

ANNEX B: TERMS OF REFERENCE FOR THE REVIEW

The study should:

1. compare the current demand for, and supply of, high-level scientific and technical skills in the UK, focusing on the type of skills required by businesses to lead and underpin their research and development activities (including examining the demand for highly specialised knowledge and skills in particular fields; for broad subject knowledge and for more generic skills);
2. investigate how the demand for, and supply of, these skills is likely to evolve over the next ten years by identifying the major sources of demand (including non science-related employment);
3. understand any factors (other than shortfalls in overall supply) that may hinder innovative companies in recruiting and retaining the highly skilled scientists and engineers with the relevant skills;
4. investigate the mechanisms through which businesses in the UK identify their needs for specific high-level scientific and technical skills and communicate these needs to the higher education sector (primarily, but not exclusively, higher education establishments and organisations in the UK);
5. investigate the way in which the higher education sector – in collaboration with other sections of the education sector – currently responds to these demands (including the process by which those in higher education can access the academic and business research opportunities available to them);
6. propose improvements, if necessary, to these mechanisms to ensure that the higher education sector can and does respond effectively to future shifts in the demand of businesses for particular skills; and
7. analyse whether, over and above any such proposals to improve to these mechanisms, more needs to be done in the short term to seek to address:
 - i. any mismatch between the overall demand for particular scientific and technical skills and their overall supply; and
 - ii. any factors that hinder the ability of innovative businesses to recruit and retain scientists and engineers with the relevant skills.

ANNEX C: GLOSSARY

This list includes abbreviations and acronyms commonly used throughout this report, as well as further information about some of the terms used.

AGCAS	Association of Graduate Careers Advisory Services
AGR	Association of Graduate Recruiters
AMAs	Advanced Modern Apprenticeships
ANRSE	A database (Analytical Researchers, Scientists and Engineers) maintained by the OECD – a data-set on human resources working on R&D in the business enterprise sector.
ARCS	Academic Research Careers in Scotland (a survey)
AST	Advanced Skills Teacher (Teachers who are deemed 'excellent' in a range of skills' in which they train colleagues).
BBSRC	Biotechnology and Biological Sciences Research Council
BCIS	Building Cost Information Service Ltd (Information services of The Royal Institution of Chartered Surveyors)
BCS	British Computer Society
BERA	British Educational Research Association (The aim of the Association is to sustain and promote a research culture in education.)
BERD	Business Enterprise expenditure on Research and Development (statistic)
CASE	Co-operative Awards in Science and Engineering (CASE projects aim to link universities, students and business employers in SET, and involve research students working on projects of one to three years in duration which are of direct relevance to a particular industry.)
Connexions Service	The government's support service for young people aged 13 – 19 in England, which aims to provide integrated advice, guidance and access to personal development opportunities.
CPD	Continuing Professional Development

CRC	Cooperative Research Centres (An Australian research centre programme which has five main areas of activity – manufacturing, information technology, mining and energy, agriculture-based industry, environment, medical science and technology.)
CRS	Contract Research Staff
CST	Council for Science and Technology
CSU	Higher Education Careers Services Unit
DfEE	Department for Education and Employment (the predecessor to the Department for Education and Skills).
DfES	Department for Education and Skills
D&T	Design and Technology
DTI	Department of Trade and Industry
doctorate	A qualification denoting training and achievement in original research; often a PhD/DPhil but also including EngD, DSc (Doctor of Science) etc. The 'new route PhD' is an experimental four-year PhD programme.
EEA	European Economic Area
EPSRC	Engineering and Physical Sciences Research Council
ESRC	Economic and Social Research Council
ETB	Engineering and Technology Board
Faraday Partnerships	Faraday Partnerships improve the flow of technology and skilled people between the science base and industry. Partnerships exist between industrially oriented research organisations and the science and engineering base, to carry out core research and provide industrially relevant postgraduate training.
FE	Further Education
FRESAs	Frameworks for Regional Employment and Skills Action
FTE	Full-time equivalent
GCE	General Certificate of Education
GCSE	General Certificate of Secondary Education
GNVQ	General National Vocational Qualification

