UKERC

UKERC ENERGY RESEARCH LANDSCAPE: OIL AND GAS

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The information contained in this landscape is a snapshot of activity at the date shown – for the most up-to-date information, the reader is advised to carry out a search of the whole UKERC Research Atlas using the interface at http://ukerc.rl.ac.uk/cgi-bin/ercri9.pl
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1. Overview

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Characterisation of the Field

Oil and gas production from the UK continental shelf (UKCS) contributed over £32 billion to the balance of payments operations (2010 data[1],[2]) with further contributions from oil field goods and services (c. £6 billion) and electricity/gas/water supply activities (£20 billion).

In addition to exploration and production activities, the oil and gas sector extends to refining, transmission and distribution of gas, power generation and fuel for transportation. The oil and gas activities are integral with and a major component of the UK economy. The UK has hundreds of businesses in the oil and gas supply chain and is also the base for a few global operators (e.g. BP, Shell, BG Group). The global nature of oil and gas pricing ensures that the sector faces both domestic and international competition.

RD&D expenditure in the oil and gas sector is several billion dollars per annum (although for most oil and gas majors the R&D budget represents less than 1% of revenues). Funding routes are through in-house research centres, partner schemes with government bodies (BIS, DECC, TSB etc.) and industry partnerships such as Industry Technology Facilitator (ITF), who issue funding calls for new research proposals (see http://www.itfenergy.com).

Oil and gas research covers a wide range of science and engineering disciplines. Although a reasonably mature industry sector, oil and gas research encompasses both fundamental studies (mathematics, physics, chemistry, biology and geosciences) and technology developments. The field is characterised by interdisciplinary research topics or themes, often organised in multi-disciplinary research centres.

Within the industry, activities are generally viewed as part of the three broad portions of the supply chain of upstream, mid-stream and downstream operations. The upstream focus is on exploration and production activities and mid-stream covers refinery and bulk transportation. Within the downstream segment, activities include, fuel consumption, combustion, and the distribution of gas and fuel products to a variety of markets.

The research landscape for "Oil and Gas" in relation to the Research Atlas is presented as a single sector of the Fossil Fuel research area with sub-topic categories: Enhanced oil and gas production; Refining, transport and storage of oil and gas; Non-conventional oil and gas production; Oil and gas combustion; Oil and gas conversion; Other oil and gas.

The UKERC Research Register records grant-funded activity divided into research types of: Basic and Strategic Research; Applied Research and Development; and, Final Stage Development and Demonstration.

Fundamental research projects address aspects of the oil and gas supply chain from the performance of hydrocarbon reservoirs to the combustion of fuels in the transport, industrial and domestic market sectors.

Research inputs to the area of Enhanced Oil and Gas Production are dominated by geosciences (Earth Systems, geology, geochemistry

[1] As reported by Oil & Gas UK, http://www.oilandgasuk.co.uk/economics.cfm, download August 2012

[2] Original data can be found at Office of National Statistics website, http://www.statistics.gov.uk

etc.) and petroleum engineering in the study of hydrocarbon reservoirs.

Much of the research activity is underpinned by mathematics, physics and computing with the need for measurement and modelling developments in all areas.

The field of Engineering and Technology contributes to the other sub-topic categories with chemical and mechanical engineering disciplines featuring widely with research topics of fluid flow, petrochemical processing and combustion.

In addition, energy efficiency and environmental themes are pursued in relation to Oil and Gas Combustion.

A particular feature of the Oil and Gas field is the number of institutions offering post-graduate taught courses specialising in petroleum industry subject matter. This reflects the size and international nature of the industry.

Research Challenges

The underlying demand for energy in the emerging economies, and energy efficiency in the mature economies, subject the oil and gas industry to policy and legislative factors as governments seek to develop economic strategies, secure and diversify energy supplies and address environmental issues.

Oil and gas accounts for about 75% of the UK energy supply and the UKCS is still producing a considerable portion of the supply. The UKCS reserves are in decline and the importation of gas, and to a lesser extent oil, are forecast to increase. To counter this, new reserves are required from a number of activities, namely: increasing the recovery from existing fields; developing new discoveries which have yet to be properly appraised; addressing resources which are not technically or economically possible currently; and exploring for new fields in deep sea locations. In addition, shale oil/gas production presents an opportunity to re-establish national hydrocarbon self-sufficiency.

Research in geosciences and field production technology lead to a better understanding of field performance and can improve the economic viability of marginal hydrocarbon resources. Reservoir characterisation and modelling expertise are critical for these developments. Such resources obtained from more technically challenging locations would have a greater reliance on new materials and equipment for remote operation and require a reliable instrumentation and control system. Deep water locations set a challenge for sub-sea production with water separation and waste management, sub-sea power and product extraction by means of longer sub-sea collecting pipelines.

Globally, there is a growing concern about fuel diversity and security of supply, particularly with regard to oil and natural gas. At the same time, global demand for oil has been increasing significantly due to the economic development of China and India. The continued reliance on oil and gas within [western] developed economies drives research in alternative/renewable energy sources and energy efficiency (in supply and fuel use) to combat price effects and climate change risk.

Security of supply is also a strong driver for the development of domestic shale oil/gas resources that could, according to some forecasts, re-establish national energy security with low-cost supplies albeit undermining the development of renewables in market terms and raising additional environmental issues.

Shale gas exploitation relies on the techniques of horizontal drilling and "fracking" (the fracturing of the hydrocarbon bearing strata). The potential environmental impact of this activity may stimulate research topics in the reservoir behaviour modelling, induced seismology and water treatment in the production process. In addition, maximising recovery of hydrocarbon or other useful resources (such as helium)

from small production streams may stimulate new technology development in gas processing.

The Oil and Gas industry in the UK relies on many science and engineering disciplines to maintain safe, reliable and efficient operations that can sustain its competitive position worldwide. RD&D is required from fundamental to near market demonstration and proving levels.

For basic and applied strategic research, the range of disciplinary inputs includes physics, chemistry, mechanical and electrical and civil and marine engineering, materials science, combustion and chemical engineering and mathematics. Modern oil and gas operations are data intense and the nature of technological applications requires that developments are supported by multi-disciplinary research.

Much of the research in the oil and gas sector has traditionally been undertaken by the companies themselves and with a strong commercial focus on applied research and product and equipment development. There is industry interaction with many universities, on many basic research topics, and a major challenge for the research community is to position their skills and expertise to expand their opportunities in applied research for this industry sector.

2. Capabilities Assessment

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UK RD&D is well placed to make significant innovations in relation to the Oil and Gas sector. Ably supported by all disciplines in the engineering and science communities and a track record in some fundamental sciences of industrial relevance, such as combustion, materials, fluid dynamics and heat transfer processes, the potential for research Impact is high. In addition, the many years of North Sea oil and gas activity has created a wide ranging expertise of engineering and technology firms which undertake product development in exploration, production (including sub-sea systems), process analysis and controls and instrumentation.

Table 2.1 Capability Assessment

UK Capability	Area	Market potential
High	Combustion systems, fuel research and engine research/design	Global – continuous time frame
High	Drilling	Global – continuous time frame
High	Technical consultancy	Global
High	Process integration, Process performance and Energy efficiency	Global – continuous time frame
High	Subsurface geological and geophysical and engineering (seismic and structural investigations, basin and thermal modelling, and reservoir simulation)	World-leading offshore hydrocarbon techniques – short and medium term
High	Enhanced Oil Recovery (mechanical engineering and geo-engineering)	Major firms support research but many smaller operators utilise the techniques in the North Sea. Global market
High	Onshore pipes Offshore pipes	Methane established technology UK subsidiaries of global companies
High	Turbines (gas and steam) in process plant	Two/more world leading companies
High	Marine structures, design and engineering, wave loading and sedimentology	Global
Medium	There is a wide range of medium to high capability across a number of the process engineering capabilities: Separation processes and membrane technology Thermodynamics of power and process plant Instrumentation (process measurement and control)	UK/European companies with global market
Medium	Advanced materials for process applications. A medium to high capability which includes chemistry and chemical engineering.	Global market – short and medium term

3. Basic and strategic research

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Research and development funding by UK oil and gas producers was about £1,000 million in 2009[3]. Details of R&D investment may be gleaned from the annual reports of oil and gas sector companies but the details of UK funded projects are not readily available. To extend the UKERC Research Register to encompass all sources of funding and commercial project details would require a major information gathering exercise to glean all local or international contracted research topics from the universities and institutions.

The funding analysis of Table 3.1 is limited to UK government bodies and the key research providers listed in Table 3.2 are those institutions currently included in the UKERC Research Register with grant funded projects since January 2007 to August 2012.(It should be noted that the staff data listed in the "No of Staff" column refers to staff who can be identified as working on Oil and Gas research, whereas the staff numbers listed within the "Description column refer to the size of the Department/Team.)

Most basic and strategic research listed in the Register is conducted by university departments and only a small percentage of grants (since 2007) are conducted through research institutes. The majority of basic research activity (about 82% of grants) is provided by EPSRC through a number of its research themes and over 16% (by number of grants) is funded by NERC. Although some grant funding is included in programmes such as SAMULET or SUPERGEN, Oil and Gas research is not contained in one research theme or programme but is characterised by activities that are related across a number of themes. For example, the research activity funding is generally attributable to EPSRC themes of Energy, Engineering, Mathematical sciences and Physical sciences.

Much of the funding in Oil and Gas maintains the expertise and fundamental research ("enabling" disciplines such as numerical modelling and fluid dynamics) in support of developments in this sector and some new research activities, especially in biology and chemistry multidisciplinary topics, seek to grow research fields.

Of the 180 to 190 projects, research activities are spread between 47 universities and institutes with particular research undertaken by over 90 departments or research centres within the universities organisational structures. The nature and range of the research topics, or sub-themes, is delivered by means of collaborative groupings by discipline, sub-topics and expertise involving a number of institutes. It is also not possible to define the number of researchers in any department that are solely engaged in oil and gas research topics. The institutions that clearly identify centres for the oil and gas sector are: Heriot-Watt University Institute of Petroleum Engineering, University of Aberdeen Geology and Petroleum Geology, and University of Nottingham Division of Fuels and Power Technology.

Although the research in the Oil and Gas category is wide ranging it falls in the general themes of geosciences, process performance and efficiency, and environmental impact (combustion and emissions). The research may, however, be grouped into the general topics of:

- Hydrocarbon reservoir related research for resource extraction performance or gas storage: geosciences, geology, geochemistry, seismology, seismography
- Marine: wave loading, structural engineering and sedimentology,

[3] "The 2010 R&D Scoreboard: The Top 1000 UK and Global Companies by R&D Investment" Department for Business, Innovation & Skills, 2010

- Process performance and energy efficiency: fuel research and combustion, tribology, energy modelling, asset life time analysis, automotive engines, drilling, hydrocarbon processes
- Fundamental Enabling topics in support of other activities: fluid flow/dynamics, numerical modelling, energy research capacity, data and information systems
    - Instrumentation and measurement, gas spectroscopy
    - Materials: strength of materials, corrosion, non-destructive evaluation, membrane technology

A characteristic of projects in the Oil and Gas category within the Register is that they are shared across a number of categories that have their own Landscape. These research topics may be summarised in the activities of:

- CO_2 capture, emissions, environmental monitoring, pollution
- Electricity generation and energy infrastructure
- Policy and economics and social science related topics.

Table 3.1: Research Funding

Programme	Funding Agency	Description	Committed Funds	Period	Representative Annual Spend
SAMULET (II)	EPSRC/TSB	SAMULET (Strategic Affordable Manufacturing in the UK through Leading Environmental Technologies) is a Rolls-Royce-led collaborative programme to accelerate the development of manufacturing and product technologies. SAMULET II - Government investing £25 million, with business providing a further £40 million for a series of collaborative research and technology projects. Related interest (small) in Oil and Gas Combustion.	£25M Govt plus £40M Rolls-Royce	2012 onwards	
SUPERGEN 2	EPSRC	Conventional Power Plant Life Extension SUPERGEN 2. The development of novel tools and methodologies to extend the life of existing conventional (ageing) steam and combined cycle power plant. The total package is £4.2 million for the period 2008 to 2012. The Oil and Gas related interest is undefined (small) under fossil fuels and Oil and Gas Combustion.	£4.2M	2008-2012	
Responsive Mode	EPSRC	EPSRC Responsive Mode funding: Mathematical and Physical Sciences		on-going	
Environment and Energy	ESRC	Policy related research – responsive mode. Related interest (small) in Enhanced Oil Recovery and Non-Conventional Oil and Gas Production		on-going	
Programmes	NERC	NERC responsive mode. Although there are no "oil and gas" programmes small components of funding is noted for two areas:		on-going	

		1) Enhanced Oil and Gas Production – mainly geosciences for reservoir performance. 2) Other Oil and Gas – seismic and geosciences (also reservoir related)			

Table 3.2: Key Research Providers

Name	Description	Sub-topics Covered	No of staff	Field
British Geological Survey (BGS)	British Geological Survey (BGS) is the world's oldest national geological survey and provides expert services and impartial advice in all areas of geoscience to public and private sector clients. Energy Sector research themes include: Advanced seismic techniques CO2 capture and storage Renewables and energy security NERC Science Programmes Director	• OIL and GAS • Geosciences, Geology	>5	PHYSICAL SCIENCES and MATHEMATICS - Physics
Brunel University, School of Engineering and Design	The School cites research for fundamental and applied research in many areas of: electronic and computer engineering; mechanical and aerospace engineering; design; advanced manufacturing engineering and management and civil and built environment engineering. Research is oil and gas combustion is ably supported in the two groups of: Centre for Advanced Powertrain and Fuels Research (CAPF); Centre for Energy and Built Environment Research (CEBER) >10 faculty, > 10 researchers, >20 research students	• OIL and GAS COMBUSTION • Fuel research and combustion		PHYSICAL SCIENCES AND MATHEMATICS - Chemistry ENGINEERING AND TECHNOLOGY – General Engineering and Mineral & Mining Engineering; Mechanical, Aeronautical and Manufacturing Engineering
Cardiff University, Chemistry	The School of Chemistry research strengths are: surface science, catalysis, chemical biology, solid-state/materials chemistry, physical organic chemistry, synthesis and theoretical chemistry. New initiatives in Chemical Biology, Structural Biology, Catalysis, Solid-state and Materials Chemistry, and Physical Organic Chemistry. Facilities are available for research in surface science, catalysis, magnetic resonance, X-ray diffractometry, mass spectrometry, spectroscopy,	• OIL and GAS • OIL and GAS CONVERSION • Fuel research		PHYSICAL SCIENCES AND MATHEMATICS - Chemistry

Name	Description	Sub-topics Covered	No of staff	Field
	and calorimetry, high-performance computing and chemical biology. >30 academic staff >30 research staff >10 PhD students			
Cardiff University, School of Earth and Ocean Sciences	Research is organised into three distinct Groups: - Climate and Life Palaeoclimate and Climate Systems Research Group Palaeobiology Research Group - Environmental Science and Policy Geomicrobiology Research Group Applied Environmental Geoscience Research Group Earth Surface Processes Research Group Marine and Coastal Environment Research Group - Solid Earth Processes Magmatism and Metallogenesis Research Group Computational Geodynamics Research Group 3D Seismics Research Group Facilities include: trace element and stable isotope geochemistry, geomicrobiology, particulate analysis, electron microscopy, 3D seismic interpretation and visualization, and parallel computing, and marine science. >50 faculty, >10 research staff, >10 PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Reservoir • Geology		ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
Cardiff University, School of Engineering	Research themes of Aerospace, Digital Economy, Transport, Materials and Nano science are developed in multidisciplinary research institutes of: - BRE Institute of Sustainable Engineering - Institute of Energy - Institute of Environment and Sustainability	• OIL and GAS • OIL and GAS COMBUSTION • OTHER OIL and GAS		PHYSICAL SCIENCES AND MATHEMATICS - Metallurgy and Materials ENGINEERING AND TECHNOLOGY - Electrical and

