Postgraduate Programme Specification

1 **Programme Title: Engineering Doctorate in Technologies for Sustainable Built Environments**

For students entering Part 1 in 2013/14

2 Awarding Institution: University of Reading

2 Teaching Institution: University of Reading

3 Relevant QAA subject benchmarking group(s) (if applicable):

Faculty of Science

4 Programme length:

48 months

Date of specification: 13.03.2013

5 Programme Director: Professor Janet Barlow

Board of Studies: : SCME Board of Studies for Postgraduate Programmes and the Annual Review Panel

6 Accreditation: EngD

7 **Summary of programme aims**

This Engineering Doctorate (EngD) programme is structured to deliver advanced knowledge and understanding of the theme Technologies for Sustainable Built Environments to Research Engineers (REs) including issues relevant to their roles as professional engineers. In particular this high-level programme examines cutting-edge development of current knowledge in sustainable and low carbon technologies used in the construction and maintenance of buildings, infrastructure and energy management. It will also equip students on the programme with the necessary skills to evaluate research findings and to conduct original research appropriate to their professional work. Many engineering issues related to sustainable technologies also deal with social, environmental, economic and communication skills areas which are covered by taught modules. A key aspect is that the programme is sufficiently flexible to cater for the varying needs of the research engineers who will be based in industry, but registered for the degree in the University.

8 **Transferable skills**

The EngD programme will train individuals capable of driving innovative thinking and developing sustainable technologies for the construction and energy management industries. Working closely with industrial partners who will be selected for their pioneering approaches to construction and technological development, University academics will provide a unique educational and research experience equipping future leaders in the construction industry with the management and technological skills required to deliver the zero carbon buildings of the future.

The RE's will be conducting research in one of the areas of the development and application of sustainable construction, renewable energy applications and energy management technologies, including their economic and social impacts. Attention will also extend to the way in which the adoption and use of such technologies can be enhanced through procurement and other policy levers. In particular, research in the Centre will be focused on the following two complementary themes:

- Sustainable building and services systems, and
- Energy management in buildings and infrastructure systems

In addition to the research programme, candidates will undertake a mixture of compulsory and optional modules, most of which are currently offered in the University for PhD research students and existing MSc courses. The taught programme is planned to fulfil the following objectives:

- provide up-to-date knowledge of the relationship between engineering research, innovative technologies, and sustainability with emphasis on application to the built environment and energy management;
- deliver professional development in management and business skills that are necessary for dealing with constantly changing legislative environment particularly in relation to energy utilisation;
- fill any knowledge gaps that may arise from the research project.

9 **Programme content**

This is separated into two distinct but related parts, one is a taught component the other is a research component.

A. The taught component

The following modules are compulsory:

Mod Code	*Module Title*	*Credits*	*Level*
INMR66	*Business Domain and Requirements Analysis*	*20*	*7*
CEMRC1	*Carbon Management*	*10*	
CEMREC1	*Energy Carbon and the Environment*	*10*	*7*
CEMREB1	*Energy in Buildings*	*10*	*7*
CEMRMR	*Research Methods*	*10*	*7*
	Total Credits	***60***	

Recommended Optional

Mod Code	*Module Title*	*Credits*	*Level*
CEMIB9	*Sustainable Design Construction & Operation*	*10*	*7*

In addition there is a need to obtain at least 60 credits of optional modules from those on offer at the University. The optional modules made available may change from time to time to incorporate new modules and accommodate resource and staff availability issues. The optional modules chosen for each student must demonstrate the application of knowledge to professional engineering applications. The module choice will be agreed between the student and the Supervisory Panel.

The new EngD cohort of REs will be required to attend an unassessed induction module that will be based on the University's Graduate Skills Development Programme to introduce the new REs to aspects of postgraduate research education.

The compulsory and optional modules would normally be delivered during the first two years of the programme.

Module delivery arrangements
Block delivery or University term.

