LTC11D023

University of East Anglia

LEARNING, TEACHING AND QUALITY OFFICE

PROPOSAL FOR COURSE(S) LEADING TO AN AWARD OF THE UNIVERSITY OF EAST ANGLIA

This document is in three parts:

PART 1: Summary of the Proposal

This section may be used for publicity purposes, once approval has been granted.

PART 2: Business Case

For consideration by the relevant Faculty Executive

PART 3: Academic Case

For consideration by the relevant Faculty Learning, Teaching and Quality Committee

All three parts need to be completed. (There are different sections for fast-track proposals and these are clearly indicated).

For certain specified types of proposal such as change of degree title, change in School of registration, use a separate PART 4 template.

Extracts from this template will be published to form the programme specification.

ROUTE FOR APPROVAL (Please refer to the accompanying guidance notes and use the questions below to help you determine the most appropriate route)

Is the subject area new to the University?	**Is the subject area new to School?**
If yes, needs PRC and LTC approval	**If yes, needs LTC approval**

PRC Approval Required		LTC Approval in Principle Required	
Full	x	Fast-Track	

PART ONE - SUMMARY OF THE PROPOSAL

(This section may be used for publicity purposes. Please attach to the Business Case and to the Academic Case.)

S1	**SUBJECT AREA(S) (please state)** Is the subject area new to the University? If yes, needs LTC and PRC approval	Yes - Engineering	
	Is the subject area new to the School? If yes, needs LTC approval in principle	In part – the course builds on some existing provision across Science Schools but there will be new subject strands being developed.	
	(If yes to either question, the fast-track route is not applicable).		
S2	**PROFESSIONAL AWARD (if any)**	None although engagement with relevant professional body – the Energy Institute - will take place to allow exemption from part of their professional engineering accreditation processes, leading to the CEng (Chartered Engineer) status. The procedure for becoming a Chartered Engineer (CEng) is in two parts. Part 1 is the academic part and Part 2 is completed by the graduate while working in industry. After receiving sufficient industrial on-the-job experience and training the young engineer applies to take a Professional Review with a Professional Institution recognised by the Engineering Council. The normal requirement for CEng is an MEng degree. It is possible to be recognised as an Incorporated Engineer (IEng) with a BEng degree. A BEng (Hons) degree allows the candidate to top up their learning with further PG training to follow a path to CEng.	
S3	**ACCREDITING/VALIDATING BODY (if relevant)**	Energy Institute	
S4	**LEVEL**	Sub-degree (e.g. Cert. Dip.)	
		Undergraduate	YES
		Integrated Masters	YES
		Masters	
		Postgraduate Research	
S5	**AVAILABLE FROM (academic session)** *Insert (mm/yyyy)*	Sep 2013	
S6	**SCHOOL OF STUDIES**	School of Mathematics on behalf of the Faculty of Science	

Please complete the following section for each new course being proposed

Course One			
S7	**COURSE TITLE**	BEng (Hons) Energy Engineering with Environmental Management BEng (Hons) Energy Engineering with Environmental Management with a Year in Industry MEng Energy Engineering with Environmental Management	
S8	**AWARD**	BEng (Hons) MEng	
S9	**DURATION** (years or months)	Three years (BEng) / four years (BEng+ind and MEng)	
S10	**MODE OF ATTENDANCE** (full-time, part-time, distance, other)	Full-time	
S11	**PLACEMENT(S)/WORK-BASED LEARNING REQUIRED**	YES	x
		NO	x
S12	**COURSE HIGHLIGHTS**		
	These new BEng (Hons) and MEng programmes will combine new investment in engineering with existing and substantial expertise across the Faculty of Science in the fields of applied mathematics, energy resource and environmental management. The programme has been developed in partnership with industry and employers, through close collaboration with the East of England Energy Group (EEEGR), and aims to address the national and regional shortage of high-calibre qualified graduates in the field of Energy Engineering. The Faculty of Science houses an impressive range of engineering expertise, particularly in the Schools of Mathematics, Environmental Sciences, Biological Sciences, Computing Sciences and Chemistry. We are internationally renowned for our research and teaching in many relevant fields, including Applied Mathematics, Computer Systems Engineering, Geophysical Sciences and Physical Oceanography and Physical Chemistry, to name but a few. This existing expertise, combined with significant new investment by the Faculty of Science, will ensure that these BEng (Hons) and MEng programmes equip students with training in the fundamentals of engineering, along with its application to the energy industry. All students will be required to undertake a substantial individual engineering project as part of the final stages of each programme, and it is anticipated that many students will have the opportunity to link this project to an employer in the energy sector. Accreditation is being sought from the Energy Institute to allow MEng graduates partial exemption towards CEng status. A requirement of this is that they complete a major team-based project and this is included in fourth year. This programme will offer excellent career prospects to graduates. Employers have identified a shortage of engineers, particularly in the energy sector, so high calibre graduates from this programme will be in demand.		

S13	**RELEVANT SUBJECT BENCHMARK STATEMENT(S)**	Engineering
S14	**ENTRY REQUIREMENTS**	BEng (Hons) – AAB MEng - AAA To include A-level Mathematics. GCSE science if not offered at A level.
S15	**CAREER POSSIBILITIES**	Employment in a wide range of engineering-related industries, particularly those related to energy (renewable and non-renewable) as well as in academia and other sectors that target engineers. Local energy engineering industry continue to report a shortage of engineers. The skills taught will also transfer into a wide range of technical career paths.
S16	**JACS Subject Level Code(s)** To be completed by the Planning Office following approval of the Business Case	
S17	**UCAS ADMISSION CODE** To be completed by the Planning Office following approval of the Business Case	
S18	**FURTHER INFORMATION** *Insert contact address/email/tel no. AAO*	Caroline Rose c.j.rose@uea.ac.uk
S19	**Course Director**	Lawrence Coates
S20	**Course Proposer(s)**	Lawrence Coates

Questions for Initiator:

1. Do you want to propose another course? If yes, please complete Sections S7 – S19 (see below) for each related but separate award for which students may register from the outset.
2. Do you want to complete the Business Case yourself or do you want to send the Business Case to another member of staff to complete?
3. Do you also want to complete the Academic Case yourself or do you want to send the Academic Case to another member of staff to complete?

Course Two

(To be completed if there is a related but separate award for which students may register from the outset.)

S7	**COURSE TITLE**	n/a	
S8	**AWARD**	n/a	
S9	**DURATION** (years or months)	n/a	
S10	**MODE OF ATTENDANCE** (full-time, part-time, distance, other**)**	n/a	
S11	**PLACEMENT(S)/WORK-BASED LEARNING REQUIRED**	YES	n/a
		NO	n/a

S12	**COURSE HIGHLIGHTS**	
	n/a	
S13	**RELEVANT SUBJECT BENCHMARK STATEMENT(S)**	n/a
S14	**ENTRY REQUIREMENTS**	n/a
S15	**CAREER POSSIBILITIES**	n/a
S16	**JACS Subject Level Code(s)** To be completed by the Planning Office following approval of the Business Case	
S17	**UCAS ADMISSION CODE** To be completed by the Planning Office following approval of the Business Case	
S18	**FURTHER INFORMATION** – *Insert contact address/email/tel no. AAO*	n/a
S19	**Course Director**	n/a

PART 2 – THE BUSINESS CASE

Note: One Business Case (BC0 to BC9) is applicable to all proposed courses

BC0	**THE RATIONALE** (Overview - brief summary)	
BC0.1	**Brief summary of the rationale for the proposal**	
	The proposal has emerged from discussions across the Science Faculty led by an Engineering Working Party, initially chaired by Professor Liss and now chaired by Dr Ben Milner. The Working Party was established in March 2009 and presented its findings, after extensive consultation within the Faculty and more widely in UEA, to the Science Faculty Executive in February 2010 and to the University's Executive Team in March 2010. Both bodies encouraged development of the plans. There has been consultation with industry, employers and professional bodies during the initial discussions and further discussions took place following the decisions at Science Executive and ET. An external consultant had been engaged to assist with further work and on the basis of the consultant's recommendations and further discussion with industry/employers, this proposal is now being brought forward. There are a large number of energy/engineering employers in the eastern region, many of whom are finding it difficult to recruit/retain staff. Staff working in the industries in the region have to travel elsewhere for postgraduate provision in the subject. UEA's experience of introducing new programmes, such as Pharmacy, to fulfil a regional need is well established. The MSc Energy Engineering with Environmental Management, launched in September 2011, was the first stage in bringing to UEA a new area of teaching and research – the provision of undergraduate degrees in energy engineering is the second stage. Ultimately provision of a broader range of engineering programmes will be considered. The primary objectives of the courses are to: • provide a high-quality and challenging degree programme which addresses a range of current issues in energy engineering, covering a range of different areas including renewables (wind, wave, tidal, hydro, solar etc) and non-renewables (oil, gas, coal, nuclear) • develop a range of subject-specific engineering skills related to energy • enable students to enhance their intellectual skills through lectures, seminars, laboratory classes, visits to employers/industry, field trips and discussion with industrial practitioners • enhance skills in critical analysis and project management to provide a range of techniques for decision making that can be employed in a range of different situations • develop transferable, employability skills in self-expression, numeracy, computer literacy, team working, project management and independent research • develop specific English language skills in both written and oral expression, including well-honed report-writing skills. • acquire skills in forming scientific hypotheses and in testing these through research of relevant literature and through practical experimentation	

	• develop skills in communication of information to peers and non-specialists alike using a range of different forms of media. • develop skills in and understanding of the process of design, from feasibility through concepts and scheme to final detailed design. The structure of the degrees has been established with a view to facilitating later growth into other engineering disciplines such as Environmental Engineering or Engineering Mathematics. (see Appendix B) : Level 1 - 80 credits, Level 2 – 60+ credits, Level 3 – 50 credits, Level 4 – 60 credits. The theme in electricity and electronics could also support degree study in that subject. The simplest model for this growth would be to maintain a general engineering approach in first and second year and allow specialisation in third year. The multi-disciplinary nature of this approach will inevitably attract industrial support. From the point of view of professional accreditation care has been taken to ensure that BEng students who graduate after three years have sufficient breadth of understanding of the sector whilst allowing MEng graduates to study renewable energies in significant depth during fourth year. The experience of the course team suggests that the fourth year team-based project will become the flagship project of the MEng degree. It is intended to support this activity by an application to the Royal Academy of Engineering for the support of a Visiting Professor.
BC0.2	**Who (externally) has been consulted about the proposals (e.g. Professional Associations, employers' groups, PSBs; independent academic (required for new course proposal); external examiner (required for fast-track proposals)).** **Please summarise here and attach copies of any responses to this document or insert their comments in this section.**
	The following external contacts have been involved in discussions about the proposed UG and PGT engineering courses: Simon Coward (Chief Executive, Hethel Engineering Centre) Gregory Darling (Chief Executive, Gardine Shipping Ltd) Jim Gunn (Technical Director, Antech Calibration Services) Celia Anderson (Executive Director, Skills for Energy -East of England) Louisa Rix (Membership Development Officer, Institute of Civil Engineers) Ian Robertson (HR / Crewing Manager, SeaJacks UK Ltd) Stuart Thornton (Operations Manager, East of England Energy Group) Blair Ainslie (Managing Director, SeaJacks UK Ltd) John Best (CEO, East of England Energy Group) Mark Boyd (Chair, Acquaterra Energy) John Canton (Regional Director and Secretary, Institute of Civil Engineers) Jonathan Reynolds (Sustainable Developments Manager, EEDA) An External Consultant – Dr Cameron Stewart, Teal Ltd – undertook a two-day consultancy with the Science Faculty about the engineering plans. The initial response from Yasmine Dialdas, Professional Development Officer at the Energy Institute is that the proposed structure is likely to satisfy their requirements for accreditation. They were particularly pleased with the level of mathematics in the degrees.