Name	Description	Sub-topics Covered	No of staff	Field
	- Institute of Green Electronic Systems - Communications, Sensors and Materials - Institute of Mechanical and Manufacturing Engineering - Institute of Mechanics and Advanced Materials - Institute of Medical Engineering and Medical Physics >15 faculty, >15 research staff, >10 PhD students			Electronic Engineering - Chemical Engineering
City University, School of Engineering and Mathematical Science	Research activities focus on fields such as energy and the environment, instrumentation, construction processes, applied mathematics, systems and control and biomedical engineering. Research Centres are: Energy & Transport Centre Instrumentation & Sensors Centre Systems & Control Centre Construction Processes Centre Applied Mathematics Centre Energy research themes include: Internal Combustion Engines; Computational Fluid Dynamics; Alternative Energy Systems & Combustion Research; Positive Displacement Compressors; Small Turbo-Compressors, Viscous Flows and Flow Control for Aeronautical and Wind Engineering; Fixed and Rotary Wing Aeronautical Design. >10 faculty, >5 research staff, <5 PhD students	• OIL and GAS • OTHER OIL and GAS • Fluid Flow		PHYSICAL SCIENCES AND MATHEMATICS- Applied Mathematics ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
Cranfield University, School of Applied Sciences	The School is organised in three departments, each comprising a number of specialist centres or institutes: - Manufacturing Department	• OIL and GAS • OTHER OIL and GAS		SOCIAL SCIENCES - Town and Country Planning - Sociology

Name	Description	Sub-topics Covered	No of staff	Field
	- Materials Department (includes: Composites Centre, Precision Engineering Institute, Welding Engineering and Laser Processing Centre) - Environmental Science and Technology Department (includes Centre for Automotive Technology, Centre for Energy and Resource Technology, Centre for Environmental Risks and Futures) >30 faculty, ? researchers, >5 PhD students			ENGINEERING AND TECHNOLOGY - Electrical and Electronic Engineering - Civil Engineering - Mechanical, Aeronautical and Manufacturing Engineering
Cranfield University, School of Engineering	Oil and Gas sector research is supported in a number of departments: - Offshore Engineering and Naval Architecture Group (OENA) e.g. offshore platforms. - Offshore Technology and Subsea Engineering, e.g. materials and corrosion, reliability of subsea systems and components. - Power and Propulsion Department - Process Systems Engineering Group (PSE), e.g. process systems engineering, multiphase flow and bio-fuels. >10 faculty, >5 researchers, >10 PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • OIL and GAS COMBUSTION • OTHER OIL and GAS • Fluid Flow • Gas spectroscopy		PHYSICAL SCIENCES AND MATHEMATICS - Physics ENGINEERING AND TECHNOLOGY - Electrical and Electronic Engineering - Mechanical, Aeronautical and Manufacturing Engineering
Durham University, Department of Earth Sciences	The Department provides 5 undergraduate Honours degree programmes: Geology; Geoscience; Earth Sciences; Environmental Geosciences; Geophysics with Geology. Major research units, the Northern Centre for Isotopic and Elemental Tracing and the Centre for Research in Earth Energy Systems, enable the research of interconnected Earth processes.	• OIL and GAS • OTHER OIL and GAS • Seismography, Numerical modelling	>20 faculty, >30 research staff, >50 PhD students	ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences

Name	Description	Sub-topics Covered	No of staff	Field
Heriot-Watt University, Institute Of Petroleum Engineering	Research activity ranges from exploration, through reservoir appraisal and development, to production technology. In addition, research extends into the whole energy sector and related environmental issues. There are 12 distinct research themes, each represented by an interactive grouping of academic/research staff and postgraduate research students, and the inter-disciplinary nature of much research spans the exploration, development and production. Research themes and leads Petroleum Geoscience Unconventional Reservoirs Carbonate Reservoirs Reservoir Geophysics Multiscale Modelling and Flow Simulation Uncertainty Quantification Production Chemistry/Scale Centre for Enhanced Oil Recovery and CO2 Solutions Hydrates, Flow Assurance & Phase Equilibria Production Technology Marine Renewables Carbon Capture & Storage	• OIL and GAS • OTHER OIL and GAS • Gas storage	>30 faculty, >20 research staff, >50 PhD students	ENGINEERING AND TECHNOLOGY - General Engineering and Mineral & Mining Engineering - Earth Systems and Environmental Sciences
Heriot-Watt University, School of Mathematical and Computer Science	The School comprises three Departments of: - Actuarial Mathematics & Statistics - Computer Science - Mathematics Research activity encompasses both Mathematical and Computer Sciences. >50 academic/research staff, >50 PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Reservoir/Numerical Modelling		PHYSICAL SCIENCES AND MATHEMATICS - Applied Mathematics ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
Imperial College	The department undertakes fundamental aerospace	• OIL and GAS	>20 academic	ENGINEERING AND

Name	Description	Sub-topics Covered	No of staff	Field
London, Department of Aeronautics	research and maintains collaborative links with Industry. Research is managed through the two sections, Aerodynamics and Aero structures, that cover a range of topics: - Fundamentals of flow - Aerospace vehicle design, aerodynamics and performance - Environmental and industrial flows - Biomedical flows - Control, dynamics and optimization - Flow Control - Turbulence, mixing and flow control - Computational mechanics - Impact of composites - Damage tolerance >20 academic staff, >20 research staff, >10 PhD students	• ENHANCED OIL and GAS PRODUCTION • REFINING, TRANSPORT and STORAGE of OIL and GAS • OIL and GAS COMBUSTION • Fluid dynamics	staff, >20 research staff, >10 PhD students	TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
Imperial College London, Department of Chemical Engineering and Chemical Technology	Departmental expertise in mathematical analysis and modelling as well as in experimental investigation and measurement support all areas of fundamental research in addition to work with the Chemicals, Oil and Gas, Pharmaceuticals and Processing Industries. Research is described in themes of: Our research is centred on six Research Themes: Biological Engineering Natural Resource Engineering Fluids Engineering Particle and Materials Engineering Process Systems Engineering Reaction and Separation Engineering	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • OIL and GAS COMBUSTION • Fluid Flow • Membrane technology • CO2 capture	>30 academic staff, >40 research associates, >20 PhD students	ENGINEERING AND TECHNOLOGY - Chemical Engineering - Mechanical, Aeronautical and Manufacturing Engineering
Imperial College London, Department of Civil and	Research is organised in six main centres: Environmental and Water Resources Engineering Fluid Mechanics	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION		ENGINEERING AND TECHNOLOGY - Civil Engineering

Name	Description	Sub-topics Covered	No of staff	Field
Environmental Engineering	Geotechnics Structures Transport Laing O'Rourke Centre (Systems Engineering and Innovation) >30 faculty, >40 researchers, >50 PhD students	• Wave load on structures		
Imperial College London, Department of Earth Science and Engineering	The Department combines the fields of geoscience and engineering. Geoscience includes the study of the solid Earth but also the atmosphere, oceans and biosphere. Research is organised in three main sections: Earth & Planets; Petroleum Geoscience & Engineering; Energy, Environment, Modelling & Minerals. Twelve specialist groups compliment the research portfolio which is supported by fundamental disciplines: Geology, Geophysics, Environmental Geoscience, Petroleum Geoscience, Petroleum Engineering, Petroleum Geophysics, Metals and Energy Finance, Remote Sensing.	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Energy Research Capacity	>60 academic staff > 50 research staff >100 research students	ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences SOCIAL SCIENCES - Education PHYSICAL SCIENCES AND MATHEMATICS - Chemistry - Physics ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
Imperial College London, Department of Mechanical Engineering	Research activities in Mechanical Engineering are split into three divisions: Applied Mechanics: Mechanics of Materials Thermofluids >60 academic staff, >40 research staff, >50 research students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • REFINING, TRANSPORT and STORAGE of OIL and GAS • OIL and GAS COMBUSTION • Corrosion		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering

Name	Description	Sub-topics Covered	No of staff	Field
		• Non-destructive evaluation • Materials strength • Fuel research and combustion • Tribology		
Imperial College London, Department of Mathematics	Research sections Applied Mathematics and Mathematical Physics Pure Mathematics Mathematical Finance Statistics Research activities include Dynamical Systems at Imperial College Fluid Dynamics Group and Stochastic Analysis Group >60 academic and research staff, >60 research students	• OIL and GAS • OIL and GAS COMBUSTION • OTHER OIL and GAS • Fluid Dynamics • Numerical modelling • Emissions		PHYSICAL SCIENCES AND MATHEMATICS - Applied Mathematics ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
Keele University, School of Computing [Computer Science] and Mathematics	Research in the School is focused in three main areas: Applied Mathematics Computer Science Applied Probability, Operational Research, and Statistics In Applied Mathematics, the research includes fluid dynamics and wave theory, with particular emphasis on geophysical fluid dynamics. >15 academic staff, <5 researchers, >10 post-graduates	• OIL and GAS • OIL and GAS COMBUSTION • Fuel research and combustion		PHYSICAL SCIENCES AND MATHEMATICS - Computer Science and Informatics
Kingston University, Faculty of Science, Engineering and Computing	The Faculty aims to encourage interdisciplinary research across its 8 teaching schools via research centres of: Centre for Earth and Environmental Science Centre for Fire and Explosion Studies Digital Imaging Research Centre (DIRC) Materials Research Centre	• OIL and GAS • OIL and GAS COMBUSTION • Fuel research • Emissions • Fluid dynamics	>25 academic/research staff, <5 PhD students	ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering

Name	Description	Sub-topics Covered	No of staff	Field
	Mobile Information and Network Technologies (MINT) Sustainable Technology Research Centre Specific research is focused via 18 research groups.			
Lancaster University, [School of] Computing [and Communications]	The School's research output spans five major sub-fields of: Communications and Networking Computer Systems Intelligent Systems Software Engineering Human-Computer Interaction >20 academic staff >20 researchers, ? PhD students	• OIL and GAS • OTHER OIL and GAS • Energy modelling		PHYSICAL SCIENCES AND MATHEMATICS - Computer Science and Informatics ENGINEERING AND TECHNOLOGY - Electrical and Electronic Engineering - Mechanical, Aeronautical and Manufacturing Engineering - Architecture and the Built Environment
Loughborough University, Aeronautical and Automotive Engineering	Research in the Department is organised into four research groups: Applied Aerodynamics Control and Reliability Low Carbon Technologies Structural Mechanics and Acoustics Research topics cover aerodynamics, control systems, engines and fuel cells, lightweight structures and vehicle refinement.	• OIL and GAS • OIL and GAS COMBUSTION • Fuel research • Energy efficiency		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering

Name	Description	Sub-topics Covered	No of staff	Field
Loughborough University, Department of Materials, [Inst of Polymer Tech and Materials Eng]	Research in the Department is organised into 4 research groups: Energy Materials Advanced Ceramics Surface Engineering Advanced Polymers >20 faculty, >20 researchers, >50 PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Asset lifetime analysis		PHYSICAL SCIENCES AND MATHEMATICS - Metallurgy and Materials ENGINEERING AND TECHNOLOGY - Electrical and Electronic Engineering - General Engineering and Mineral & Mining Engineering - Mechanical, Aeronautical and Manufacturing Engineering
Loughborough University, School of Mechanical and Manufacturing Engineering	Research programmes are undertaken within the School's 10 research groups including Thermofluids and Combustion >30 faculty, >40 researchers, ? PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Fuel research • Automotive engines • Emissions		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
Manchester Metropolitan University, School of Computing, Mathematics and Digital Technology	Research in the School is distributed across the following active groups: - Centre for Mathematical Modelling and Flow Analysis (CMMFA) - Future Networks and Distributed Systems (FUNDS) - Image and Sensory Computation Group (ISCA) - Intelligent Systems Group (ISG) - Logic and Computation Group (LCG)	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Fluid dynamics • Wave load on structures		PHYSICAL SCIENCES AND MATHEMATICS - Applied Mathematics

Name	Description	Sub-topics Covered	No of staff	Field
	- Novel Computation Group (NCG)			
Manchester Metropolitan University, School of Science and the Environment [Environmental and Geographical Sciences]	The integrated school is able to develop and enhance teaching and research synergies from across the disciplines of Biology, Chemistry, Forensic Science, Ecology, Environmental Science, Geography and Sustainability. School Divisions - Division of Biology and Conservation Ecology - Division of Chemistry and Environmental Science - Division of Geography and Environmental Management Geography and Environmental Management is a multidisciplinary division with expertise in geography, physical geography, human and cultural geography, environmental management, sustainability, Geographical Information Systems (GIS) and remote.	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Fluid dynamics • Wave load on structures	>5 faculty, >5 researchers, ? PhD students	ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
Max Planck Institute for Dynamics and Self-Organization, Complex Dynamics and Turbulence	Research Focus: - Fluid Dynamics, Pattern Formation and Nanobiocomplexity - Dynamics of Complex Fluids - Nonlinear Dynamics	• OIL and GAS • REFINING, TRANSPORT and STORAGE of OIL and GAS • Fluid dynamics		PHYSICAL SCIENCES AND MATHEMATICS - Physics - Applied Mathematics ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
Newcastle University, School of Civil Engineering and Geosciences	Research activities are organised in six groups: Environmental Engineering Geomatics Geosciences Geotechnical and Structural Engineering Transport	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • NON-CONVENTIONAL OIL and GAS PRODUCTION		PHYSICAL SCIENCES AND MATHEMATICS - Computer Science and Informatics BIOLOGICAL AND AGRICULTURAL

Name	Description	Sub-topics Covered	No of staff	Field
	Water >20 academic staff >20 research staff >20 PhD students	• OTHER OIL and GAS • Reservoirs • Marine engineering • Environmental monitoring • Geochemistry • Energy infrastructure		SCIENCES - Biological Sciences ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences ENGINEERING AND TECHNOLOGY - General Engineering and Mineral & Mining Engineering - Mechanical, Aeronautical and Manufacturing Engineering - Electrical and Electronic Engineering - Civil Engineering - Architecture and the Built Environment
Newcastle University, School of Chemical Engineering & Advanced Materials	Research Themes: - Chemical Engineering Science - Measurement and Analysis - Products and Processes - Natural Resources >20 faculty, >20 researchers, ? PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Membrane technology		PHYSICAL SCIENCES AND MATHEMATICS (Chemistry) 33%; PHYSICAL SCIENCES AND MATHEMATICS (Metallurgy and Materials) 33%; ENGINEERING AND TECHNOLOGY (Chemical Engineering) 34%;
Open University, Mathematics, Computing and Technology –	New technologies in health, agriculture and energy. DPP research focuses on these key drivers of change.	• OIL and GAS • OTHER OIL and GAS • Policy and economics		SOCIAL SCIENCES - Politics and International Studies - Development Studies

