Report of Validation Panel

Date of Meeting: 12/05/2010

Programme Title: Bachelor of Science (Honours) in Environmental Science and Sustainable Technology

NFQ Level: 8

Intakes Commencing: Proposed for September 2010

ECTS/ACCS Credits: 240

PANEL MEMBERS

Dr. Norman McMillan, Founder and Director, Drop Technologies Ltd. / IT Carlow - Chairperson
Dr. Tom Kelly, Manager, Cleantech, Electronics and Lifesciences Division, Enterprise Ireland
Mr. Paul Greene, General Manager, ProsCon Ltd. (Rockwell Automation)
Mr. John Carmody, Engineering Manager, EMC Ireland
Mr. Ed Riordan, Deputy Registrar and Head of Academic Quality, CIT
In attendance: Dr David Williams (recording).

PROPOSING TEAM MEMBERS

Dr. Eamonn Cashell, Head of School of Science
Dr. Liam McDonnell, Head of Dept. of Applied Physics & Instrumentation
Mr. Eamonn Butler, Lecturer, Dept. of Applied Physics & Instrumentation
Dr. Josh Reynolds, Lecturer, Dept. of Applied Physics & Instrumentation
Dr. Catherine Frehill, Lecturer, Dept. of Applied Physics & Instrumentation
Dr. Guillaume Huyet, Senior Lecturer, Dept. of Applied Physics & Instrumentation
Dr. Anthony Grant, Lecturer, Dept. of Applied Physics & Instrumentation

BACKGROUND TO THE PROPOSED PROGRAMME

the Department of Applied Physics & Instrumentation (DAPI) are proposing a Level 8 Bachelor of Science (Honours) degree programme in Environmental Science and Sustainable Technology **(BEST).** The main aim of this programme is to produce graduate scientists for careers within environmental science and sustainable technology. The programme provides a comprehensive foundation in the physical sciences coupled with specialist studies relevant to environmental science and sustainable technology. The need for this programme has been driven by a number of factors as outlined below.

- ***National policy*** – several recent Programmes for Government, and reports such as *Building Ireland's Smart Economy – A Framework for Sustainable Economic Growth*, have highlighted the need for Ireland to create a smart and green economy, and to embrace sustainable methodologies and technologies. €30 billion will be committed to clean energy alone in Ireland over the next decade.
- ***Economic impact*** – the global environmental goods and services (EGS) market is estimated at €950 billion per annum. The Irish market is valued at some €2.8 billion, with over 6,500 people directly employed in EGS companies. Of this domestic market, green energy only accounts for 25%, with areas such as waste management and environmental services also key activities.
- ***Legislative framework*** – European legislation now enshrines the importance of sustainability in every aspect of commercial activity. The EU has agreed to commitments on climate Change and Energy, setting targets on greenhouse gas emissions, renewable energy use and energy efficiency to be achieved by 2020.
- ***Research priorities*** – Throughout Europe and the US, funding agencies have emphasised the importance of sustainability in their research programme priorities. The European Framework Programme 7 has a budget of €1.9 billion for 2007-2013 committed to ten research priorities with sustainable or green related topics.

Gaps in provision in Ireland – A number of third level institutions in Ireland have introduced green Level 8 programmes, the majority of which are either engineering orientated, or heavily weighted towards biological sciences. There is a distinct lack of such green courses which focus on the physical and chemical sciences.

Employment potential – The BEST programme, anchored in the scientific domain, is designed to support the current and future 'greening' of all sectors of the economy. Recent estimates suggest that more than 50% of new recent employment falls into the green sector, and there are 125 companies in Ireland whose principal business/service is definitively in the green sector. BEST graduates will be suitable for employment in areas such as environmental management, environmental monitoring, waste and emissions reduction, energy generation using sustainable technologies, carbon footprint reduction, and research & development and business enterprise.

FINDINGS OF THE PANEL

1. General Findings

The Panel commends the quality of the proposal and the associated documentation.

2. Validation Criteria

The Panel has considered the documentation provided and has discussed the programme with the proposers. The panel has concluded that the programme meets the required standards in the Science field of study at Level 8 of the National Framework.

The proposed Programme Outcomes as presented to the Panel are attached as Appendix 1.

The panel notes that the content of the programme has been developed following extensive consultation with industry. This took the form of two surveys of relevant companies, identifying the areas of knowledge and understanding, and skills set, within the BEST programme which are most important and relevant to industry. Eighteen new modules have been written for the programme, with the remainder of the course content drawing on existing modules from a number of departments within CIT. The programme descriptor and draft modules have been reviewed by two external reviewers and recommended for approval.