BC0.3	**Is this a Fast-track proposal?**	**YES**	
		NO	**NO**
BC0.4	**If Yes, what features of the proposal make it a fast-track?** *Please refer to the New Course Approval Procedure*		
	n/a		

BC1	**ACADEMIC AND RECRUITMENT STRATEGY**	
BC1.1	**How does the proposal fit with School academic plans?**	
	The course is a good fit with research within the School of Mathematics and School of Environmental Sciences, as well as a number of currently taught modules that will still exist under NAM.	
	The Faculty's academic plans?	
	The Faculty is committed to expanding its delivery of STEM (Science, Technology, Engineering and Mathematics) subjects and this development fits in with that plan by expanding existing expertise. The plan also fits with HEFCE's shift of funds towards STEM subjects from other teaching areas.	
	The University's Corporate Plan?	
	The University is committed to enhancing its role in the Eastern region. The region is renowned for its energy industries but there is currently no directly relevant academic provision. The proposed undergraduate courses will therefore significantly enhance UEA's role with this industrial base.	
BC1.2	**Proposed Recruitment Strategy**	
	The aim is to recruit both regionally, nationally and in EU countries as part of the UCAS process. Local employers may also support some of their better apprentices in improving their knowledge, which will make the BEng with a Year in Industry degree attractive. Recruitment from outside the region will require appropriate resources to be readily accessible on the website, and any initiatives that can enhance the web presence of engineering (ENG) would be welcomed. It is expected that UEA's new MSc programme in Energy Engineering with Environmental Management will also raise awareness of the developments in engineering at UEA. Anecdotal evidence from colleagues in the International Office indicate that there will be international interest in the programme. An international recruitment strategy is being developed which will focus on specific countries initially for the marketing push for the new course (including Japan and China in the first phase). The School will work with Admissions Recruitment and Marketing to make the region aware of the growing presence of engineering at UEA, by visits to schools or inviting school parties	

	on campus. The School has expertise in running Taster Courses of various types (e.g. Headstart) and there is time to set one up for July 2012. A particularly important issue is the web-presence. At the moment a potential applicant would struggle to find the MSc degree. It will be important to place Engineering within the SCI structure on the web even if this then links to the MTH site for the actual module details. A virtual School of Engineering may also be necessary to facilitate this and other issues. In March 2010 the predecessor to ARM conducted detailed market research and identified the following key issues (in italics): **1.** *This is an increasingly crowded market place – Whilst the number of applications and accepts to this course type has grown over the last five years this has been matched by a growth in courses on offer. The University will need to design a course and marketing strategy which is distinct and appealing to the market.* Appendix A shows a list of potential competitors. In reality only those prestigious universities that are offering MEng degrees and requiring high level grades at entry are true competitors. Eight have been highlighted on the basis of reputation and similarity of provision. USPs for UEA will be a) an emphasis on technical and mathematical skills that industry needs b) industry sponsorship, c) opportunity to take advantage of the internationally respected environmental science modules in combination with energy engineering, d) industry-linked teaching throughout, e) Energy Institute Accreditation, f) inclusion of energy-focused material from level 1 onwards. *2. Applicants who are highly qualified make up a very small part of the market- The bulk of the market for this course is non-traditional students and those with relatively low A level scores. The Faculty will need to plan for how best to target the top end of the market if it is to meet the University's desire for stronger qualified applicants whilst also attracting enough applications and accepts to run the course.* Applicants will want value for money. Potential employment is a key factor so every effort will be made to attract sponsorship. In the early years every effort will be made to offer appropriate new modules from the BEng and MEng provision as options across SCI. **3.** *There is a lack of existing local demand – Currently very few applications and accepts to these courses come from the University's local area. To be successful the proposed course would either need to be attractive enough to encourage students from further a field or the Faculty will need to work to 'sell' both the concept of studying engineering and benefits of studying this at the University to the local market. Working with local schools and employers will be important to this. Highlighting the employability of graduates of the course will also be key.* All the above points are accepted. Anecdotally the problem is that local applicants want to go to UEA and as there has not been an opportunity to do engineering up to now they have chosen other subjects. Visitors to the PGT Open Day on 15th Oct indicated that they were interested in energy engineering but hadn't realised that UEA did it. Current students in SCI have indicated the same. So a major awareness-raising campaign is needed. Appendix D shows a draft employability matrix.		
BC1.3a	**Is the proposal commercially sensitive?**	**YES**	
		NO	NO
BC1.3b	**If yes, what are the reasons?**		

BC2 – This section is to be sent to ARM. You can do this after you have finished completing the Business Case or do so now. (ARM is requested to return comments within 10 working days of receipt). The Business Case cannot be considered by the Faculty Executive until this section is completed.

BC2	**MARKET RESEARCH** **(to be completed by ARM)**	
BC2.1	**What other and type of institution offers identical and/or similar courses in the UK?**	
	The Market Research team ordered data from UCAS based all UK undergraduate courses containing the keywords 'engineering,' 'energy' and 'environment.' These were then filtered by the Faculty to only include courses which appeared to be relevant competitors to the proposed course. The number of courses selected by the Faculty as comparable to the proposed UEA course, and the number of institutions offering these, increased considerably between 2005 (31 courses at 14 institutions) and 2009 (59 courses at 30 institutions).	
BC2.2	**Are there any likely international competitors?** (Please give brief details)	
	Unknown at this stage.	
BC2.3	**What is the annual number of applicants currently applying nationally for similar courses?**	In 2009, 1058 applications were made to the selected competitor courses in the UK.
BC2.4	**What is the evidence for current and future demands for the course from** **・ potential students?** **・ Employers (public services, private sector, the professions etc)**	
	Based on the experience of the selected competitor courses, energy engineering appears to be a viable market for the University to operate in and indeed appears to have the advantage of a growing number of interested potential students and a strong conversion rate to capitalise on. • Between 2005 and 2009 the market for the selected energy and engineering courses grew significantly. • Applications and accepts grew year on year with both having tripled between 2005 and 2009. • Over the five years reviewed, the proportion of applications becoming accepts each year remained relatively stable but very healthy with the high conversion rate of on average 25%. **However, the market has become increasingly crowded and the University will need to be sure that it can compete effectively before deciding to launch a course in this subject.**	
BC2.5	**Can current and projected demand be met from existing provision?**	
	Nationally:	No
	Regionally:	No

BC2.6	**Where is/what are the competitive advantage(s) for UEA?**
	The Courses will help develop existing relationships with engineering and energy companies and build new relationships within this sector. The Sector is fast moving and does generate a significant amount of editorial coverage - UEA should be able to leverage PR benefit by demonstrating its research connections within this field and its ability to provide the next generation of leaders within the sector, PR will require commitment from the academic team to contribute to stories as they develop. The sector also provides significant opportunity to demonstrate a strong employability story, whilst there will be a delay before our first students graduate, there are a number of UEA graduates, including some from ENV, who are employed with the sector and we could use to demonstrate a strong employability story. Businesses who advised UEA on the development of the course include employers who have appointed UEA graduates or taken graduate interns.
BC2.7	**ADDITIONAL COMMENTS BY ARM:**
	In terms of applications and accepts, a course in this subject area appears to be a viable proposition as there has been growing demand for this subject area over the last five years. See observation/comments included in BC1.2 If offering this course is viable Sci need to ensure that they have a strong offering in order to be able to compete. It is recommended that it incorporates work experience and good contacts with employers.

BC3 – This section is to be sent to the Careers Centre. You can do this after you have finished completing the Business Case or do so now. (Careers is requested to return comments within 10 working days of receipt.) The Business Case cannot be considered by the Faculty Executive until this section is completed.

BC3	**MARKET DEMAND AND RECRUITMENT (to be completed by the Careers Centre)**	
BC3.1	**What graduate career opportunities may be available?**	
	Within the region a significant skills gap at this level has been identified (e.g. EEEGR/Skills for Energy Feasibility Report for an Energy Skills Centre – Nautilus 2010: Power – Offshore Wind Supply Chain Study for the East of England – Douglas Westwood 2005; Norfolk Skills Economy Project Energy Skills Needs in Norfolk & Suffolk April 2011) It is, therefore envisaged there will be opportunities for graduates with an understanding of the current issues in energy engineering, covering a range of different areas including renewables (wind, wave, tidal, hydro, solar etc) and non-renewables (oil, gas, coal, nuclear). It can be assumed that this demand for higher level skills within the energy sector will exist beyond the East of England, presenting graduates with opportunities globally	
BC3.2	**Who (externally) has been consulted about the proposals (e.g. Professional Associations, employers' groups, PSBs)**	

	Simon Coward (Chief Executive, Hethel Engineering Centre) Gregory Darling (Chief Executive, Gardine Shipping Ltd) Jim Gunn (Technical Director, Antech Calibration Services) Celia Anderson (Executive Director, Skills for Energy -East of England) Louisa Rix (Membership Development Officer, Institute of Civil Engineers) Ian Robertson (HR / Crewing Manager, SeaJacks UK Ltd) Stuart Thornton (Operations Manager, East of England Energy Group) Blair Ainslie (Managing Director, SeaJacks UK Ltd) John Best (CEO, East of England Energy Group) Mark Boyd (Chair, Acquaterra Energy) John Canton (Regional Director and Secretary, Institute of Civil Engineers) Jonathan Reynolds (Sustainable Developments Manager, EEDA) An External Consultant – Dr Cameron Stewart, Teal Ltd – undertook a two-day consultancy with the Science Faculty about the engineering plans. Yasmine Dialdas, Professional Development Officer at the Energy Institute.
	ADDITIONAL COMMENTS BY CAREERS:
	No further comments as we have confidence in the number of employers who have already been consulted on this course, many of whom are experienced in skills development in their sector.

To be completed by the course proposer. BC4 may be completed prior to return of BC2 and BC3, but the Business Case cannot be considered until all sections are complete.

BC4	**RESOURCES**		
BC4.1	**STUDENT NUMBERS AND TUITION FEES**		
BC4.1.1	***Student Numbers*:**		
	Proposed student target intake	25 FTE	
	FT - Home/EU **- International**	**20 Home/EU** **5 International**	
	PT (Heads)		
	DL (Heads)		
	Minimum viable intake (ftes)	10 FTE	
	Maximum viable intake (ftes)	60 FTE	
	Are the student numbers:		
	a) available via redistribution within the School? *(Consult the Head of School)*	**YES** **NO**	 NO
	b) available via redistribution with the Faculty? *(Consult the Dean of Facult)*	**YES** **NO**	 NO
	c) additional numbers required? *(Consult the Planning Office, ACAD)*	**YES**	The Admissions offer grades have been set as AAB (BEng), AAA

			(MEng) and ASNs for a this new subject will be needed.
		NO	
BC4.1.2	***Tuition Fees**:*		
	Please select the relevant fee schedule:		
	a) Standard Home/EU/International	YES	
	b) Full-cost *(Please specify requested fee levels)*		
	c) External Teaching Contract *(Please provide brief details*)		
BC4.2	**EQUALITY AND DIVERSITY**		
BC4.2.1	Does the course and/or School cover a subject area(s) which traditionally attract(s) a very specific or narrow student profile?	**YES**	YES
		NO	
BC4.2.2	If yes, what steps will be taken to attract non-traditional students to the course / School? (Aspects to consider include: age, disability, ethnicity (home and international), gender and socio-economic group.)		
	Mathematics courses in the UK attract roughly equal numbers of male and female students. However engineering courses in the UK traditionally attract male students. The proposed BEng/MEng is one which will look at new and non-traditional ways of teaching the subject and has a wider range of entry routes than many traditional engineering courses. The Faculty of Science is proposing to apply for group membership of the Women's Engineering Society and will be exploring other relevant networks to learn from best practice at other institutions about marketing and recruiting from as wide a pool as possible. Outreach activities through both the Science Outreach Officer and the STEM-NET Co-ordinator (also based in the Faculty) will continue to try to broaden the appeal of engineering beyond the 'traditional' audience and help promote the subject to schools and colleges in the region.		

