enterprise Oil Building (1993 – £270,000 of total £900,000 donated)[101], Super-computing facility in Department of Petroleum Engineering, 'substantially supported by Schlumberger Cambridge Research; Enterprise Oil and Silicon Graphics, Scanning electron microscope was supported by cash donations totalling £155,000 from BP, Conoco, Philips Petroleum and Texaco[102],
Imperial College, London	Geoquest exploration and production software, donated by Schlumberger, January 2001[103]
Oxford	Donation of between £50,000 and £99,999 from Shell UK Ltd, 1995-96[104]
Robert Gordon	Enterprise Lecture, sponsored by Amerada Hess (£5,000) in 1993[105], Offshore Management Centre, established in 1993, has since been sponsored and supported by Shell, AMEC Process and Energy, AOC International, BHP, Computer Management Group and Texaco[106]
University College, London	Santa Fe Laboratory for Offshore Engineering, in the Department of Mechanical Engineering, set up in 1989 to provide long term research and short term technology support to Santa Fe Exploration (UK) Ltd (now Saga Petroleum (UK) Ltd) and to Santa Fe Drilling[107].
University of Wales, Swansea	Esso Lecture Theatre in Department of Engineering (Esso provided part-funding for refurbishment)[108]
Warwick	Modern Records Centre part-financed by BP (on condition that it could house the company archives under the same roof)[109],

applicability comes to be seen as a valuable goal in itself, and large corporate donations are celebrated as a major success. In a time of limited public funding for higher education, high-profile gifts from the private sector play an important psychological role in encouraging collaboration between academia and business.

University level

At university level, the views and backgrounds of senior university personnel drive institutional policy and culture. The Principal's views are key to encouraging industry collaboration. According to Duncan Rice, Principal of Aberdeen University: 'The energy industry is going to be a huge part of the North-east economy for many years to come and for us as a university not to want to do everything we can to serve the industry would be irresponsible. We simply have to try to do what we can in terms of research contracts, in terms of thinking what new technologies would be useful, and in terms of our training programme'[111].

Many university leaders come from the oil and gas industry: Prof John Archer, Principal of Heriot-Watt, is a petroleum engineer, and worked in industry from 1968 to 1980[112]. Dr Ian Graham-Bryce, Dundee's Principal until 2000, was previously head of the environment division of Shell[113].

The cultural shift within universities towards corporate values can be seen in their language. Prof Rice of Aberdeen, for example, commented of his university: 'We are a reasonably large business with a turnover of £106 million and, if you look at that current order book in the energy industry there is a bit over £6 million there, with £2.6 million worth of business already done in this financial year'[114].

Universities are 'positioned' through whom they recognise with honorary degrees. For example, John Browne, chief executive of BP, has Honorary Doctorates from Heriot-Watt, Robert Gordon, Warwick and Sheffield Hallam Universities, Honorary Degrees from Dundee and Cranfield Universities and is an Honorary Fellow of St John's College, Cambridge (not to mention the US universities!).

Government level

Government policy sets the framework within which higher education operates – and this has increasingly encouraged working with and for industry.

The industrialisation of university research began with the LINK Programme, established in 1988, whereby a research project is funded partly by a Research Council[b] and partly by an industry (or government) partner. Its aims are to 'accelerate the commercial exploitation of science and technology; promote a close interaction between industry and the research base, so that nationally supported programmes of basic research are influenced by awareness of the needs of industry; use the research base effectively and increase UK industrial competitiveness'[115].

In 1993, the Conservative government published the White Paper *Realising Our Potential*, which reorientated publicly-funded research towards areas relevant to industry; emphasised wealth creation in the mission statements of research councils; required research councils to work more closely with industry; and initiated awards for academics working with industry. As a result, the Research Councils are now mostly run by industrialists. For example, in order to determine grant awards, the Engineering and Physical Sciences Research Council (EPSRC) has a 'Peer Review College'. It members include 12 oil and gas company executives and just two renewable energy company representatives[116].

The Technology Foresight programme followed the White Paper and established panels of experts from universities, industry and government to identify research most likely to promote wealth creation. They gave unprecedented input to industry on what the priorities of *publicly funded* research should be. Research Councils are expected to reflect agreed Foresight priorities in their programmes and criteria.

While funding for specific research projects has increasingly emphasised commercial relevance, untied core funding has been cut back. In 1999, the Higher Education Funding Council for England (HEFCE) – which provides untied grants to universities – complained that its funding had suffered 'real terms reductions of more than 35% over the previous eight years', some of this having been transferred to Research Councils[117].

Furthermore, HEFCE reports that 'an important part of HEFCE's strategy is to ensure higher education is responsive to the needs of business and industry.' HEFCE's Generic Research Initiative (£20 million for 1999-2000) encourages institutions to collaborate with industry or government on long-term research. Meanwhile, its Higher Education Reach Out to Business and the Community Fund (£10 million for 1999-2000, and £ 20 million per year thereafter) 'will provide an incentive to build a sustainable and broadly based capability to respond to the needs of business'[118].

Since it was elected in 1997, the Labour government has continued to support industry-relevant research. In 1998, then Trade and Industry Secretary Peter Mandelson set up an Oil and Gas Industry Taskforce to help improve the competitiveness of the UK's industry. In January 2000, this evolved into the PILOT Taskforce, which meets quarterly and comprises industry managers, regulators and government. Its secretariat is within the DTI, and it is chaired by the Energy Secretary.

PILOT's meeting in June 2001 concluded that 'University research needs to be in line with needs of industry' and called for 'enhanced industry input to Research Councils'[119]. This is despite the fact that the oil and gas industry already plays a major role in the Research Councils and research agenda are already closely aligned to industry needs. PILOT is also attempting to attract more graduates into the oil

BP Institute

Sir Robert May, President of the Royal Society and former government Chief Scientist opening the BP Institute, Cambridge University, 29th May 2001, following a £25m donation from BP From left to right: Dr Andrew Mackenzie (BP Group Vice President Technology), Professor Andrew Woods (BP Professor, Cambridge University), Sir Alec Broers (Vice Chancellor, Cambridge University), Lord Browne (BP Chief Executive Officer), Dick Olver (head of BP Exploration & Production) and Professor Ekhard Salje (Professor in Earth Sciences, Cambridge University)"

and gas industry – for example, between January and May 2003, the Department of Trade and Industry is sponsoring a mobile careers fair, designed to showcase opportunities in the oil and gas industry, which will tour 21 universities.

In both cases – early stage R&D and the attraction of graduate recruits – it is surprising that, given its resources, the industry cannot manage the processes itself.

The oil and gas industry has gained influence in government, through appointments of industry managers to policy-making roles. Examples include:

- John Cadogan, after retiring as BP's research director in 1992, became Director General of Research Councils in the government's Office of Science and Technology until 1998.[120]

- Robin Nicholson, a non-executive director of BP, was a member of the government's Council for Science and Technology, which advises ministers on policy from its inception in 1993 until 2000[121].

- Robert Malpas was a BP managing director during the 1980s, then became chair of LINK from its inception in 1988 until he was appointed chair of the Natural Environment Research Council (NERC) in 1993, where he stayed until 1996.

- The late Keith Taylor, former chair and chief executive of Esso UK, was a board member of the Higher Education Funding Council for England (HEFCE).[122]

- Richard Hardman, Vice President of Exploration of Amerada Hess International, is a member of the Council of NERC and chair of its Science and Technology Board.[123]

The government's Foresight Programme guides R&D priorities to ensure wealth creation. In November 2000, Foresight's Energy Futures taskforce published *Fuelling the Future – A Consultation Paper*, which proposes different scenarios for the future of energy supply without discussing the effects of climate change in any depth. Improved fossil fuel extraction is identified as a key R&D challenge[124].

Ralph Rayner, Managing Director of Fugro GEOS, a consultancy providing services to the offshore oil and gas industry, is a member of the Marine Foresight Panel, and chair of its Marine Resources and Environment taskforce[125]. Meanwhile, the Energies from the Sea taskforce is chaired by John Griffiths of JWG Consulting, formerly of AMEC, the contractor responsible for constructing many of the oil and gas platforms in the North Sea[126].