GTP	Graduate Teacher Programme (This programme is designed to allow schools to employ unqualified teachers who are preparing for QTS assessment, assess them against the standards for the award of QTS, and devise individual training plans for them.)
grade drift	The movement of a member of staff from a lower pay-scale "grade" to a higher one in order to increase his or her salary, perhaps occurring when it is not possible to better pay the members of staff concerned on the lower scale (determined by national pay scale bargaining).
H&S	Health and Safety
HE	Higher Education
HEIs	Higher Education Institutions (encompassing colleges of higher education as well as universities).
HEIF	Higher Education Innovation Fund (A DTI Knowledge transfer/exploitation fund (<i>England only</i>) supporting the interaction of HEIs with businesses and the wider community.)
HEFCE	Higher Education Funding Council for England
HESA	Higher Education Statistics Agency
ICT	Information and Communication Technology: telecommunication and computer technology
IENG	Incorporated Engineering degree
IIES	Institute of Employment Studies
IMRCs	Innovative Manufacturing Research Centres
INSET	In-Service Education of Teachers
IoP	Institute of Physics
IT	Information Technology
ITT	Initial Teacher Training (required to attain QTS – see below).
JIF	Joint Infrastructure Fund
KT	Knowledge Transfer
LEAs	Local Education Authorities
MASN	Maximum Allowable Student Numbers (a term formerly used by HEFCE to determine the number of students allowed per HEI).

Master's degree (MSc/MPhil)	MSc degrees are awarded to graduates who have degree undertaken a further course of study, after an honours degree, either full or part-time. Master's degrees may be taken following a period of work experience and some courses take the form of company training programmes. MPhil degrees may be awarded following a period of research rather than a course of study. The Master of Research (MRes) degree is a one year full-time course with postgraduate training in methods and practice of research and in relevant transferable skills that are not normally offered in MSc courses.
MPhys/MEng	These are both examples of four-year undergraduate degrees whereby the fourth year of the courses leads to a Master's qualification usually required for advanced professional work (physics) and chartered status for engineers.
MRC	Medical Research Council
MSP	Maths and Science Partnership Programme (which supports schools working with universities and community to improve science, technology and mathematics education.)
NATFHE	National Association of Teachers in Further & Higher Education (The University and College Lecturers' Union)
NBER	National Bureau of Economic Research
NERC	Natural Environment Research Council
NICEC	National Institute for Careers Education and Counselling (based at Lucy Cavendish College, Cambridge).
NMW	National Minimum Wage
Neighbourhood Engineers Programme	The Neighbourhood Engineers Programme (NEP) aims to enhance young people's scientific and technical capability and raise awareness of the importance of engineering to the economy and society. Neighbourhood Engineers (NEs) attend schools to enthuse young people by practically assisting with curriculum linked activities. It is financially supported by the ETB.
OECD	Organisation for Economic Co-operation and Development
OFSTED	Office for Standards in Education (officially the Office of Her Majesty's Chief Inspector of Schools in England).
OST	Office of Science and Technology

PGCE	Postgraduate Certificate in Education (generally a one year postgraduate qualification) leading to Qualified Teacher Status.
PI	Principal Investigator (an academic who obtains funds to carry out a research project from Research Council or other funding).
PISA	Programme for International Student Assessment (carried out by the OECD)
postgraduate	A student on a course which normally requires a first degree as a condition of entry.
PPARC	Particle Physics & Astronomy Research Council
PSREs	Public Sector Research Establishments
QAA	The Quality Assurance Agency for Higher Education which assesses teaching quality in universities and HE colleges.
QCA	Qualifications and Curriculum Authority (a national body which determines the national curriculum and contributes to the design of national examinations).
QR	Quality-related Research funding – part of the block grant of state funding given to English HEIs by HEFCE.
QSEs	Qualified Scientists and Engineers
QTS	Qualified Teacher Status (required by teachers to work in maintained schools in England).
RAE	Research Assessment Exercise – The process of assessing the quality of research in UK HEIs for funding purposes. The RAE is carried out every few years by the four UK funding bodies. The last RAE was in 2001.
RAIS	Research Assistants Industrial Secondments scheme
RCs	Research Councils
RCI	Research Careers Initiative (This is to monitor progress towards meeting the agreed concordat on contract research staff concerning the management of staff appointed on fixed term contracts – set up in 1996).
RCGSP	Research Councils Graduate Skills Programme
RDAs	Regional Development Agencies
Researchers in Residence	A scheme run by a number of the Research Councils and the Wellcome Trust, in collaboration with Sheffield Hallam University, which allows PhD students to support school science to make it relevant and exciting for young people.