Now complete BC5 AND BC6 if the proposal is following the 'full' new course proposal route.

OR

Complete BC5F AND BC6F if the proposal is following the 'fast-track' route.

FOR FULL NEW COURSE PROPOSALS

BC5	What is the impact of the proposal on ACADEMIC STAFF?		
	Setting up a viable engineering capability requires commitment and resources from the university. Clearly the campus has a lot to attract students but to secure sufficiently high calibre applicants, in competition with established engineering institutions, requires significant investment in both staff and impressive equipment. Whilst industry are undoubtedly supportive in ways that fit their business plans, e.g. a few special lectures and site visits might attract a good graduate to them, this cannot be relied upon to sustain a long-term development. The first steps have been made. An ATS Senior Lecturer in Engineering was appointed in October 2011. He has the expertise to plan the teaching of most of the new material but to deliver a credible research-led programme of energy engineering requires a phased appointment of new academic staff, in addition to the existing MSc provision. Appendix C shows the way that the new modules phase in for students admitted in October 2013 with estimates of the new academic appointments necessary as an absolute minimum. As new posts are advertised if suitable additional applicants emerge they should be appointed ahead of the plan. An ATS2/ATR2 post is already in plan for September 2012. Fortunately SCI has a few qualified engineers with backgrounds in mechanical, civil, structural, electrical and energy engineering who have served on the UG Engineering Working Party. These people have expressed a willingness to teach on the new course and this should be within the normal allocation. In addition, a model for such teaching engagement needs to be established whereby other staff are released from some duties or rewarded in other ways that facilitate their School's research priorities.		
BC5.1	**Are new appointment(s) required?**	**YES**	YES
		NO	
	If yes, how many of what type (e.g. Teaching and Scholarship, Teaching and Research) and at what level?	For the BEng/MEng programme three new academic (ATR) posts are required (See Appendix C).	
	What is the source of funding for new academic staff?	The Science Faculty financial plan has provision for these posts, which will also count towards the SSR for MTH. See Business Plan	
BC5.2	**If no new teaching appointments are required, are any teaching adjustments required if new modules are to be introduced and if other modules are to be withdrawn? (Please include code, credit value and level/year of any new modules and/or modules to be withdrawn).**		
	n/a		
BC5.3	**Is any course(s) to be withdrawn?**	**YES**	
		NO	NO
	If Yes, please specify UCAS Code(s) and session from which course(s) withdrawn?	MTH has withdrawn several UG courses recently, eg, U1G1G4301 U1G1L1301	

		U1G1FX301 U1G1G3301
BC5.4	**Are there any implications outside the sponsoring School (e.g. service teaching, by other Schools of Studies)?**	
	There are implications for other Science Schools where modules or lectures will be delivered (ENV, CMP and BIO). There may also be elements of the programme which will be delivered by NBS. Discussions have been held with all relevant Schools during the development of the programme and all are supportive of the proposals. Within SCI a working party has been established to implement changes arising from the new academic model. This working party is well aware of the module requirements of the engineering courses and will ensure that these modules remain available.	

FOR FAST TRACK NEW COURSE PROPOSALS

BC5F	**What is the impact of the proposal on ACADEMIC STAFF?**		
	n/a		
BC5F.1	**Are new appointment(s) required?** If yes, please complete Full New Course Proposal	**YES**	
		NO	
BC5F.2	**Are any new modules to be introduced?**	**YES**	
		NO	
	If yes, please include code, credit value and level/year.		
BC5F.3	**Is any course(s) to be withdrawn?**	**YES**	
		NO	
	If Yes, please specify course and UCAS Code(s) and session from which course(s) withdrawn?		
BC5F.4	**Are there any implications outside the sponsoring School (e.g. service teaching, by other Schools of Studies)**		

FOR FULL NEW COURSE PROPOSAL

BC6	**What is the impact of the proposal on PHYSICAL RESOURCES & OTHER FACILITIES?**
	There will be three approaches to physical resources. The primary approach is to use laboratories and facilities which currently exist at UEA. Normal lecturer/seminar rooms will be needed from the pool of centrally-bookable rooms. Office space for one of the new appointments will be found from within the

	current space envelope within MTH. Existing teaching laboratories will be used (such as the Lewin Lab), as will existing research facilities (such as the Flume in ENV). Some new equipment purchases will be necessary, such as flexible hydraulic benches for mounting a range of fluid and thermodynamic test rigs on, materials and testing equipment. The strengths in fluid mechanics in the Maths School suggest that some of this might be of use to MTH students, which would be novel initiative. Secondly a flexible space will be required on campus for dedicated heavy equipment to support the research strengths of the new appointments, without which it may be difficult to recruit high calibre staff. Finally in partnership with industry in the region, access to a range of specialist facilities is being sought, both through EEEGR and energy companies. For example this may involve the new Skills for Energy training centre, and also specific teaching at company premises. This must be seen as a variable bonus rather than a consistently reliable provision, not least because of the challenges of timetabling. It may well manifest itself as focused site visits. Even so EEEGR companies are consistently supportive. Accreditation bodies will need to be convinced that the students have had sufficient exposure to laboratory experience. This can be achieved by ensuring that the learning outcomes of the programme are satisfied in this regard. In the longer term (5 years) however there will be a need to invest in a significant laboratory space if the engineering teaching is to be research-led and to grow. There will also be impact on technical support staff when laboratory provision is installed ready for first year.		
BC6.1	**What are the recurrent or non-recurrent expenditure to be incurred in respect of:**		
	i) Classroom and study facilities?	The business plan for these new programmes, compiled assumes that 50% of the additional revenue generated will be spent on (i) staffing and (ii) consumables and equipment.	
	ii) Other equipment?	See (i) above	
	iii) Consumables?	See (i) above	
BC6.2	**Computer equipment?**	See (i) above	
BC6.3	**What additional books/journals/electronic resources other than those already available will be required year by year until steady state is reached?**		
	It is likely that some new materials may be needed to cover aspects of the new modules on the BEng/MEng course. Eg On-line British Standards, commercial software such as AutoCAD, Engineering research databases.		
BC6.4	**Are there any other special arrangements on which this new course proposal will depend? (E.g. placements, year abroad).**	**YES**	YES
		NO	
	If Yes, please give details of likely costs/whether appropriate agreements are in place/have to be drawn up?		

	Agreements will be drawn up in respect of students on the BEng/MEng course visiting a range of employers in the region to see the application of taught material in the modules in industrial settings.		
BC6.5	**Are there any start-up costs (e.g. any initial publicity and promotion?)**	**YES**	X
		NO	
	If yes, please give details:		
	It will be necessary to raise awareness on two fronts: a) Local and national schools will need a publicity leaflet/poster explaining that engineering is starting at UEA. Under UCAS rules this is allowed for new degrees. b) International students have been continually told that UEA does not offer engineering. It will be necessary to send countering leaflets to all British Council offices and all UEA agents abroad. In parallel with this publicity a specific web presence will be established to which the leaflets can refer.		

FOR FAST TRACK NEW COURSE PROPOSALS

BC6F	**What will be the impact of the proposal on existing physical resources & other facilities**?
	n/a

BC7 seeks comments from other Divisions which have an interest in new course proposals, for examp, because it has an impact on central provision of IT or requires new library books or there are issues regarding regulatory frameworks. This section is for their comments.

Please send the Summary and Business Case completed to date to:

- *Dean of Students*
- *Director of Information Services*
- *Central Academic Division (Academic Registrar)*
- *Director(s) of Faculty Administration*
- *Residences and Services Division*
  and if their comments have not already been obtained:
- *Director of Library Services*
- *Admissions and Outreach Office*
- *Careers Service*

Also send to the Partnerships Office of the Learning, Teaching and Quality Office

Partner Colleges may be informed of the proposal unless it is deemed to be commercially sensitive (see Section BC1.3)

Please complete the relevant section on behalf of the Divisions/Offices for which you are responsible, and return (email) to the Course Proposer within 10 working days of receipt.

Please note that the process cannot proceed to approval until comments have been received. ***Please enter "no comment" if appropriate****.*

This proforma may have been sent to other Divisions/Offices for consultation in parallel.

BC7A	**Comments by Dean of Students**
	What is the impact of the proposal on support staff and resources in the office for which you are responsible?
	In general terms, this does not raise any serious concerns and we would hope to offer the full range of provision to any student admitted to such a course. However, one of the areas of greatest demand for my office is for the mathematics support provided within the Learning Enhancement Team – the number of booked appointments with a maths tutor has risen by 231% over the last 3 years and further increases are not sustainable on current resources. A significant proportion of these appointments were made by students in CHE, ENV, and CMP but even MTH students have sought help. If the level and scope of mathematical skills demanded by the proposed course is greater than the skills level of any of those admitted to it, we may struggle to provide the same level of service that we currently offer.

BC7B	**Comments by Director of Information Services**
	What is the impact of the proposal on support staff and resources in the office for which you are responsible?
	No concerns from an IT perspective.

BC7C	**Comments by Central Academic Division (Academic Registrar)**
	What is the impact of the proposal on support staff and resources in the office for which you are responsible?
	These courses will be complex to administer and manage and have the added workload associated with accreditation. The course information places great emphasis on the role of visiting speakers, site visits, and the setting up agreements with local employers in relation to site visits, securing industrial partners for the team Energy project and in anticipating that many students will have the opportunity to link their individual projects to employers in the energy sector. Students will also require assistance in securing year in Industry placements. Whilst some of this activity will fall on the LTS other aspects will require academic administrative leadership with support from the Faculty Local Support team. We are still in the early days of running an integrated LTS and some of these boundaries remain rather fluid but I consider that it is unlikely that the LTS could absorb the workload associated with these courses with current boundaries and with current staffing levels. I consider that additional resource will be required both in the LTS and SCI Local Support team.

	Dr Andrea Blanchflower Director of University Services Learning & Teaching 24.11.11

BC7D	Comments by Director(s) of Faculty Administration
	What is the impact of the proposal on support staff and resources in the office for which you are responsible?
	Following the Integration Project there are three areas of support staff resource to consider: Local Support, Technical Support and Finance Support. There will be minimal impact on the local support office in CMP/MTH as the School of Mathematics has recently decided to stop recruiting for a number of undergraduate degree programmes and thus will have lost approximately the same number of students which are proposed to be recruited via the additional proposed degree programmes. The proposal should therefore be cost neutral for the CMP/MTH local support office in terms of administrative load. In order to obtain professional accreditation of these programmes, there will be considerable demand for technical resources by the students registered on these proposed programmes as a significant number of compulsory modules are delivered using teaching laboratories. Laboratory teaching will be especially prominent in the third year of the proposed BEng programme and the fourth year of the MEng programme as both contain compulsory laboratory based projects. Existing laboratory space in the School of Computing Sciences should be used for this purpose initially, however, in the long-term; this may mean sharing laboratory space with other SCI schools or investment in further dedicated teaching laboratory space in the SCI Faculty, i.e. from 2015/16 onwards once the first BEng intake will be completing their third year project. Similarly, initially the existing technician in the School of Computing Sciences will be able to provide the technical support required, yet in the long-term additional technician resource will need to be found. It is hoped that this can be provided from a pool of SCI technicians to ensure that the overall technical resource in SCI is used to its optimum and that no further technical appointments will be necessary. Impact on the Finance office will be negligible. Please direct any queries regarding these comments to Claudia Gray, SCI Faculty Manager.

BC7E	Comments by Residences and Services Division
	What is the impact of the proposal on support staff and resources in the office for which you are responsible?
	Potentially 25 extra rooms would be required in UEA Accommodation. The extra workload for Accommodation Staff would be minimal.