6. Influencing energy economics

Universities' role in climate change

Summary

- The burning of fossil fuels is the single biggest cause of climate change. R&D in universities mostly serves to unlock more carbon from geological resources – through discovery and through extraction technology. It increases the total available stock of fossil fuels that will be burned over the future, and increases the immediate rate of extraction. If we are to curb climate change, both of these must stop.
- The North Sea oil fields are small, difficult and expensive, and account for only 0.5% of world reserves. They are being run down rapidly, and no royalties or petroleum tax are now charged by the government on new fields. The UK Continental Shelf has been used as a development and testing ground for new extraction technologies to export to oilfields elsewhere in the world.
- Boosting the supply of fossil fuels also helps to keep their price down, limiting the market penetration of alternative energy sources (such as renewables), which must compete on relative price.
- Oil companies compete increasingly on the quality of their management, and the strategies they develop. Universities support this through providing training and skilled graduate recruits. In serving the goal of increasing shareholder value, they must maximise growth (ie extract more hydrocarbons) and ensure that their economic position is not challenged by the arrival of new energy technologies, such as renewable energy. When an oil company becomes more competitive, it competes better not just against other oil companies but against other energy companies generally.

Background – climate change

Few can seriously doubt that humans are having an impact on the climate, or that the consequences will be severe. The Third Assessment Report of the IPCC (Intergovernmental Panel on Climate Change – the United Nations' scientific authority on climate change), published in January 2001, projects that global temperatures over the next century will increase between 1.4-5.8 ^{o}C[127]. The results will be sea-level rise, extreme weather events and shifts in local climate, leading to destruction of ecosystems, severe damage to property and infrastructure, threats to availability of water and food, economic disruption, and an increase in vector-borne diseases (such as malaria) and the creation of many environmental refugees.

60% of the enhancement of the greenhouse effect is due to carbon dioxide (CO_2), about three quarters of which comes from burning fossil fuels. Around 30% of methane emissions (the second most important greenhouse gas) come from fossil fuels[128]. Yet while many agree there is a major problem, none (whether government, industry, NGO or academic) has a coherent response. The Kyoto Protocol was designed to reduce industrialised country emissions of CO_2 by an average of 5.2% below 1990 levels. But the world's largest polluter, the US, has refused to ratify the treaty. Climate negotiations in Bonn in July 2001 introduced loopholes, which allow polluting countries to meet targets by using carbon sinks such as forests. According to the Worldwide Fund for Nature, this has effectively cut the target to 1.8%[129].

While fossil fuels remain underground, carbon is safely locked away. Climate change involves two processes: carbon is extracted to the surface as fossil fuel (*production*), and then it is combusted, releasing it into the atmosphere (*consumption*). The Kyoto targets address consumption, but not production. Yet by reducing only the demand/consumption side, there is a danger that supply/production side pressures could prevent targets being reached.

Which is easier to regulate – consumption or production? Mathematician Julian Todd argues that 'it is far easier to regulate fossil fuel carbon extraction (oil drilling, gas pumping or coal mining) than carbon release into the atmosphere (from cars, homes, factories etc). This is because: 1) extraction installations are fixed and small in number (there are only a few thousand working oil wells in the world, compared to hundreds of millions of cars) – so responsibility is clearer and policing easier; 2) they are already accurately measuring and controlling their production; 3) possession of a permit to extract would be as easy to prove as possession of stock market shares'[130]. Precedents exist, where industrial production has been restricted rather than individual consumption – eg. the Montreal Protocol on ozone-depleting substances, or quota systems against over-fishing.

Carbon logic – phase out fossil fuels

Based on *Fossil Fuels and Climate protection: The Carbon Logic* by Bill Hare, Climate Policy Director of Greenpeace International

Given that climate change is a serious threat which needs mitigating, the next step should be to agree a limit on how much climate change is 'acceptable'. The UN Advisory Group on Greenhouse Gases (AGGG) suggests a maximum 1ºC mean global temperature rise and 20-50cm sea level rise. Beyond this, there may be 'rapid, unpredictable and non-linear responses that could lead to extensive ecosystem damage'.

According to IPCC figures, a 1ºC temperature increase corresponds to a carbon dioxide concentration of 350 ppmv (parts per million by volume). By using carbon cycle models we can estimate the amount of cumulative carbon emissions corresponding to this level of atmospheric carbon concentration. Ignoring other greenhouse gas producing factors (eg. deforestation, thawing permafrost), we arrive at the conclusion that we can burn 295 billion tons of carbon (295 GtC) over the next 100 years.

Current consumption of fossil fuels is six billion tonnes of carbon per year, rising by 2% per year – at these rates of consumption and growth, the 295 GtC quota would be exhausted in 36 years. Even if we opt for a maximum increase of 2ºC (as the EU has proposed), the maximum amount of carbon we can burn is 585 GtC.

By comparison, the world's economically recoverable reserves of fossil fuels (including oil, gas and coal) amount to 1,000 GtC. Counting likely resources not yet found or not recoverable with current technologies, the total is over 4,000 GtC. Clearly, we have already found more carbon than we can afford to burn, even using the higher limit of 2ºC. So we need to stop looking for more fossil fuel reserves and phase in replacement energy technologies.

Research and development

R&D in an industry sector dealing in primary commodities (such as oil and gas) differs from that in a manufacturing or service sector. In the latter, R&D aims to add value, distinguishing products from their competition. But a primary commodity is sold essentially in the form in which it is extracted. So the function of R&D in this case is not to make a *better* product, but to obtain *more* product, at lower cost and more easily deliverable to markets. The R&D in the extractive industries addresses the *process* of production, rather than the product.

In general, the western oil companies extract reserves as quickly as possible, provided they are economically feasible. In contrast to OPEC producers, they do not regulate their production so as to influence the economics of the business; instead, they aim to maximise their rate of production.

As a result, each new field found and brought onstream, each increase in the proportion of a field's extractable hydrocarbons, has an impact now, as an increase in the rate of production. Thus, through exploration and technology, each company aims to increase its annual oil and gas production. BP, for example, has a target of 5.5% increase per year[131].

Clearly, such an approach of ever-increasing production is incompatible with a gradual reduction in greenhouse gas emissions – in other words, if we are to reduce the quantity of carbon released into the atmosphere, we must simultaneously reduce the rate at which carbon is unlocked from geological fossil fuel reserves.

i) The North Sea

After falling in the late 1980s, North Sea production of oil and gas increased throughout the 1990s. Nine new fields opened during 1999, with UK oil production reaching a record 137 million tonnes. Gas production also hit record levels[132]. Since 1985, 63 new fields have come onstream. Without the cost-saving technology which has removed the need for fixed platforms, many of these fields would not have been developed[133]. Production would still have grown in the early 1990s (due to fiscal relaxation and the discovery of the large Scott and Nelson fields), but after 1995, production would have fallen sharply without these fields.

The PILOT Taskforce estimates that from 1990-97, technological advances were responsible for additional reserves of 5.8 billion barrels of oil equivalent (boe) in the UKCS. New technology could help open up 4.3 billion barrels' worth of new fields over the next five years, and add 1.3 billion barrels to the amount recovered from existing fields[134]. So research input has turned a sharply declining North Sea oil and gas province into one which continues to grow.

But R&D for the UK oil and gas industry has an impact not only on the resources directly extracted from the North Sea.

North Sea oil and gas fields are small and operating conditions are harsh. Production facilities had to be designed to withstand wind gusts of 180 km/hour and waves 30 metres high[135]. Most of its early development occurred during the high oil prices of the 1970s-80s. After that, offshore activity was sustained by generous tax cuts. While competing with far more profitable areas worldwide, the UK industry had to find a way to remain competitive.

The solution came through technology – improved exploration techniques; leaner, cheaper platforms; platform-free developments; sophisticated drilling; deepwater facilities; and subsea infrastructure. The UK became a world leader in oilfield technology. That technology, tested in the North Sea, has been exported around the world, bringing down the industry's costs and increasing access to reserves. So the R&D contribution of UK universities not only improves the competitiveness of UK companies, it promotes the growth of the global oil and gas industry. Since the UK continental shelf contains just 0.5% of the world's oil and gas reserves[136], from a global perspective, it serves more as a *laboratory* for the industry than as a genuine producing area.

ii) Oil and gas reserves

At present, known exploitable global reserves amount to 40 years of oil consumption and 61 years of gas[137] – thus if no further exploration or technological development occurred, we could go on consuming at the current rate for this many years.[c] However, more research will release more carbon from reserves to be combusted and emitted into the atmosphere.

The oil and gas industry spends considerable capital 'upfront' in exploration and field development. Income received over the lifetime of a field is expected to recoup upfront expenditure. So no oil and gas company could countenance *not* extracting all available oil and gas from a discovered field – to do so would incur enormous loss. Thus *found* oil and gas is as 'committed' (to being ultimately consumed/burned) as *extracted* oil and gas. Current exploration is greater than extraction, for both oil and gas, so at the end of each year the quantity of remaining reserves increases[138]. As reserves grow, this allows an *increased* year-on-year rate of consumption and production.