Name	Description	Sub-topics Covered	No of staff	Field
International Development [Development Policy and Practice]				AREA STUDIES - Middle Eastern and African Studies - Asian Studies
Open University, Materials Engineering	Research is based around core expertise in Structural Integrity (safe design and assessment of components and structures under load). Other research groups: - Solder Research Group; - Forensic Engineering Group; - Surface Engineering Research Group. >5 academic >5 research >10 PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Materials strength • Structures		PHYSICAL SCIENCES AND MATHEMATICS - Metallurgy and Materials ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
Queen Mary, University of London, School of Engineering and Materials Science	Research is coordinated within the following research areas: Biomedical Engineering and Materials Modelling and Simulation in Engineering Systems Functional Nanomaterials Research fields include thermodynamic principles, combustion and condensation heat transfer, electrospray technology and medical engineering. >40 academic >20 research staff ? PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Fuel research • Emissions		ENGINEERING AND TECHNOLOGY - Chemical Engineering - Mechanical, Aeronautical and Manufacturing Engineering
Queen Mary, University of London, School of Mathematical Sciences	Research is organised in three groups covering topics in: - Applied Mathematics - Pure Mathematics - Statistics Research collaborations with the departments of Engineering, Electronic Engineering and Computer Science, Physics, Biology, and the Astronomy Unit.	• OIL and GAS • OTHER OIL and GAS • Fluid dynamics		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering - Electrical and Electronic Engineering PHYSICAL SCIENCES

Name	Description	Sub-topics Covered	No of staff	Field
	40 faculty, ? researchers, ? PhD students			AND MATHEMATICS - Applied Mathematics
Royal Holloway, University of London, Department of Earth Sciences	Research interests include: environmental geoscience, geochemistry and geophysics, magmatic processes, palaeobotany, and structural and sedimentary geology. Research activities are divided into three main themes of Global Environmental Change (GEC), Geodynamics & Sedimentary Systems (GSS) and Physics & Chemistry of Earth Processes (PCEP). These topics also entail collaborative links with the petroleum geosciences industries. >20 academic >5 research >5 PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • NON-CONVENTIONAL OIL and GAS PRODUCTION • Reservoirs		ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
Sheffield Hallam University, Materials and Engineering Research Institute	Research topics range from semiconductors to concrete and from theoretical modelling to industrial applied coatings. Specific activity in the fields of: Advanced coatings Automation and robotics Corrosion and structural integrity HIPIMS Infrastructure management Materials analysis Materials modelling and complex flows Polymers and nanocomposites Sustainability and process simulation >10 faculty, >10 researchers,	• OIL and GAS • OTHER OIL and GAS • Materials		SOCIAL SCIENCES - Business and Management Studies BIOLOGICAL AND AGRICULTURAL SCIENCES - Biological Sciences PHYSICAL SCIENCES AND MATHEMATICS - Metallurgy and Materials ENGINEERING AND TECHNOLOGY - Chemical Engineering

Name	Description	Sub-topics Covered	No of staff	Field
	? PhD students			
UK Energy Research Centre	Technology and Policy Assessment	• OIL and GAS • OTHER OIL and GAS • Energy research capacity		SOCIAL SCIENCES - Economics and Econometrics - Town and Country Planning - Politics and International Studies - Sociology - Education PHYSICAL SCIENCES AND MATHEMATICS - Computer Science and Informatics ENGINEERING AND TECHNOLOGY - Electrical and Electronic Engineering - Mechanical, Aeronautical and Manufacturing Engineering - Architecture and the Built Environment ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University College London, Department of Mathematics	Applied mathematics research is organised by groups: - Cross-Disciplinary Group (biology, medicine, physics, chemistry and economics) - The Fluid Dynamics Group (astrophysical fluid dynamics and statistical physics; direct	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Fluid flow • Numerical modelling		PHYSICAL SCIENCES AND MATHEMATICS - Applied Mathematics ENVIRONMENTAL SCIENCES - Earth Systems and

Name	Description	Sub-topics Covered	No of staff	Field
	numerical simulation and modelling of turbulent flows; modelling of fluid suspensions, fluid-fluid interfaces, free-surface flows, nonlinear wave equations and random disturbances in ocean currents) - The Environmental Flows Group (dynamics of rotating and stratified fluids; modelling of vortices, convection and rotating hydraulics) - The Industry Oriented Group >10 faculty, >10 researchers, ? PhD students			Environmental Sciences
University College London, Mechanical Engineering	The department concentrates its research under three major research themes: Biomedical Engineering Thermofluids Marine These are applied across a broad range of industries, notably Energy, Biomedical Engineering, Maritime Defence, Transport and Offshore sectors. >15 academic >10 research staff >20 research students	• OIL and GAS • OIL and GAS COMBUSTION • Fluid dynamics • Fuel analysis • Emissions		PHYSICAL SCIENCES AND MATHEMATICS - Chemistry ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Aberdeen, School of Engineering	The School undertakes research in a broad range of fundamental and applied Engineering topics in: Civil Mechanical Electrical & Electronic Chemical and Petroleum engineering. The School has a strong tradition of research in a number of areas including applied dynamics, impact mechanics, engineering materials, sediment	• OIL and GAS • REFINING, TRANSPORT and STORAGE of OIL and GAS • OIL and GAS COMBUSTION • Fluid dynamics • Drilling		PHYSICAL SCIENCES AND MATHEMATICS - Applied Mathematics ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering - General Engineering and Mineral & Mining

Name	Description	Sub-topics Covered	No of staff	Field
	transport, communications protocols, and holography. >50 academic staff >30 research staff >70 research students			Engineering
University of Aberdeen, Geology and Petroleum Geology	Research work is carried out across 5 research themes: Climate change, tectonics and sediment flux Terrestrial ecosystems Deep-water frontiers Geofluids and porous media Meteorite impacts and astrobiology	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • OTHER OIL and GAS • Geosciences, geology • Seismology	>10 academic <5 research staff >20 post-grad students	ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University of Bath, Department of Chemical Engineering	Research topic are pursued through multidisciplinary Research Centres: - Centre for Extremophile Research - Centre for Regenerative Medicine - Centre for Sustainable Chemical Technologies - UK Sustainable Hydrogen Energy Consortium - BRE Centre for Innovative Construction Materials - Institute for Sustainable Energy and the Environment >10 academic staff >10 research staff >5 PhD students	• OIL and GAS • REFINING, TRANSPORT and STORAGE of OIL and GAS • Hydrocarbon processing		ENGINEERING AND TECHNOLOGY - Chemical Engineering
University of Bath, Department of Mechanical Engineering	Research activities cover the broad areas of Design and Manufacturing, Machine Systems, Solid Mechanics and Materials and Thermo-Fluids. Research is embedded in one of more of the Research Centres which include: - Institute for Sustainable Energy & the Environment (I-SEE) - Materials Research Centre - Centre for Power Transmission and Motion	• OIL and GAS • OIL and GAS COMBUSTION • Fluid dynamics		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering

Name	Description	Sub-topics Covered	No of staff	Field
	Control - Powertrain and Vehicle Research Centre - Composites Research Unit - Sustainable Energy Research Team (SERT) >20 academic staff >20 research staff >5 PhD students			
University of Birmingham, School of Chemical Engineering	Research is organised via two multi-disciplinary centres: - Centre for Formulation Engineering - Topics include: design and characterisation of microstructured products; heat and mass transfer; fluid flow; particle technology and materials engineering across chemical, biological and physical systems. - Interdisciplinary Research Centre in Materials Processing >20 academic ? research staff ? research students	• OIL and GAS • REFINING, TRANSPORT and STORAGE of OIL and GAS • Hydrocarbon processing		ENGINEERING AND TECHNOLOGY - Chemical Engineering
University of Birmingham, School of [Manufacturing and] Mechanical Engineering	Mechanical Engineering research is organised into three focused research centres: - Bio-medical and Micro Engineering - Manufacturing Processes, Technology & Modelling - Vehicle Technology >10 academic >10 research staff ? research students	• OIL and GAS • OIL and GAS COMBUSTION • Fuel research • Emissions		ENVIRONMENTAL SCIENCES - Geography and Environmental Studies ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Birmingham, School of Metallurgy and Materials	Research areas: - Alloy Processing - Characterisation and Modelling - Engineering Properties of Materials	• OIL and GAS • OIL and GAS COMBUSTION • OIL and GAS		PHYSICAL SCIENCES AND MATHEMATICS - Metallurgy and Materials ENGINEERING AND

Name	Description	Sub-topics Covered	No of staff	Field
	- Functional Materials Processing >10 academic >10 research staff ? research students	CONVERSION • Materials		TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Birmingham, School of Computer Science	Research Themes and Groups: - Nature-Inspired and Intelligent Computation - Computing Systems Formal Verification and Security Parallel and Distributed Computing - Theoretical Computer Science - Software Engineering Research Group - Research Centres Centre of Excellence for Research in Computational Intelligence and Applications Centre for Computational Neuroscience and Cognitive Robotics Physical Sciences of Imaging in the Biomedical Sciences Doctoral Training Centre HCI Centre >30 academic >20 research staff >50 research students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Data and information systems		OTHER PHYSICAL SCIENCES AND MATHEMATICS - Metallurgy and Materials -Computer Science and Informatics ENGINEERING AND TECHNOLOGY - General Engineering and Mineral & Mining Engineering
University of Birmingham, School of Geography, Earth & Environmental Sciences	The School has an established history in research and teaching of both geology and geography. Research activity addresses issues such as climate change, oil exploration, renewable energy and resilience and is organised into five inter-disciplinary and multi-disciplinary research themes of: Environmental health sciences Geosystems Society, economy and environment Water sciences	• OIL and GAS • OIL and GAS COMBUSTION • Sedimentology • Emissions	> 84 academic and research staff > 90 research students	ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences - Geography and Environmental Studies

Name	Description	Sub-topics Covered	No of staff	Field
	Urban and regional studies (Centre for Urban and regional studies).			
University of Birmingham, School of Mathematics	The main research activities are: - Pure Mathematics - Applied Mathematics - Theoretical and Computational Optimization - Statistics - Mathematics Education >40 academic >10 research staff >10 research students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Reservoirs • Numerical modelling		PHYSICAL SCIENCES AND MATHEMATICS - Applied Mathematics
University of Brighton, School of Environment and Technology	The School generates new knowledge of earth systems, human actions that affect the natural and built environment, and civil engineering. Research covers five themes: - Applied geosciences - Ecology, landscape and pollution management - Society, space and environment - Ground, water and structural engineering - Sustainable construction and environmental planning >50 academic staff >30 research staff 43 research students	• OIL and GAS • Sedimentology		ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University of Brighton, School of Computing, Engineering and Mathematics	Research activity is organised into the following groups: - Computing and Mathematical sciences - Digital Technologies and Informatics - Engineering and Product Design - Physics >50 academic staff >10 research staff >30 PhD students	• OIL and GAS • OIL and GAS COMBUSTION • OIL and GAS CONVERSION • Fuel research • Fluid dynamics		PHYSICAL SCIENCES AND MATHEMATICS – Physics ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Bristol,	Research themes:	• OIL and GAS		ENVIRONMENTAL

Name	Description	Sub-topics Covered	No of staff	Field
School of Earth Sciences	- Climate and Ecosystem - Evolution and Architecture of the Solid Earth and Planets - Evolution of Biodiversity and Morphology - Geological Hazards and Risk - Global Biogeochemical Cycles - Reservoirs and Resources Research groups: - Bristol Experimental Earth Studies Group - Climate and Environmental Change - Geochemistry - Geophysics - Palaeobiology and Biodiversity - Volcanology >50 academic and research staff >60 PhD students	• ENHANCED OIL and GAS PRODUCTION • Reservoirs • Seismology		SCIENCES - Earth Systems and Environmental Sciences
University of Bristol, School of Geographical Sciences	The school's research is focussed on a number of themes: - Bristol Research Initiative for the Dynamic Global Environment (BRIDGE) - Geographies of Political Economy - Glaciology - Historical-Cultural Research Group - Hydrology Group - Personal Finance Research Centre - Spatial Modelling >80 academic and research staff >30 PhD students	• OIL and GAS • OTHER OIL and GAS • Reservoirs • Numerical modelling		ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University of Bristol, Mechanical Engineering	Research groups: - Dynamics and Control - Fluids and Aerodynamics - Robotics	• OIL and GAS • REFINING, TRANSPORT and STORAGE of OIL and	>? academic staff >? research staff >? PhD students	ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and

Name	Description	Sub-topics Covered	No of staff	Field
	- Solid Mechanics - Systems Centre - Ultrasonic and NDT (non-destructive testing)	GAS • OIL and GAS COMBUSTION • Non-destructive testing • Numerical modelling		Manufacturing Engineering
University of Cambridge, Department of Chemical Engineering [and Biotechnology]	Research is conducted in the themes of: - Biotechnology - Measurement - Microstructure engineering - Modelling - Processes Research activities cover a broad range of topics, for example: - Biochemical and Environmental Engineering - BioScience Engineering - Cambridge Analytical Biotechnology - Cambridge Centre for Neuropsychiatric Research - Catalysis - Cell and Organism Engineering - Colloidal Dispersions - Combustion - Computational Modelling - Electrochemical and Micro Engineering - Fluids and Environment Group - Healthcare Biotechnology - Laser Analytics - Magnetic Resonance - Molecular Microbiology - Polymer Processing Research - Powder and Paste Processing - Process Systems Engineering - Structured Materials	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • OIL and GAS COMBUSTION • OTHER OIL and GAS • Fuel research • Combustion • Emissions • Bioengineering		ENGINEERING AND TECHNOLOGY - Chemical Engineering

Name	Description	Sub-topics Covered	No of staff	Field
	- Terahertz Applications >25 academic >50 research staff >100 PhD students			
University of Cambridge, Department of Engineering	Research is conducted on Strategic Themes: - Energy, transport and urban infrastructure - Uncertainty, risk and resilience - Engineering for life sciences and healthcare - Inspiring research through industrial collaboration >50 academic and research staff >10 PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Fluid dynamics • Fuel research • Emissions • Combustion		PHYSICAL SCIENCES AND MATHEMATICS - Physics ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Cambridge, Department of Materials Science & Metallurgy	Research themes: Device materials Electron microscopy Materials chemistry Medical & pharmaceutical materials Structural materials Clean energy & sustainability Nuclear energy >20 academic and research staff >? PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Materials strength		PHYSICAL SCIENCES AND MATHEMATICS - Metallurgy and Materials
University of Dundee, Civil Engineering	Research is undertaken within two thematic groups: - Environment Research: - Specific research is in: Fluid Mechanics Geotechnical Engineering - Infrastructure Research >20 academic staff >5 research staff >? PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Fluid dynamics		ENGINEERING AND TECHNOLOGY - Civil Engineering
University of Edinburgh, Institute	Research Areas: - Marine Energy - Wave and tidal energy;	• OIL and GAS • ENHANCED OIL and	>10 academic staff	PHYSICAL SCIENCES AND MATHEMATICS -

