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Accreditation of an Industry-Based Education and Training Programme for Power Station Operators

Daniel Byrne
Department of Engineering Technology, Dublin Institute of Technology (DIT), Bolton Street, Dublin, Republic of Ireland

This paper describes the historical background to, and the development of, a co-operative agreement between the Dublin Institute of Technology (DIT) and the Electricity Supply Board (ESB) of Ireland for the accreditation by DIT of largely ESB based and taught courses for the training of ESB Unit Assistant and Operator grade staff. In 1996 the Quality Assurance Committee of the DIT considered the ESB application and in principle was pleased to pursue the possibility of a formal academic association. A Joint Course Committee was formed in October 1996 and commenced work on the drafting of a submission document for accreditation of the programmes for the awards of *Preliminary Certificate in Power Plant Operation,* and *Certificate in Power Plant Operation.*

INTRODUCTION

In 1995 the Generation Services Department of the Electricity Supply Board (ESB) approached the Dublin Institute of Technology (DIT) to investigate the possibility of the DIT accrediting training courses for Unit Assistants and Unit Operators employed in the ESB's Thermal Power Stations.

The courses, which will be accommodated in the ESB's premises and largely taught by ESB staff, will provide education and training for ESB staff who operate the power generation plant in ESB power stations throughout Ireland. The ESB have prepared detailed course manuals for the education and training needs of its power plant operating staff. The courses will serve the ESB's needs for formal qualifications for the Unit Assistant and Unit Operator grades within its organisation; the duties of a Unit Operator in an ESB power station include the operation and monitoring of the generation, boiler and ancillary equipment in the station, and the Unit Assistant's duties include physical inspection and operation of the plant.

In 1996 the Quality Assurance Committee of the DIT considered the Application of the ESB for accreditation and in principle was pleased to pursue the possibility of a formal academic association between the DIT and the ESB. The DIT's Quality Assurance Committee decided that a Joint Course Committee comprising of representatives from both the DIT and the ESB should be established. The initial task of this committee was to prepare a submission document, which, together with the ESB's training programmes, would be submitted to a Validation Panel appointed by the DIT's Academic Council in accordance with the Institute's quality assurance procedures.

A Joint Course Committee, comprising representatives from DIT Bolton St, DIT Kevin St and the Generation Services Department of the ESB, was formed in October 1996 and commenced work on the drafting of a submission document for the course. The committee prepared course documents and requested accreditation of the programmes for the awards of:

- Preliminary Certificate in Power Plant Operation; and
- Certificate in Power Plant Operation.

HISTORICAL CONTEXT

The involvement of the DIT with the validation of these programmes follows its long traditional commitment to fostering close links with industry. Looking back at the history of formalised technical instruction in Ireland, we are reminded that one of the earliest forms of industrial education in Ireland was that organised by the Royal Dublin Society in the late 18th century. Regional scientific institutions were set up in a number of centres, including Belfast, Cork and Galway.

From the 1820s, Mechanics Institutes began to be

established in Britain to instruct artisans in the scientific principles of their trade. The Dublin Mechanics Institute was set up in 1837, followed by institutions in Armagh, Belfast, Cork, Galway, Limerick, Clonmel and Waterford.

In 1853 a Department of Science and Art, whose authority extended to Ireland, was set up in London to establish a system of examinations and to put in place a system of *payments-by-results* for teacher initiative.

By the 1870s, following the progress of industrialisation in the USA, France and particularly in Germany where close links between industry and the Techniche Hochschulen were already in place, a Royal Commission on Technical Education was established. This resulted in the expansion of technical education funded from municipal rates and the drafting of the 1889 and 1891 *Technical Instruction Acts*.

A major development in technical education in Dublin followed the *Artisans Exhibition* in 1885, organised by the Dublin Workingman's Club and with Arnold Graves as the organising secretary. Arnold Graves, a University of Dublin graduate and barrister, was to have a significant influence in the development of technical education in Ireland. The Dublin United Trades Council was established and proposed to Dublin Corporation that a technical school be established in Kevin St to educate artisans and apprentices in science, arts and trades. Financial support was available from the Royal Dublin Society, Guinness and Jameson as well as the Corporation. Arnold Graves was also involved with the establishment of technical institutions in Limerick, Galway and the Pembroke Technical and the Fisheries School at Ringsend, Dublin.