Governments should set targets based on how much climate-related damage they are prepared to accept in the future, rather than how much action they are willing to take now. This means that governments should establish an 'envelope' for maximum greenhouse gas emissions (and hence fossil fuel consumption and production) for the next few decades. From this we could determine how long current reserves will last and how much, if any, new exploration is needed.

iii) The oil price

The price of oil is determined globally by market forces: a warm winter in America and Europe will reduce demand for fuel, so the oil price will fall; a war in the Persian Gulf will threaten oil supplies, so increasing the price.

Most important though are the actions of the OPEC cartel – dominated by the five Gulf states (Saudi Arabia, Iraq, Kuwait, United Arab Emirates and Iran). OPEC countries control about 40% of oil production and about 75% of reserves[139]. Oil there is onshore in easily accessible, large oilfields, so there are not the same kinds of geological or technological constraints faced by the western oil companies. Infrastructure capacity generally exceeds production rate. So these countries can increase or cut production rates at will, thereby decreasing or increasing prices.

Oil production in the Middle East will always be cheaper than in areas where western companies have control – whatever new technology is developed. So actions by western oil and gas companies – including in universities – do not have a *direct* impact on the oil price. However, there is a longer term impact on price. If there were no exploration or technology development, global oil reserves would expire in 40 years and gas reserves in 61 years (at current rates of depletion). Thus over the next few decades, the price would inevitably rise as supplies became more limited. This price rise would in turn encourage the development of renewable energies. So continued geological research and technology development is helping keep long term oil prices down.

Renewable energy technologies

According to a DTI paper on renewable energy, 'Reducing our use of fossil fuels, and replacing them with non-fossil sources, will be a key part of our long-term strategy to reduce greenhouse gas emissions'[140]. The UK aims for renewables to provide 10% of electricity generation by 2010, 'subject to the cost being acceptable to consumers'[141]. Another DTI assessment comments: 'The future prospects for particular renewable technologies in the UK will be determined by the commercial availability of that technology, the presence of an exploitable resource, the economic competitiveness of the technology compared to other available options, and the overall demand for energy'[142].

The government's renewables policy is that 'Each technology will progress through the stages of assessment, R&D, demonstration, market entry, full-scale industrialisation and finally open competition…

An exit strategy would be needed to encourage the industry to become competitive without subsidy. Green trading for electricity [ie consumers actively choosing a renewables supply option] could be a significant element in a strategy to move from a subsidised regime to one where renewables operate in a purely commercial market'[143]. It is note-worthy that the government does not have an exit strategy from its support for oil and gas development.

Much R&D – both in universities and in companies – is devoted to reducing the cost and increasing the deployability of renewable energies. However, if the approach to technology substitution is to be a market-based one – as the government insists it must be – reduction of the costs of renewable energy sources themselves is not all that is required. Within a market approach, renewable sources are employed *in competition* with other (conventional) sources, so it is the *relative* rather than absolute price that is relevant. This is particularly the case within the now liberalised energy market. According to the European Commission's 1997 White Paper on renewable energy, 'At present, prices for most classical fuels are relatively stable at historically low levels and thus in themselves militate against recourse to renewables'[144].

R&D into oil and gas production serves indirectly to keep down the global price of fossil fuels. By enhancing the competitiveness of oil and gas companies operating in the North Sea, such R&D also helps these companies compete with suppliers of renewable energy. So efforts by government to bring renewable energy to market through cost reductions are counteracted by their continued R&D support for fossil fuels. Furthermore, while countries have set targets for reducing their greenhouse gas emissions, many simultaneously aim to maximise their rates of hydrocarbon extraction. Consequently, with *supply* of fossil fuels increasing and demand decreasing, the price of oil and gas will fall further.

Meanwhile, the UN's Solar Energy Group on Environment and Development (UNSEGED) comments that 'there is large untapped potential for harnessing all renewable energy forms... Renewable energy R&D could be adequately funded by shifting priorities for existing research, development and demonstration financial resources'[145]. Yet not only is much R&D funding devoted to oil and gas, when it could be helping bring renewables to market, that very R&D is keeping down the price of oil and gas, and so making renewables relatively less competitive.

Recruitment and training

Western oil and gas companies only control a minority of the world's oil production. They have to find new oil and gas outside the Gulf states to remain competitive, especially since their fields are depleting far faster than those in the Middle East. Key to their survival are exploration and technology – which makes companies highly dependent on R&D. In obtaining this from universities, companies are receiving *intellectual income*. More importantly, companies must possess their own intelligence – *intellectual capital*, which comes through the recruitment and training which only universities can provide.

A current trend is that of 'outsourcing' functions traditionally carried out by the corporation. While the oil and gas industry has outsourced at the operational level for decades, it is now outsourcing headquarters functions such as accounting, marketing and human resources. As the corporation's core shrinks, its remaining functions become owning assets and determining strategies to exploit them. As strategy grows in importance, so the talent of the company's managers becomes ever more crucial as a basis of corporate success.

In order to maintain growth in the face of competition, companies will increasingly rely on their management skills. Rodney Chase, Deputy CEO of BP, points out: 'Knowledge is embodied in people, and they are the real key to the next level of productivity. No machine can innovate. No piece of technology can think about its own limitations and experiment with progress. No oil rig has ever walked into my office with a great new idea. That's why in the new connected knowledge economy, the first war of this century will be the war for human talent'[146] .

When a university supports the recruitment efforts of oil and gas companies or provides them with training, it is investing intellectual capital in the company. This plays a crucial role in the company's competitiveness, thereby helping fossil fuels maintain their dominance relative to renewable energy sources.

Government policy

Over the last two decades, untied public support for universities has been cut back, forcing them to rely on output-focused funding for specific research. Much funding has come from the private sector – actively promoted by government. Meanwhile, government research support has increasingly been driven by the goal of 'wealth creation'.

The motivation for these policies is the drive for 'competitiveness' – but only in the narrowest sense. It means supporting the ability (mainly of multinational companies) to compete within the liberalised global economy (against other multinationals) – rather than the creation of dynamic, vibrant competition within the UK's borders.

One might expect that small, nascent industries, such as renewable energy, are more deserving of government support than mature, profitable industries such as oil and gas. The fossil fuel industry has the resources to fund R&D by itself, while the renewable sector is dependent on initial investment to get established. Greater support for smaller, newer players would seem to be in the interests of competition and innovation. Moreover, from a public interest perspective, support for 'clean' rather than 'polluting' industry makes sense, especially faced with climate change.

But bigger industries have more resources to match funding for research, and more capacity to commercialise the results. Current government research policy is biased towards projects that support bigger industries and, as a result, conflicts with the government's determination to tackle climate change. While study of the science and impacts of climate change is a major funding priority for NERC, another of its priorities is enhancing the competitiveness of the oil and gas industry.

As the Royal Commission on Environmental Pollution commented in its 2001 report on climate change and the energy industries, 'UK governments have never pursued an integrated and coherent energy policy. Policies have been separate and sometimes conflicting: to promote the development of North Sea oil and gas, to sustain the coal industry, to maintain gas as a premium fuel, to use the non-fossil fuel obligation to shelter the nuclear industry and promote the development of renewable sources'[147]. The idea that we can address climate change without challenging the dominant position of fossil fuels in the energy economy is short-sighted, to say the least.

7. Intellectual pollution

The damage to academic enquiry

Summary

- The commercialisation of academia skews public debate by limiting the field of inquiry – in that study is only fundable of subjects and approaches that have commercial application or interest. Even within disciplines, debate is further skewed by the greater fundability of academics who hold views useful to corporations.
- The application of confidentiality agreements undermines the open, interactive culture of academia, and thus constrains the advance of knowledge.
- Some scientists are sceptical as to the existence of a significant human effect on climate – many of these are funded or otherwise supported by the fossil fuels industry. They are small in number, and not influential in the scientific discourse, but have a disproportionate impact on the public debate. In the US, climate scepticism consists in denial, whereas in Europe, the problem is acknowledged but fossil fuel companies' solutions to it endorsed.
- Some academic centres, thought not all, have gone so far as to promote the intellectual position of their corporate paymasters.

The relationship between oil and gas companies and universities not only affects the economics of energy – with severe consequences for the environment – it also has impacts on a far more basic, public 'commodity': knowledge.