With regard to the CIT Validation Criteria:

2.1 Is there a convincing need for the programme with a viable level of applications?

- Yes.

Positioning of the programme **-** The proposers outlined how they had identified a clear gap in the course offerings available nationally, positioning the programme in the physical and chemical sciences sector, but away from energy and wet environmental sciences. The course is well separated from engineering and the department's key strength of instrumentation science, and deliberately does not go into some areas, such as instrument engineering and programming. It is centred around the application of green technology, and reports from California and the UK show that jobs are available in this 'green' space.

Marketing and recruitment – The panel made in-depth enquiries about how the programme would be marketed to potential students, competition from other degrees, and expectations of uptake. The proposers noted that, at school level, a clear distinction is made between scientists and engineers, which can be a difficulty for inter-disciplinary courses – the BEST programme is targeting scientists, not engineers. There is clear evidence that 2nd level students are interested in green issues, at the recent CIT SciFest exhibition many of the projects presented were green-oriented. The proposers realise it is important to present specific career opportunities for BEST graduates, however there is no single job description which would accurately cover all possibilities. Instead, approach will be to present 3-4 employment profiles (e.g. sustainability manager), demonstrating to the students that the degree gives a number of career options and room to adapt their career path. It will be marketed towards students who wish to become champions of environmental issues and sustainability. The course is aiming to offer ~20 places per year; the Sustainable Energy Technology course launched in CIT three years ago has about 80

students per year, so proposers are confident of a strong uptake for the BEST programme and of subsequently finding job placements for graduates.

BEST will not compete directly with the CIT Sustainable Energy course (an engineering course), since it has deliberately distanced itself from the green energy *generation* area. The proposers noted that it is difficult to get reliable figures from other colleges, since they will all claim 100% job placement.

The panel observes that many people/students like to be associated with "disruptive technologies", and to be regarded as "agents of change". This could be a selling point.

Gender balance – The panel suggested that there was a great opportunity with the BEST programme to recruit more girls into science. Because of the environmental and sustainability aspects of the programme, the course doesn't present itself as a physics course, which in this case is an advantage, and it therefore avoids the traditional perception of physics being difficult and male-dominated. The proposers agreed with this, but raised the caveat that students with a Leaving Certificate science background based on Biology might struggle in the course unless they were fully aware of what to expect.

Employment opportunities – Following on from marketing and recruitment, the panel explored how the BEST graduates would be suited to the needs of potential employers, and the skill sets that they would develop. They identified two threads of green sector activity; the 'greening' of existing industries, and businesses which directly produce green technologies or services, and asked the proposers to comment on how the BEST graduates would fit with these. The course will try to straddle both threads, giving the graduates the skills set for both types of job. There will be enough core science to allow flexibility in the career path, but with a wider remit of management and global influence. Graduates will be well able to leave the lab and talk to production managers, etc.

Industrial placements occur in 3rd year, in effect the most effective "job interview". The panel raised the concern that current graduates tend to concentrate too much on process control aspects, and don't have sufficient understanding of the principles behind how the process works. In response, the proposers noted that there is a lot of chemistry and physics taught in the BEST course, more than in the Industrial Engineering and Control courses. They are confident that BEST graduates will be able to communicate effectively with both process control and process engineering personnel. However, some aspects are very specific to e.g. chemical engineering, and it would be very difficult to include them in a Physics course without overextending.

The panel noted a change in attitude by companies towards green issues; formerly regarded as an expense, now seen as a cost-saving endeavour. In the past, employees from other roles were brought in to perform green-related tasks, now and in the future, companies are looking for dedicated people and setting up positions such as Sustainability Officer.

2.2 Are the level and type of the proposed award appropriate?

Yes.

2.3 Is the learning experience of an appropriate level, standard and quality?

Yes.

The panel asked for details on the process by which the programme descriptors were developed, and how existing modules fit in with the programme. An initial feasibility study identified the spectrum of employment opportunities, and programme outputs and descriptors were developed from this. The modules were then written/chosen to provide these. This top-down method was different from previous course developments, and reflected a change in philosophy within CIT. The proposers made sure to talk to the people delivering existing modules and ensure they fitted with the programme. Modules from several departments were used, highlighting the multi-disciplinary nature of the programme.

2.4 Is the programme structure logical and well designed (including procedures for access, transfer and progression)?

Software/IT, Statistics, Legislation, Teamwork, Business skills – The panel requested clarification of the content on these specific topics within the course. Surveys indicated computer programming was not a highly important

requirement, so no dedicated module in programming is included. The BEST course concentrates on systems rather than components, and to cover programming in detail would require losing other strengths. However, a number of software packages are used within other modules, such as macros, Simulink, COMSOL, Minitab.