R&D	Research and Development
RDS	Research Defence Society
RTOs	Research and Technology Organisations
RTP	Registered Teacher Programme – a DfES programme for people that have completed recognised teacher training overseas, and who have been accepted onto a UK course leading to a first degree (or equivalent qualification). Schools employ RTP trainees, working in partnership with HEIs, since participants must complete a degree at the same time as qualifying as a teacher. This programme requires maths, English and science standards.
SARTOR	Standards and Routes to Registration for engineers
SBS	Small Business Service
SCAA	School Curriculum and Assessment Authority (predecessor to QCA)
SCOEG	Standing Committee on the Employment of Graduates (predecessor to AGCAS)
scientists and engineers	Often used in this report as shorthand for 'scientists, engineers, technologists and mathematicians'.
SEAs	Science and Engineering Ambassadors programme – this is sponsored by DTI and DfES, and encourages scientists and engineers to help in schools.
SET	Science, Engineering and Technology (including the mathematical sciences).
SETNET	Science, Engineering Technology and Mathematics Network (a network, funded in part by Government, which aims to act as an enabling interface between businesses and schools in the areas of science, technology, engineering and mathematics).
SETPoints	The regional branches of SETNET (above).
SHEFC	Scottish Higher Education Funding Council
SME	Small or Medium Enterprise
SRIF	Science Research Investment Fund
STEM	Science, Technology, Engineering and Mathematics
STEP	Shell Technology Enterprise Programme

stipend	A grant paid to PhD students to fund them while they carry out their research projects – often awarded by Research Councils.
TCS	A Government programme, formerly known as the Teaching Company Scheme .
TTA	Teacher Training Agency
third stream activity/funding	Colloquially, activity by HEIs which is not funded as teaching or research; in this report, principally refers to funding for HEIs to engage in joint activity with businesses.
UCAS	Universities and Colleges Admissions Service
UCEA	Universities and Colleges Employers Association
undergraduate	Student working towards a first degree, higher education certificate or diploma or equivalent.
UUK	Universities UK (formerly CVCP – Committee of Vice-Chancellors and Principals).
VCE	Vocational Certificate of Education
Wellcome Trust	An independent medical research-funding charity, established under the will of Sir Henry Wellcome in 1936, and funded from a private endowment.

LIST OF TABLES

- 1.1 Percentage of 'year group' gaining SET qualifications, 2000
- 1.2 Real-terms increases in median salary for technical and senior R&D specialists
- 1.3 Increase in average gross weekly pay in real terms, 1994 to 2000
- 2.1 Pupils taking selected A-levels, 1991/92 to 1999/00
- 2.2 Entries to selected first degree courses, 1994/95 to 1999/00
- 2.3 A-level A-E grades in SET subjects as a percentage of A&E grades in all subjects, by English region
- 2.4 Targets and actual recruitment for Initial Teacher Training in England, 2001
- 2.5 Deterrents to teaching
- 3.1 Changes in student numbers for SET subjects
- 3.2 HEFCE subject premia price groups
- 4.1 Comparison of PhD stipend levels with available salaries
- 4.2 Uptake of RCGSP places by SET students, 2001
- 4.3 Thesis submission rates for Research Council students, 1994-1999
- 4.4 Comparison of benefits of 3 year and 4 year PhDs
- 5.1 Training provision and uptake by CRS
- 5.2 Percentage of wholly institutionally funded staff aged 55+ in 1994/95 and 1999/00
- 5.3 Actual and forecast inflows by SET discipline 1998, 2005 and 2010
- 5.4 Comparison of modelled inflows and PhD output
- 5.5 International comparison of average academic salary spending power, 1998
- 5.6 Grade drift in UK HEIs between 1995 and 2000 by subject of highest qualification
- 5.7 Increases in senior lecturer and professorial grades in UK HEIs 1995 to 2000