Limiting the field of inquiry

A key impact of the industry's capture of academia is in determining what research gets carried out. With the emphasis on industrial funding of research – or industrial applicability of publicly-funded research – academic work is fundable only if geared towards commercial goals. Prof Duncan Rice, Principal of Aberdeen University, puts it well: 'Research, and this is true of applied as well as theoretical research, tends to be demand-led...the energy industry often has a strong demand component because someone is interested in a particular problem and wants it researched. If there isn't someone coming here and saying I would like to give you a research contract, then it may tend not to happen'[148].

One consequence of oil and gas industry capture is that many geologists are not very engaged in the problem of climate change. Nigel Woodcock, a geology professor at Cambridge University, comments that 'geologists...of all people, should be able to spot the threat of a slow catastrophe beginning to happen; to see the climate-modellers' writing on the greenhouse wall… [Yet] we keep our eyes on the ground, and more often under it. We are disinclined to focus upwards on the atmospheric consequences of using these resources. There are many geological jobs in finding fossil fuels so we are therefore reluctant to admit the link between fossil fuels and global warming. People in glasshouses don't throw stones'[150].

Influence over safety research

Based on *Power, ideology and the regulation of safety in the post-Piper Alpha oil industry,* by David Whyte of Manchester Metropolitan University

Industry influence over research extends from the 'hard' sciences to social sciences – including research on offshore health and safety, mainly funded by the Health and Safety Executive (HSE).

The HSE's philosophy is to encourage industry compliance rather than enforce regulations. Hence HSE's research funding seeks to promote the industry as 'one of the safest in the UK', rather than addressing systemic causes of safety problems. Managerial solutions to safety are favoured, while suggestions that the fault may lie in excessive emphasis on productivity and costs are frowned upon. For example, an Offshore Management Centre (Robert Gordon University) project, commissioned in October 1995, aimed at establishing a link between accidents and 'human error', and attracted £140,000 in funding from the HSE and various oil and gas companies.

It is often extremely difficult to get research funding which does not further the agenda of the HSE and industry. Meanwhile, the financial power of the funders creates enormous pressure for researchers not to challenge their views. A researcher at the Offshore Management Centre who discovered one oil and gas company had been falsifying its accident figures explained, 'When I ask these guys about why the accident rates are changed for their own records, they tell me to shut up. Of course I do. Because you can't challenge what they say if you want to keep credibility'[149].

The industry may also restrict researchers' access to employees and facilities. For example, a 1994 HSE-funded study into safety, health and working effectiveness in offshore shift patterns sought United Kingdom Offshore Operators Association (UKOOA) approval to gain access to member companies. UKOOA's subsequent letter to the HSE asks, 'will [the study] be used to prepare new guidance on conditions of work offshore, which may restrict the industry's current approaches?' and notes that 'individual operators would seek involvement in steering the work and in reviewing the results prior to publication.'

Meanwhile, industry-friendly approaches to climate change receive prestigious support. For example, the Centre for CO_2 Technology, in the Department of Chemical Engineering at University College, London, was set up to study the separation and burial of carbon dioxide from the burning of fossil fuels – an approach which is both more expensive than renewable energies and highly risky in terms of environmental safety[151]. BP, Shell and others have representatives on the Centre's Advisory Panel, 'to maintain the relevance of the work of the Centre for CO_2 Technology to industrial needs'[152].

Furthermore, the traditionally open spirit of scientific inquiry is threatened by confidentiality agreements – research becomes not public knowledge but intellectual property. Holders of intellectual property rights have the option to withhold information that might damage their commercial advantage.

Getting the right answers

Big industry not only sets the topics for investigation, it decides which academics to support. An academic may feel pressured by the knowledge that, if they come up with data critical of the sponsor's operation, they are unlikely to be sponsored by that company again. Self-censorship is not uncommon. According to Colwyn Williamson of the Campaign for Academic Freedom and Academic Standards, 'The name of the game is getting funding and everyone is being pressured. It has always been possible to buy one or two individuals but now the universities are up for sale'[153].

For Charles Woolfson, head of the graduate school in the Social Sciences Faculty at the University of Glasgow, this undermines the primary role of universities: 'Our essential role is one of criticism, of scrutiny, of testing conventional wisdom and of challenging the official version of reality. The pressures to be involved in funded research, particularly commercially sponsored research for career reasons, are enormous and the fear is that this is beginning to compromise the intellectual independence we should pursue'[154].

Studying climate change

A small but vocal minority of scientists remains sceptical about whether humanity has a significant effect on climate. According to *New Scientist*, 'Their prime motivation seems to be indignation, coupled with a maverick instinct to buck the latest fashion. But they have also managed to secure some lucrative lecturing fees and consultancy deals with commercial concerns – such as the coal industry – who are anxious to undermine international efforts to control emissions of greenhouse gases such as CO_2'[168].

Box 7.2: Exxon-funded research greenwashes Alaska oilspill

Based on *The Exxon Valdez – a case of corporate virtual reality,* by Andrew Rowell, for Greenpeace

After the grounding of the *Exxon Valdez* oil tanker off Alaska in March 1989, Exxon flew three British scientists out to the scene to assess the damage: Prof Robert Clark (Dept of Zoology, University of Newcastle), Dr Paul Kingston (Institute of Offshore Engineering, Heriot-Watt University) and Dr Jenny Baker (consultant).

Clark, Kingston and Baker released a report in 1990, which argued that: 'The overall impact of the oil spill on the environment in Prince William Sound and the Gulf of Alaska is likely to be short-lived'. It claimed that: 'Animals may accumulate petroleum hydrocarbons while their environment is oily, but they subsequently purge themselves in a relatively short time and return to normal levels.'[155].

In June 1990, Prof Clark said: 'Oil spills create a big mess. They cause short-term damage, but the long-term effects are nil'[156]. In a 1991 article, Clark observed that 'The effects of the cleanup, coupled with the scouring action of winter storms, left the shoreline largely free of oil by the spring of 1990.... There is evidence that [the] remaining oil is neither toxic nor harmful'[157]. Clark notes that in 1990 'sea otters are still abundant in the sound and, with their high reproductive rate, can rapidly reverse whatever losses they sustained'. Of *murres* (seabirds), Clark states that in the northeast Atlantic their population has mushroomed despite losses from oil pollution, and he expects the same to be the case in Prince William Sound (PWS)[158].

By contrast, the US's National Oceanic and Atmospheric Administration estimated in autumn 1992 that 12% of the total oil spilled still remained in sub-tidal sediments, and 3% on the beaches[159]. Rick Steiner, an Associate Professor at the University of Alaska, commented that 'Four years after the spill, oil still remains trapped in mussel mats in the inter-tidal zone, being picked up into the food chain'[160]. The *Exxon Valdez* Oil Spill Trustees expect direct damage to wilderness to continue for decades[161]. An overview of the scientific studies of sea otters reported: 'By late 1991, three findings indicated that chronic damages were limiting recovery of the sea otter population in PWS: patterns of mortality were abnormal when compared to pre-spill data, surveys showed no increase in abundance, and juvenile survival was low in oiled areas of western PWS'[162]. According to the Trustees, by 1993 there was still little or no evidence of recovery of the sea otter population, which may take decades[163]. The number of breeding *murres* fell by up to 70%, and there was complete reproductive failure in 1989, 1990 and 1991[164]; the Trustees suggest that it may take a century for the population to recover, if at all[165].

Thus the views of Baker, Clark and Kingston are not common to all scientists in the field of marine pollution. In fact, the three are known as 'sceptics' with regard to the ecological damage caused by oil spills (their main point being that oil spills' effects are short-term, and do not significantly impact upon populations or ecosystems in the longer term), and have written extensively on the subject since at least the early 1980s. Kingston is part of the Institute of Offshore Engineering at Heriot-Watt University, most of whose work is for the oil and gas industry, and Kingston himself 'has worked on most major North Sea petroleum developments'[166].

That their views are 'friendly' is at least partly why Exxon chose these three to assess the *Valdez* damage. But more cynically, Otto Harrison, Exxon's Director of Operations in Alaska, told an Institute of Petroleum conference in London that Exxon had used British scientists because the American public would find a scientific message more credible and more impressive if it is spoken in an English accent[167].

Two of the most prominent British sceptics, Dr Jack Barrett and Prof Robin Vaughan, are from Imperial College London's Department of Mathematics, whose research clients include Schlumberger and British Gas amongst others[169]. Another, Dr John Emsley, is from the Department of Chemistry at Southampton, which is sponsored by Shell and BP[170]. Their views appear in *The Global Warming Debate* (ed. JW Emsley), published in 1996 by the Institute of Economic Affairs and launched with the help of Texaco[171].