Name	Description	Sub-topics Covered	No of staff	Field
for Energy Systems	offshore wind; coastal defence. - Power Systems - Distributed renewable generation; asset management and planning; power quality and reliability assessment; load modelling; demand-side management. - Energy and Climate - Wind, marine and hydropower resource modelling; climate change impact assessment; life cycle assessment; decarbonising energy supply. - Machines and Power Electronics - Novel generator designs for renewables; power converter design for renewables; switched-mode power supplies. - Innovation and Policy - Techno-economic analysis; roadmaps and standards; governance and policy; innovation systems; societal engagement with energy.	GAS PRODUCTION • OTHER OIL and GAS • Fluid dynamics • Energy modelling • Energy infrastructure	>20 research staff >50 research students	Physics ENVIRONMENTAL SCIENCES - Geography and Environmental Studies SOCIAL SCIENCES - Economics and Econometrics - Business and Management Studies ENGINEERING AND TECHNOLOGY - Electrical and Electronic Engineering - Mechanical, Aeronautical and Manufacturing Engineering
University of Edinburgh, School of Chemistry	Research activities span: - Chemistry/Biology Interface - Experimental and Theoretical Chemical Physics - Materials Chemistry >40 academic staff >80 research staff (including St Andrews) >250 research students (including St Andrews)	• OIL and GAS • OIL and GAS CONVERSION • Fuel research •		PHYSICAL SCIENCES AND MATHEMATICS - Chemistry
University of Essex, School of Biological Sciences	Research is organised through Groups, with common interests: - Molecular Biophysics - Environmental Biology - Molecular Medicine - Sports and Exercise Science Specific research activity is conducted mainly in the	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • NON-CONVENTIONAL OIL and GAS PRODUCTION • Pollution	>? academic staff >? research staff >? PhD students	BIOLOGICAL AND AGRICULTURAL SCIENCES - Biological Sciences

Name	Description	Sub-topics Covered	No of staff	Field
	Research Centres: - The Centre for Environment and Society - Essex Biomedical Science Institute - Centre for radicals and oxidative stress			
University of Glasgow, School of Geographical and Earth Sciences	Research is conducted in the fields of Human Geography and Earth Systems, Earth Systems Research addresses: - Earth-life processes - Surface processes - Shallow crustal processes - Extra-terrestrial and mantle processes - Earth observation and technology >50 academic and research staff >20 PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • OTHER OIL and GAS • Geosciences, geology • Numerical modelling		ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University of Huddersfield, School of Computing and Engineering	Informatics Research is organised in research groups: - Centre for High-Performance Intelligent Computing (CHIC) - Computer Graphics, Imaging and Vision Research Group High Performance Computing Research Group - Knowledge Engineering and Intelligent Interfaces (KEII) Research Group - Software Engineering Research Group - XML, Database and Information Retrieval (XDIR) Research Group - Serious Games Research Group - Computing and Engineering Pedagogical Research Group Engineering and Technology Research is organised as follows: - Centre for Precision Technologies Advanced Machining Technology Group Surface Metrology Research Group	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Fluid flow • Numerical modelling		PHYSICAL SCIENCES AND MATHEMATICS - Applied Mathematics ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering

Name	Description	Sub-topics Covered	No of staff	Field
	Engineering Control and Machine Performance Group - Centre for Diagnostic Engineering Energy, Emissions and the Environment Research Group Machinery Condition and Performance Monitoring Research Group Machinery Informatics and Dynamic Analysis of Systems (MIDAS) Research Group - Automotive Engineering Group - Systems Engineering Group - Electron Microscopy and Materials Analysis (EMMA) Research Group >20 academic staff >20 research staff >1 PhD students			
University of Leeds, Institute of Particle Science & Engineering	Current activities are organised within the following areas: - Particulate measurement systems - Particulate systems modelling - Manufacture of advanced particulates Research activities encompass Colloid, Nanoparticle and Interfacial Engineering; Multi-scale and Systems Modelling; Pharmaceutical and Fine Chemicals; Mineral and Waste Processing; Powder and Formulation Engineering; and In-Process Measurement and Control of Process Systems. >10 academic staff >10 research staff >? PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • OIL and GAS COMBUSTION • OTHER OIL and GAS • Fluid Flow • Numerical modelling • Materials		PHYSICAL SCIENCES AND MATHEMATICS – Chemistry - Metallurgy and Materials - Computer Science and Informatics - Applied Mathematics ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Leeds, School of Earth and Environment	School of Earth and Environment: Earth Surface Science Institute Institute for Climate and Atmospheric Science Institute of Geophysics and Tectonics	• OIL and GAS • OTHER OIL and GAS • Sedimentology	>50 academic staff >50 research staff >50 research	ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences

Name	Description	Sub-topics Covered	No of staff	Field
	Sustainability Research Institute		students	
University of Leicester, Department of Geology	Research is focused in three principal groups: - Crustal Processes: - Large Scale Magmatic and Volcanic Processes; Earth Systems Processes; Tectonics and Sedimentology; Fluid Processes. - Palaeobiology - Geophysics & Borehole Research: Crustal Geophysics; Applied Geophysics; Petrophysics >20 academic staff >10 research staff >30 post-grad students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • NON-CONVENTIONAL OIL and GAS PRODUCTION • Reservoirs • Geosciences, geology		ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University of Liverpool, Department of Earth and Ocean Sciences	Research activities address the physics, chemistry, biology, geography and geology of the Earth, and is organised in the clusters of: - Earth's Interior Dynamics - People Space and Place - Earth's Changing Environment - Oceans and Ecosystems >40 academic and research staff >40 PhD students	• OIL and GAS • OTHER OIL and GAS • Geosciences, geology		ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University of Liverpool, School of Engineering	Research is organised in themed centres: - Centre for Engineering Dynamics (covering the dynamics of fluids, structures and flight) - Centre for Engineering Sustainability - Centre for Materials and Structures >20 academic staff >20 research staff >40 post-grad students	• OIL and GAS • OIL and GAS COMBUSTION • Fluid dynamics • Numerical modelling		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Liverpool, Department of	Research is organised in the clusters of: - Earth's Interior Dynamics - People Space and Place	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION		ENVIRONMENTAL SCIENCES - Geography and Environmental

Name	Description	Sub-topics Covered	No of staff	Field
Geography	- Earth's Changing Environment - Oceans and Ecosystems >20 academic staff >5 research staff >10 PhD students	• NON-CONVENTIONAL OIL and GAS PRODUCTION • Climate change		Studies
University of Manchester, School of Earth, Atmospheric and Environmental Sciences	The School is organised in research groups: - Centre for Atmospheric Science - Basin Studies and Petroleum Geoscience - Isotope Geochemistry and Cosmochemistry - Environmental Biochemistry and Geomicrobiology - Physics and Chemistry of Minerals and Fluids - Structural and Petrological Geoscience - Palaeontology and Palaeobotany >45 academic staff >45 research staff >50 PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • NON-CONVENTIONAL OIL and GAS PRODUCTION • Geosciences		ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University of Manchester, School of Electrical & Electronic Engineering	Research groups: Control Systems Electrical Energy and Power Systems Microelectronics and Nanostructures Microwave and Communication Systems Power Conversion Sensing, Imaging and Signal Processing >50 academic staff >25 research staff >5 PhD students	• OIL and GAS • REFINING, TRANSPORT and STORAGE of OIL and GAS • Energy infrastructure • Instrumentation		ENGINEERING AND TECHNOLOGY - Electrical and Electronic Engineering
University of Manchester, School of Materials	Research groups Biomaterials Ceramics and Glasses Composite Materials Corrosion and Protection Metallic Materials Graphene and Nanostructured Materials	• OIL and GAS • OIL and GAS COMBUSTION • Materials strength		PHYSICAL SCIENCES AND MATHEMATICS - Metallurgy and Materials

Name	Description	Sub-topics Covered	No of staff	Field
	Paper Science Polymer Science and Engineering Textile Design, Fashion and Management Textile Science and Technology >20 academic staff >? research staff >1 PhD students			
University of Manchester, School of Mechanical, Aerospace and Civil Engineering	Research groups Aerospace Energy, Environment and Climate Change Structures, Dynamics and Extreme Loading Manufacturing and Management Nuclear Expert Groups include: Advanced Flow Diagnostics and Instrumentation Coastal Processes Computational Fluid Dynamics Energy and Multiphysics Geo-Engineering Impact and Explosion Turbulence Mechanics >20 academic staff >20 research staff >10 PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Fluid dynamics • Hydrocarbon processing		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Manchester, Physics and Astronomy	Research groups: Accelerator, Nuclear and Particle Physics Condensed Matter, Atomic and Biological Physics Jodrell Bank Centre for Astrophysics Theoretical Physics >30 academic staff >50 research staff >5 PhD students	• OIL and GAS • REFINING, TRANSPORT and STORAGE of OIL and GAS • Fluid dynamics		PHYSICAL SCIENCES AND MATHEMATICS - Physics
University of	The Faculty of Engineering research activities are	• OIL and GAS	>? academic staff	PHYSICAL SCIENCES

Name	Description	Sub-topics Covered	No of staff	Field
Nottingham, Division of Fuels and Power Technology	organised in multi-disciplinary Research Divisions: - Architecture and Urbanism - Electrical Systems and Optics - Energy and Sustainability - Advanced Materials Research Group, Cleaner Fossil Energy and CO2 Mitigation, Institute of Building Technology (IBT) and Institute of Sustainable Energy Technology (ISET), The Centre for Innovation in Carbon Capture and Storage, Thermofluids - Infrastructure and Geomatics - Manufacturing - Materials, Mechanics and Structures - Process and Environmental	• OIL and GAS COMBUSTION • Combustion • Fuel research • Fluid dynamics	>? research staff >? PhD students	AND MATHEMATICS - Physics
University of Nottingham, Department of Chemical and Environmental Engineering [Envir & Mining Eng]	The Faculty of Engineering research activities are organised in multi-disciplinary Research Divisions: - Architecture and Urbanism - Electrical Systems and Optics - Energy and Sustainability - Infrastructure and Geomatics - Manufacturing - Materials, Mechanics and Structures - Process and Environmental - environmental flows, bioprocess engineering, industrial microwave processing, particle and fluid processing >20 academic staff >10 research staff >? PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Hydrocarbon processing • Fluid flow • Reservoir		ENGINEERING AND TECHNOLOGY - Chemical Engineering
University of Nottingham, Department of Electrical and Electronic	The Electrical Systems and Optics Research Division includes: - Cummins Innovation Centre - Applied Optics Group - George Green Institute for Electromagnetics	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Hydrocarbon processing		ENGINEERING AND TECHNOLOGY (Electrical and Electronic Engineering) 50%;

Name	Description	Sub-topics Covered	No of staff	Field
Engineering	Research - Institute of Biophysics, Imaging and Optical Science - Photonic and Radio Frequency Engineering Group - Power Electronics, Machines and Control Group - Power Electronic Energy Conversion, Conditioning and Control; Power Electronics Integration, Packaging and Thermal Management; Motor Drives and Motor Control; Electrical Machines >20 academic staff >20 research staff >1 PhD students	• Reservoir		ENGINEERING AND TECHNOLOGY (Mechanical, Aeronautical and Manufacturing Engineering) 50%;
University of Nottingham, School of Mathematical Sciences	Research activities are organised in seven research groups: Algebra and Analysis Industrial and Applied Mathematics Mathematical Medicine and Biology Mathematical Physics Number Theory Scientific Computation and Analysis Statistics and Probability >60 academic staff >10 research staff >50 PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Fluid flow • Numerical modelling		PHYSICAL SCIENCES AND MATHEMATICS (Applied Mathematics) 100%
University of Nottingham, Department of Mechanical, Materials and Manufacturing Engineering	The Materials, Mechanics and Structures Research Division spans bioengineering, geomechanics, materials science, and structural engineering. Organisation includes: - The Nottingham Centre for Geomechanics - The Centre for Structural Engineering and Construction - Advanced Materials Research Group	• OIL and GAS • OIL and GAS COMBUSTION • Materials strength		PHYSICAL SCIENCES AND MATHEMATICS (Metallurgy and Materials) 50%; ENGINEERING AND TECHNOLOGY (Mechanical,

Name	Description	Sub-topics Covered	No of staff	Field
	- Bioengineering Research Group - Polymer Composites Research Group - Structural Integrity and Dynamics Research Group >20 academic staff >20 research staff >1 PhD students			Aeronautical and Manufacturing Engineering) 50%;
University of Oxford, Department of Engineering Science	The Department undertakes an extensive range of research projects and activities are conducted in inter-disciplinary research groups: Active Vision Biomedical Image Analysis Biomedical Instrumentation Biomedical Signal Processing & e-health Biomedical Ultrasonics, Biotherapy & Biopharmaceuticals Laboratory (BUBBL) Civil Engineering Communications Control Group Cryogenic Engineering Discrete Element Research Group Electrical Power Group Energy Engineering Environmental Chemical Engineering Fluidics and Biocomplexity Internal Combustion Engine Group Invensys UTC Mechanobiology Microelectronic Circuits and Analogue Devices Mobile Robotics Ocean and Coastal Engineering and Water Resources Ophthalmic Engineering Optical Communications	• OIL and GAS • OIL and GAS COMBUSTION • Fuel research • Automotive engines • Combustion • Emissions		PHYSICAL SCIENCES AND MATHEMATICS (Physics) 50%; ENGINEERING AND TECHNOLOGY (Mechanical, Aeronautical and Manufacturing Engineering) 50%;(General Engineering and Mineral & Mining Engineering)

Name	Description	Sub-topics Covered	No of staff	Field
	Orthopaedic Biomechanics Osney Thermo-Fluids Laboratory Pattern Analysis & Machine Learning Physiological Understanding through Modelling Scanning Optical Microscopy Solid Mechanics and Materials Engineering Systems Engineering Systems of Systems Tidal Energy Research Group Tissue Engineering and Bioprocessing Visual Geometry >50 academic staff >30 research staff >30 PhD students			
University of Oxford, Department of Materials	The Department covers a wide range of research topics of an interdisciplinary nature. Research groups include: Structural and Nuclear Materials Device Materials Polymers and Biomaterials Nanomaterials Processing and Manufacturing Characterisation Computational Materials Modelling >20 academic staff >40 research staff >60 post-grad students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Materials strength • Reservoir • Hydrocarbon processing		ENGINEERING AND TECHNOLOGY (Electrical and Electronic Engineering) 100%
University of Oxford, Department of Chemistry	Research themes include: - Catalysis - Synthesis - Chemistry at the interface with biology and medicine - Sustainable Energy Chemistry - Interfacial Science	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • OTHER OIL and GAS • Fluid dynamics • Reservoir		PHYSICAL SCIENCES AND MATHEMATICS (Chemistry) 100%

Name	Description	Sub-topics Covered	No of staff	Field
	- Kinetics, dynamics and mechanism - Advanced functional materials - Innovative Measurement and photon science - Theory and modelling of complex systems >50 academic staff >20 research staff >? PhD students			
University of Oxford, Department of Physics	Research themes and groups include: Research themes Accretion, Outflows & Shocks High-energy astrophysics Applications & Innovations Biological Physics Citizen Science Climate Physics Condensed Matter Theory Dark matter and Precision measurements Dust, Gas and Molecules in the Universe Exoplanets Experimental Radio Cosmology Galaxies High-energy frontier physics High-Redshift Neutrinos. Optical & Infrared Instrumentation Particle Theory Planetary Physics Quantum Materials Semiconductor Materials, Devices & Nanostructures The Dark Universe The Transient Universe >50 academic staff >50 research staff	• OIL and GAS • OIL and GAS COMBUSTION • Combustion • Instrumentation		PHYSICAL SCIENCES AND MATHEMATICS (Physics) 100%