B. Research Component
Before an RE is accepted on the EngD Programme a research project will be identified with and agreed between the industrial collaborator, the RE, the industrial and academic supervisors, and the EngD Programme director. The project will form the basis for the RE's EngD thesis to be submitted at the end of year 4. The EngD thesis will consist of a substantial study or a series of coherent studies aligned to a general theme. These to be undertaken either at the collaborating company or at the University and jointly supervised by University and Industrial Supervisors. The nature and scope of the substantial studies will be identified and discussed at regular meetings involving the RE, the industrial and academic supervisor(s). These are subject to review by a Supervisory Panel as well as an Annual Review Panel (described under "Support for students and their learning").

The RE will be expected to undertake a programme of research within the areas of development and application of sustainable construction, renewable energy applications and energy management technologies, including their economic and social impacts to qualify for EngD degree. In particular, the RE will be selecting a research project within one of the following two main research themes:

Sustainable Building and Services Systems (Building Scale)
- *The application and development of advanced computer simulation tools for the evaluation of conceptual design, detailed design, and optimisation of the performance of buildings and the systems*
- *Passive solar systems, such as solar walls and roofs, natural and hybrid ventilation systems*
- *Sustainable heating systems, such as ground source heat pumps, combined heat and power, biomass fuel systems, etc.*
- *Building integrated renewable energy systems, such as micro wind turbines, photovoltaic power generation, solar thermal systems, etc.*
- *Advanced operation and maintenance of building services systems for optimising performance and energy efficiency during their operation and ensuring compliance with the Energy Performance of Buildings Directive (EPBD)*
- *Developing new concepts and maintenance procedures for extending system durability and sustainability to reduce frequency of breakdown and replacement*

Energy Management in Buildings and Infrastructure Systems (Site Scale)
- *Life-cycle assessment of potential renewable resources, e.g.: urban wind, solar, hydro, biomass, large-scale combined heat and power, ground heat, etc.*

- *The evaluation, application and maintenance of low to zero carbon (LZC) generation technologies at the site scale, e.g. micro-wind, micro-hydro, ground source heat pumps, air-source heat pumps, solar thermal, solar photovoltaic, biomass, heat and power storage.*
- *Systems integration of LZC generation technologies*
- *Energy distribution and management systems including:*

The University Code of Practice for Research Students will apply to all RE's on the programme.

10 Part-time or modular arrangements
None

11 Progression requirements
The Taught Component

In order to successfully complete the taught element of the EngD programme a student must fulfil the requirements of the Postgraduate Diploma, to a minimum of the Pass level, detailed below.

The SCME Postgraduate Examination Board assesses all the taught component modules. The current marking criteria and classification framework as shown at: http://www.reading.ac.uk/Exams/ will be applied by the Examination Board. The assessment criteria relating to the 120 credit Postgraduate Diploma will be applied to the taught component of this programme.

Students who do not meet the required standard for the award of Engineering Doctorate or who leave the Programme early may be awarded a Postgraduate Diploma or a Postgraduate Certificate.

For PG Diploma in Technologies for Sustainable Built Environments (120 credits required)
To qualify for Distinction, students must gain an overall average of 70 or more over 120 credits and must not have any mark below 40.

To qualify for Merit, students must gain an overall average of 60 or more over 120 credits and must not have any mark below 40.

To qualify for Passed, students must gain a weighted average mark of 50 or more over modules totalling over 120 credits, which must include the 60 credits specified as compulsory listed above and 60 credits from relevant level 7 elective modules. The total credit value of all modules marked below 40 must not exceed 30 credits and the total credit value of all modules marked below 50 must not exceed 55 credits. The optional modules chosen for each student must demonstrate the application of knowledge to professional engineering applications. The module choice will be agreed between the student and the Supervisory Panel.

For PG Certificate in Technologies for Sustainable Built Environments (60credits required)
To qualify for a Postgraduate Certificate, students must gain a weighted average mark of 50 or more over 60 credits from the modules listed as compulsory and have no mark below 40 in any of the selected modules.

The Director of the EngD programme is a member of the Examination Board which includes the Directors of all taught postgraduate programmes and external examiners for

those programmes. The module results for all RE's is separately reported to the Examination Board and reported to the Annual Review Panel.

The Research Component
The research project will form the basis for the RE's EngD thesis to be submitted at the end of year 4.
Candidates for the EngD will be supervised by University and Industrial supervisors and progress will be monitored at 6-monthly intervals.