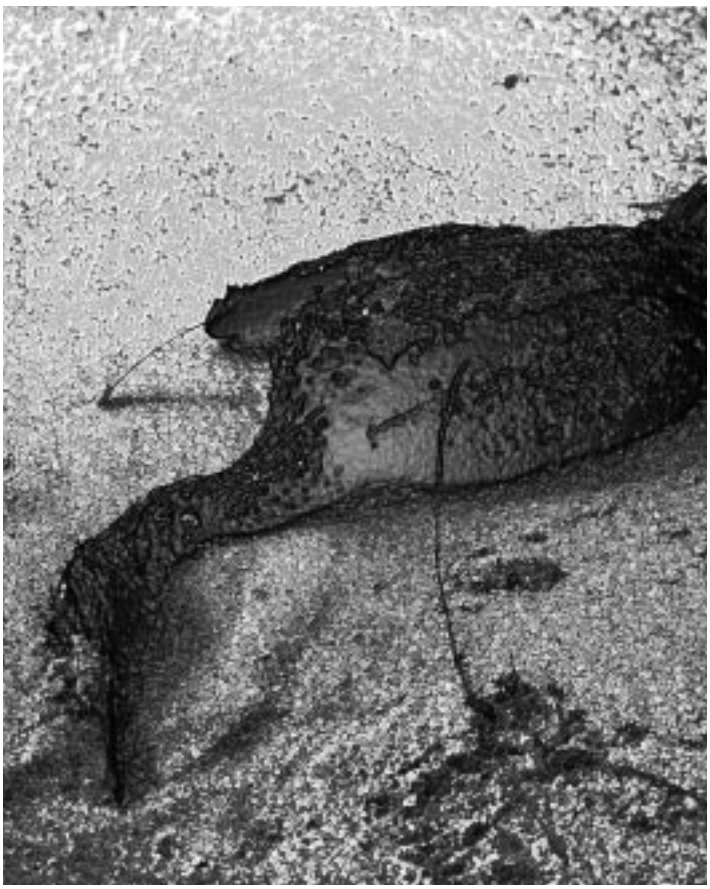
Climate sceptics, despite having virtually no influence in the scientific arena, are very significant to the public debate. Former IPCC chair Bert Bolin explains that 'the press is anxious to seize on scientific controversies', since climate change warnings are no longer news. But, he adds: 'An increasing polarisation of the public debate...is not a reflection of a similar change among experts'[172].

In the US the approach of climate sceptics is one of denial, whereas in Europe companies and governments accept the reality of the issue, but seek business-friendly solutions. Academia plays a key role in legitimising this approach. In January 1996, Tom Wigley, a former director of the Climatic Research Unit at the University of East Anglia, co-wrote a report which argued against early action on climate change. As one of the lead authors of the IPCC's 1995 report, he is not a sceptic. But he maintained that, while a maximum atmospheric concentration of carbon dioxide should be agreed, greenhouse emissions need not be reduced for 30 years, when technology will make such reductions cheaper. His work was funded by the US energy industry's Electric Power Research Institute and the US Department of Energy[173]. It was published two months before international negotiations on how much industrial nations should reduce their emissions after 2000.

Corporate promotion

Other sponsorship is geared towards promoting the reputation of the funding company as environmentally responsible. For example, in 1998 Shell sponsored a series of lectures on the environment at the Centre for Philosophical Studies at King's College, London. One speaker, an Australian philosopher, pulled out in protest, saying: 'I did not really want to appear on a programme that says 'supported by Shell' and is seen as therefore promoting the idea that Shell is a good corporate citizen...I think that you can see a connection between the money that is going here [to the King's Centre] and the profits made out of the extraction of oil in Nigeria, with all of the consequences that has for the Ogoni people, both in terms of environmental damage to their land, and the way in which Shell revenues support the Nigerian dictatorship'[174].

BP set up and funds the Corporate Citizenship Unit at Warwick University, which in turn consistently promotes BP as a good corporate citizen. BP chair Peter Sutherland and CEO John Browne were both contributors to the unit's series of essays, *Visions of Ethical Business*[175]. Chris Marsden, who joined the unit from BP, has even written: 'A few companies, notably oil giants BP and Shell, are accepting responsibility for key sustainability issues like global warming and human rights. They are also refining their business goals beyond shareholder value towards creating added value from their operations for society as a whole – the famous triple bottom line'[176].



8. Recommendations

Recommendations for government

- Public money must no longer be used to subsidise fossil fuel technologies, and should be switched to renewable energy technologies. Similarly, government support for training and personnel development must be focused on building the workforce for the new industries which will help us deal with climate change, rather than those which cause the problem.
- There should be proper public support for research into energy efficiency and renewable energy, backed by a budget designed to deliver a level of renewable energy generation, and efficiency gains, commensurate with solving the problem.
- The need to contribute to the solution of social and ecological problems (and not to exacerbate them) should be written into the mission statements of public funding bodies such as Research Councils, where it should take higher priority than the goal of wealth creation.
- The involvement of private interests in public institutions must be made transparent. Universities should be required to publish compulsory registers of all industrial sponsorship, and of research projects to include funding sources and any other industrial connections. Funding sources and business links should be declared on all academic and other departmental publications. Academics should report all external professional commitments.

Recommendations for universities

- Universities should aim to cease to carry out research and development which increases the extraction of fossil fuels.
- Universities should cease to subsidise training by including elements in degree courses relevant to the oil and gas industry; they should refuse to support or encourage the movement of their graduates into an unsustainable industry.
- University departments and research centres should subscribe to an academic hippocratic oath when working on issues of global public interest, committing themselves to serve the public good before all other interests.
- University departments should develop strategies for diversifying away from dependence, particularly on unsustainable industries such as oil and gas – and they should seek government support to do this.
- Universities should encourage full debate on the consequences and desirability of industry funding. Freedom of thought, enquiry and publication must be held up as an over-riding priority.

Climate change – an imperative for action

Faced with the threat of climate change, caused primarily by burning hydrocarbons, action is needed to cut emissions of greenhouse gases and reduce our dependence on fossil fuels. Two processes need regulating: extraction of fossil fuels, which unlocks stored hydrocarbons; and burning of those fuels, which releases carbon dioxide into the atmosphere.

The role of higher education

The real significance of the UK industry is in being a:

- **Technology exporter** – the North Sea's difficult fields could only be exploited using new technologies, developed and exported by the UK. The North Sea serves as a *laboratory* for the global industry.
- **Corporate centre** – two of the world's three biggest western oil and gas companies have bases in the UK (BP and Shell). They are dominated by British managers, mostly graduates from UK universities.

By researching into more efficient means of extraction and by providing graduates and training for the industry, universities support the continued dominance of fossil fuels within the energy economy. Universities must stop supporting the causes of climate change and focus on its solution. As independent centres of study, they could lead the debate about restructuring energy economics and developing new technologies.

Many skills developed for the fossil fuel industry are transferable. Offshore engineers could develop offshore wind power infrastructure.

Fluid engineers are needed in wave, tidal and wind power. Materials scientists are needed for structures and electronics (eg. photovoltaic cells). Chemical engineers are required to develop biomass burning, fuel cells and photovoltaic coatings. Geologists could study climate change and its ecological impacts, or search not for hydrocarbons but fresh water – one of this century's most pressing environmental problems.[184]

Bad news for higher education – the short-term approach

Research into expanding fossil fuel production wastes universities' resources, by developing knowledge which will become redundant when policy makers decide to take serious measures against climate change. Justifying research decisions according to their immediate commercial benefit is short-termist and neglects work which could build up useful long-term capabilities.

Industry involvement is concentrated in a few institutions. 60% of oil and gas R&D is carried out in just 11 institutions, and 40% of recruitment is from just four. University departments should avoid dependence on funding from unsustainable industries; and academics should encourage full debate on the consequences of industry funding. Freedom of thought, enquiry and publication must be held up as over-riding priorities.

Public subsidy to the oil and gas industry – a conflict of policy

Over 50% of oil and gas research in universities is fully or partly funded by the public purse. That does not count use of common university facilities and uncharged overheads. This public subsidy is led by the focus on wealth creation, built into the remits of Research Councils. Much of their project funding must be matched by industrial partners, or the projects they help start up must rapidly achieve industrial funding.

Robert Gordon University – Showing potential but must try harder...

Robert Gordon University (RGU), based in Aberdeen, has since the 1970s specialised in serving the oil and gas industry's needs, especially working with oilfield service companies. These are companies which do not own oilfields, but provide contracted services to the companies that do, such as construction, engineering, drilling or geological services. RGU is one of the UK's most important research and training centres for the oil and gas industry.

Its Principal and Vice Chancellor, Prof Bill Stevely, boasts that 'the university has always had a special relationship with the oil and gas industry. It has a substantial history of providing education and training to meet the needs of the industry'[177].