BC7F	**Comments by the Director of Library Services**:
	What is the impact of the proposal on support staff and resources in the office for which you are responsible?
	The Library has been involved in early discussions and fully understands the strategic benefits of the course and is keen to support it. However we have only recently become aware of the scope to include the BEng and, over time, significant number of students. As the proposal rightly points out, this is a new subject area to UEA. There is some cross-over with existing resources but now that a Course Leader, Dr. Lawrence Coates (MTH) has been appointed, the expectations in terms of additional resources may be higher than the one sentence summary in BC6.3 suggests: "It is likely that some new materials may be needed to cover aspects of the new modules on the BEng/MEng course. Eg On-line BritishStandards, commercial software such as AutoCAD, Engineering research databases." In further discussions, Lawrence has identified a need for these resources to be built up over 3-4 years but as they are all **recurrent**, we will need to agree a source of funds for these prior to sign-off:- • British Standards online. JISC deal is until May 2014, currently JISC band D costs £16,897 rising to £17,925 per annum in 2014 (INCL VAT). • Autocad software - As an indicative price, we have a cost of £295 for the first user and then an extra cost of £74 for each additional user (incl VAT). Depending on numbers, a site license cost would be approximately £24,000 incl VAT per annum. • Knovel- (online reference works in Engineering and Science with analytical tools). There is a JISC deal for Knovel interactive Library until 31st July 2013, currently if subscribed to engineering subject areas (4 areas) it would cost £4,501 per annum (INCL VAT). • Digimap- Dr Coates has confirmed that there will be a need for 3rd and 4th years to access Geology digimap (to which UEA does not subscribe). There is a JISC deal for Geology digimap until July 2016, currently JISC band D costs £812 rising to £1,371 (INCL VAT) in 2016. • Ei Compendex (5000 journals & conference proceedings in engineering, technology and applied sciences. Eduserv deal until Dec 2013, cost would be 12,860 Euros (INCL VAT). (£11,127 INCL VAT at current exchange rate). • the Proceedings of the Institute of Civil Engineers (ICE) series of journals (Current price for electronic access is £6,270 INCL VAT). I need to make it clear that this level of resourcing cannot be supported for our existing allocation and is unprecedented outside the creation of new Schools. Instead, unless the requirements are reduced, ISD will be seeking a recurrent subvention of at least £40k per annum rising (based on 2011/12 prices) to provide the resources for this course (this total EXCLUDES Autocad). I believe the most recent precedent for the Library to request such a subvention was when Pharmacy and Medicine came into being. Nicholas Lewis, Library Director 25/11/11

This section enables the course proposer to respond to any comments received prior to consideration of the business case for approval.

BC8A	COURSE PROPOSER'S RESPONSE TO SUPPORT STAFF/PHYSICAL RESOURCES COMMENTS AND MARKET RESEARCH/DEMAND COMMENTS (WHERE RELEVANT)

BC2 (ARM)

In the absence of a response from ARM** the following short summary is provided.

Detailed Market Research was completed by the predecessor to ARM in March 2010, by Becky Price and Rosie Filby.

Recently examination of the UCAS website reveals 36 competitor universities (See Appendix A) offering a range of BSc, BEng and MEng programmes in energy engineering. Of those only 3 have a specific year in industry. Of the 36, 5 offer a Foundation Degree which could perhaps provide a vehicle for a possible partnership. Of the 36, 20 universities offer a MEng degree programme and are true competitors.

This level of competition is actually healthy because it allows a good sixth-former to feel confident in putting the relatively new degree subject on their UCAS form. It is particularly important that Cambridge is in the market as this allows high-calibre applicants to put UEA on their UCAS form without their school objecting.

We have not identified any competitors within the Eastern Region, and employers have identified a shortage of HE training in the field of Energy Engineering within the region.

The earlier Market Research indicated the following numbers of applicants

Year	2005	2006	2007	2008	2009	
Applications	313	358	713	718	1058	

The trend is clearly rising but a major marketing exercise will be needed to recruit a viable number. The School is aware of this.

The degree title has been carefully chosen to present a broad interest whilst taking advantage of the acknowledged expertise in ENV.

**Addendum.
The information in BC2 arrived after the deadline and after the above information was collected. The School recognises that this was due to circumstances in ARM largely beyond their control caused by the resignation of key staff. The information does not raise any additional issues beyond those raised in the 2010 Market Research. It does however reinforce the apparent viability of the proposal.

In BC2.6 the helpful comments about employability of ENV graduates will be exploited in publicity.

The additional comment is made in BC2.7 that "*If offering this course is viable Sci need to ensure that they have a strong offering in order to be able to compete. It is recommended that it incorporates work experience and good contacts with employers.*"

The School and Faculty have been receiving considerable support from the members of the East of England Energy Group. Companies are offering to allow their support to be used in publicity. The proposal includes a Year in Industry option, but the School is also

	proposing to use a separate industry sponsorship scheme (with the acronym SELECT) that allows better marketing. In terms of a "strong offering" the School has made the bold decision to set the offer grades at AAB (BEng) and AAA (MEng) in order to establish that we are aiming for quality. All the evidence is that all that setting a low offer would do is attract more unacceptable applicants. To sustain this it is important that the degree is professionally accreditable and the School is actively engaged with the Energy Institute in securing this as early as possible. **BC7A – Dean of Students** In the absence of actual numbers the School feels that the tutorial system in MTH is likely to have led to only a few students seeking help. For ENG courses similar local support should mean that numbers are similarly low. The standard of entrant should reflect the lowest proposed offer which will be AAB with A2 Maths as a compulsory subject. Once the degree is established opportunities will be taken to encourage older students to help younger students, in turn benefiting from consolidating their understanding. **BC7B- Information Services** No response necessary. **BC7C – Central Academic Division** The School is grateful that the possibility of additional administrative support has been flagged up. Ultimately as the programme grows the additional student numbers will inevitably lead to increased administrative tasks for which an additional local support person would be useful. Additional management of module assessments may also require some additional support in the hub eventually. However the elements of the programme identified in the comment are very unlikely to be dealt with in detail by administrative staff, beyond catering or parking arrangements on occasions when several visitors attend. Visiting speakers, site visits, agreements with local employers, industrial partners for team projects and linking individual projects to employers are all tasks that the recently appointed course director has performed in the recent past as an academic. Such industry engagement can feed into teaching in all sorts of ways that can also benefit a course director. Once the degree is established the additional teaching staff can share some of this load. For projects the major load is always supervision and assessment, not administration. However the issue of industry placements does require a bit more resource. The intention is to identify one of the new academic appointments in part as Industrial Liaison Officer (ILO) in a similar way to academic staff in ENV, CMP etc. have been used. A small amount of administrative support may be required at certain times of the year when a lot of company representatives are on campus. This ILO role can also assist with careers and employability issues. However the University cannot be expected to actually guarantee such placements and a student who is unable to secure a placement can be easily transferred at the end of second year into the full-time degrees. That has to be the formal position because placements are subject to the prevailing economic climate. Nevertheless a pro-active ILO can act as a useful focus for companies to work with and can often assist students in an informal sense. **BC7D – Director of Faculty Administration** The reduction in degree programmes will indeed have significantly reduced the administrative load, but the student numbers will not actually have reduced.

Laboratory provision is indeed an important part of a professionally accredited degree programme. As mentioned a significant proportion of third year students may choose experimentally-based projects and so will need access to research-led laboratory facilities. It is important to note that from first year there will be a need for several small pieces of laboratory equipment that can perhaps be sited within existing laboratory space. It would be very helpful to have assistance in identifying possible spaces within SCI or on campus. Often a single item of equipment only requires 4 to 6 m^2 of floor space, and between three and five such pieces of equipment may need to be located for first year in 2013/14. The idea of a pool of technicians to efficiently support this additional laboratory work is a good one, but may need review if the new ATR appointments need specific expertise in support of research grant-funded equipment.

BC7E – Residences and Services

No response needed.

BC7F – Library Services

The Course Director is grateful for the early pro-active support he has received from the library. It is agreed that the ultimate recurrent costs need to be identified early, but there may be less expensive ways of operating until it is clear that the student intake has stabilised and the degrees are established.

From the list of items identified the following comments are made.
1. British Standards on-line. This is an expensive resource for the number of occasions that students may wish to use it. There is no doubt that if engineering broadens its presence to cover other disciplines than energy then such a resource is inevitable. Until the degrees are well-established the considerable cost should be compared to purchasing a few key items individually for use in the library, and use of inter-library loans.

2. Autocad software. It is not clear how the total of £24k has been arrived at given the quoted rates. It is believed that registered students are allowed to freely download a student version of AutoCAD for use, as long as they remain students. So the on-campus provision can be limited to those machines necessary to provide any larger than A3 printing/plotting. It may also be possible to provide a different sort of software such as SolidWorks at a fairly inexpensive rate by working with Hethel Engineering Centre for example.

3. Knovel could prove extremely useful with the team-based project when students have to complete a lot of research in response to the challenges presented by an industrial partner. This seems to be extremely good value and a higher priority purchase than item (1).

4. Digimap. UEA subscribes to the historical database. This is very important when completing feasibility studies of design projects. The geology add-on can probably be justified if enough users gain from it. Although the low student numbers on engineering probably don't justify the cost (because it may be possible to access relevant geological maps from the British Geological Society given enough notice of the site) it may be worth asking if ENV would also benefit from this purchase. The Fossil Fuels module for example could make good use of this. The degrees in geography, geophysics and earth sciences could also value this resource if asked.

5. EI Compendex is undoubtedly a valuable resource. However the combination of Scopus and IEEE Xplore (both of which UEA has) should provide enough relevant energy engineering resource for students to complete valuable research, at least in the

	short-term. 6. Proceedings of the Institution of Civil Engineers definitely does not warrant the investment. Too many of the series of journals are not relevant to energy engineering. Student membership of the Institution is free and allows access to their library resources. Staff can make available relevant copies of their own journals. The SCI Faculty will shortly secure affiliate membership with the Energy Institute which provides free membership for all SCI students who wish it and a magazine called Energy World. On balance the School feels that a combination of Knovel and Ei Compendex plus a few specialist energy engineering journals (as yet unspecified) up to a total of around £25k per annum would be a prudent commitment at this stage. This could be reviewed in 2 year's time.

Once all sections have been completed, the Business Case may be sent for approval

Approval of the Business Case

BC8	APPROVAL/SIGNATURES	Approved Yes/No?	Date
BC8.L1	School Director of Learning, Teaching and Quality:		
BC8.L2	Head of School (on behalf of School Board):		
BC8.L3	Dean of Faculty (on behalf of Faculty Executive):		
BC8.L4	PRC (if relevant)		
BC8.L5	LTC (if relevant)		

BC9 tells you who must now be informed once the business case has been approved.

BC9	Send approved Summary and approver list (BC8) to:
	Chair, Recruitment, Admissions and Marketing Committee
	CAMS Manager/Planning Office (ACAD) for allocation of: • ROU code for each proposed ROU course • JACS code • UCAS admissions code

The Academic Case, for consideration by the Faculty Learning, Teaching and Quality Committee (LTQC) now follows. You may complete this in parallel with the Business Case BUT the approval of the Business Case by the Faculty Executive should precede consideration by the LTQC.