The Technical Education Association of Ireland, established in 1893 by Arnold Graves, campaigned for a separate Irish Department for Technical Education. The Department of Agriculture and Technical Education was established in 1900. It is interesting to note that technical instruction was defined in an Act as:

> *Instruction in the principles of science and art applicable to industries and in the application of special branches of science and art to specific industries and employers.*

The Act provided for the establishment of local technical education committees which were required to submit their annual *Schemes of Instruction* to the Department.

Between 1900 and 1911 the Technical Education Committee opened four new schools to add to the Kevin Street Technical School. These were the School of Music in Chatham Row (1890), College of Commerce in Rathmines (1905), School of Domestic Economy in Parnell Square (1905) and Bolton Street Technical School (1911).

In 1924 the new Saorstat Eireann government established a Department of Education. This Department set up a Commission on Technical Education in 1926. The Chairman of the Commission was John Ingram, Inspector of the Technical Instruction Branch of the Department of Education, and included amongst its members two foreign technical education experts, Professor A. Rohn of Switzerland and Mr N. Fredrickson of Sweden. The 1927 *Report of the Commission* led to the 1930 Vocational Education Act. This Act provided for the establishment of 38 vocational County, Borough and Town Education Committees. Two crucial definitions of continuation and technical education were included in the Act. Continuation education is:

> *education to continue and supplement education provided in elementary schools and includes general and practical training in preparation for employment in trades, manufacture, agriculture, commerce and other industrial pursuits and also general practical training of young persons in the early stages of such employment.*

Technical Education is:

> *education pertaining to trades, manufacture, commerce and other industrial pursuits (including the occupation of girls and women connected with the household) and includes education in science and art, music and physical training.*

The higher level courses conducted in the technical schools in the 1930s by the City of Dublin Vocational Education Committee (CDVEC) was attended largely on a part-time basis. In the late 1930s and 1940s, courses were developed for apprentices from the Irish Sugar Company, CIE, ESB and Guinness. During the late 1940s and 1950s, day and evening courses were commenced for students studying the external examinations of particular professional bodies or UK based educational establishments.

In the early 1960s a most significant event in technical education took place when the CDVEC published a report titled *Technological Education*. A subcommittee that included the Chief Chemist of Guinness, the Chief Engineer of Aer Lingus, the Deputy Chief Engineer of the ESB and the architect Michael Scott prepared the report. The Committee put forward cogent arguments for the development of full-time courses to educate technicians. The CDVEC pressed ahead and technician courses were established in which students sat for VEC examinations and were awarded VEC diplomas.

On a National basis the 1970s saw the establishment of the network of regional technical colleges preparing students for the Certificate and Diploma Awards of the National Council for Educational Awards. These colleges, like the DIT, have gone on to develop a range of programmes at degree level.

THE ESB

In relation to the ESB, a brief review of the staffing and training arrangements over the last few decades will illustrate the historical context of the development of the new courses.

Prior to the early 1960s, the typical staffing arrangement in ESB power stations was that the Shift Manager was always a graduate engineer. The operating staff consisted of the separate categories of boiler operators, turbine operators and control room operators. Control room operators were always recruited from qualified electricians. Training was conducted off the job for selected applicants in the ESB training centres. Operators sat the examinations of the City and Guilds of London course in *Basic Boiler and Turbine Operation and Boilerhouse Practice and Power Plant.*

In 1965 the advent of unitised plant (boiler and turbine installed as a single plant item) led to the combining of the categories of boiler and turbine operator, and the training reflected this fact. Control room operators were still a separate category.

In 1969 complete unitisation of plant saw the installation of plant where the boiler, turbine and generator were installed as a single unit. Staffing and training arrangements were put in place to reflect the new grouping of plant. The shift supervisor positions were now open to all operators, although a quarter of all such positions was reserved for control room operators by union agreement, and operators sat for the examinations of the City and Guilds of London *652 Auxiliary Plant Operators Certificate* and *653 Principles and Operations of Power Plant* (Parts 1& 2 POPP) Course.