But in the early part of the 21st Century, RGU has begun to show what might be possible in transferring academic skills and resources from oil and gas work to more socially useful activities. Since 2001, RGU has seen itself as 'the Energy University', rather than merely a servant of oil and gas[178].

The School of Engineering has applied its expertise in mechanical and offshore engineering – which was developed to help build oil rigs and platforms – to offshore wind and tidal energy structures. Its expertise in fluid engineering – developed to study the flow of hydrocarbons – is being applied to understand the flow of renewable resources such as wind and water. And its expertise in process, chemical and electrical engineering is shifting to developing photovoltaic panels, fuel cells and integration of renewables into power supply systems.

The Centre for Environmental Engineering & Sustainable Energy is now one of the key research centres in the School[179].

However, while this transfer of research capacity is an important step, it is not enough: the continued research into oil and gas undermines the development of renewable energy technologies. And RGU's School of Engineering still has more staff working on oil and gas than on renewables. The School also continues to work with the more commercial parts of the university. About 40% of RGU's 'business' directly serves the energy sector – mostly in oil and gas[180].

The School of Engineering supports the university's commercial subsidiary, Univation, which has provided training courses to Russian drilling managers, Kazakhstan operators and Shell Nigeria[181], and research consultancy to BP Exploration, Oiltools International and Shell International[182].

The School also works with the Offshore Management Centre (OMC), part of the university's Aberdeen Business School. The Centre was established in 1993 – with sponsorship from Shell Expro, Texaco, AMEC Process & Energy, BHP and others – "to create a knowledge-based resource for managers in the oil and gas industry" [183].

But RGU's first moves in the right direction should be encouraged. The British government could help by funding a rapid expansion of renewable energy technology development – to allow institutions like Robert Gordon to shift *all* of their oil and gas capacity into renewables.

Perversely, the focus on industrial applicability of university research results in a bias towards projects that support bigger industries, where there is more co-funding available and more opportunity for application. As a result, mature industries (eg. oil and gas) are supported over nascent ones (eg. renewable energies).

A rational policy would support nascent industries and leave mature industries to fend for themselves. This would lead to greater competition and meet the public policy objective of preventing disastrous changes to the climate. Yet for the government, 'competitiveness' means not the fostering of an environment of competition, but the creation of mega-players who can win in any competition – in this case, the polluters. It seems that the government's concern over climate change receives lower priority than its concern for the success of big business.

Public money must no longer be used to support an industry which neither needs it nor meets environmental policy objectives. Instead, public subsidies for fossil fuel technologies should be switched to renewable energy. Similarly, government support for training and personnel development must be focused on new industries which provide solutions to climate change.

Accountability and openness

We have had great difficulties in acquiring the information for this report. There are no registers of universities' corporate connections and even where information was available it was not easily accessible and often limited in scope. Since universities exist in the public interest and are largely funded by the public purse, they should be publicly accountable. That means publishing registers of all industrial sponsorship, both research contracts and other aspects of academic life, with a recognition that the protection of the integrity of higher education institutions outweighs considerations of commercial confidentiality.

References

[1] BP Institute website, www.bpi.cam.ac.uk, accessed 15/10/01

[2] Imperial College, Department of Earth Science & Engineering website, http://www.ese.ic.ac.uk/general.php?GenID=40, accessed 28/1/03

[3] Imperial College press release, 18/1/01, 'Imperial College Receives Geoscientific and Reservoir Simulation Software from Schlumberger'

[4] Imperial College press release, 18/9/01, 'Imperial College appoints Pro Rector for Public and Corporate Affairs'

[5] Imperial College press release, 4/7/00, 'Imperial College and BP Amoco form a new alliance'

[6] Imperial College Huxley School website, www.huxley.ic.ac.uk/research/PETROLCENTRE/cpsstaff.html, accessed 6/11/01

[7] *Press & Journal* (Aberdeen), 8/9/99, 'City university committed to North Sea industry', by Jeremy Cresswell

[8] University of Aberdeen news release, 5/9/95, 'University announces oil & gas institute'

[9] *Press & Journal*, 26/5/99, 'University lands hefty grant for offshore research centre', by Jeremy Cresswell

[10] University of Aberdeen, Department of Geology & Petroleum Geology, 'Introduction to the Department', on website, www.abdn.ac.uk/geology/departmental-info.htm, accessed 3/2/03

[11] University of Aberdeen, 'MSc in Petroleum Geology', on website, www.abdn.ac.uk/geology/msc_pg_info.htm, accessed 3/2/03

[12] University of Aberdeen, 'Petroleum Economics', on website, www.abdn.ac.uk/oilgas/petecon.htm, accessed 3/2/03

[13] *Press & Journal*, 3/2/99, 'Blair's history brief for Aberdeen Prof', by Jeremy Cresswell and David Perry

[14] University of Aberdeen, news release, 5/9/95, *op cit*

[15] *ibid*

[16] *ibid*

[17] *ibid*

[18] Heriot-Watt University, 'Postgraduate Studies', on website, www.pet.hw.ac.uk/courses/courses.htm, accessed 10/1/03

[19] Heriot-Watt University, 'General Overview', on website, www.pet.hw.ac.uk/geninfo/geninfo.htm, accessed 10/1/03

[20] Heriot-Watt University, Annual Review 2001, Principal's review of the year

[21] Heriot-Watt University, 2001/2 Postgraduate Prospectus, p.62

[22] Heriot-Watt University, 'General Overview', *op cit*

[23] Heriot-Watt University, 2001/2 Postgraduate Prospectus, p.62

[24] Heriot-Watt University, 'General Overview', *op cit*

[25] Heriot-Watt University, 'Graduate Studies', on website, www.pet.hw.ac.uk/courses/finsupp.htm, accessed 10/1/03

[26] Heriot-Watt University, Postgraduate Prospectus 2003-4, Petroleum Engineering

[27] Heriot-Watt University, 2001/2 Postgraduate Prospectus, p.62

[28] University of Dundee, CEPMLP, 'Postgrad international business studies' on website www.dundee.ac.uk/cepmlp/main/html/business.htm, accessed 3/2/03

[29] University of Dundee, CEPMLP, 2000, Graduate Research Manual, Part I - About the Centre

[30] University of Dundee, CEPMLP, 2000, Graduate Research Manual, Appendix A - The CEPMLP Staff/Information Services

[31] University of Dundee, CEPMLP, 'Peter Davies', on website www.dundee.ac.uk/cepmlp/main/html/davies.htm , accessed 3/2/03

[32] University of Dundee, 'Peter Davies', on website, www.dundee.ac.uk/petroleumlaw/html/davies.htm, accessed 5/2/99

[33] Robert Heinemann (Chief Technology Officer, Halliburton Co), January 2001, 'A brief look forward', guest editorial in the *Journal of Petroleum Technology* (pub Society of Petroleum Engineers)

[34] *Oil & Gas Journal*, 5/7/93, 'Tough economics remold production R&D campaign', by AD Koen, pp.14-18

[35] Centre for Marine and Petroleum Technology (CMPT), 1997, International Petroleum Research Directory (IPRD) (5th edition), ed. Colin Sanderson

[36] *pers. comm.*, Minoo Patel, 5/1/01; Alain Gringarten, 11/1/01; Peter Hooper, 11/1/01

[37] CMPT, 1997, *op cit*. About a third of the projects listed in the IPRD record their cost. We have averaged these costs for each area of study and divided project cost by project duration to get cost per year. We have then multiplied this by the number of projects in each area to arrive at total expenditure.

[38] *ibid*

[39] *Guardian*, 6/5/98, 'Take the money, but check the source', by Donald McLeod, p.18

[40] We assume that the public purse provides on average 35% funding of the joint public/private projects. We further assume that publicly funded projects cost the same, on average, as privately funded ones. Thus we can calculate that public subsidies amount to: (0.35 x 0.23 + 0.52) x £ 67 million = £ 40 million

[41] Office of Science and Technology, 1999, 'Forward Look of Government-funded Science, Engineering and Technology' (pub. HMSO)

[42] Engineering Physical Sciences Research Council (EPSRC), 'New programme in oil and gas extraction – First call for research proposals', on website, www.epsrc.ac.uk/documents/support_for_researchers/calls_for_proposals/enginf/athog1.htm, accessed 8/10/98

[43] EPSRC's research portfolio, industrial sector 'Mining & Mineral Extraction (Energy Producing Matls)' and research area 'oil and gas extraction' on website www.epsrc.ac.uk/epsrcgrants/portfolio.asp, accessed 22/11/01.