PART 3 – THE ACADEMIC CASE

Please complete sections *AC1 b/c to AC8* for each new course being proposed

AC1a	Faculty	Faculty of Science
	School(s)	School of Mathematics
	Course Director(s)	Dr Lawrence Coates

AC1b	Course Title	**BEng (Hons) Energy Engineering with Environmental Management** **BEng (Hons) Energy Engineering with Environmental Management with a Year in Industry** **MEng Energy Engineering with Environmental Management**

AC1c	Exit Award(s) and Title	**CertHE in Energy Engineering with Environmental Management** **DipHE in Energy Engineering with Environmental Management**

AC2	**(For undergraduate or integrated masters programmes only:)** Please select only from the permitted options		
	Weighting for degree classification:		Exit Award (please indicate: e.g. CertHE, DipHE, PgCert, PgDIP)
	Stage 0		
	Stage 1	0% BEng, 0% MEng	CertHE
	Stage 2	40% BEng, 20% MEng	DipHE
	Stage 3	60% BEng, 30% MEng	BEng
	Stage 4	50% MEng	MEng
	Stage 5		
	Stage 6		
	Stage 7		

AC3	**COURSE MANAGEMENT INFORMATION**				
AC3.1	REGULATORY FRAMEWORK (please tick all that apply)				
	CCS for Undergraduate Courses [Assumed NAM for BEng]				Y
	Graduate Diplomas				
	Integrated Master's				Y
	PGCE				
	Common Master's Framework				
	Postgraduate Research				
	Certificate/Diploma in Continuing Education				
	Is the course as a whole assessed on a pass/fail basis?	YES		NO	N
	Are any modules assessed on a pass/fail basis?	YES	Y	NO	

	If so, how many modules and what is the credit volume for each module?
	Only year in industry modules which are 120 credits in total.

AC4	NEW MODULES		
AC4a	Are there any new modules to be introduced?	YES	YES [See also appendix B & C]
		NO	
	If Yes, then proceed to AC4b		
	If No, then proceed to AC4c		
AC4b	Please complete for: New Core, Compulsory, Option A, Option B, Option C module(s):		
	Module Title:	**Energy Engineering Revolution**	
	Level:	1	
	Credit Value:	20	
	Semester:	1 and 2	
	Module Organiser	Dr Ben Milner	
	Module Type (e.g. EX/CW/WW/PR etc):	CW	
	Module marking Scheme:	Coursework 100%	
	Proposed module code:	ENG-1E1Y	
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus-based	
	Brief Outline:	This module introduces the breadth of the energy industry utilising a number of invited speakers, an introduction to both renewable and non-renewable sources, and opportunities for site visits. Students will begin to understand the reasons for the dramatic changes in the sector whilst developing a number of transferable skills, such as technical report writing skills, oral presentation skills and team working.	
	Core, compulsory or free choice (please state)	Compulsory	

	Module Title:	**Engineering Principles and Laws**
	Level:	1
	Credit Value:	20
	Semester:	1 and 2
	Module Organiser	Dr Lawrence Coates

	Module Type (e.g. EX/CW/WW/PR etc):	WW
	Module marking Scheme:	Exam 70% CW 30%
	Proposed module code:	ENG-1E2Y
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus based
	Brief Outline:	This module introduces the theme that extends into second year of technical underpinning material that all engineers use : Basics of Thermodynamics, Mechanics of Fluids, Properties of Materials, Structural Mechanics, Electricity. Each element will be supplemented by laboratory exercises.
	Core, compulsory or free choice (please state)	Compulsory

	Module Title:	**Engineering Practice**
	Level:	1
	Credit Value:	20
	Semester:	1 and 2
	Module Organiser	Dr Lawrence Coates
	Module Type (e.g. EX/CW/WW/PR etc):	CW
	Module marking Scheme:	Coursework 100%
	Proposed module code:	ENG-1E3Y
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus based
	Brief Outline:	This module utilises the important principles and techniques of engineering design to introduce a range of transferable skills. Principles of Design, Professional Ethics, Sustainability, Engineering Drawing, CAD and Sketching. A series of mini projects will introduce the material in context and provide opportunities for developing skills in report-writing and oral presentation. A key feature will be the culmination of pre-induction activities in a small team design project.

	Core, compulsory or free choice (please state)	Compulsory

	Module Title:	**Engineering Mathematics and Mechanics**
	Level:	1
	Credit Value:	20
	Semester:	1 and 2
	Module Organiser	Dr Lawrence Coates
	Module Type (e.g. EX/CW/WW/PR etc):	WW
	Module marking Scheme:	Exam 50% CW 50%
	Proposed module code:	ENG-1E4Y
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus based
	Brief Outline:	This module complements the mathematics for science modules by introducing techniques used by practising engineers when dealing with real world problems. A key feature is the estimation involved when presented with a poorly defined problem without enough data. Presentation and analysis of data, graphical presentation, errors, practical geometry, numerical methods and estimation are supplemented by practical exercises. Specific topics include Newton's laws of motion, particle dynamics, orbits and conservation laws.
	Core, compulsory or free choice (please state)	Compulsory

	Module Title:	**Energy Engineering Principles**
	Level:	2
	Credit Value:	20
	Semester:	1 and 2
	Module Organiser	Dr Lawrence Coates
	Module Type (e.g. EX/CW/WW/PR etc):	WW

	Module marking Scheme:	Exam 70% CW 30%
	Proposed module code:	ENG-2E01
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus based
	Brief Outline:	This module continues the theme of principles from first year using a novel technique whereby real world applications are used to teach each principle in an energy context. This allows this module to also act as a pre-cursor for the more detailed study of energy technologies at levels 3 and M. Examples include : The structural mechanics and stability of wind turbine towers and power line carriers, free surface fluid mechanics associated with water waves, pipe and pump flow associated with hydroelectric power generation, control electronics associated with solar power and building management.
	Core, compulsory or free choice (please state)	Compulsory

	Module Title:	**Electricity supply**
	Level:	3
	Credit Value:	20
	Semester:	2
	Module Organiser	Dr Ben Milner
	Module Type (e.g. EX/CW/WW/PR etc):	CW
	Module marking Scheme:	Coursework 100%
	Proposed module code:	ENG-3E02
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus based
	Brief Outline:	This module builds on the introductory material of the first and second year theme of electricity by studying the technical aspects, e.g. transformer design, cable constraints, of the provision of a national grid for electricity together with the practical aspects and costs involved. Detailed consideration of

		the various contributions to demand and their mis-match with supply will lead naturally to considerations of the established and novel methods for storing electricity, e.g. pumped-storage schemes or super-capacitors.
	Core, compulsory or free choice (please state)	Compulsory

	Module Title:	**Renewable Energy**
	Level:	2
	Credit Value:	20
	Semester:	2
	Module Organiser	Dr Lawrence Coates
	Module Type (e.g. EX/CW/WW/PR etc):	CW
	Module marking Scheme:	Coursework 100%
	Proposed module code:	ENG-2E02
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus based
	Brief Outline:	This module builds on the introductory material of first and second year with detailed consideration of wind, wave, tidal and hydroelectric energy. Alternative techniques such as ground and air source heat pumps, deep geothermal, anaerobic digestion and waste to energy schemes will be studied in detail. The emphasis of the module will be on developing an understanding of how these various technologies can realistically contribute to the energy mix. Further detailed study of renewable energy takes place in fourth year.
	Core, compulsory or free choice (please state)	Compulsory

	Module Title:	**Nuclear and Solar Energy**
	Level:	3

	Credit Value:	20
	Semester:	1 and 2
	Module Organiser	Dr Lawrence Coates
	Module Type (e.g. EX/CW/WW/PR etc):	CW
	Module marking Scheme:	Coursework 100%
	Proposed module code:	ENG-3E3Y
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus based
	Brief Outline:	This module utilises the contrasting technologies of nuclear power and solar energy to study in context the important topics of health and safety risk management, environmental impact assessment, energy economics, planning and facilitating legislation and societal perception.
	Core, compulsory or free choice (please state)	Compulsory

	Module Title:	**Individual Energy Project**
	Level:	3
	Credit Value:	40
	Semester:	1 and 2
	Module Organiser	Dr Lawrence Coates
	Module Type (e.g. EX/CW/WW/PR etc):	PR
	Module marking Scheme:	PR 100%
	Proposed module code:	ENG-3P1Y
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus based
	Brief Outline:	In this module the student undertakes a substantial piece of individual work in energy engineering. The scope is broad but the project will comprise research, design, implementation and practical elements. The subject of the project is determined by agreement between the student and supervisor.

		Aspects of project management & research skills, team working, report-writing, and the applied design process will be taught during the module (primarily at the start) and will be integrated into the project process.
	Core, compulsory or free choice (please state)	Compulsory

	Module Title:	**Team Energy Project**
	Level:	M
	Credit Value:	60
	Semester:	1 and 2
	Module Organiser	Dr Lawrence Coates
	Module Type (e.g. EX/CW/WW/PR etc):	DS
	Module marking Scheme:	DS 100%
	Proposed module code:	ENG-MP2Y
	Module Delivery: (e.g. distance-learning, campus based, work placement)	Campus based
	Brief Outline:	This module is based on the design of a real energy-related industrial process in teams competing for the client's support. Industrial partners will offer a new project each year. Semester 1 is dominated by significant team activity in taking proposals from concept through to scheme stage. In semester 2 each team member will focus on a sub-element of the process to complete a significant individual design before the team delivers its final report and presentation. Examples include : the design of a CHP facility utilizing gas derived from the anaerobic digestion of industrial effluent as a fuel source, energy integration to improve the efficiency of an industrial process such as sugar manufacture. Key introductory features will include considerations of risk management and engineering design.
	Core, compulsory or free choice (please state)	Compulsory

AC4c	DESCRIBE CORE OR COMPULSORY EXISTING MODULES Please complete for existing modules that are Core or Compulsory for this course	

AC4c	DESCRIBE CORE OR COMPULSORY EXISTING MODULES Please complete for existing modules that are Core or Compulsory for this course	
	Module Title:	Maths for Scientists A
	Module Code:	ENV-1**
	Level:	1
	Credit Value:	20
	Semester:	1 and 2
	Module Organiser	Dr Adrian Matthews
	Module Type: (EX / CW / WW / PR etc)	CW
	Module marking Scheme:	Examination 60%, Coursework 40%
	Brief Outline:	This module is designed for students in the Faculty of Science with A2 or AS level mathematics. It covers differentiation, integration, vectors, partial differentiation, ordinary differential equations, further integrals, power series expansions, complex numbers, and statistical methods. In addition to the theoretical background, there is an emphasis on applied examples. Previous knowledge of calculus is assumed. This module is the first in a series of three maths modules for students across the Faculty of Science, that provide a solid undergraduate mathematical training. The following modules are Mathematics for Scientists B and C.

AC4c	DESCRIBE CORE OR COMPULSORY EXISTING MODULES Please complete for existing modules that are Core or Compulsory for this course	
	Module Title:	Circuits and Systems

	Module Code:	CMPE2D01
	Level:	2
	Credit Value:	20
	Semester:	1
	Module Organiser	Dr Mark Fisher
	Module Type: (EX / CW / WW / PR etc)	WW
	Module marking Scheme:	Coursework 40%, Exam 60%
	Brief Outline:	This module introduces students to techniques for analysis of analogue electronic circuits and systems. The module comprises lectures, workshops and laboratories. Workshops develop analytical and problem solving skills. Practical exercises and projects, undertaken in the Lewin Laboratory support the underpinning theory and enable students to build a range of simple electronic devices, e.g. AM comms system, video-scope, digital thermometer, etc.

AC4c	DESCRIBE CORE OR COMPULSORY EXISTING MODULES Please complete for existing modules that are Core or Compulsory for this course	
	Module Title:	Fossil Fuels
	Module Code:	ENV-3A33
	Level:	3
	Credit Value:	20
	Semester:	1
	Module Organiser	Prof Jan Alexander
	Module Type: (EX / CW / WW / PR etc)	WW (Examination 67%, Coursework 33 %)
	Module marking Scheme:	Examination with coursework or project
	Brief Outline:	The module explains the formation and accumulation of fossil fuel (oil, natural gas and coal). Geological, economic and political aspects of fossil fuel exploration and production are introduced and used to discuss environmental concerns arising from the use of fossil fuels, and the potentially profound implications of future fuel scarcity.