In 1972 the City and Guild of London changed the format and standards of the POPP course. Prospective ESB operators now availed of the new POPP course on a part-time correspondence basis. This arrangement was unsatisfactory as the POPP course was knowledge-based only, had no competency testing, and was dominated by coal-fired boiler technology which was not a major factor in ESB stations at that time.

In the following years the training of new staff was mainly achieved by the operator spending a period paralleling on shift (*sit by Nelly*) and attending class room tuition sessions. The ESB developed self-test questions to assist the learning process.

However, in 1992 the ESB initiated a study group to *research and map the totality of the practice of Shift Management in power stations and other selected electricity utilities*. The development of the curriculum for the new courses to be accredited by DIT evolved from this and other subsequent studies.

Curriculum development

In 1993 a study team under the leadership of Mr Frank Scott (Generation Services, ESB) was requested to develop pre-appointment and assessment procedures together with the appropriate training and development modules for operations staff in the power stations. Study teams visited locations in Ireland, USA, Holland, Germany and the UK where training of power station operatives is undertaken. As a result of their visits and from a reflection of their own personal experiences the study team recommended the development of the programmes submitted for validation by DIT. The ESB are confident that their programmes represent an industry standard that is second to none in Europe.

The Electricity Supply Board operates 16 Power Stations in Ireland. The total generated load is approximately 4000MW. The number of Unit Operators and Unit Assistants employed at present is 410. Currently, prospective and existing Unit Operators and Unit Assistants wishing to acquire qualifications in this field undertake a distance learning/correspondence course in preparation for the examinations of the City and Guilds of London *652 Auxiliary Plant Operators Certificate* and *653 Principles and Operation of Power Plant*. These courses are knowledge-based and include an emphasis on the coal and nuclear plants common in the UK's Central Electricity Generating Board (CEGB) operation, but are not particularly relevant to the ESB's plant. The examinations are written and do not include testing for competency in the actual operation of power plant. The ESB conducted wide ranging evaluations (1991-92) of these courses among their management and operations staff and the overwhelming conclusion was that the ESB should develop their own plant specific courses and that these should be accredited by an internationally recognised educational institution.

The ESB wish to establish an accredited education/training course with two stages appropriate for the grades of Unit Assistant and Unit Operator which will be competency-based. These courses will provide the formal training for these grades and will be the recognised qualification for future recruitment to the position of Unit Assistant and for promotion to the position of Unit Operator in the ESB.

The ESB anticipate that the course will be provided for approximately 20 Unit Assistants and 20 Unit Operators each year. Initially these courses will be

provided for ESB staff but, having examined the format and content, the DIT's Joint Course Committee envisions the possibility of further development of these unique courses for companies operating large process plants.

The ESB has identified the need for this course as a means of providing training for particular grades of its staff. The ESB also recognised that formal accreditation of the course by an academic institution would be desirable. The ESB investigated a number of academic bodies and decided that validation of the courses by the DIT would offer suitable recognition for the awards gained by the students.

The DIT in turn acknowledged the quality of the course material prepared by the ESB and is familiar with the high standards maintained by ESB staff in all its operations. The Quality Assurance Committee considers the DIT's association with this course to be an exciting development and anticipate that its experience with the course will lead to other co-operative ventures with other organisations.

ACCOMMODATION AND FACILITIES

All training will take place on ESB premises. Training will be conducted in the Training Centre in Ringsend, Dublin and in the power stations around Ireland.

In the Training Centre in Ringsend Power Station there are lecture rooms equipped with suitable audio/visual aids to conduct the classroom modules of the course. The trainee operators will have access to a large range of lecture notes and generic material in audio and video format. Training will also be conducted in the Electrical, Control and Instrumentation laboratories.

The Training Centre is very fortunate to have available two full scope simulators. These simulators have been installed at a cost of £8 million. They represent the 3 x 305MW coal-fired plant at Moneypoint, and the 4 x 250/270MW oil/gas fired plants at Poolbeg, Tarbert and Aghada. A *Real-time Object-oriented Software Environment* (ROSE) supports the simulators. Computer and library facilities are available in addition to a canteen and stationary stores to support the learning environment.

In each of the power stations throughout the country, lecture rooms and support equipment are available. Each station has plant specific course material in lecture note and audio/visual format. Computer facilities to the value of £20,000 have been installed in each station to assist the learning process.