Name	Description	Sub-topics Covered	No of staff	Field
	>100 PhD students			
University of Reading, School of Construction Management and Engineering	The research theme of the School is schools are developing the policy, theory and practice of the organisation and management of the built environment. The five main research areas are: Health Care Infrastructure Digital Practices Business Innovation in Construction Transition Pathways to a Low-Carbon Economy Innovative and Sustainable Technologies >20 academic staff >10 research staff >30 PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Energy efficiency		ENGINEERING AND TECHNOLOGY (Architecture and the Built Environment) 100%
University of Reading, Department of Mathematics and Statistics	Research groups: - Pure, Applicable, and Numerical Analysis, including ◇ Analytic Number Theory ◇ Operator Theory ◇ Spectral Theory ◇ Inverse Problems and Data Assimilation ◇ Nonlinear PDEs ◇ Linear Waves ◇ Statistical Physics and Complex Systems ◇ Centre for the Mathematics Of Human Behaviour ◇ Numerical Analysis ◇ Mathematical Biology - Complex Fluids and Theoretical Polymer Physics - Applied Statistics >40 academic staff >? research staff >40 research students	• OIL and GAS • OTHER OIL and GAS • Seismology • Numerical modelling		PHYSICAL SCIENCES AND MATHEMATICS (Applied Mathematics) 100%
University of	The research themes are sustainability and	• OIL and GAS		ENGINEERING AND

Name	Description	Sub-topics Covered	No of staff	Field
Salford, School of the Built Environment	sustainable communities. Research Centres: - Centre for Applied Archaeology - Centre for Disaster Resilience - Centre for Information Technology in Construction - Centre for Real Estate and Facilities Management - Management in Construction Research Centre - Research Centre for Education in the Built Environment >60 academic staff >50 research staff >50 PhD students	• Climate change • Energy Efficiency		TECHNOLOGY - Architecture and the Built Environment
University of Sheffield, School of Mathematics and Statistics [Applied Mathematics]	Research activities cover a broad range of science and technology applications. Research Groups are: - Algebra - Analysis - Category Theory - Differential Geometry - Environmental Dynamics - Fluid Dynamics - Mathematical Biology - Nonlinear Control - Number Theory - Particle Astrophysics and Gravitation - Probability and Statistics - Solar Physics and Space Plasma Research Centre - Topology >30 academic staff >10 research staff >50 post-grad research students	• OIL and GAS • OTHER OIL and GAS • Instrumentation		PHYSICAL SCIENCES AND MATHEMATICS - Applied Mathematics
University of Sheffield,	Research Groups are: - Biomaterials and Tissue Engineering	• OIL and GAS • OIL and GAS		PHYSICAL SCIENCES AND MATHEMATICS -

Name	Description	Sub-topics Covered	No of staff	Field
Department of Materials Science and Engineering	- Ceramics - Glasses, Cements and Waste Immobilisation - Magnetics - Metallurgy - Nanomaterials and Nano engineering - Polymers and Composites - Surface Engineering and Tribology >40 academic staff >50 research staff >? PhD students	COMBUSTION • Materials strength		Metallurgy and Materials
University of Sheffield, Department of Mechanical Engineering	Research activities are organised in four main groups of: Thermofluids Design & Manufacturing Solid Mechanics Dynamics >40 academic staff >30 research staff >? PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Energy analysis		ENGINEERING AND TECHNOLOGY - mechanical, Aeronautical and Manufacturing Engineering
University of Southampton, Faculty of Engineering and the Environment	Research utilises core engineering and environmental science disciplines applied across many activities: Aerodynamics and Flight Mechanics Astronautics Bioengineering science Computational Engineering and Design Dynamics group Electro-Mechanical engineering Energy and Climate Change Energy technology Engineering materials Environment group Fluid Dynamics and Acoustics group Fluid Structure Interactions Human Sciences group Infrastructure group	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • REFINING, TRANSPORT and STORAGE of OIL and GAS • Fluid flow • Wave loading on structures		ENGINEERING AND TECHNOLOGY - Civil Engineering - Mechanical, Aeronautical and Manufacturing Engineering

Name	Description	Sub-topics Covered	No of staff	Field
	national Centre for Advanced Tribology at Southampton (nCATS) Signal Processing and Control group Transportation group Waste Management >300 academic and research staff >300 post- grad research students			
University of Southampton, Institute of Sound and Vibration Research	Research Groups (from within the Faculty above): Fluid Dynamics & Acoustics; Signal Processing & Control; Dynamics; Human Sciences. >30 academic staff >? research staff >? PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Tribology		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Southampton, National Oceanography Centre Southampton	NOCS is the integrated collaboration between the Southampton-based part of the Natural Environment Research Council's National Oceanography Centre, and the University of Southampton's Ocean and Earth Science. Research Groups: Ocean Biogeochemistry and Ecosystems Geology and Geophysics Ocean Observing and Climate Ocean Modelling and Forecasting Geochemistry Palaeoceanography and Palaeoclimate Coastal Processes >45 academic staff >500 research staff >? PhD students >700 students…	• OIL and GAS • OTHER OIL and GAS • Seismography		ENGINEERING AND TECHNOLOGY - Electrical and Electronic Engineering ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University of Southampton, Optoelectronics Research Centre	Research Groups: - Advanced Fibre Technologies & Applications - Advanced Solid-State - Computational Nonlinear Optics	• OIL and GAS • OIL and GAS COMBUSTION • Gas spectroscopy		PHYSICAL SCIENCES AND MATHEMATICS - Physics) ENGINEERING AND

Name	Description	Sub-topics Covered	No of staff	Field
	- Distributed Optical Fibre Sensors - Fibre Bragg Gratings - High Power Fibre Lasers - Infrared Science & Technology - Integrated Photonic Devices - Laser-Induced Forward Transfer - Microstructured Optical Fibres - Nanophotonics & Metamaterials - Nonlinear & Microstructured Optical Materials - Novel Glass & Fibre - Optical Biosensors & Biophotonics - Optical Fibre Communication - Telecommunications Devices and Sub-systems - Optical Microfibre Devices and Sensors - Optical Parametric Oscillators - Optical Sensors & Instrumentation - Photonic, Electronic and Plasmonic Microstructured Optical Fibres - Physical Optics - Planar Optical Materials - Planar Waveguide and Slab Lasers - Power Photonics & Applications - Pulsed Fibre Lasers - Pulsed Laser Deposition - Semiconductor Fibre Devices for Nonlinear Photonics - Scanning Near-Field Optical Microscopy - Silica Fibre Fabrication - Ultrafast Laser X-Ray >? academic staff >30 research staff >? PhD students			TECHNOLOGY - Electrical and Electronic Engineering
University of	As Faculty above:	• OIL and GAS	>? academic staff	PHYSICAL SCIENCES

Name	Description	Sub-topics Covered	No of staff	Field
Southampton, School of Engineering Sciences	Areas of interest: Aeronautics and Astronautics Audiology Biomedical Engineering Civil and Environmental Engineering Computational Engineering Environmental Science Maritime Engineering and Ship Science Materials and Surface Engineering Mechanical Engineering Sound and Vibration	• ENHANCED OIL and GAS PRODUCTION • OIL and GAS COMBUSTION • Fluid flow • Tribology • Combustion • Numerical modelling • Emissions • Wave load on structures	>? research staff >? PhD students	AND MATHEMATICS – Chemistry ENGINEERING AND TECHNOLOGY - General Engineering and Mineral & Mining Engineering - Mechanical, Aeronautical and Manufacturing Engineering - Civil Engineering ENVIRONMENTAL SCIENCES - Earth Systems and Environmental Sciences
University of St Andrews, School of Mathematics and Statistics	Research groups and themes encompass: - Applied Mathematics - - Numerical Analysis - Plasma Physics - Solar and Magnetospheric Theory - Vortex Dynamics - Pure Mathematics - Statistics >30 academic staff >20 research staff >20 PhD students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Fluid flow • Numerical modelling		PHYSICAL SCIENCES AND MATHEMATICS - Applied Mathematics
University of Strathclyde, Electronic and Electrical Engineering	Research activities are organised in six research groups: Centre for Intelligent Dynamic Communications. Centre for Excellence in Signal & Image Processing. Institute for Energy & Environment Centre for Microsystems & Photonics.	• OIL and GAS • Non-destructive evaluation		PHYSICAL SCIENCES AND MATHEMATICS - Metallurgy and Materials ENGINEERING AND TECHNOLOGY - General Engineering and Mineral & Mining

Name	Description	Sub-topics Covered	No of staff	Field
	Industrial Control Centre. Centre for Ultrasonic Engineering. >50 academic staff >30 research staff >80 research students			Engineering - Mechanical, Aeronautical and Manufacturing Engineering
University of Strathclyde, Naval Architecture & Marine Engineering	The main research activities are in: Ship Stability and Safety Marine Hydrodynamics Marine Structures Ocean Engineering Marine Engineering Emerging Technologies Marine Renewable Energy and Alternative fuels >10 academic staff >10 research staff >20 research students	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Energy research capacity		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Surrey, Centre for Environmental Strategy	Research and teaching is based around three inter-related themes: • Sustainable Systems: Tools for Analysis and Design • Social and Economic Research on Sustainability: Developing Concepts and Themes • Policy, Strategy and Governance >10 academic staff >5 research staff >20 PhD students	• OIL and GAS • OIL and GAS CONVERSION • Energy research capacity • Energy efficiency		SOCIAL SCIENCES - Town and Country Planning - Business and Management Studies - Sociology ENGINEERING AND TECHNOLOGY - Electrical and Electronic Engineering ENVIRONMENTAL SCIENCES - (Earth Systems and Environmental Sciences
University of Sussex, Department of Engineering and Design	Research activity is organised into three main groups with several specialist sub-groups. The main research areas are: - Biomedical Engineering	• OIL and GAS • OIL and GAS COMBUSTION • Combustion		PHYSICAL SCIENCES AND MATHEMATICS - Chemistry - Physics

Name	Description	Sub-topics Covered	No of staff	Field
	- Electrical and Electronic Engineering: - Centre for Physical Electronics and Quantum Technology - Communications - Industrial Informatics and Manufacturing Systems Research Centre - Mechanical Engineering: - Thermo-fluid Mechanics Research Centre (TFMRC) - Dynamics and Automotive Engineering (DAE) - Tribology >30 faculty staff >? research staff >60 post-grad research students			ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Wales, Swansea, College [School] of Engineering	Research within the school follows multi-disciplinary activities and is organised into research centres: - Civil & Computational Engineering Centre - Materials Research Centre - Multidisciplinary Nanotechnology Centre >40 academic staff >5 research staff >? PhD students	• OIL and GAS • OIL and GAS COMBUSTION • Materials strength		ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
University of Warwick, School of Engineering	Research activity follows two main Strategic Themes of: Biomedical Energy And is organised in Research Groups of: - Civil, Structural, Environmental & Sustainable Development - Electronics, Power and Microsystems - Fluid Dynamics - Information & Communication Technologies - Sustainable Energy Engineering and Design	• OIL and GAS • OIL and GAS COMBUSTION • OIL and GAS CONVERSION • Combustion • Energy efficiency		PHYSICAL SCIENCES AND MATHEMATICS – Chemistry ENGINEERING AND TECHNOLOGY - Chemical Engineering - Mechanical, Aeronautical and Manufacturing Engineering

Name	Description	Sub-topics Covered	No of staff	Field
	- Systems, Measurement and Modelling >50 academic and research staff >200 post-grad students			

4. Applied research

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There are 15 grants in the applied research category of the UKERC Research Register with the work spread over 14 university departments. The research activity is applicable to oil and gas extraction. Funding is primarily EPSRC for the Oil and Gas sector and with two earth science related topics funded via NERC.

Within the commercial sector, applied research activities are often more "near market" driven development topics. Much of this activity is undertaken by suppliers to the industry with interests in technological improvements for product development. Also, most of the commercially focused research will be conducted in-house or with bi-lateral agreements between companies and research providers. For example, Schlumberger operates with an annual research budget of about one billion dollars (2011-12) and 25 of their own R&D centres across the world.

Commercial research topics pursued by the energy majors are often included in web-site material (to show clean energy credentials) but project (and research programme) details are not as readily available as in previous years.

Software development for process control and analysis applications are developed commercially albeit that the companies are often associated with university technology campuses.

Applied research and links with industry are often established on a local basis between companies and university departments. These projects are not captured within the Research Register.

A recent development to hydrocarbon production licences in Brazil is that operators are required to spend 1% of the value of future production on local R&D in Brazil. This condition set on licences of international operators may have a major impact on the UK research landscape in future years.

Government funding (BIS, DECC, DEFRA, TSB etc.) of applied research is enabled by means of number of funding programmes such as INNOVATE UK (see table below). Also, for example, the related Scottish Enterprise funding call for research and innovation project proposals on subsea operations in oil and gas production and also for improved hydrocarbon reservoir imaging.

Near market developments require "proof of concept" projects to acquire major funding for the demonstration stage of new technologies. Commercially based project can raise funds through company formation and AIM listings that attract investors. For example, Hydrodec[4] are seeking the next level of funding to develop a demonstration plant for their oil re-refining process. At each stage of this process a robust financial investment case must be made to attract funding.

UK oil and gas majors are a major source of research funding. As direct participants the research topics are aimed at industry applications although longer term and blue-sky research activities are also funded. Levels of R&D expenditure are generally reported in the annual accounts and general areas of activity are described on company websites. RD&D funding routes are through in-house research centres, partner schemes with government bodies (BIS, DECC, TSB etc.) and industry partnerships such as Industry Technology Facilitator (ITF).

[4] Hydrodec Group plc is developing an industrial oil re-refining process to extend its technology into paraffinic feedstock and products with the potential to utilise the technology to re-refine engine oils. http://www.hydrodec.com

Much of the technical improvements in the oil and gas sector arise from engineering design and development of operational improvements in the field. This activity, supported by the numerous engineering consultants, design companies and engineering construction firms within the UK may not interact with the research institutions and is therefore not captured within research project data.