AC4c	DESCRIBE CORE OR COMPULSORY EXISTING MODULES Please complete for existing modules that are Core or Compulsory for this course	
	Module Title:	Mathematics for Scientists B

	Module Code:	ENV-2A21
	Level:	2
	Credit Value:	20
	Semester:	1
	Module Organiser	Dr Hayder Salman
	Module Type: (EX / CW / WW / PR etc)	WW
	Module marking Scheme:	Examination with coursework or project
	Brief Outline:	This module is the third in the series of four mathematical modules for students across the Faculty of Science. It covers vector calculus (used in the study of vector fields in subjects such as fluid dynamics and electromagnetism), time series and spectral analysis (a highly adaptable and useful mathematical technique in many science fields, including data analysis) and fluid dynamics (which has applications to the circulation of the atmosphere, ocean, interior of the Earth, chemical engineering, and biology). There is a continuing emphasis on applied examples, and the use of numerical computing software (Matlab).

AC4c	DESCRIBE CORE OR COMPULSORY EXISTING MODULES Please complete for existing modules that are Core or Compulsory for this course	
	Module Title:	Mathematics for Scientists C
	Module Code:	ENV-2A22
	Level:	2
	Credit Value:	20
	Semester:	2
	Module Organiser	Dr Adrian Matthews
	Module Type: (EX / CW / WW / PR etc)	WW
	Module marking Scheme:	Examination with coursework or project
	Brief Outline:	This module is the fourth in a series of four mathematical modules for students across the Faculty of Science. It covers matrix algebra and numerical methods (with applications to many multi-variable problems in science) second order partial differential equations (which govern the behaviour of diffusive, advective and wave-like systems) and solid mechanics (applications in geophysics, glaciology and material science). There is a continuing emphasis on applied examples, and the use of numerical

		computing software (Matlab) is extended with a dedicated programming component.

AC4c	DESCRIBE CORE OR COMPULSORY EXISTING MODULES Please complete for existing modules that are Core or Compulsory for this course	
	Module Title:	Wind Energy Engineering
	Module Code:	ENG-MA04
	Level:	M
	Credit Value:	20
	Semester:	2
	Module Organiser	Dr Lawrence Coates
	Module Type: (EX / CW / WW / PR etc)	CW
	Module marking Scheme:	Coursework 100%
	Brief Outline:	Wind energy is the main provider of renewable energy and the source that is receiving the majority of investment in both the UK and overseas, making its study vital to energy engineering. This module begins by examining the kinetic energy of air and the design of wind turbines to extract this energy. Relationships between wind speed, blade area, turbine height and resulting output power are studied. Different turbine designs are examined and comparisons made of their effectiveness. Issues regarding placement of wind turbines are discussed as well as the choice of onshore or offshore locations. Practical considerations are discussed and include data collection of wind speeds for possible wind farm sites and implications of optimal spacing of turbines.

AC4c	DESCRIBE CORE OR COMPULSORY EXISTING MODULES Please complete for existing modules that are Core or Compulsory for this course	
	Module Title:	Tidal, wave and hydro engineering
	Module Code:	ENG-MA06
	Level:	M
	Credit Value:	20
	Semester:	2
	Module Organiser	Dr Lawrence Coates
	Module Type: (EX / CW / WW / PR etc)	CW

	Module marking Scheme:	Coursework 100%
	Brief Outline:	This module studies renewable energy sources that use the energy stored in water to produce electrical energy. An examination is made into the potential energy and kinetic energy stored in water, either implicitly through waves/tide or explicitly in hydro. Devices for energy extraction from waves are examined with the effect of wave height, period and speed considered. Tidal energy extraction devices are also studied with design decisions regarding the tide-pool considered. Finally the design and operation of hydroelectric turbines is studied. Practicalities are discussed such as the characteristics of regions that are suitable for each of the energy generation modes and how measurements can be made as to a site's likely energy output.

AC5	If the course is a joint course, how will the student experience be managed?
	NA

AC6	**BOARD OF EXAMINERS**				
AC6.1	Is there an existing Board of Examiners?	Yes		No	N
AC6.2	If YES, which existing board will be responsible for the course?				
AC6.3	If NO, please enter details for new board of examiners	The Board of Examiners will consist of an academic member of staff from each of the Schools with key teaching on the programme – MTH, ENV, CMP and with the Course Director and one External Examiner			
AC6.4	Are any new external examiner(s) required?	Yes	Y	No	
AC6.5	If yes, how many?	One			

AC7	ACCREDITATION/VALIDATION				
AC7.1	Is accreditation/validation by a Professional and/or Statutory Body required?	Yes	*	No	
AC7.2	Please specify which PSB and when accreditation/validation may take place.				
	It is not *required* but accreditation will be sought for the BEng(Hons) and MEng programmes from the Energy Institute. It is anticipated that this will allow partial exemption from the academic requirements for CEng status. Graduates from the BEng programme will eligible for progression to IEng status and be required to complete further academic study of one year to become eligible for progression to CEng status. An Accreditation panel visit will visit mid-way through the programme and ultimately will backdate accreditation as soon as the first graduates are produced. Accreditation of the MSc programme should be completed by 2013 which will provide the panel with evidence of fourth year modules in advance.				

BEng (Hons) Three-year full time

[Year in Industry Variant interposes the year in industry after second year]

AC8	COURSE PROFILE AND AWARD REQUIREMENTS	
	Year 0	
	Core Modules	
	Compulsory Modules	
	Option A	
	Option B	
	Option C	
	Free Choice Modules – Enter number of credits	
	Year 1	
	Core Modules	
	Compulsory Modules	ENG-1E1Y Energy Engineering Revolution (20 credits) ENG-1E2Y Engineering Principles and Laws (20 credits) ENG-1E3Y Engineering Practice (20 credits) ENV-1** Maths for Scientists A (20 credits) ENG-1E4Y Engineering Mathematics and Mechanics (20 credits)
	Option A	Choose 20 credits ENV-1A** Understanding the Dynamic Planet (20 credits) ENV-1A29 Global Environmental Challenges (20 credits) ENV-1A** Earth's Chemical processes I & Atmosphere and Ocean (20 credits) ENV-1A28 Biodiversity in a Changing World & Sustainability and Society (20 credits) CMPC-1M0Y Programming 1 (20 credits)
	Option B	

	Option C	
	Free Choice Modules – Enter number of credits	
	Year 2	
	Core Modules	
	Compulsory Modules	CMPE-2D01 Circuits and Systems (20 credits) ENG-2E01 Energy Engineering Principles (20 credits) ENG-2E02 Renewable Energy (20 credits) ENV-2A21 Mathematics for Scientists B (20 credits) ENV-2A22 Mathematics for Scientists C (20 credits)
	Option A	Choose 20 credits from semester 2 modules ENV-2A82 Low Carbon Energy (20 credits) ENV-2A06 Environmental Politics and Policy Making (20 credits) MTH-** Dynamical and Lagrangian Systems MTH-** Mathematical Modelling CMPC-2X02 Programming for non-specialists CMPE-3D02 Embedded Systems
	Option B	
	Option C	
	Free Choice Modules – Enter number of credits	
	Year 3	
	Core Modules	
	Compulsory Modules	ENG-3E02 Electricity Supply (20 credits) ENV-3A33 Fossil Fuels (20 credits) ENG-3E3Y Nuclear and Solar Energy (20 credits) ENG-3P1Y Individual Energy Project (40 credits)
	Option A	Choose 20 credits ENV-3A11 Modelling Environmental Processes (20 credits) ENV-3A31 The Carbon Cycle and Climate Change (20 credits) ENV-3A49 Climate Change: Physical Science Basis (20 credits) ENV-3A48 Climatic Change Reconstruction and Projection (20 credits) ENV-3A80 Atmospheric Composition: Measurement and Modelling (20 credits) ENV-3A20 Global Environmental Change (20 credits) ENV-3A40 Human Geography of Climate Change (20 credits) MTH-3D41 Fluid Dynamics (20 credits) MTH-3D43 Continuum Mechanics and Elasticity (20 credits) MTH-3E48 Dynamical Oceanography (20 credits) MTH-3D52 Dynamical Meteorology MTH-3E74 Electricity and Magnetism (20 credits) MTH-3D77 Free Surface Flows (20 credits)
	Option B	
	Option C	
	Free Choice Modules – Enter number of credits	

MEng Four-year full time
[See appendix D for suggested module JACS codes]

AC8	COURSE PROFILE AND AWARD REQUIREMENTS	
	Year 0	
	Core Modules	
	Compulsory Modules	
	Option A	
	Option B	
	Option C	
	Free Choice Modules – Enter number of credits	
	Year 1	
	Core Modules	
	Compulsory Modules	ENG-1E1Y Energy Engineering Revolution (20 credits) ENG-1E2Y Engineering Principles and Laws (20 credits) ENG-1E3Y Engineering Practice (20 credits) ENV-1** Maths for Scientists A (20 credits) ENG-1E4Y Engineering Mathematics and Mechanics (20 credits)
	Option A	Choose 20 credits ENV-1A** Understanding the Dynamic Planet (20 credits) ENV-1A29 Global Environmental Challenges (20 credits) ENV-1A** Earth's Chemical processes I & Atmosphere and Ocean (20 credits) ENV-1A28 Biodiversity in a Changing World & Sustainability and Society (20 credits) CMPC-1M0Y Programming 1 (20 credits)
	Option B	
	Option C	
	Free Choice Modules – Enter number of credits	
	Year 2	
	Core Modules	
	Compulsory Modules	CMPE-2D01 Circuits and Systems (20 credits) ENG-2E01 Energy Engineering Principles (20 credits) ENG-2E02 Renewable Energy (20 credits) ENV-2A21 Mathematics for Scientists B (20 credits) ENV-2A22 Mathematics for Scientists C (20 credits)
	Option A	Choose 20 credits from semester 2 modules ENV-2A82 Low Carbon Energy (20 credits) ENV-2A06 Environmental Politics and Policy Making (20 credits) MTH-** Dynamical and Lagrangian Systems MTH-** Mathematical Modelling CMPC-2X02 Programming for non-specialists CMPE-3D02 Embedded Systems

	Option B	
	Option C	
	Free Choice Modules – Enter number of credits	
	Year 3	
	Core Modules	
	Compulsory Modules	ENG-3E02 Electricity Supply (20 credits) ENV-3A33 Fossil Fuels (20 credits) ENG-3E3Y Nuclear and Solar Energy (20 credits) ENG-3P1Y Individual Energy Project (40 credits)
	Option A	Choose 20 credits ENV-3A11 Modelling Environmental Processes (20 credits) ENV-3A31 The Carbon Cycle and Climate Change (20 credits) ENV-3A49 Climate Change: Physical Science Basis (20 credits) ENV-3A48 Climatic Change Reconstruction and Projection (20 credits) ENV-3A80 Atmospheric Composition: Measurement and Modelling (20 credits) ENV-3A20 Global Environmental Change (20 credits) ENV-3A40 Human Geography of Climate Change (20 credits) MTH-3D41 Fluid Dynamics (20 credits) MTH-3D43 Continuum Mechanics and Elasticity (20 credits) MTH-3E48 Dynamical Oceanography (20 credits) MTH-3D52 Dynamical Meteorology MTH-3E74 Electricity and Magnetism (20 credits) MTH-3D77 Free Surface Flows (20 credits)
	Option B	
	Option C	
	Free Choice Modules – Enter number of credits	
	Year 4	
	Core Modules	
	Compulsory Modules	ENG-MP2Y Team Energy Project (60 credits) ENG-MA04 Wind energy engineering (20 credits) ENG-MA06 Wave, tidal and hydro energy engineering (20 credits)
	Option A	Choose 20 credits ENV-MA63 Theory of environmental assessment (20 credits) BIO-M103 Biofuel, Bioremediation and Bioproducts (20 credits) ENV-MA64K Environmental assessment effectiveness (20 credits) MTH-MD41Fluid Dynamics With Advanced Topics (20 credits) MTH-MD43 Continuum Mechanics and Elasticity With Advanced Topics (20 credits) MTH-ME48 Dynamical Oceanography with Advanced

		Topics (20 credits) MTH-ME74 Electricity and Magnetism with Advanced Topics(20 credits) MTH-MD77 Free Surface Flows with Advanced Topics (20 credits) MTH-ME84 Slow Viscous Flow (20 credits) MTH-** Fluid Solid Interaction (20 credits)
	Option B	
	Option C	
	Free Choice Modules – Enter number of credits	

NOTE: Whilst the University will make every effort to offer the module listed, changes may sometimes have to be made for reason outside the University's control (e.g. illness of a member of staff) or because of low enrolment or sabbatical leave. Where this is the case, the University will endeavour to inform students

PROGRAMME SPECIFICATION FOR AN AWARD OF THE UNIVERSITY OF EAST ANGLIA

(The summary section may be used for publicity purposes. The full specification may also be publicly available).