LIST OF FIGURES

- 1.1 Business enterprise expenditure on R&D (BERD), as a per cent of GDP, 1981 and 1999
- 1.2 New science and engineering graduates per 10,000 in the labour force aged 25 to 35, 1999
- 1.3 Students graduating with first degrees in SET subjects, 2000
- 1.4 Students graduating with first degrees in SET subjects, percentage change in number 1994/95 to 1999/00
- 1.5 Students gaining scientific and technical qualifications, 1994/95 to 1999/00
- 1.6 First destination of first degree graduates entering employment in 1999/00
- 1.7 Graduates' average gross salary in primary job, 2001
- 1.8 Economic activity rates for SET postgraduates, 2001
- 2.1 Pupils' achievements in Key Stage 2 examinations
- 2.2 Pupils' achievements in Key Stage 3 examinations
- 2.3 Pupils' achievements in selected GCSE examinations, 1991/92 to 1999/00
- 2.4 Pupils' achievements in selected GCSE examinations, 1999/00
- 2.5 Pupils' achievements in selected A-level examinations, 1999/00
- 2.6 Ranks of pupils' mathematical literacy by country
- 2.7 Ranks of pupils' scientific literacy by country
- 2.8 Percentage growth in proportion of pupils receiving grades A-C at A-level, 1991/92 to 1999/00
- 2.9 Distinctions and passes in GNVQs, 1997/98 to 1999/00
- 2.10 Entry and achievement by girls in selected GCSEs, 1999/00
- 2.11 Entry and achievement by girls in selected A-levels, 1999/00
- 2.12 Achievement in mathematics and sciences by ethnic group of pupil (Birmingham LEA, 1999)
- 2.13 Proportion of schools in which teacher shortages/inadequacy are adversely affecting pupils' performance, by subject, 'a lot' or 'some'
- 2.14 Teacher demographics by discipline

- 2.15 Proportion of entrants to Initial Teacher Training with a 2:1 or better in their first degree, 2000
- 2.16 Proportion of teachers of physics, chemistry and biology without qualifications in the subject
- 2.17 Median salaries of male physics graduates in different sectors of employment, 2001
- 2.18 Adequacy of school laboratories, 2000/01
- 2.19 Proportion of schools in which inadequate science equipment is hindering pupils' learning
- 2.20 Proportion of schools in which inadequate buildings are hindering pupils' learning
- 3.1 Changes in numbers of entrants onto SET courses, 1994/95 to 1999/00
- 3.2 Proportion of female entrants to SET courses, 1994 to 2000, by subject
- 3.3 Ethnicity of SET course entrants in 2000
- 3.4 Bids for additional student numbers in 2000/01 by subject
- 3.5 Sandwich students as a percentage of full-time first degree students, 1994/95 to 1999/00
- 3.6 Proportion of SET first years expecting to study for over three years and less than four
- 3.7 Number of SET undergraduate degrees by classification and subject over time
- 4.1 Number of first year postgraduates (full and part-time), 1994/95 to 1999/00
- 4.2 Gender and subject of qualifying postgraduates, 1999/00
- 4.3 Proportion of doctorates awarded to women, 1995/96 to 1999/00
- 4.4 Comparison of PhD stipend, graduate starting salary and national average salary, 1966/67 to 2002/03
- 4.5 Gross annual pay in main job by discipline and level, 2001
- 4.6 Per cent of PhD entrants with a 2:1 or First, 1996 to 1999
- 4.7 Number of UK doctorates by discipline and student origin, 1995/96 to 1999/00
- 4.8 Location of first and current jobs of EPSRC postgraduates
- 4.9 Proportion of UK doctorates in engineering by student origin, 1995/96 to 1999/00

- 5.1 Full-time and part-time researchers by gender, 1994/95 to 1999/00
- 5.2 Percentage breakdown of full-time staff by grade and SET discipline, 1999/00
- 5.3 Training or relevant experience reported by CRS in 2000
- 5.4 Comparison in real terms of spinal point 4 and 6 with graduate starting salaries
- 6.1 First destination of first degree graduates entering employment, 1999/00
- 6.2 Full-time staff employed in R&D, 1986 to 1999
- 6.3 Employment of professional scientists and engineers in business enterprise research sectors, 1986 and 1996
- 6.4 Median salaries of male physics graduates by sector and age, 2001
- 6.5 Growth in median salaries of male members of the Institute of Physics in various careers, between ages 25-29 and 35-39
- 6.6 Regional GDP, R&D activity and SET first degree entrants
- 6.7 Proportion of UK domiciled graduates and postgraduates taking employment abroad, 1999/00
- 6.8 Proportion of non-UK domiciled students at undergraduate level by subject, 1999/00