The staff of the ESB have developed a comprehensive set of manuals for the classroom and on the job training programmes for their Unit Assistants and Unit Operators. These training manuals were prepared to suit the specific training needs of the ESB and relate to the various types of plant presently in operation in the power stations in Ireland. The Joint Course Committee prepared a submission document to illustrate the scope of the courses for which accreditation is sought.

The course material includes the body of knowledge required to ensure that Unit Assistants and Unit Operators acquire the technical information required to fulfil their duties in the power stations. The training programme includes sufficient competency testing to guarantee that graduates of the course will operate the power station plant in a safe and efficient manner.

The importance of ensuring that the ESB's power stations operate properly at all times is emphasised when we note that the total capital investment by the ESB in power plant represents 8% of the National Debt of Ireland. The cost of the downtime of a typical 300MW Generating Unit is £40,000 per day.

MONITORING THE COURSE

The Joint Course Committee appointed by the Quality Assurance Committee will continue to oversee the operation of the course and monitor the standards achieved by the graduates. The Course Committee will meet at least three times per year and fulfil all the functions required of it as detailed in the DIT's *Quality Assurance Handbook*. Members of the Committee will be appointed for a period of three years by the DIT Academic Council's Quality Assurance Committee and will include representatives from the DIT, ESB, other learned institutions, public bodies or private companies as appropriate. A permanent liaison representative has been appointed by the DIT to ensure continuity of contacts between the ESB and the DIT. External examiners will be appointed to monitor the standards of the written examinations and the on-the-job competency tests undertaken by the students on the courses. The Joint Course Committee will continue to monitor the course and will ensure by means of its regular reviews that the content of the course remains current and relative to the changing profiles of the plant employed in the ESB's power stations.

The examination and assessment results of the *Preliminary Certificate* and *Certificate Programmes* will be presented by the Chairperson of the Joint Course Committee at the Examination Board meetings of the Dublin Institute of Technology's Faculty of Engineering each year.

The DIT Academic Council will sanction the awards. The awards of *Preliminary Certificate* and *Certificate* to the successful participants will take place at the appropriate award ceremony of the DIT's Faculty of Engineering.

These courses have been designed to prepare students for specific tasks in the ESB power stations. Therefore the course has as its first and foremost objective the training of the participants to undertake their duties as Unit Assistants and Unit Operators in power generating stations.

The course utilises a lecture format in the classroom modules and the theoretical knowledge acquired will be examined by the traditional written and oral examination methods. However, the largest proportion of time is allocated to the acquisition of knowledge and skills by *hands-on* applications on simulators or on the actual power plant on site. The rigorous and wide-ranging competency testing programme will ensure that the graduates achieve the learning objectives of the course.

COURSE STRUCTURE

Figures 1 and 2 illustrate the outline of the course structure. The course consists of classroom modules, on-the-job modules and competency modules.

The theoretical knowledge will be examined by written examinations, its practical application by oral examinations after on-the-job training, and finally the competency of the operator to perform particular tasks will be assessed after the competency modules.