A review panel (also referred to as a monitoring team), which will be comprised of University and Industry supervisors and at least one Independent Academic, will formally assess student progress at least on an annual basis. This process will operate with regard to the procedures outlined in the Code of Practice on Research Students (Section 6 [b]). If the view of the review panel is that progress is unsatisfactory then the procedures stated in the Code of Practice on Research Students (Section 6 [d]) would normally be applied in the first instance. Subsequently, if progress is still deemed unsatisfactory then the Head of School may need to invoke the University's procedures on Neglect of Work and Unsatisfactory Progress (as enshrined in Ordinance XVII).

During the second year of registration, the student should undergo an in-depth assessment of progress, which will be equivalent to the "Confirmation of Registration" process outlined in the Code of Practice for Research Students (Section 6 [f]); the possible outcomes of this process are set out in the Code.

In the final year the Annual Review Panel will be superseded by the examination of the RE's thesis.

12 **Assessment and Classification**

The compulsory and optional modules will be taught in either a block delivery mode or over one University term. The full detail of teaching and assessment in each module is given in the module descriptions. The general approach to teaching is to deliver lectures, tutorials, project and laboratory work and site visits either during study visits, usually of one-week module duration, or over one University term. These attendance periods are supported with guided study through traditional private study and web based learning

The modules will be assessed by examination and coursework or by coursework alone. All modules are offered to other programmes within the University and the teaching, which may be cohort specific, will facilitate the interaction between all of the students on the modules. In this way the EngD student experience is enhanced. The assessment criteria for all modules will be as that described in the current module description.

Successful completion of all 60 credits of the compulsory modules and at least 60 credits of optional modules is required for the award of an EngD.

The current marking criteria and classification framework as shown at: http://www.reading.ac.uk/Exams/ will be applied to all modules.

The criteria for the assessment of the EngD thesis will be as shown in the Rules for the Submission of Theses for Higher Degrees at: http://www.rdg.ac.uk/Exams/ThesesRules.pdf and the Guide for Examiners for Higher Degrees by Research as shown at: http://www.reading.ac.uk/Exams/phdexaminers.pdf

In addition, an annual EngD conference will be organised during which all REs will present their research output which will be assessed by the University and industrial supervisors and the EngD programme director

13 Admission requirements

Entrants to this programme are normally required to have obtained:
Entrants to this programme are normally required to have obtained a 2.1 class honours first degree or better; or an alternative qualification of equivalent academic standing; in a relevant science or engineering subject.

Or
A Masters degree at merit level or better; or an alternative qualification of equivalent academic standing; in a relevant science or engineering subject.

All RE's must be sponsored by a company who have a current contract with the University to be engaged with the EngD programme. All applicants will be interviewed prior to admission to the EngD programme.

For applicants with prior learning and prior experiential learning the University Policy and procedure for the Assessment of Prior (Experiential) Learning (AP(E)L) will be followed.

Admissions Tutor: EngD Programme Director

14 Support for students and their learning

University support for students and their learning falls into two categories.

Learning support is provided by a wide array of services across the University, including: the University Library, the Careers, Placement and Experience Centre (CPEC), In-sessional English Support Programme, the Study Advice and Mathematics Support Centre teams, IT Services and the Student Access to Independent Learning (S@il) computer-based teaching and learning facilities.There are language laboratory facilities both for those students studying on a language degree and for those taking modules offered by the Institution-wide Language Programme.

Student guidance and welfare support is provided by Personal Tutors, School Senior Tutors, the Students' Union, the Medical Practice and advisers in the Student Services Centre. The Student Services Centre is housed in the Carrington Building and offers advice on accommodation, careers, disability, finance, and wellbeing, academic issues (e.g. problems with module selection) and exam related queries. Students can get key information and guidance from the team of Helpdesk Advisers, or make an appointment with a specialist adviser; Student Services also offer drop-in sessions and runs workshops and seminars on a range of topics. For more information see www.reading.ac.uk/student

The RE will have at least two supervisors. There will be one or two University supervisors and at least one industrial supervisor. Every RE will have a Supervisory Panel which will include the University and industrial supervisors. Whilst the University supervisors will be engaged in routine RE monitoring and research project supervision, the Supervisory Panel will formally monitor the RE's progress every six months. In addition an annual

review of the progress of the RE will be undertaken by an Annual Review Panel. This will include University and industrial supervisors and an independent Academic..