Table 4.1: Research Funding

Programme	Funding Agency	Description	Committed Funds	Period	Representative Annual Spend
High Hydrogen	ETI: Energy Technologies Institute (Funds via EPSRC, TSB from BIS)	The goals of the project are to increase the range of fuels that can be safely used in power and heat generating plant by: - Identifying the boundaries of safe design and operation of power generation systems using hydrogen based fuels; and - Identifying improvements in the detailed design and instrumentation of hydrogen fuelled power systems in order to deliver more robust and inherently safer system designs.	£2 million	2011 -	
	DECC	Current research programmes are aimed at emission reduction, carbon capture and energy efficiency. Implications for natural gas: demand side management "smart grid" extended to gas meters and gas distribution cost savings. PILOT: formerly the Oil and Gas Taskforce facilitates a partnership between the UK Oil and Gas Industry and government to ensure full economic recovery of UK hydrocarbon resources. [see TSB below]			
	DEFRA	Programme of research for pollution controls, impinges on Oil and Gas offshore activity (licence and regulatory issues: oil spills and dispersants and equipment/methodology, noise and nuisance, air quality, ozone etc.). More recently, potential shale gas recovery and water table implications are under consideration.			
NERC research programmes	NERC NERC	Only two grants on the register related to Oil and Gas: - Virtual Seismic Atlas Project - Conceptual uncertainty of Geological Data VSA The Virtual Seismic Atlas (VSA) Project will generate an independent, free-to-use, community-based internet resource,	 NERC £368,078	 2007 - 2008	 See column 4, two year period.

		which will capture and share the geological interpretation of seismic reflection data in picture and workbook format. Seismic data are expensive to acquire and process, yet give key insights into geological structure and processes. VSA data, including seismic data and their derivatives, will be searchable and downloadable. Other NERC research has implications for Oil and Gas activity in programmes such as Methane Network or CCS in depleted gas fields.	Norsk Hydro £36,000 Shell £36,000 Amerada Hess £36,000 Statoil £36,000		
Innovation Programmes	TSB	Previous investment of £4.3m in nine collaborative R&D projects in oil and gas technologies. The total value of, when business contribution is included, is just over £10m. Investment of up to £1 million is being directed to feasibility studies led by SMEs which will stimulate innovation in the oil and gas sector and accelerate the development and deployment of new technologies.	£1 million	2012 - on-going	
BP R&D Programme	BP	BP invests around 35% of its total annual R&D spend with UK universities and government initiatives. For example, the BP Institute (BPI, http://www.bpi.cam.ac.uk) was established as an interdisciplinary research institute at Cambridge University over a decade ago. The BPI's research has touched on everything from oil recovery to areas such as geological storage of carbon dioxide, building ventilation and ocean currents.	£130 million	Annual	
Shell R&D Expenditure	Shell	In 2011, R&D expenses were $1,125 million, compared with $1,019 million in 2010 and $1,125 million in 2009. The R&D programme is executed by a single integrated R&D organisation where in-house development of proprietary technologies is complemented with external scientific and technological partnerships. UK details not available.			
ITF	Oil and Gas Industry	Industry Technology Facilitator (ITF), is a "not for profit" organisation owned by 30 major global operators and service	£16 million worldwide	6 – 36 months	

		companies. Its key objectives are to identify technology needs, foster innovation and facilitate the development and implementation of new technologies. Live project in UK research providers listed below:			
	ITF	University of Leeds Petrophysics of Tight Gas Sandstones Phase II	£150,000	36 months	
	ITF	University of Aberdeen Novel Underwater Cuttings - Phase 1a	£104,937	5 months	
	ITF	Heriot Watt University Hydrate Safety Margin Monitoring and Formation Detection Systems (Phase 3)	£490,000	24 months	
	ITF	TWI Ltd, UNITED KINGDOM Continued Development of High Performance Coatings to Prevent Scale Accretion - Phase 2	£32,000	12 months	
	ITF	Project Development International Limited (PDi Ltd), UNITED KINGDOM Options for Decommissioning Subsea Pipeline Bundles	£107,500	5 months	
	ITF	Flexlife, UNITED KINGDOM Riser End of Life JIP	£199,998	12 months	
	ITF	University of Leeds, UNITED KINGDOM Improved methods for measuring the permeability of shale	£399,000	30 months	
	ITF	Heriot Watt University, UNITED KINGDOM Direct Visualisation of Oil Recovery Mechanisms by Low Salinity Water Injection	£360,600	36 months	
	ITF	Rockfield Software, UNITED KINGDOM Improved Hydraulic Fracture Stimulation of Tight Gas Reservoirs using FE Modelling and Microseismic Monitoring	£903,000	36 months	
	ITF	Imperial College London, UNITED KINGDOM Next-generation full-wavefield imaging and inversion: A game-changing technology	£1,751,500	36 months	
	ITF	Rockfield Software, UNITED KINGDOM Computational Modelling of Structural Geology Applications	£240,000		
	ITF	Heriot Watt University; University of Edinburgh, UNITED KINGDOM Role of Microporosity and Wettability on Fluid Flow in Carbonates	£448,800	36 months	
	ITF	University of Bristol, UNITED KINGDOM Integrated Reactive Transport Modelling of Dolomite Evolution	£464,000	36 months	
	ITF	University of Aberdeen, UNITED KINGDOM The influence of carbonate depositional and diagenetic faces on the petrophysical properties of fault damage zones	£240,000	36 months	
	ITF	Heriot Watt University; Imperial College London; Montan	£456,000	36	

		University of Leoben, UNITED KINGDOM Improved Simulation of Faulted and Fractured Reservoirs – itf-ISF Phase 3: Gravity-Assisted Recovery Processes		months	
	ITF	University of Manchester, UNITED KINGDOM Integrated structural, sedimentological and diagenetic evaluation of hydrothermal dolomite, Cretaceous-Eocene, Hamman Faraun Fault Block, Gulf of Suez	£523,600	36 months	
	ITF	Heriot-Watt University, Institute of Petroleum Engineering, UNITED KINGDOM Evaluation of Low Dosage Hydrate Inhibitors: KHI Evaluation using Novel Crystal Growth Inhibition Techniques & Advanced AA Performance Assessment	£105,000	36 months	
	ITF	VerdErg Ltd., UNITED KINGDOM Wet Aerogel Insulation for Extended reach Subsea Systems	£294,000	9 months	
	ITF	Rockfield Software; University of Bristol; University of Leeds, UNITED KINGDOM Enhanced integrated geomechanics-seismic model for improvement of lifecycle performance of tight gas sand reservoirs	£620,000	36 months	
	ITF	Go Science, UNITED KINGDOM RHyVAU Mobile4COcean Bottom Seismic Sensor 3D/4C	£472,000	15 months	
	ITF	Corac, UNITED KINGDOM Downhole Compression in Natural gas Wells – Ph 2 Detailed Design / Component Testing	£1,750,000	36 months	
	ITF	MCS Kenny, UNITED KINGDOM Advancing Integrity Management of Subsea Umbilical, Riser and Flowlines	£280,000	18 months	

Table 4.2: Key Research Providers

Name	Description	Sub-topics Covered	No of Staff	Sector
Cardiff University, School of Engineering	Research themes of Aerospace, Digital Economy, Transport, Materials and Nanoscience are developed in multidisciplinary research institutes of: - BRE Institute of Sustainable Engineering - Institute of Energy - Institute of Environment and Sustainability - Institute of Green Electronic Systems - Communications, Sensors and Materials - Institute of Mechanical and Manufacturing Engineering - Institute of Mechanics and Advanced Materials - Institute of Medical Engineering and Medical Physics	• OIL and GAS • OIL and GAS COMBUSTION • OTHER OIL and GAS • Electrical infrastructure • Electricity generation	FACULTY: >250 academic and research staff. Institute of ENERGY: >15 academic, >15 research staff, >10 PhD students TOPIC: >5 researchers	Electricity and gas Manufacturing
Cranfield University, School of Engineering	Oil and Gas sector research is supported in a number of departments: - Offshore Engineering and Naval Architecture Group (OENA) e.g. offshore platforms. - Offshore Technology and Subsea Engineering, e.g. materials and corrosion, reliability of subsea systems and components. - Power and Propulsion Department - Process Systems Engineering Group (PSE), e.g. process systems engineering, multiphase flow and bio-fuels. Research topics include: - Multiphase Flows Technology - Flow Measurement and Instrumentation	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Fluid Flow	OFFSHORE PROCESS and ENERGY ENGINEERING: >10 faculty, >5 researchers, >10 PhD students	Energy extraction energy

Name	Description	Sub-topics Covered	No of Staff	Sector
	- Process Modelling, Simulation and Optimisation - Advanced Control - Energy System Design & Operation - Energy Systems & Thermo-Fluid Phenomena			
Health and Safety Laboratory	Services include specialist advice and consultancy in industrial sectors of: - Aerospace - Construction Sector Construction - Defence and Security Sector Defence & Security - Healthcare Sector Healthcare - Manufacturing - Oil, Gas and Chemicals - Power, Utilities & Nuclear - Transport	• OIL and GAS • OIL and GAS COMBUSTION • Combustion • Fuel research • Hydrogen	>350 professional and support staff	Energy ENGINEERING AND TECHNOLOGY - Mechanical, Aeronautical and Manufacturing Engineering
Heriot-Watt University, Institute Of Petroleum Engineering	Research activity ranges from exploration, through reservoir appraisal and development, to production technology. In addition, research extends into the whole energy sector and related environmental issues. There are 12 distinct research themes, each represented by an interactive grouping of academic/research staff and postgraduate research students, and the inter-disciplinary nature of much research spans the exploration, development and production. Research themes and leads Petroleum Geoscience Unconventional Reservoirs Carbonate Reservoirs Reservoir Geophysics Multiscale Modelling and Flow Simulation	• OIL and GAS • OTHER OIL and GAS • Gas storage	FACULTY: >30 faculty, >20 research staff, >50 PhD students CO2 storage research in collaboration with Scottish Centre for Carbon Capture and Storage: >65 researchers	Energy extraction Energy Electricity and gas

Name	Description	Sub-topics Covered	No of Staff	Sector
	Uncertainty Quantification Production Chemistry/Scale Centre for Enhanced Oil Recovery and CO2 Solutions Hydrates, Flow Assurance & Phase Equilibria Production Technology Marine Renewables Carbon Capture & Storage			
Imperial College London, Department of Aeronautics	The department undertakes fundamental aerospace research and maintains collaborative links with Industry. Research is managed through the two sections, Aerodynamics and Aerostructures, that cover a range of topics: - Fundamentals of flow - Aerospace vehicle design, aerodynamics and performance - Environmental and industrial flows - Biomedical flows - Control, dynamics and optimization - Flow Control - Turbulence, mixing and flow control - Computational mechanics - Impact of composites - Damage tolerance	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Fluid dynamics	DEPARTMENT: >20 academic staff, >20 research staff, >10 PhD students TOPIC: >5 research staff >3 PhD students	Energy extraction Manufacturing Electricity and gas
Imperial College London, Department of Chemical Engineering and Chemical Technology	Research Themes: Biological Engineering Natural Resource Engineering Fluids Engineering Particle and Materials Engineering Process Systems Engineering Reaction and Separation Engineering Research Focus Groups: Biotechnology and Bioprocess Engineering Biomedical Engineering	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Fluid Flow	DEPARTMENT: >30 academic staff, >40 research associates, >20 PhD students TOPIC: >5 researchers	Energy extraction Energy

Name	Description	Sub-topics Covered	No of Staff	Sector
	Complex Materials Energy Engineering Environmental Engineering Fluid Mechanics Molecular Modelling and Thermodynamics Process Systems Engineering Reaction Engineering and Catalytic Technology Separation Engineering and Technology			
Imperial College London, Department of Mechanical Engineering	Research activities in Mechanical Engineering are split into three divisions: Applied Mechanics: - Design Engineering - Dynamics - Mechatronic systems - Medical engineering - Non-destructive evaluation - Nuclear engineering - Railways - Tribology Mechanics of Materials - Adhesion and adhesives - Deformation and fracture of polymers and composites - Metal forming and materials modelling - Nanomaterials - Soft solids - Structural integrity Thermofluids	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Corrosion • Non-destructive evaluation • Materials strength	DEPARTMENT: >60 academic staff, >40 research staff, >50 research students TOPIC: <10 researchers	Manufacturing
University of Aberdeen, Geology and Petroleum Geology	Research work is carried out across 5 research themes: Climate change, tectonics and sediment flux Terrestrial ecosystems Deep-water frontiers Geofluids and porous media	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Geosciences, geology • Seismology	>10 academic <5 research staff >20 post-grad students	Energy extraction

Name	Description	Sub-topics Covered	No of Staff	Sector
	Meteorite impacts and astrobiology			
University of Bath, Department of Chemical Engineering	Research activities are grouped into three areas: Advanced Materials and Porous Solids Biochemical and Biomedical Engineering Catalysis and Reaction Engineering Research topic are pursued through multidisciplinary Research Centres: - Centre for Extremophile Research - Centre for Regenerative Medicine - Centre for Sustainable Chemical Technologies - UK Sustainable Hydrogen Energy Consortium - BRE Centre for Innovative Construction Materials - Institute for Sustainable Energy and the Environment	• OIL and GAS • REFINING, TRANSPORT and STORAGE of OIL and GAS • Hydrocarbon processing	DEPARTMENT: >10 academic staff >10 research staff >5 PhD students TOPIC: >5 researchers	Energy extraction Refining
University of Birmingham, School of Chemical Engineering	Research is organised via two multi-disciplinary centres: - Centre for Formulation Engineering - Topics include: design and characterisation of microstructured products; heat and mass transfer; fluid flow; particle technology and materials engineering across chemical, biological and physical systems. - Interdisciplinary Research Centre in Materials Processing – IRC focuses on the development of materials, through materials processing and of manufacturing technologies Research Groups - Catalysis and Chemical Reaction	• OIL and GAS • REFINING, TRANSPORT and STORAGE of OIL and GAS • Hydrocarbon processing	DEPARTMENT: >20 academic ? research staff ? research students TOPIC: >10 researchers	Energy extraction Refining

Name	Description	Sub-topics Covered	No of Staff	Sector
	Engineering - Fuel Cells - Nanoengineering and Surface Chemistry			
University of Birmingham, School of Metallurgy and Materials	Research areas: - Alloy Processing - Characterisation and Modelling - Engineering Properties of Materials - Functional Materials Processing	• OIL and GAS • OIL and GAS CONVERSION • Materials •	DEPARTMENT: >10 academic >10 research staff ? research students TOPIC: >5 researchers	Manufacturing
University of Bristol	IRT-MODE - Integrated Reactive Transport Modelling of Dolomite Evolution. This project integrates process-based numerical modelling with existing observational data to generate predictive concepts of diagenetic modification of reservoir-quality in fractured carbonates.			
University of Glasgow, School of Geographical and Earth Sciences	Research is conducted in the fields of Human Geography and f Earth Systems. Earth Systems Research addresses: - Earth-life processes - Surface processes - Shallow crustal processes - Extra-terrestrial and mantle processes - Earth observation and technology	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • OTHER OIL and GAS • Reservoir • Geosciences, geology • Numerical modelling	DEPARTMENT: >50 academic and research staff >20 PhD students TOPIC: >5 researchers	Energy extraction
University of Leeds CiPEG	IPEGG - Integrated Petroleum Engineering - Geomechanics - Geophysics - Next Generation technology for the petroleum industry. With support and funding from four ITF member companies, researchers with a broad expertise (including geology, geophysics, geomechanics, petroleum engineering) from the University of Leeds, Bristol University and Rockfield Software	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • OTHER OIL and GAS • Reservoir • Geosciences, geology • Numerical modelling	>5	Energy extraction

Name	Description	Sub-topics Covered	No of Staff	Sector
	Ltd collaborated and embarked on a multidisciplinary study to assess how geophysical indicators of stress and mechanical property distributions within reservoirs can be integrated with coupled geomechanical- fluid flow models to predict reservoir behaviour (i.e. stress changes, compaction, fault reactivation) during production.			
University of Liverpool Mass Spectrometry Group	The MIMMS (Membrane Inlet Miniature Mass Spectrometry Based Water Monitoring System) project developed by Liverpool University is a novel oil-in-water monitor based on miniature mass spectrometry technology.	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Gas measurement	6 Group members	Energy extraction
University of Nottingham, Department of Chemical and Environmental Engineering [Envir & Mining Eng]	The Faculty of Engineering research activities are organised in multi-disciplinary Research Divisions: - Architecture and Urbanism - Electrical Systems and Optics - Energy and Sustainability - Infrastructure and Geomatics - Manufacturing - Materials, Mechanics and Structures - Process and Environmental - environmental flows, bioprocess engineering, industrial microwave processing, particle and fluid processing	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Hydrocarbon processing • Fluid flow • Reservoir	DEPARTMENT: >20 academic staff >10 research staff >? PhD students TOPIC: >10 researchers	Energy extraction Energy
University of Nottingham, Department of Electrical and Electronic Engineering	The Electrical Systems and Optics Research Division includes: - Cummins Innovation Centre - Applied Optics Group - George Green Institute for Electromagnetics Research - Institute of Biophysics, Imaging and	• OIL and GAS • ENHANCED OIL and GAS PRODUCTION • Hydrocarbon processing • Reservoir	DEPARTMENT: >20 academic staff >20 research staff >1 PhD students TOPIC:	Energy extraction

Name	Description	Sub-topics Covered	No of Staff	Sector
	Optical Science - Photonic and Radio Frequency Engineering Group - Power Electronics, Machines and Control Group - Power Electronic Energy Conversion, Conditioning and Control; Power Electronics Integration, Packaging and Thermal Management; Motor Drives and Motor Control; Electrical Machines		>5 researchers	

5. Development and Demonstration Funding

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There are currently no grants listed on the UKERC Research Register in this category of funding.