Data presentation and statistics are important, and the feedback from reviews of modules has been positive concerning the amount of this in the course. The relevant modules appear late on due to the fairly high level of maths required, and are also embedded in two scientific modules.

In the environmental area, understanding relevant legislation and regulations is important. While a dedicated module on this was considered, instead it was decided to distribute it throughout the modules. The 4 capstone modules in the 4th year each contain a legislative element. The panel agreed this was a good design model.

While students work in the lab individually, there are also team-based tasks. The small class sizes and accessibility of the lecturers will build a class ethos in which students help each other and work together.

For business skills, an innovative approach to industrial placements will include the option to design their own business, or offer free environmental audits to schools, etc. There are also several innovation initiatives organised on a college-wide basis that would be relevant. An industry advisory panel will be established to offer guidance on this issue.

2.5 Are the programme management structures adequate?

Yes.

There is evidence of a committed course team with a real concern for quality and student welfare.

2.6 Are the resource requirements reasonable?

The Panel was assured on behalf of the President and Head of School that appropriate resources in terms of staffing and facilities will be put in place when the programme is validated.

2.7 Will the impact of the programme on the Institute be positive?

Yes.

Links with research? Researchers based in this Department work with a number of SMEs and multi-national companies through e.g. projects funded by Enterprise Ireland, SFI, which often involve improving efficiencies in their production processes. BEST will provide appropriate graduates. Researchers' links with industry will also help with placements in companies.

3. Programme Structure

The Panel notes that the programme structure had already been the subject of external peer evaluation. It is considered satisfactory.

4. Specific Modules

The Panel notes that many modules on the proposed programme are pre-approved modules derived from related programmes in the CIT Modular system. The Panel was also informed that the new draft modules have been the subject of internal and external scrutiny including external reviewers.

5. Conclusions

The panel made the following conclusions and recommendations;

- The panel commend the proposers on the effort put into preparing the submission.
- The panel agree that the proposed programme is a worthwhile and timely degree, with a very innovative approach

- The panel were impressed with the manner in which the proposers took account of the national situation and policies.
- The proposal aligns well with government and institutional strategy.
- The panel are satisfied that the programme is sufficiently differentiated from other course offerings within CIT.
- Industry should welcome graduates with the knowledge and skills provided by the programme
- The panel suggests that the marketing of the degree emphasises the 'Agent for Change' role of the graduate, and that it seeks to tap a broader profile of student than would heretofore have considered an applied physics course.
- The panel sees the programme as a great opportunity to encourage greater uptake of female students in the physical sciences, and strongly urges the proposers to make specific efforts to pursue this
- Dr. Tom Kelly/Enterprise Ireland and Dr Normal McMillan kindly offered to consult further with the Department with regard to business and innovation aspects of the course.

The Panel recommends that the Programme be validated for five years, or until the next programmatic review, whichever is soonest, on completion of the module moderation process.

APPENDIX 1 – Proposed Programme Outcomes

Programme Outcomes

On successful completion of this programme the learner will be able to demonstrate:

PO1	**Knowledge - Breadth**	a comprehensive knowledge and understanding of the principles of physical sciences and their application coupled with knowledge of mathematics, analytical chemistry, instrumentation, information and communication technologies, management techniques and regulations and their application within environmental science and sustainable technology.
PO2	**Knowledge - Kind**	an understanding of the advantages, limitations, inherent assumptions and range of applicability of specific scientific and other principles, together with their potential for development in environmental science and sustainable technology.
PO3	**Skill - Range**	an ability to investigate and analyse complex problems using appropriate tools such as statistics, data processing and advanced computer skills; effective oral and written communication skills necessary to construct, evaluate and present solutions.
PO4	**Skill - Selectivity**	an ability to address complex issues in a structured manner using research and consultation; to design scientific studies, including experimentation, to test formulated hypotheses and draw appropriate conclusions.
PO5	**Competence - Context**	an awareness of the need to consider a range of environmental management options and analysis tools and select, design or develop, debate and present practical solutions within regulatory and ethical frameworks.
PO6	**Competence - Role**	the ability to work professionally; individually; as a member of an interdisciplinary team, or as a team leader; the ability to prepare project specifications, plan and manage a project from initiation to handover.
PO7	**Competence - Learning to Learn**	the ability to undertake appropriate research in order to develop their state of knowledge; to critically approach academic literature and other sources of information; a recognition of the importance and the need for, and an ability to engage in, life-long learning.
PO8	**Competence - Insight**	techniques to critically analyse and develop appropriate strategies and solutions to resolve environmental problems; to recognise the role of the scientist in the development of environmental science and sustainable technology.