[44] CMPT, 1998, 'A report to the Engineering and Physical Sciences Research Council with regard to the establishment of a managed programme in Offshore Oil and Gas'

[45] NERC website, 'Ocean Margin Programme Steering Committee, www.nerc.ac.uk/funding/thematics/oceanmargins/omsteering committee.htm , accessed 2/9/01

[46] NERC / OSO, 1999, 'Making the right connections', report on the Hydrocarbon Reservoirs Programme

[47] NERC, Annual Report, 1999-2000

[48] pers comm, Steve Tampling (Offshore Safety Division, Health & Safety Executive), 13/9/01

[49] *ibid*

[50] CMPT, 1997, *op cit*

[51] *Euroil*, January 1997, 'Meeting the 21st century challenge', by Amanda Battersby, pp.34-36

[52] pers comm, Helen Fairclough (Energie Helpdesk UK), 4/4/01

[53] Archie Dunham, spring / summer 1999, 'Petroleum Companies and the Quest for Graduates Who Make a Difference', Executive Column in *Discovery*, (pub. University of Oklahoma, School of Petroleum and Geological Engineering)

[54] Institute of Petroleum, 'Educational courses of direct relevance to the petroleum industry', page on website, www.petroleum.co.uk/is28.htm, accessed 18/8/01

[55] PILOT Taskforce, Notes of sixth meeting, 25/6/01

[56] Bill Stevely & Steven Hill, February 1998, 'Lifetime learning in oil and gas related courses at Robert Gordon', pp.27-29 in 'Lifetime Learning', special supplement to *Petroleum Review* (pub. Institute of Petroleum)

[57] Institute of Petroleum, 'Other training organisations: professional level and short courses', on website www.petroleum.co.uk/others_train.htm, accessed 19/8/01

[58] Esso video, 2000, 'Graduate opportunities in Esso – a closer look'

[59] Stevely & Hill, February 1998, *op cit*

[60] *Press & Journal* (Aberdeen), 9/5/00, 'Scottish Knowledge leads the way into UAE'; *Scotsman*, 28/4/00, 'Shell to set up e-university', by Victoria Masterson, p.26

[61] *Press & Journal*, 9/5/00, *op cit*

[62] *Sunday Times*, 11/4/99, 'Scots discover global market for learning', by Ricky Dalton

[63] Higher Education Statistics Agency (HESA), 1998, Individualised Student Record 1997/98, First Destinations Supplement 1997/98 (Copyright Higher Education Statistics Agency Limited 2001, reproduced by permission of the Higher Education Statistics Agency Limited).

[64] *ibid*

[65] *Press & Journal*, 8/9/99, *op cit*

[66] PILOT Taskforce, Skills & Training Workgroup, 2001, Supplementary Paper – 'Attract and Retain Graduates and Trainees'

[67] Lloyds List Energy Day23/3/98, Recruitment & Training - 'Strategies for major change', p.10

[68] Independent, 21/3/96, cited in Industry and Higher Education, June '96, Vol.10, #2

[69] Nagelvoort, 1/1/98, *op cit*

[70] Esso video, 2000, 'Graduate opportunities in Esso – a closer look'

[71] BP Institute website, www.bpi.cam.ac.uk , accessed 8/10/01

[72] *Scotsman*, 28/3/00, 'All's well thanks to software for oil companies'

[73] *THES*, 29/8/97, 'Chairs / noticeboard', #1295, p.26

[74] *Press & Journal* (Aberdeen), 22/8/92, 'Oil company shells out', p.7

[75] University of Aberdeen, Department of Geology & Petroleum Geology, 'Staff ', on website www.abdn.ac.uk/geology/staff.htm, accessed 29/11/00

[76] BP Institute website, www.bpi.cam.ac.uk , accessed 8/10/01

[77] *Financial Times* 28/4/98, 'Super-deals put Cambridge on the corporate funding map', by Simon Targett

[78] University of Dundee, CEPMLP, 'Professor Paul Stevens', on website www.dundee.ac.uk/cepmlp/main/html/stevens.htm, accessed 4/2/03

[79] University of Edinburgh, 1991/92, *Bulletin* #3, 'Elf UK supports Safety Engineering'

[80] Imperial College, 2000/01 Annual Report

[81] Imperial College, Department of Earth Resources Engineering, website www.mr.ic.ac.uk/general/staff.html, accessed 8/10/98

[82] Imperial College Huxley School website, www.huxley.ic.ac.uk/research/PETROLCENTRE/cpsstaff.html, accessed 6/11/01

[83] Leeds University, Earth Sciences Department website, http://earth.leeds.ac.uk/people/r_clark.htm, accessed 29/10/01, updated 24/9/01

[84] *THES*, 16/8/96, 'Honorary degrees / noticeboard', # 1241, p.27

[85] *Press & Journal*, 6/10/94, p.19

[86] Royal Holloway, Geology Department website, www.gl.rhbnc.ac.uk/staff/pdf/krm.pdf accessed 29/10/01

[87] UCL Non-destructive Evaluation Centre website, www.nde.meng.ucl.ac.uk, accessed 29/10/01

[88] Imperial College Huxley School website, www.huxley.ic.ac.uk/research/PETENG/Perm/agringarten.htm, accessed 6/11/01

[89] *THES*, 29/8/97, 'Chairs / noticeboard' in #1295, p.26

[90] Warwick Business School website, http://users.wbs.warwick.ac.uk/ccu/mern /tags.pdf, accessed 6/11/01

[91] *THES*, 7/2/97, 'Honorary degrees / noticeboard', #1266, p.30

[92] University of Aberdeen news release, 5/9/95, *op cit*

[93] *THES*, 30/8/96, 'Chairs / noticeboard', #1243, p.24

[94] *THES*, 18/8/95, 'Top ten amplifies 500 years of music in Aberdeen', by Olga Wojtas, #1189, p.6

[95] BP Institute website, www.bpi.cam.ac.uk/, accessed 18/8/01

[96] *Financial Times*, 28/4/98, *op cit*; and *Times*, 29/6/99, 'BP Amoco endows Cambridge institute', by Carl Mortished

[97] University of Cambridge, Department of Chemistry, 'Research profile and strategy', April 1996, on website www.ch.cam.ac.uk/CUCL/Appl/UL97/researchprofile.html, accessed 4/2/03

[98] *Financial Times* 28/4/98, *op cit*

[99] University of Edinburgh, 1993/94, *Bulletin* #5, 'Companies rally to support Centenary Scholarship fund'

[100] DTI & CIHE, 1990, *op cit*

[101] *Press & Journal*, 4/12/91, 'Enterprise donation', p.13

[102] Heriot-Watt University, Annual Report, 1997, p.9

[103] Imperial College press release, 18/1/01, 'Imperial College Receives Geoscientific and Reservoir Simulation Software from Schlumberger'

[104] University of Oxford, Annual Report, 1995-1996, p34

[105] *Press & Journal*, 20/1/93, 'Oil firm sponsors lecture', p.9

[106] Robert Gordon University, Offshore Management Centre, website www.rgu.ac.uk/subj/bms/omc.htm, accessed 9/10/98

[107] UCL Mechanical Engineering Department website, www.meng.ucl.ac.uk/~sf_web/index.html, accessed 29/10/01

[108] University of Wales, Swansea, 'Media Services – audio visual facilities', on website www.swan.ac.uk/media/audiovis.htm, accessed 19/11/01

[109] *THES*, 27/1/95, 'Warwick joins fellowship elite', by Simon Targett, #1160, p.6

[110] Warwick Business School website, http://users.wbs.warwick.ac.uk/ccu/consortium.htm, accessed 6/11/01

[111] *Press & Journal*, 8/9/99, *op cit*

[112] Heriot-Watt University, Annual Report, 1995/96, inside cover

[113] *Scotsman*, 20/4/00, *op cit*

[114] *Press & Journal*, 8/9/99, *op cit*

[115] LINK Steering Group, February 1992, first report

[116] EPSRC, 'Membership of the EPSRC Peer Review College 2000 - 2002, as at 1 October 2000', on website www.epsrc.ac.uk/EPSRCWEB/MAIN/Suppres/Mechanisms/Membership_list.htm, accessed 2/11/01

[117] HEFCE, Annual Report, 1999

[118] Office of Science and Technology, 1999, 'Forward Look of Government-funded Science, Engineering and Technology'

[119] Notes of PILOT 6th Meeting, 25/6/01, opening session on Technology & Innovation

[120] *Financial Times*, 'Oiling wheels of Research', 19/11/93, p.25

[121] BP plc, Annual Report 2000, p.74

[122] *THES*, 10/10/97, 'Checkland aims to open access', by Harriet Swain, #1301, p.4