Government funding (BIS, DECC, DEFRA, TSB etc.) of demonstration projects would be enabled by means of funding programmes led with a call for funding proposals. This process is rolled out to regional development boards (e.g. in Section 4, Scottish Enterprise funding call for research and innovation project proposals on subsea operations).

DECC funding is currently focused on CCS and renewables (e.g. MEAD marine energy Array demonstrator).

Other funding routes are through direct investment from the oil and gas companies or industry service providers or venture capital. Project delivery may be in-house research centres or project companies or independent ventures.

University technology campuses and innovation funds are mechanisms for later stages of development and commercialisation, e.g. ISIS Innovation[5].

The demonstration stage for some major new technologies in the oil and gas sector can demand funding levels that are several times more than that required for basic research. After proof of concept, demonstration plant must be developed to prototype equipment for field-testing.

Complex projects require considerable levels of funding and require a single project company focus to take the developments to the demonstration stage and beyond. For example, Compact GTL have developed their version of the syn-gas and Fischer-Tropsch process for producing hydrocarbon liquids (syn-crude) from "waste" gases produced by oil extraction. From the original design concept and laboratory tests (as Accentus plc, formerly part of the UK Atomic Energy Authority, later acquired by Coller Capital, private equity fund) a development laboratory was established in Abingdon and a demonstration plant in Wilton, Teeside. The modular design is aimed at capturing flare gas from offshore (or inshore) oil production and creating high value liquids. The proof of concept must also address commercial viability and the commercial pilot plant (in Brazil) is supported by a business plan incorporating strategic alliances for design, manufacture and installation of the compact modules.

For service providers to the industry this stage of development has a strong commercial focus with the near market development aimed at specific product or service improvements.

[5] Example from ISIS: Oxford Catalysts is a commercial venture out of Wolfson Catalysis Centre. Catalysts were developed for use in transforming waste methane into the chemical building blocks of liquid fuels (see GTL demonstration project).

6. Research Facilities and other Assets

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Many organisations and universities have facilities relating to energy, science or technology studies which can be adapted to use for oil and gas related research topics. The many organisations listed in section 3 have the expertise and laboratory facilities to support basic research (e.g. mathematics, physics, and computational analysis departments). Engineering departments support specific topics (e.g. materials, engines or fuels) and applied research may be supported by the multidisciplinary centres that now exist in many universities.

Fundamental research on materials may be undertaken at the STFC funded neutron source ISIS at the Rutherford Appleton Laboratory and Diamond (synchrotron).

Government funding in this sector is predominantly related to the environmental impact of the industry's activities. Industry research is diverse and widespread with companies accessing global research and skills base.

Oil and gas companies historically maintained their own research facilities and research programmes, particularly for hydrocarbon reservoir and fuel related topics. The research centres and facilities tended to be for "in-house" research programmes only. In the UK the number of such centres has been greatly reduced with companies now developing research programmes in association with university centres. For example, BP is investing in a research centre for advanced materials at Manchester University. (See section 7 for ITF projects with Heriot Watt Institute of Petroleum).

In addition to the major petroleum companies and larger service companies there are numerous service providers in the industry. These include engineering consulting firms (with a range of sizes and skills), materials testing laboratories (reservoir fluids, corrosion and air quality topics), to geoscience based companies undertaking reservoir performance modelling. Many of these develop their own software and analysis packages that require only conventional computing power and good geological data. The data acquisition, by seismic survey, is generally acquired by and remains confidential to the exploration companies.

Research data is shared through industry groups (see section 7) or commercial arrangements and general database information is not readily available. Oil and gas production statistics are readily available in publications such as the BP Statistical Review[6]. Global and country forecasts for energy use and oil and gas production are available from institutions such as the IEA, OECD and the EIA[7]. Data relating to the UK oil and gas reserves are available from DECC[8]. This information (previously published as the "Brown Book") relates to the hydrocarbon exploration and production licences and contains historic figures of production and estimates of reserves in addition to drilling activity statistics and some well performance and field geological data.

[6] This may be downloaded from the BP website at http://www.bp.com/sectionbodycopy.do?categoryId=7500&contentId=7068481

[7] Energy Information Administration, website http://www.eia.gov/

[8] See link http://og.decc.gov.uk/en/olgs/cms/data_maps/data_maps.aspx for details

Table 6.1: Research Facilities and Assets

Name	Description	Type of asset	Scale of operation	Annual Operating Budget
BGS	British Geological Survey	Laboratory/centre Test facility Database Model	>700 staff and visiting researchers Ten locations.	
Exova	Metals and material testing laboratories	Laboratory/centre		
Intertek	Material testing laboratories, metering, calibration, petrochemical quality measurement.	Laboratory/centre		
OSEMOSYS Energy Modelling Network	OSEMOSYS represents a group of international experts developing the OSEMOSYS model into a working analytical framework.	Open Source Energy Modelling System		
GL Noble Denton	The former Advantica facilities (and previously British Gas Research centres) are now included in the Germanischer Lloyd Noble Denton group. A range of technical services are offered to the oil and gas industry including instrument testing calibration and certification, pipeline materials testing and explosion and fire testing.	Laboratory/centre Test facility Model		
University College London MPRG	Maghreb Petroleum Research Group – geological test facilities. Mass spectrometry, mineral analysis etc.	Laboratory/centre Database	>10 research staff	
BP International Centre for Advanced Materials	Engineering and Physical Sciences at Manchester University. Selected by BP as the hub of their new International Centre for Advanced Materials. Research programmes in collaboration with University of Cambridge, University of Illinois at Urbana-Champaign and Imperial College, London.	Laboratory/centre Test facility Database Model	£64 million invested. The ten-year investment programme will fund is expected to support 25 new academic posts, along with 100 post-grad researchers and 80 postdoctoral fellows.	
Institute of Petroleum	Heriot Watt centre for geosciences, hydrocarbon reservoir and production research.(see also section 7, IofP provides services to ITF)	Laboratory/centre Model	>30 research staff plus associates and students	
Centre for Process Integration	Manchester University. Research centre with specific expertise in conceptual process design. Links to	Model	10 core academic staff plus 7 associates	

	industry are maintained through the Research Consortium.			
National Subsea Research Institute University of Aberdeen, School of Engineering	The National Subsea Research Institute (NSRI) is a research centre for the subsea industry. It is a partnership between the UK subsea industry and academia with a remit to develop and lead a co-ordinated research strategy for the UK subsea sector. Deep sea testing facilities			

7. Networks

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Oil and Gas networks range from the formal co-ordinating bodies (government and institutional level) through trade associations and commercial interest groups to collaborative project groupings. In addition professional engineering and science institutions form subject specific discussion and working groups.

Networks included here are those with more explicit and formal memberships and excludes the many informal arrangements or collaborative projects organised on a commercial basis (details of which are not always available) and the many industry sponsored conference and technology exhibitions and events. Many of the research networks that include oil and gas sector business are formed from common interests in climate change issues (and legislation) which tends to be at the energy consumption end of the hydrocarbon supply chain. Research in exploration related activities, other than some fundamental topics, is conducted within the industry research centres and interest groups to maintain proprietary interests.

There is no single industry model for oil and gas research activity. The existence of large corporate structured research centres typical of the energy majors in the 1980s has been replaced with a more open model and reduced technology and engineering focused centres (see Exxon Total). A number of companies employ an "outreach" programme of managed research relationships with R&D services (university or commercial) on a global basis (see BP-Oxford memorandum of understanding, 2010 and Statoil Innovate). In addition, the service providers to the oil and gas sector have increased their activity in product and technological developments (see ITF in Table below). The involvement of the suppliers to the industry puts greater emphasis on the demonstration and development stages of the RD&D process.

Table 7.1 Networks

Network	Established	Description	Membership	Activities
Energy Research Partnership	The ERP was established in 2005 by Sir David King (then Government Chief Scientific Advisor) and Paul Golby (then Chief Executive of E.ON UK). The Analysis Team was formed in 2008.	The Energy Research Partnership is a high-level forum bringing together key stakeholders and funders of energy research, development, demonstration and deployment in Government, industry and academia; plus other interested bodies, to identify and work together towards shared goals.	• ERP membership is drawn from public sector bodies, companies (over 10) and academics actively committed to, and/or engaged in energy research and innovation. • Members websites • ABB • Arup • Atkins Global • BP • Carbon Trust • DCLG (Department for Communities & Local Government) • DECC • Department for Transport • Doosan Power Systems • Drax Power • E.ON • EPSRC • ETI (The Energy Technologies Institute) • Friends of the Earth • National Grid • Ricardo • Royal Academy of Engineering • Scottish Enterprise • Scottish & Southern Electric • Shell • Technology Strategy Board	ERP undertakes a number of activities: - workshops and seminars to include external stakeholder and present and disseminate findings. Current projects Hydrogen Resource Use Efficiency International Abatement Opportunities Flexibility Options Industrial Energy Efficiency International Engagement Nuclear Energy Storage Bioenergy Previous work - Innovation Milestones to 2050, report March 2010 - Electricity Infrastructure, report November 2009 - Carbon Capture and Storage, consultation responses Sep 2008 and Sep 2009 - Heat, workshop report June 2009 - Energy Technologies Matrix, report March 2009 - Investigation into high level skills shortages in the energy sector, March 2007 - UK Energy Innovation, 2007

			• UKERC • University of Cambridge • Welsh Government	
International Council of Academies of Engineering and technological Sciences Inc. (CAETS)	1978	CAETS has initiated a number of joint projects on engineering issues of international importance and activity. Developing strategies to accelerate the rate at which new low-carbon technologies can be deployed internationally.	• Research Academies from 26 countries • UK rep: Royal Academy of Engineering (RAEng)	
Oil and Gas UK	April 2007, but previously UK Offshore Operators Association (30 year history)	The leading representative body for the UK offshore oil and gas industry.	30 major UK hydrocarbon companies, 15 associates	Information/knowledge exchange for environment, oil spill response, safety and legislation Single industry voice Reports outlining views to Government
PILOT web archive here	DECC on-going –	PILOT (formerly the Oil and Gas Taskforce) facilitates a unique partnership between the UK Oil and Gas Industry, and government. They cooperate to deliver quicker, smarter and sustainable energy solutions to secure the long-term future of the UKCS and ensure full economic recovery of our hydrocarbon resources.	• Industry membership of PILOT comprises industry stakeholders able to make a significant commitment to PILOT and represent a broad spectrum of views rather than just those of their company or group. This includes eight members of the board of Oil and Gas UK, and around five independent members – all industry leaders at a managing director / chief executive level. • The forum is chaired by the Secretary of State for Energy and Climate Change and vice	The aim of PILOT has been to: - focus on delivery of actions that will improve the competitiveness of the UK oil and gas industry - deliver the PILOT 2010 vision, which will contribute to the longer term security of energy supply - promote continued dialogue between government and industry

			chaired by a Minister of State for Energy and Climate change	
COMMEND		COMMEND (COMMunity for ENergy environment & Development) is an international initiative designed to foster a community among energy analysts working on energy for sustainable development, and is managed by the Stockholm Environment Institute (SEI). A premise of COMMEND is that institutional and human capacity for energy and environmental analysis is in acutely short supply, and that developing country analysts are isolated from their colleagues in other institutions and from sources of institutional support in both the North and South. In short, there is a pressing need for initiatives that can professionalize sustainable energy analysis in the South and increase its role in decision-making.	• 15066 members • Individual professional users • 190 countries	COMMEND activities include: • Regular Regional Training Workshops for southern energy professionals that build capacity in energy-environment analysis techniques and the specific skills needed to use LEAP. Workshops have been organized by Fundacion Bariloche in Argentina for Latin American energy professionals, and by ERC in South Africa for Southern African professionals. • Updates to LEAP designed to support the continuously evolving needs of Southern energy professionals. • The COMMEND Web Site, which includes access to LEAP, information on other relevant software tools, and an online resource library as well as technical support and discussion forums designed to foster a community among COMMEND members.
Methane Network	NERC 2009: links related research (by NERC) on environment	Climate change interest – NERC funded		Earth science research themes cross-cutting with geological interest of oil and gas (also methane hydrates) and also environmental impact of oil and gas industrial activity.

Imperial College Energy Futures Lab Research Network		Networks to encourage researchers to communicate within and between disciplines and technologies, and to help establish Grand Challenge programmes.	• The Futures Energy Lab is involved in ERP, see above.	Details are held within the researcher communications.
GERG	European Gas Research Group, was founded in 1961	GERG seeks to strengthen the Gas Industry within the European Community by promoting effective, gas-related R&D. Membership reflects natural gas R&D activity across Europe and GERG members are actively conducting natural gas research and technical development within the European Community. GERG project websites: • iNTeg-Risk, Early Recognition, Monitoring, and Integrated Management of Emerging, New Technology related, Risks and, in particular, unmanned airborne vehicles for pipeline monitoring. • NATURALHY, a project to determine the problems and benefits associated with distributing hydrogen in the European natural gas system. • VOGUE, Visualisation Of Gas for Utilities and the Environment. • DEO, A large demonstration project of various gas technologies.	• 24 major companies with upstream and energy utility interests	Research activities range from gas chromatography, materials and corrosion to combustion and utilisation of natural gas. R&D priorities - Securing the European gas supply - Improving the safety and integrity of gas networks - Developing smart gas uses & managing energy demand - Improving the sustainability of natural gas supply and use & future energy schemes Maintain Academic network Avoid duplication of effort

		• COMBO • LABNET, a network of laboratories working for the improvement of the methodologies of measurement for domestic boilers and other domestic appliances based on combustion of fuel (gas, fuel oil, wood etc.). • ORFEUS, Optimised Radar to Find Every Utility in the Street • PIPEMON, Geo-information Services for Pipeline Operators: Ground motion monitoring and route planning from space. • PRESENSE, Pipeline Remote Sensing for Safety and the Environment		
PERF	1986	The Petroleum Environmental Research Forum (PERF), is a non-profit organization created to provide a stimulus to and a forum for the collection, exchange, and analysis of research information relating to the development of technology for health, environment & safety, waste reduction and system security in the petroleum industry	• Amerada Hess Corporation • BP plc. • Chevron Research &Technology Company • ConocoPhillips • CH2MHill • ExxonMobil • Phillips 66 • Petrobras • Repsol YPF • Saudi Aramco Oil Company • Shell • Statoil • Suncor • Syncrude Canada Ltd • Total • Plus associate members	PERF does not itself participate in research projects but provides a forum for members to collect, exchange, and analyse research information relating to practical and theoretical science and technology concerning the petroleum industry, and a mechanism to establish joint research projects in that field.

			• Plus external Group liaison	
British Flame	Formed in 1956. It is a founder member of the International Flame Research Foundation	British Flame is the trading name of the British Flame Research Committee. It is a professional association providing the important bridge between industry and academia to apply and exploit a range of developments in industrial combustion and environment engineering	• Hamworthy Combustion Engineering • Hotwork Combustion Technology • RJM International • Scottish Power • RWEnpower • Doosan Babcock Energy Ltd • E.ON UK Ltd • Cardiff University • University of Glamorgan	Activities include Flame Days and specific topic orientated seminars and provides a unique network of companies, research organisations and universities with a common purpose in solving todays energy requirements
PSIG	The Pipeline Simulation Interest Group (PSIG) was formed in 1969 and is administered by an executive council.	To facilitate the interchange of information and to advance the state of the art in the areas of modelling, simulation, optimization, transient flow, two phase flow, and related subjects as applied to gas, liquids, and solids pipeline systems.	• Representatives of • major gas companies • major oil companies • specialized consultants • universities in the United States, Canada, Europe, Australia, and Asia.	Annual meetings for the presentation of expert papers allowing for discussion and comparison across industry interests.
OFGEM IFI	2003/04	The Distribution Price Control Review (DPCR) and Transmission Price Control Review (TPCR), introduced the Innovation Funding Incentive (IFI) mechanism to encourage network operators to apply innovation in the technical development of their networks. The IFI is intended to provide funding for projects primarily focused on the technical development of the networks, to deliver value (e.g. financial, quality of supply, environmental, safety) to consumers.		