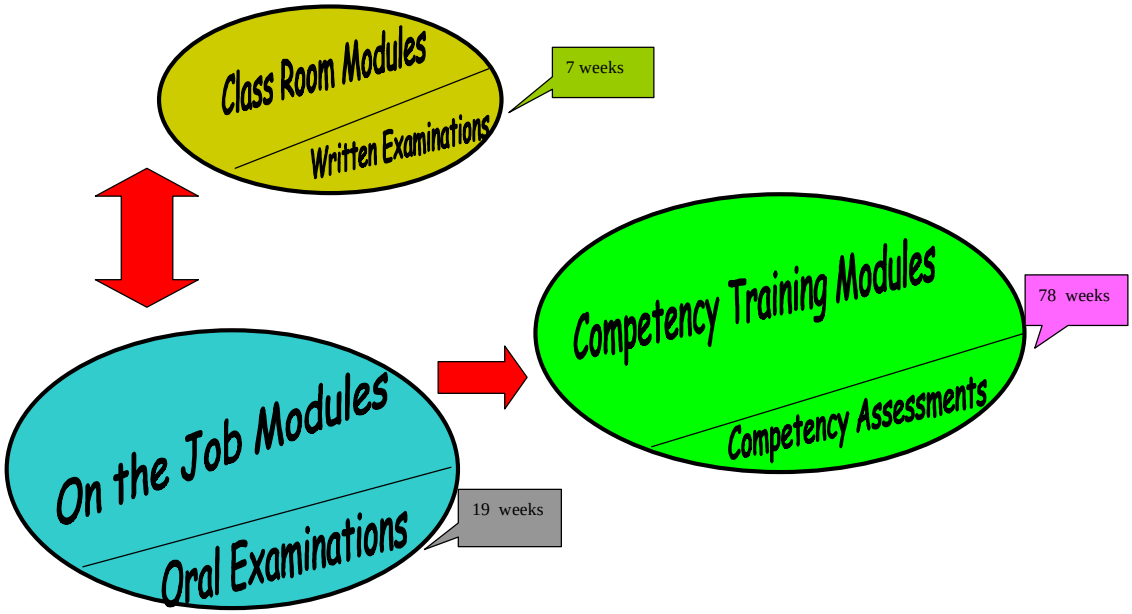

Figure 1: Two year preliminary certificate programme layout for the training of power plant Unit Assistants.

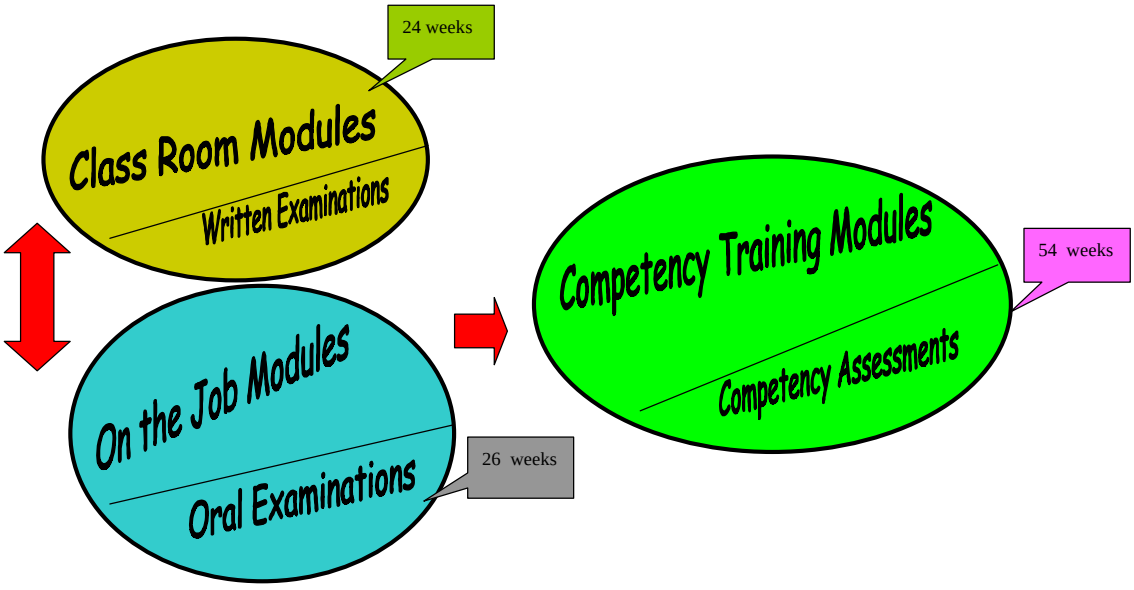

Figure 2: Two year certificate programme layout for the training of power plant Unit Operators.

BIOGRAPHY

Daniel Byrne, Acting Head of the Department of Engineering Technology at the Dublin Institute of Technology, qualified as a Building Services Engineer in 1969. He worked as Technician Engineer for Unidare Ltd, manufacturer of electrical products, and Cadburys Ltd in Dublin before joining the Electricity Supply Board in 1965. He worked as a design technician engineer for a wide variety of mechanical and electrical projects.

Having qualified as an engineer, he joined the Dublin Institute of Technology to launch technician and degree programmes in the new discipline of building services engineering. Since the early 1970s the majority of graduates in Ireland in this discipline have emerged from the Dublin Institute of Technology.