All supervisors and the new cohort of REs will be required to attend an induction workshop for the purpose of familiarisation with the EngD programme and to develop competencies in the supervising and management of RE's. A Handbook describing the EngD Programme and including distribution of responsibilities of all those involved will be prepared and distributed to all REs and supervisors.

The industrial supervisors will be selected on the basis of their knowledge in the research topic. Any action taken with regards to replacement of the supervisor will be in accordance with the Collaborative Contract Agreement between University, Industrial Sponsor and the RE.

University support for students and their learning falls into two categories. Learning support includes IT Services, which has several hundred computers and the University Library, which across its three sites holds over a million volumes, subscribes to around 4,000 current periodicals, has a range of electronic sources of information and houses the Student Access to Independent Learning (S@IL) computer-based teaching and learning facilities. There are language laboratory facilities both for those students studying on a language degree and for those taking modules offered by the Institution-wide Language Programme. Student guidance and welfare support is provided by Programme Directors, the Careers Advisory Service, the University's Special Needs Advisor, Study Advisors and the Students' Union.

15 Career prospects

The EngD Programme will be able to accommodate Research Engineers at all levels from a wide range of collaborating companies whose businesses are in construction, energy generation, and energy management. The programme will offer the RE competence in his/her own specialised research field in addition to more generic leadership and project management skills via a series of compulsory and optional taught modules and project work. The TSBE Centre will offer participants the chance to engage in holistic projects dealing with sustainability and energy efficiency in the built environment. It is anticipated that those trained will add significant value to the companies they will be working in by increasing efficiency from design to build, delivery and operation. This project-based research training will also offer participating REs the chance to interact extensively with others enrolled on the programme, increasing networking opportunities and the ability to learn from each other, thus providing significant added value to the researchers' experiences and future career prospects.

16 Opportunities for study abroad or for placements

It is possible that some RE's who will be working with a multi-national company could carry out part of their research abroad. However, all RE's will be encouraged to attend and present their research output at international conferences abroad and network with international researchers

17 **Programme Outcomes**

Knowledge and Understanding

A. Knowledge and understanding of:	**Teaching/learning methods and strategies**
Research methods and design study Project planning and management Advanced engineering and related methods in applied engineering research and professional practice Relevant professional issues	Reflection on course materials and related research and readings Face-to-face teaching and supervision Face-to-face discussion Professional experiences ***Assessment*** Assessment of assignments, based on the criteria stated in the summary of teaching assessment.

Skills

B. Intellectual skills – able to:	**Teaching/learning methods and strategies**
Analyse concepts, arguments, data and situations Synthesise descriptions and underlying features of situations from a variety of sources Create plans of various kinds, including research investigations Evaluate statistical results and research findings Relate systematic evidence to issues arising in professional practice	Activities based on course materials, related research, readings, participating in seminars and workshops, attending conferences. ***Assessment*** Assessment of assignments is based on the criteria stated in the summary of teaching assessment.

C. Practical skills – able to: Use statistical and related methods in professional context Formulate and manage research projects Access wide range of literature and data using bibliographic and IT skills Use IT for data handling and simulation software for analysis Communicate to different audiences	**Teaching/learning methods and strategies** Activities based on course materials and related research and readings Assignment preparation for taught modules *Assessment* Assignments and thesis will report the results of such activities

D. Transferable skills – able to: Monitor own learning Communicate orally and in writing Search for information in the literature and on the internet Use information to make decisions Project planning and management Data analysis Report and thesis writing	**Teaching/learning methods and strategies** Course materials Discussion with supervisors and peers Presentations at workshops and conferences *Assessment* Literature review

18	**Please note - This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the module description and in the programme handbook. The University reserves the right to modify this specification in unforeseen circumstances, or where the process of academic development and feedback from students, quality assurance processes or external sources, such as professional bodies, requires a change to be made. In such circumstances, a revised specification will be issued.**