ITF	Established in 1999	Industry Technology Facilitator (ITF), is a "not for profit" organisation owned by 30 major global operators and service companies. Its key objectives are to identify technology needs, foster innovation and facilitate the development and implementation of new technologies.	• Aramco Services • BG Group plc • BP • Chevron • Conoco Phillips • Dong Energy • EnQuest • Exxon Mobil • GE Oil and Gas • KOC, Kuwait Oil Company Ltd • Maersk • Marathon Oil • Nexen • Petrofac • Petronas • Petroleum Development Oman • Premier Oil • PTT Exploration and Production • Qatar Petroleum • Schlumberger • Shell • Siemens • Statoil • Technip • Total • Tullow • Weatherford • Wintershall • Wood Group • Woodside	• Identify the shared technology needs of our member companies • Seek out innovative solutions • Engage the development community (call for proposals, review and approval of funds, involvement of universities, research centres and innovative companies) • Monitor project and Technology Implementation

8. UK Participation in EU Framework Programmes

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Research activities currently being undertaken are under Framework Programme 7 (FP7). The objective of the FP7 Energy Programme is to aid the creation and establishment of technologies necessary to adapt the current energy system into a more sustainable, competitive and secure one. It should also be less dependent on imported fuels and use a diverse mix of energy sources, in particular renewables, energy carriers and non-polluting sources.

The major research activities funded under the FP7 Energy Programme are:

- Hydrogen and fuel cells
- Renewable electricity generation
- Renewable fuel production
- Renewables for heating and cooling
- CO2 capture and storage technologies for zero emission power generation
- Clean Coal Technologies
- Smart energy networks
- Energy efficiency and savings
- Knowledge for energy policy making

The programme titles reflect the energy diversity and environmental study directions of FP7 and do not relate to the Oil and Gas Landscape sectors as labelled in the Register for aspects of fossil fuel research. However, there are significant synergies between research topics that are captured in the other Landscapes. For example, common interests in marine structures and mooring inspection feature in offshore installation research under the renewable theme. Sub-sea, drilling and seismic research is featured within the environmental areas of the programme.

Funding for the natural gas sector features in the Smart energy network programme. This relates to security of supply and involves aspects of EU-wide policy, network integration and market regulation (see DG-TREN for EU programme and infrastructure implications). For gas networks, the objective is to demonstrate more intelligent and efficient processes and systems for gas transport and distribution, including the effective integration of renewable energy sources and the use of biogas in the existing networks.

CORDIS, Community Research and Development Information Service, is an information space devoted to European research and development (R&D) and innovation activities that provides details of EU funded activities. Oil and Gas sector projects are listed in Table 8.1 below.

Demonstration and implementation is taken forward via Intelligent Energy Europe (IEE) with funding for energy efficiency and integrated energy project (mainly demand-side initiatives).

Table 8.1: EU Framework Programme Participation

Project	Objectives	Action Line	Type of Action	UK Participants	Co-Ordinator And Partners	Total Funding	EU Funding	Duration	Annual Spend
Strategic Energy Technology (SET) Plan	The SET-Plan of the EU aims to establish a new energy research agenda for Europe, to make better use of and increase resources, both financial and human, so as to accelerate the development and deployment of low-carbon technologies of the future.	The two main components of the SET-Plan are European Industrial Initiatives (EI Is) and the European Energy Research Alliance (EERA, described above). EIIs are a set of large-scale public-private demonstration activities aimed at rapid development of key energy technologies at the European level.		The Energy Research Partnership organised a meeting to discuss UK engagement in the EIIs, with participants from Government, industry and academia. More information can be found at www.energyresearchpartnership.org.uk/eii	Paul Durrant Energy Innovation at Energy Group Organisation Dept of Business, Enterprise & Regulatory Reform				
OFFGAS Offshore Gas	Gas separations on offshore platforms are of increasing importance for the purification	FP7-PEOPLE	Marie Curie Action	University of Edinburgh	University of Edinburgh and	€252K	€252K	2012-05-01 to 2016-04-	€63K

Project	Objectives	Action Line	Type of Action	UK Participants	Co-Ordinator And Partners	Total Funding	EU Funding	Duration	Annual Spend
Separation	of natural gas and for the separation of CO2 used in enhanced oil recovery (EOR). Developing effective materials and efficient process technologies for gas separations at high pressure plays a key role in the economic exploitation of offshore resources. Both Brazil and the EU have large vested interests in this field: Brazil has important offshore gas reservoirs situated where the seabed is too deep for a fixed platform, while EOR will be widely exploited in the North Sea. The proposed project will involve exchanges among three universities that are already conducting world-class research on materials and adsorption and membrane processes, thereby bringing together expertise on different aspects of the gas separation technology.		"International Research Staff Exchange Scheme"		Universidad de Malaga			30 48 months	
MINSC Mineral Scale formation: from the	The prime aims of this network is to provide research and training opportunities to a new generation of young fellows in fundamental and collaborative	FP7-PEOPLE	Marie-Curie Action: "Initial Training	University of Leeds	University of Leeds Københavns Universitet Westfaelische	€3796k	3796k	2012-06-01 to 2016-05-31	€949K

Project	Objectives	Action Line	Type of Action	UK Participants	Co-Ordinator And Partners	Total Funding	EU Funding	Duration	Annual Spend
atomic to the field scale	research projects related to the nucleation and growth of a series of relevant scale mineral systems in the absence or presence of inhibitors agents. The ultimate goal is to better understand one of the highly relevant problems in oil, geothermal and food industrial processes: pipe clogging and surface corrosion by mineral scale precipitates during production. The MINSC Initial Training Network (ITN) is comprised of partners from first-rate universities and high-level industrial partners located in the United Kingdom, France, Denmark, Iceland, Germany, Norway, and Italy.		Networks"		Wilhelms-Universitaet Muenster Haskoli Islands Centre National de la Recherche Scientifique Universitetet i Oslo Orkuveita Reykjavikur SF Maersk Olie og Gas as West Systems SRL			48 months	
SUBCOAST A collaborative project aimed at developing a GMES-service for monitoring and	The objective of SubCoast will be to develop a service for monitoring the extent and impact of subsidence in coastal lowlands and demonstrate its capability in various pilots for a variety of settings around Europe. The service will be designed to appropriately determine the effects of subsidence on current and	FP7-SPACE	Collaborative project: Stimulating the development of downstream GMES services	Natural Environment Research Council	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek – TNO The Geological	€40846k	€3108k	2010-04-01 to 2013-09-30 42 months	€1166k

Project	Objectives	Action Line	Type of Action	UK Participants	Co-Ordinator And Partners	Total Funding	EU Funding	Duration	Annual Spend
forecasting subsidence hazards in coastal areas around Europe	future flood risk in coastal lowlands, monitor the integrity of coastal barrier systems and infrastructure and assess the impact of subsidence due to natural or man-made causes (groundwater pumping and oil/gas production) on land use and hydrology.				Survey of Denmark and Greenland Alma Mater Studiorum-Universita Di Bologna Technische Universiteit Delft Tele-Rilevamento Europa - T.R.E. S.R.L. Stichting Deltares Natural Environment Research Council Hansje Brinker BV Panstwowy Instytut Geologiczny - Panstwowy Instytut Badawczy Consorci Institut de Geomatica Lietuvos Geologijos				

Project	Objectives	Action Line	Type of Action	UK Participants	Co-Ordinator And Partners	Total Funding	EU Funding	Duration	Annual Spend
					Tarnyba Prie Aplinkos Ministerijos Fugro NPA Limited				
SUBCTEST	Development of novel Non Destructive Testing (NDT) techniques and autonomous robots to be deployed by Remote Operating Vehicles (ROVs) for the sub-sea inspection of offshore structure welds.	FP7-SME	Research for SMEs SMEs co-operative research contracts SMEs collective research projects	TWI Limited Granta Park, Great Abington Cambridge United Kingdom Health and Safety Executive Technical Software Consultants Ltd General Robotics Limited	TWI Limited Vermon SA I & T Nardoni Institute SRLl Health and Safety Executive Dacon as Petroleumstilsynet Zachodniopomorski Uniwersytet Technologiczny W Szczecinie Technical Software Consultants Ltd General Robotics Limited	€1482.5k	€1101.1k	2008-09-01 to 2010-10-31 26 months	€684k
MICROCLEANMUD	Microwave Cleaning of Drilling Mud and Oil Containing	FP7-SME	Co-operative	Industrial Control	Retura Norge AS	€1501k	€1145k	2009-09-01 to	€750k

Project	Objectives	Action Line	Type of Action	UK Participants	Co-Ordinator And Partners	Total Funding	EU Funding	Duration	Annual Spend
	Hazardous Waste.		Research (all areas of science and technology)	Solutions Limited Arbel Electronics Ltd	Industrial Control Solutions Limited Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung E.V Nor-Tek Teknologisenter er AS Statoil ASA Arbel Electronics Ltd Fernando Dominguez SLU Lunagua S.L. Romill Spol SRO Heckmann Maschinenbau und Verfahrenstechnik Gmbh			2011-08-31 24 months	
DSF	The Deep Sea & Sub-Seafloor	FP7-	Contributi	University of	Universitaet	€1159.6k	€1000k	2010-01-	€464k

Project	Objectives	Action Line	Type of Action	UK Participants	Co-Ordinator And Partners	Total Funding	EU Funding	Duration	Annual Spend
	Frontier. [Project DS3F] Abstract had quoted oil sector activity as a related issue.	ENVIRONMENT	on of subsea floor sampling programs to European deep-sea research	Southampton	Bremen Istituto Nazionale di Geofisica e Vulcanologia Universitat de Barcelona Institut Francais de Recherche pour l'Exploitation de la Mer Institut de Physique du Globe de Paris Max Planck Gesellschaft zur Foerderung der Wissenschaften E.V. University of Southampton Universitetet i Tromsø Aarhus Universitet			01 to 2012-06-30 30 months	

9. International Initiatives

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The International Energy Agency (IEA) provides an important framework for wide-ranging international cooperation in energy related R&D in the form of its Implementing Agreements. Although there are currently 41 Implementing Agreements in the energy sector (now listed as Multilateral Technology Initiatives on the website) there are only four areas of activity that align to the Oil and Gas Landscape themes. These are:

- Advanced Motor Fuels
- Emissions Reduction in Combustion
- Enhanced Oil Recovery
- Multiphase Flow Sciences

In addition, the IEA foster a number of networking and information sharing initiatives such as Energy Technology Data Exchange (ETDE) and Energy Technology Systems Analysis Programme (ETSAP) for the R&D community of signatory countries.

There are many international collaborative networks relating to energy technology with governmental involvement reflecting the political and economic aspects of the energy sector. A list of some of the networks is included in Table 9.1.

Table 9.1: International Activities

Name	Type	Description	UK Contact Point
Advanced Motor Fuels	IEA Implementing Agreement	Related to Oil and Gas Combustion. End use: transport (relates to Transport Sector of Energy Efficiency Landscape) The objectives of the Implementing Agreement on Advanced Motor Fuels are to: - promote understanding of alternative motor fuels, their role in energy security, relative efficiencies and environmental consequences; - facilitate understanding of impacts of economic, environmental and technical factors on the market for alternative motor fuels; - facilitate the harmonisation of legislation, standards and regulations concerning alternative motor fuels.	UK is not a signatory to this agreement.
Agence Nationale de Recherche (ANR		Energy Committee: Agence Nationale de Recherche (ANR), the French National Research Agency aims to increase the number of research projects issued from the entire scientific community, and to provide funding based on calls for proposals and peer review selection processes.	RCUK ESRC
Emissions Reduction in Combustion	IEA Implementing Agreement	Related to Oil and Gas Combustion. End use: industry The goal of the Implementing Agreement on Energy Conservation and Emissions Reduction in	Link for agreement: http://ieacombustion.net

		Combustion is to accelerate the development of combustion technologies that demonstrate reduced fuel consumption and have lower pollutant emissions. The focus on emissions is primarily concerned with toxic or noxious emissions, rather than greenhouse gases, although improved combustion efficiency will lead to a reduction in emissions of carbon dioxide. Signatories : Belgium, Canada, Finland, Germany, Italy, Japan, Korea (Republic of), Norway, Sweden, Switzerland, United Kingdom, United States.	
Energy Technology Data Exchange (ETDE)	IEA Technology Agreements	This is a Cross Cutting activity (data, modelling, technology transfer). The ETDE agreement supports Information dissemination leading to opportunities to improve on sustainable energy practices and even to discovery and innovation.	UK is not PRESENTLY a signatory to this agreement.
IEA - EOR	IEA Implementing Agreement	The technology agreement on Enhanced Oil Recovery currently pursues six tasks: Studies of fluids and interfaces in porous media; Fundamental research on surfactants and polymers; Development of gas flooding techniques; Thermal recovery; Dynamic reservoir characterization; Emerging technologies.	UK Executive Committee member listed: Mr. Peter Haile Director Exploration, Development Unit (EDU) Department of Energy and Climate Change 1 Victoria Street London SW 1H OET United Kingdom Tel: +44 171 215 5085 Fax: +44 171 215 5212 Email: peter.haile@decc.gsi.gov.uk
	IEA Committees	Committee on Energy Research and Technology (CERT) Working Party on Fossil Fuels (WPFF) Experts Group on Science for Energy (EGSE) Experts Group on R&D Priority Setting	

IEAGHG	IEA	A network which aims to provide an international forum for organisations with an interest in the development of Oxy-Fuel Combustion Technology.	Executive member, UK rep. Mrs Louise Barr Head of Outreach and Engagement Office of Carbon Capture and Storage Department of Energy & Climate Change
NEET	International Collaborative Networks Related to Energy Technology	NEET is part of the IEA's programme supporting the G8 Gleneagles Plan of Action. It works to foster broader, more effective international co-operation, in particular with non-IEA countries. Other useful links: African Development Bank (AfDB) Asia Pacific Economic Cooperation (APEC) Asian Development Bank (ADB) Asian-Pacific Partnership (APP) Carbon Sequestration Leadership Forum (CSLF) European Bank for Reconstruction and Development (EBRD) European Biofuels Technology Platform European Technology Platform for Zero Emission Fossil Fuel Power Plants (ETP ZEP) European Union Energy Initiative (EUEI) Extractive Industries Transparency Initiative (EITI) Global Earth Observation System of Systems (GEOSS) Global Gas Flaring Reduction Partnership (GGFR) Global Network on Energy for Sustainable Development (GNESD) Guide on Resource Revenue Transparency (GRRT) International Emissions Trading Association (IETA) International Energy Agency (IEA) International Energy Forum (IEF) International Finance Corporation (IFC) International Standards Organization (ISO) Joint Oil Data Initiative (JODI) Methane-to-Markets Partnership (M2M) Organization of the Petroleum Exporting Countries (OPEC)	

		World Bank World Energy Council (WEC)	