Note: One Programme Specification may be used for all courses (ROUs) in the proposal. Please indicate where there are any differences (including any course (ROU) specific learning outcomes) between courses (ROUs) in the free text and explain how learning outcomes at the programme level (i.e. covering all courses) may be demonstrated.

PS1	**EDUCATIONAL AIMS AND LEARNING OUTCOMES**
PS1.1	Overview of aims and learning outcomes:
	• provide a high-quality and challenging degree programme which addresses a range of current issues in energy engineering, covering a range of different areas including renewables (wind, wave, tidal, hydro, solar etc) and non-renewables (oil, gas, coal, nuclear) • develop a range of subject-specific engineering skills related to energy • enable students to enhance their intellectual skills through lectures, seminars, laboratory classes, visits to employers/industry, field trips and discussion with industrial practitioners • enhance skills in critical analysis and project management to provide a range of techniques for decision making that can be employed in a range of different situations • develop transferable, employability skills in self-expression, numeracy, computer literacy, team working, project management and independent research • develop specific English language skills in both written and oral expression, including well-honed report-writing skills. • acquire skills in forming scientific hypotheses and in testing these through research of relevant literature and through practical

	experimentation • develop skills in communication of information to peers and non-specialists alike using a range of different forms of media. • develop skills in and understanding of the process of design, from feasibility through concepts and scheme to final detailed design. The above are demonstrated by successful completion of a range of formative and summative assessments within several modules.
PS1.2	Knowledge and Understanding: a. Knowledge of primary renewable and non-renewable sources of energy, their practicality, variability and likely power outputs. b. Underpinning fundamental mathematical techniques and design principles c. Engineering mathematics of fluid mechanics, thermodynamics and structural mechanics d. Engineering material properties and selection for use in a range of applications. e. Methods of electricity generation from renewable sources, generator design, electricity transmission, storage and distribution f. UK energy system, supply and demand, National Grid g. Estimation of energy in wind, turbine designs, extraction of energy from wind, measurement of wind energy, optimal placement of turbines and practical issues h. Estimation of energy in wave, tidal and hydro sources, design of machinery to extract energy, optimal placement of equipment and practical issues i. Non-renewable energy source (oil, natural gas and coal), geological and economic issues j. Environmental and social impacts of renewable energy, location of sites, regulatory and compliance issues k. Principles and practice of health and safety risk management, and professional ethics. l. Financial implications of developing renewable energy sources and appraisal of schemes from an investment viewpoint
PS1.3	Cognitive Skills: a. Application of numerical, reasoning and problem-solving skills b. Development of knowledge and understanding c. Review published information and draw summaries and conclusions d. Critical evaluation of research and design ideas relating to their practical implementation and deployment from an engineering perspective

	e. Presentation and understanding of quantitative and qualitative information f. Assimilation of information as a platform for self-directed learning g. Act autonomously in planning and implementing tasks at a professional level
PS1.4	Subject specific skills (including practical skills):
	a. Ability to calculate energy potential available from different renewable sources b. Ability to evaluate potential sites for renewable energy generation c. Ability to appraise formations for commercially viable fossil fuel deposits d. Ability to produce professional engineering drawings and sketches using appropriate tools e. Ability to produce an engineering detailed design in response to a clients brief with limited or insufficient data. (MEng only) f. Ability to make reasonable and justified estimations in the absence of data g. Ability to dispassionately appraise the provision for energy demand utilising a range of sources. h. Ability to develop an energy data-gathering exercise and apply meticulous approaches to gaining data of good quality.
PS1.5	General/transferable key skills and attributes:
	See also appendix E a. Managing an individual and a team-based project b. Presentation skills (oral and written) c. Teamworking d. Numeracy and IT skills e. Formation of hypotheses f. Analysis of published information g. Understanding experimental design h. Communication of engineering through a variety of media

PS2	**TEACHING AND ASSESSMENT STRATEGIES AND METHODS**
PS2.1	(please describe including how these enable students to demonstrate achievement of the learning outcomes):
	Teaching is through a combination of lectures, seminars, laboratory classes and industry visits. Lectures normally use slides and handouts and are the primary source of engineering theory. They generally offer one-way communication, but do

	have provision for appropriate discussions to take place. Seminar classes begin to apply this theory to design problems and provide students with opportunities for peer led group discussions to confirm and correct their knowledge and understanding. Laboratory classes take this further and require practical testing and implementation of engineering designs. Industry visits introduce students to the practical design and deployment of much of the theoretical work introduced. Self directed learning and group learning is a central feature of modules, particularly for laboratory classes and coursework. Lecturers, seminars, laboratory classes and industry visits are the main direct source of knowledge and understanding, which students supplement with self-directed study and student-centred learning or enquiry-based learning. Assessment is through a combination of examination (key theories), coursework (practical design and implementation) and projects by combining theory and practical skills in one large piece of work in the context of a real industrial challenge. Cognitive skills are developed in all modules through analysis and critical evaluation of published data. Presentation skills are developed through oral presentations both in seminars and as parts of assessment in modules. The engineering projects develop an understanding of research design; the project reports and oral presentations provide the challenge of bringing all relevant cognitive skills together. In all modules students receive appropriate feedback from academic staff which is an important process in the development of their cognitive skills. Subject-specific practical skills are assessed within each of the modules during both seminar and laboratory classes and associated coursework. Further assessment of practical skills takes place in the engineering projects. Transferrable and key skills are taught implicitly throughout the course, such as presentation and communications skills, teamwork and analytical skills.

PS3	**EQUALITY**
PS3.1	How do the admissions criteria ensure equality of opportunity for all applicants?
	Applicants will be selected on the basis of the appropriateness of the qualifications and experience they have. This will be broad and encompass a range of science and engineering backgrounds. The practical nature of the course is likely to be of interest to people already working or who have been in employment and admission will also be available through these routes. Care will be taken to ensure that students coming from such non-traditional routes have sufficient background knowledge. The engineering industry provides a range of career opportunities for graduates with disabilities. Although certain avenues such as site work may be closed, there are opportunities within the field of energy design to work in an office environment. On that basis there is no reason to restrict access to the degree programme.
PS3.2	What steps have been taken to ensure an inclusive curriculum?
	The curriculum has been devised with the input of an internal Engineering Working Party and from extensive consultation with representatives from relevant energy-based industries (see Section BC0.2 for specific details). All compulsory modules are accessible to a range of different learning abilities.

	From time to time site visits will be arranged and occasionally such visits may not allow certain categories of learner for health and safety reasons. On those rare occasions staff will make a photographic record, for example, and discuss the key aspects of the visit after the event.
PS3.3	In what ways do learning and teaching and assessment methods ensure inclusivity and equality of opportunity?
	Information relating to teaching and assessment methods is published in the student handbook and on School webpages. Different methods of teaching and assessment will be used on different modules, allowing students to demonstrate their strengths across a range of assessment types. Blackboard will be used to communicate with all students equally. Non-native speakers have access to English language support through the Dean of Student's office.

Please send (email) the whole <u>Academic Case</u> and the <u>Summary</u> (including programme specification) to:

- **the Learning, Teaching and Quality Office** (Assistant Registrars for Ug, Pgt as appropriate)
- **the Equality and Diversity Manager (in parallel) for comment.**

Comments will be returned within 10 working days of receipt.

Please complete the relevant section and return (email) to the Course Proposer within <u>10 working days</u> of receipt.

Sections AC9.1 and AC9.2 may be completed in parallel.

AC9	**COMMENTS**
AC9.1	Learning, Teaching and Quality Office (UG or PGT Assistant Registrar):
	The LTS notes that this would be a new qualification for the University and so will require particular attention. However, it is assumed that the course will be developed in accordance with the New Academic Model and that the standard regulatory framework will apply.
AC9.2	Equality and Diversity Manager:
	No comments received.

AC10	APPROVALS	SIGNATURE AND DATE
AC10.1	**Head of School**	
	Approved:	
	Approved with amendments:	
	Rejected:	
AC10.2	**Faculty Associate Dean (following Faculty LTQC)**	
	Approved:	
	Approved with amendments:	
	Rejected:	

AC11	CIRCULATION (for office use only)	
	Course Proposer	• Summary • Approvals
	LTQO (for report to LTC)	• Summary • Approvals
	Planning Office	• Summary • Academic Case (including course profile) • Approvals
	Faculty Office	• Summary • Programme Specification • Course profile • Approvals
	Admissions and Outreach	• Summary • Approvals
	Academic Officer of the UUEAS / President of GSA (for taught postgraduate only)	• Summary • Approvals

Appendix A
UCAS competitors October 2011

University	Found	BSc	BEng	MEng/ MSci	With Industry
Blackpool and The Fylde College	✓				
City University			✓	✓	
Cornwall College	✓				
De Montfort University		✓			
Durham University				✓	
Edinburgh Napier University			✓		
Glyndwr University	✓		✓		
Heriot-Watt University			✓	✓	✓
Imperial College				✓	
Lancaster University				✓	
Newcastle College	✓				
Plymouth University	✓				
Queen Mary, University of London			✓	✓	✓
Sheffield Hallam University			✓		
Swansea University				✓	
The University of Birmingham			✓	✓	✓
The University of Bradford			✓	✓	
The University of Edinburgh			✓	✓	
The University of Huddersfield			✓	✓	
The University of Manchester				✓	
The University of Nottingham			✓	✓	
The University of Strathclyde				✓	
University of Bath			✓	✓	
University of Cambridge				✓	
University of Central Lancashire		✓			
University of Cumbria			✓		
University of Dundee		✓		✓	
University of Exeter		✓		✓	
University of Leeds			✓	✓	
University of Portsmouth		✓			
University of Southampton			✓		
University of Sunderland		✓			
University of the Highlands and Islands		✓	✓		
University of the West of England		✓			
University of Ulster			✓	✓	

Appendix B Proposed Degree Structure

<table>
<tr><th>Year 1</th><th colspan="2">Year 2</th><th colspan="2">Year 3</th><th colspan="2">Year 4</th></tr>
<tr><td>Energy Engineering Revolution[1]</td><td>Circuits and Systems[7]</td><td></td><td rowspan="2">Fossil Fuels – Oil and Gas</td><td rowspan="2">Electricity Supply[9]</td><td></td><td rowspan="2">Wind Energy Engineering[13]</td></tr>
<tr><td>Engineering Principles and Laws
Basics of Thermodynamics, Fluids, Materials, Structures, Labs, Electricity[2]</td><td rowspan="2">Energy Engineering Principles[8]
Advanced Fluids, Structures, Materials. Examples from energy: Wind, wave, tidal, hydro, solar</td><td rowspan="2">Renewable Energy[10]
Wind, Wave, tidal and hydro energy, Heat Pumps & Geothermal, AD</td><td></td></tr>
<tr><td>Engineering Practice[3]
Principles of Design, Ethics, Sustainability, Engineering Drawing, CAD and Sketching. Done as mini projects</td><td colspan="2">Nuclear and Solar Energy[11]
Risk, EIAs, Economics, Health and Safety, Social and Planning</td><td rowspan="2">Team Energy project[14]
(Including 10 credits of taught material, autumn term team-based, spring mostly individual but linked to main team project)</td><td rowspan="2">Wave, tidal, hydro[13]</td></tr>
<tr><td>Mathematics for Scientists A</td><td rowspan="2">Maths for Scientists B</td><td rowspan="2">Maths for Scientists C</td><td colspan="2" rowspan="2">Individual Energy Project (BEng & MEng)[12]
Industry-linked project, Project management & research skills, team working, report-writing, applied design process.</td></tr>
<tr><td>Engineering Mathematics[5] and Mechanics[4]</td><td>Team Energy project</td></tr>
<tr><td>Environmental choice of options[6]</td><td></td><td>Environmental choice of options</td><td colspan="2">Choice of Environmental and Mathematical Options</td><td colspan="2">Choice of Environmental and Mathematical Options</td></tr>
</table>

Key

Box Colour
Energy Engineering related modules
Mathematics theme
ENV modules
Italicised titles & subsections

Text Colour
Existing modules with minimal resource implications
New modules that do not require a lot of new teaching, either because they are student-centred or involve invited speakers. Project supervision required.
New modules
Modules that are already part of the MSc Energy Engineering with Environmental Management.
These modules could form the basis of other engineering degrees.