[123] NERC website, 'Council members' biographies', www.nerc.ac.uk/aboutus/council/Council_biogs/councilbiogs2.shtml, and 'Science and Technology Board membership', www.nerc.ac.uk/funding/board/memberships.html, accessed 2/11/01

[124] Energy Task Force, November 2000, 'Fuelling the Future – A Consultation Paper'

[125] Foresight Programme website, www.foresight.gov.uk/default1024.htm, accessed 2/11/01

[126] AMEC website, www.amec.co.uk/group/mid_b_services.html, accessed 13/6/99

[127] Intergovernmental Panel on Climate Change (IPCC), Working Group I (WGI), January 2001, Summary for Policymakers of Third Assessment Report, p.13

[128] IPCC WGI, January 2001, *op cit*, p.7

[129] Worldwide Fund for Nature, 27/7/01, Analysis of the Bonn political agreement on the Kyoto protocol

[130] pers comm., 8/11/01

[131] BP, 13/2/01, strategy presentation to financial analysts

[132] Department of Trade and Industry (DTI), 'UK Energy in Brief', November 2000, p. 10

[133] Steve Martin, November 1997, 'What factors are driving UK North Sea oil production?', in Oxford Energy Forum, pp.9-11 (pub. Oxford Institute for Energy Studies)

[134] PILOT Taskforce Supplementary Paper, 1999, Innovation & Technology Workgroup Report

[135] UKOOA, 2000, 'Britain's offshore oil & gas'

[136] *BP Statistical Review of World Energy*, 2001; figures for year 2000

[137] *ibid* – reserves: production ratio

[138] *BP Statistical Review of World Energy*, 2001 – reserves

[139] *BP Statistical Review of World Energy*, 2001

[140] DTI consultation paper, March 1999, New & Renewable Energy - Prospects for the 21st Century

[141] Department of the Environment, Transport and the Regions (DETR - now DEFRA), 2000, 'Climate Change Programme', p.29

[142] DTI, 1999, 'New and Renewable Energy: Prospects in the UK for the 21st Century: Supporting Analysis', p.12

[143] DTI, February 2000, 'Renewable Energy: Conclusions in Response to the Public Consultation'

[144] European Commission, Directorate General XVII (EC-DGXVII), 26/11/97, 'Energy for the future: renewable sources of energy - White Paper for a Community strategy and action plan', COM (97) 599 final

[145] United Nations Solar Energy Group on Environment & Development (UNSEGED), 1994, 'Solar energy: a strategy in support of environment and development', in 'Yearbook of Renewable Energies', 1994, p.251, ed H Scheer, M Ghandi, D Aitken, Y Hamakawa & W Palz (pub James & James Scientific Publishers, London)

[146] Rodney Chase, 15/5/00, 'The Value of Knowledge', speech to the FT Conference, Chicago

[147] Royal Commission on Environmental Pollution, 2001, 'Energy – the changing climate'

[148] *Press & Journal*, 8/9/99, *op cit*

[149] pers comm Dave Whyte, 6/11/00

[150] NH Woodcock, 'Geologists and global warming', in *Geoscientist*, vol.1 #6, pp.8-11, 1991 (pub. The Geological Society, Bath)

[151] see for example, Greg Muttitt and Ben Diss, 28/10/01, 'Injecting carbon: an addict's approach', in *Observer* special supplement on climate change (in conjunction with the *Ecologist*)

[152] Centre for CO_2 Technology website, www.chemeng.ucl.ac.uk/co2centre/ accessed 26/10/01

[153] *Guardian*, 6/5/98, *op cit*

[154] *Scotsman*, 4/12/98, 'Spectre of big business hangs over universities', by Ian Smith, p.8

[155] Dr Jennifer Baker, Prof Robert Clark & Dr Paul Kingston, June 1990, 'Environmental Recovery in Prince William Sound and the Gulf of Alaska', commissioned by Exxon, pp.3, 9 (pub. Institute of Offshore Engineering, Heriot-Watt University)

[156] Reuter News Service, 14/6/90, 'Exxon scientists see Alaska oil spill recovery'

[157] Robert Clark, Winter 1991, 'Recovery: the untold story of Valdez spill', in *Forum for Applied Research and Public Policy*, pp. 24-26

[158] *ibid*

[159] *Golob's Oil Pollution Bulletin*, 7/5/93, 'Exxon claims ecosystem has recovered from Exxon Valdez', in vol.V #11

[160] Rick Steiner, 1993, 'Lessons from Alaska for Shetland - lessons from both for the world'

[161] Exxon Valdez Oil Spill Trustee Council, June 1993, 'Exxon Valdez oil spill restoration plan - summary of alternatives for public comment', supplement to draft, Anchorage, B17

[162] Brenda Ballachey & James Bodkin (both of Alaska Fish & Wildlife Research Centre, National Biological Survey, Anchorage), & Anthony De Gange (Marine Mammals Management, US Fish & Wildlife Service, Anchorage), 1994, 'An overview of sea otter studies', in 'Marine Mammals and the Exxon Valdez', ed. Thomas R Loughlin, UK edition, London, p.55 (pub. Academic Press)

[163] Exxon Valdez Oil Spill Trustee Council, June 1993, *op cit*

[164] Exxon Valdez Oil Spill Trustees, April 1992 'Exxon Valdez oil spill restoration - Volume 1 - restoration framework', , pp.31-32

[165] Exxon Valdez Oil Spill Trustee Council, June 1993, *op cit*, B9

[166] Baker, Clark & Kingston, June 1990, *op cit*, p.12 - About the authors

[167] Otto Harrison (of Exxon), 4/3/92, 'Lessons from the Exxon Valdez', lecture to Institute of Petroleum

[168] Fred Pearce, 19/7/97, 'Greenhouse wars', in *New Scientist* vol.155 #2091, p.38

[169] Imperial College, Department of Mathematics, 'Research grants and contracts', on website, www.ma.ic.ac.uk/introduction/Grants2.html, accessed 15/10/98, updated 31/7/98; and 'Current Research in Britain - Physical sciences research', 1997, p. 227 (pub. Cartermill)

[170] Current Research in Britain, 1997, *op cit*, pp.389-390

[171] Greenpeace International, 1996, 'The scourge of the sceptics - industry attacks on the IPCC Second Assessment Report', p.8

[172] Fred Pearce, 25/3/95, 'Fiddling while Earth warms', in *New Scientist* vol.145 #1970, p.14

[173] TML Wigley, R Richels, JA Edmonds, 18/1/96, 'Economic and environmental choices in the stabilisation of atmospheric CO_2 concentrations', in *Nature* vol.379 #6562, pp.240-243

[174] quoted in *Philosopher's Magazine*, 7/3/00, 'Peter Singer – Ethics in the age of evolutionary psychology', by Francis Steen

[175] Warwick Business School website, http://users.wbs.warwick.ac.uk/ccu/publications/visions.htm, accessed 6/11/01

[176] Chris Marsden, November 1998, 'Citizenship plc', in *Insights* #28 (pub ID21, University of Sussex)

[177] Stevely & Hill, February 1998, *op cit*

[178] Robert Gordon University press release, 16/8/01, 'RGU - The Energy University'

[179] Robert Gordon University, School of Engineering website, www.rgu.ac.uk/eng/, accessed 4/2/03

[180] Robert Gordon University press release, 16/8/01, *op cit*

[181] Stevely & Hill, February 1998, *op cit*

[182] Univation, 'Contract research and consultancy', on website http://univation.rgu.com/main/services/consult1.htm, accessed 4/2/03

[183] Offshore Management Centre, 'About the Offshore Management Centre', on website www.omc.rgu.ac.uk/about/about.htm, accessed 4/2/03

[184] see Nigel Woodcock, 1991, *op cit*

[a] 'Institutional capture' is defined by Peter Utting of the United Nations Research Institute for Social Development (UNRISD) as the situation where 'corporate interests come to dominate or heavily influence the decision-making processes of public-interest institutions' [Peter Utting, January 2000, 'Business responsibility for Sustainable Development', UNRISD Occasional Paper #2, Geneva]

[b] There are two main streams of government funding for universities' research: through research councils, which mostly fund specific research projects, and through the higher education funding councils, which provide core, untied support to build up universities' general capacity

[c] Taking into account the rate of growth of consumption, currently known reserves of oil and gas together would last about 40 years. Note that reserves of coal, in contrast, are sufficient to last for far longer

This report is a collaboration between Corporate Watch, PLATFORM and the New Economics Foundation

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