Explanatory Notes:

1. Energy Engineering Revolution. This is modelled on a similar and successful module in CMP. It involves a number of invited speakers, an introduction to both renewable and non-renewable sources, and opportunities for site visits. It will always have an energy focus. Staff load is low but includes the admin of identifying speakers. A half load has been assumed.

2. Engineering Principles and Laws. This covers physical principles and laws at a fundamental level that will be needed in later years in specific applications to energy engineering. However it is deliberately set up in such a way that it could be core for other engineering disciplines which might be introduced later. The challenging but important concepts of thermodynamics are balanced against slightly easier topics.

3. Engineering Practice (nee Engineering Mini Project). For accreditation there has to be a design element, or even theme. Engineers design things. Principles of Design, Ethics, Sustainability, Engineering Drawing, CAD and Sketching, are all included and will be introduced using teamwork as appropriate.

4. Mechanics and Modelling. At first sight this would seem to duplicate A level mechanics. But a lot of A level students manage to do statistics instead of mechanics. It will be important to be able to sell the multiple repeats of A-level topics to those with good A-level maths grades by using energy-related examples.

5. Engineering Maths. Most of the maths needed for engineers is already covered in the other modules. However presentation and analysis of data, graphical presentation, errors, geometry, numerical methods and most importantly estimation could all be included. The module must be interesting (or even fun) because there is a lot of maths in the degree. It could be driven from engineering case studies. MTH have confirmed that MTH 1C32 can be combined with engineering focused material into a module ENG 1E04Y Engineering Mathematics and Mechanics with a separate exam/assessment. It is not appropriate to use the new MTH 20-credit module in its entirety.

6. ENV Options. A number of modules exist so choice will be subject to timetable. This provides a theme of environmental science and management throughout all years of the degree. Choice will be limited by the need to balancing credits across both semesters as well as timetable.

7. Circuits and Systems. This module exists as a mainly electronic and hands-on module. It now builds on the first year principles module and can be easily adapted to lay the foundations for the third year electrical generation module. It provides some evidence of lab work for accreditation.

8. Energy Engineering Principles. This module builds on the first year Engineering Principles. The mode of teaching will be to use one of the energy-related examples as a vehicle for introducing the theory. Examples from wind, wave, hydro, solar and others will be used, but the actual technology will be introduced in third year. For example, the statics and mechanics taught in first year can be built on with structural mechanics applied to the forces exerted on the structure and foundations of a wind turbine.

9. Electricity Supply. This is a level H(3) version of the LM module Electricity generation, storage and transmission. in the MSc programme. There are precedents for this sort of efficiency. It is important that both BEng and MEng students study this material.

10. Renewable Energy. Care will be taken that this does not duplicate later material. This will be a broad overview suitable for those graduating with BEng and as a useful foundation for the MEng fourth year. This lends itself to detailed consideration of the energy mix, projections etc.

11. Nuclear and Solar Energy. This is a curious combination but the title is driven by the industrial partners. For accreditation purposes we have to demonstrate where we include health and safety risk management, and since *The Tolerability of Risk from Nuclear Power Stations* is a classic broad consideration of risk this seems the best module to fit it in. The impact of planning legislation can use solar as an example. Pay-back calculations also fit well here.

12. Individual Projects (40 credits). MEng accreditation requires students to have completed both a team-based and an individual project. It seems sensible to delay the team-based project to fourth year by which time the students know enough to tackle a real industrially-based project. However this means that third year of MEng is no different from third year of BEng and some accreditation panels don't like that. So it may be necessary to distinguish between BEng and MEng individual projects by setting them at different levels. The 40-credit individual project will include formal guidance on project management, research skills etc. Based on 25

students each requiring 0.25hrs per week plus marking of 4hrs each = 250hrs. One 20-credit module is 60hrs and therefore 1 staff FTE of 40 credits is 120 hrs. 250/120 ~ 2 FTEs or the equivalent of 80 credits]

13. MSc core modules. Both of these modules are in semester 2 at present on the MSc Energy Engineering with Environmental Management (to deliberately give the MSc students time to consolidate their maths skills during autumn term). This means that the ENV option should probably be compulsorily in semester 1, this could then work well because the 60 credit team project would be 40 credits in autumn and 20 in spring. The spring part would be dominated by the individual element.

14. Team-based project (60 credits). This is the culmination of the MEng and the flagship project. Each year a different industrially-based project will be tackled by teams of 6 to 10 students as a design project. Each student will then identify the element that they will take to detailed design as an individual submission. This avoids placing huge pressure on a peer assessment system for a 60-credit module. Team project supervision could be 3hrs per week of formal contact and 3hrs per week of informal supervision per staff member and administration. Individual design supervision can be pooled to 2hrs per week, but assessment is intensive and equates to 4hrs per student. So for 25 students this module is approximately 2.5 Staff FTEs [2 staff involved. Autumn term 6hrs * 12 weeks + Spring term 2hrs * 12 weeks plus 4hrs * 25 students = 292 staff hrs. One 20-credit module is 60hrs and therefore 1 staff FTE of 40 credits is 120 hrs. 292/120 ~ 2.5 or the equivalent of 100 credits]

In the above calculations the assumption is being made that if numbers grow much above 25 per year the desire to maintain the SSR will justify additional staff.

Appendix C - Phasing of New Modules if direct entrants to second year are not allowed in advance.

Core Module Titles	Module Credits	2012/13	2013/14	2014/15	2015/16	2016/17
ENG-1E1Y Energy Engineering Revolution	20		✓	✓	✓	✓
ENG-1E2Y Engineering Principles and Laws	20		✓	✓	✓	✓
ENG-1E3Y Engineering Practice	20		✓	✓	✓	✓
ENV-1** Maths for Scientists A	20	E	E	E	E	E
ENG-1E4Y Engineering Mathematics and Mechanics	20		✓	✓	✓	✓
CMPE-2D01 Circuits and Systems	20	E	E	E	E	E
ENG-2E01 Energy Engineering Principles	20			✓	✓	✓
ENG-2E02 Renewable Energy	20			✓	✓	✓
ENV-2A21 Mathematics for Scientists B	20	E	E	E	E	E
ENV-2A22 Mathematics for Scientists C	20	E	E	E	E	E
ENV-3A33 Fossil Fuels	20	E	E	E	E	E
ENG-3E02 Electricity Supply	20	E	E	E	E	E
ENG-3E3Y Nuclear and Solar Energy	20				✓	✓
ENG-3P1Y Individual Energy Project	40				✓	✓
ENG-MA04 Wind energy engineering	20	E	E	E	E	E
ENG-MA06 Wave, tidal and hydro energy engineering	20	E	E	E	E	E
ENG-MP2Y Team Energy Project	60					✓
New Appointments to be in Post ->			1FTE	1FTE	1FTE	1FTE
Residual staff teaching load from existing SCI staff ->			20 credits	0 credits	60 credits	60 credits

E = Already Exists

The projected Staff FTEs are for academic only. Technician support will need to grow and will peak when the individual projects begin in 2015/16. The basis is that part of the load will be spread around a number of individuals in SCI and 1 staff FTE = two 20-credit modules per annum plus research and admin load. Project modules have been dealt with separately as explained in the notes in Appendix B. The significant residual credits in third and fourth year are largely project supervision and assessment. The use of PGRs in support of assessment has not been factored in.

Appendix D. Module details and suggested JACS codes for new modules only.

Core Module Titles	Module Credits	Suggested JACS code	Brief description of module delivery
ENG-1E1Y Energy Engineering Revolution	20	H100	A number of visiting industrials running case studies with students, who in turn will produce presentations and reports
ENG-1E2Y Engineering Principles and Laws	20	H100	A series of lectures, supplemented by laboratory exercises in pipe flow, materials testing, structures testing, thermodynamics experiments.
ENG-1E3Y Engineering Practice	20	H150	A workshop-based module requiring drawing boards, design facilities for models and PC-based CAD
ENG-1E4Y Engineering Mathematics and Mechanics	20	G160	A formal lecture course with tutorial support.
ENG-2E01 Energy Engineering Principles	20	H221	A series of lectures, supplemented by laboratory exercises in fluid flow, structures testing, aerodynamics experiments etc.
ENG-2E02 Renewable Energy	20	H221	A series of lectures supplemented by site visits to local facilities. Some small-scale laboratory experiments.
ENG-3E02 Electricity Supply	20	H630	A series of lectures supplemented by site visits to local facilities. Significant hands-on electronic experiments and assembly.
ENG-3E3Y Nuclear and Solar Energy	20	H821/221	A series of lectures supplemented by site visits to local facilities. Significant hands-on solar panel experiments and assembly.
ENG-3P1Y Individual Energy Project	40	H100	Depending on the nature of the individual projects laboratory equipment, field sensors and test rigs may be required,
ENG-MA04 Wind energy engineering	20	H221	A series of lectures supplemented by site visits to local facilities. Some small-scale laboratory experiments.
ENG-MA06 Wave, tidal and hydro energy engineering	20	H221	A series of lectures supplemented by site visits to local facilities. laboratory experiments utilising water flumes and pipe flow..
ENG-MP2Y Team Energy Project	60	H100	A workshop-based module requiring drawing boards, design facilities for models and PC-based CAD

Appendix E – Transferable and Employability Skills Matrix

Core Module Titles	Module Credits	Oral communication	Written communication	Organisation & planning	Gathering information	Teamwork	Initiative & Resourcefulness	Critical thinking	Self & peer evaluation	Personal / interpersonal	Computing & IT	Problem Solving
ENG-1E1Y Energy Engineering Revolution	20	F & S	S		U	F				U		
ENG-1E2Y Engineering Principles and Laws	20		S					S				S
ENG-1E3Y Engineering Practice	20	F & S	S	S				S	U	U		S
ENV-1*** Maths for Scientists A	20							S			S	F & S
ENG-1E4Y Engineering Mathematics and Mechanics	20		S				U	S				S
CMPE-2D01 Circuits and Systems	20					U	U				F	S
ENG-2E01 Energy Engineering Principles	20		S					S				S
ENG-2E02 Renewable Energy	20				F			S				S
ENV-2A21 Mathematics for Scientists B	20							S			S	S
ENV-2A22 Mathematics for Scientists C	20							S			S	S
ENV-3A33 Fossil Fuels	20		S			U						S
ENG-3E02 Electricity Supply	20							S			S	S
ENG-3E3Y Nuclear and Solar Energy	20							S				S
ENG-3P1Y Individual Energy Project	40	S	S	F & S	U		F & S	S		U	U	U
ENG-MA04 Wind energy engineering	20				U			S				S
ENG-MA06 Wave, tidal and hydro energy engineering	20							S				S
ENG-MP2Y Team Energy Project	60	F & S	F & S	F & S	U	F & S	F & S	S	S	U	U	U
Totals ->												

F = Formative assessment
S = Summative assessment
U = Completed but Unassessed