

## **EDUCATING EIRGRID'S POWER SYSTEM ENGINEERS TO FACILITATE A SUSTAINABLE FUTURE - A PARTNERSHIP OF ACADEMIA AND INDUSTRY**

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### **ABSTRACT**

This paper describes the role and activities of EirGrid plc, and the skills and knowledge required of its circa 150 engineers in order to support EirGrid plc's role of ensuring competitiveness, sustainability and security of electricity supply across Ireland. The education of engineers is a life-long enterprise in which academia, industry and the engineer all have a responsibility. The paper focuses on the different interactions among EirGrid TSO (Transmission System Operator), Academic Institutions and students which influence the education of engineers and the direction and industry focus of research. The paper discusses how educating engineers continues as lifelong learning and describes initiatives including EirGrid TSO's Graduate Development Programme and commitment to Continuing Professional Development (CPD) which facilitate the continued learning for engineers.

*Keywords: TSO, Industry, Partnership, Professional Development, Skills*

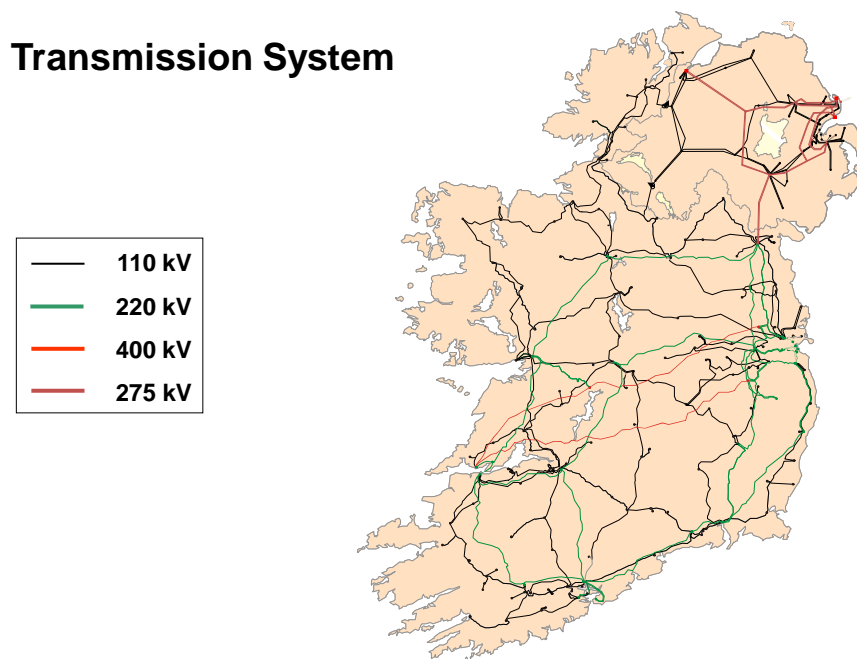
### **INTRODUCTION**

EirGrid plc is the commercial state-owned company established under Irish and EU law to carry out the role of independent Electricity Transmission System Operator (TSO) and Market Operator (MO) in Ireland. Through System Operator Northern Ireland (SONI), which became part of the EirGrid Group in March 2009, it is also the Electricity Transmission System Operator and Market Operator in Northern Ireland. As transmission system operator, and market operator, EirGrid plays a key role in ensuring the competitiveness, sustainability and security of electricity supply across the island of Ireland.

EirGrid as an organisation relies on having highly skilled staff in a variety of disciplines. There is a high engineering content in its activities and to succeed in its roles requires having a significant number of skilled engineers. Currently EirGrid has more than 150 qualified engineers (approximately 50% of staff). EirGrid has a strong interest in the quality and supply of engineering graduates. It has a number of initiatives in place to work in partnership with universities to strengthen links between universities and the industry. This paper describes EirGrid's activities and its need for engineering skills. It describes how the partnership initiatives in place contribute to the ability of EirGrid to develop the depth of engineering skills and knowledge required in order to fulfil its key role.

## OVERVIEW OF EIRGRID'S ACTIVITIES

As transmission system operator, EirGrid is responsible for operating a safe, secure, reliable, economical and efficient power system 24/7 for the benefit of our customers, the users of the system in Ireland and Northern Ireland. The grid comprises the meshed system of transmission stations and of lines and cables at and over 110,000 volts as shown in Figure 1. EirGrid is also responsible for providing transparent, non-discriminatory transmission system access to generators (conventional and renewable), demand customers and interconnectors and for planning the development of the system in Ireland. SONI manages the power flows on the Moyle Interconnector between Northern Ireland and Scotland. The Single Electricity Market Operator (SEMO, a joint venture between EirGrid and SONI) operates the Single Electricity Market which is the wholesale electricity market across the two jurisdictions on the island of Ireland. The Market Operator settles all trades made in the electricity market and administers all payments made to and received from generators and suppliers. A single scheduling and dispatch tool is utilised to minimise generation costs in the single electricity market.



**Figure 1: The Transmission Grid**

Ireland's renewable energy potential is one of the finest in the world and the government is fully committed to exploiting this abundant resource to reduce Ireland's dependence on fossil fuel imports. Ireland's target is to have 40% of electricity generation from renewable energy

by 2020 which will involve accommodating one of the highest levels of wind generation in the world and will position Ireland as a world leader in the integration of wind energy onto a small island system. There are a number of initiatives in place to enable this target to be met and EirGrid is being proactive in identifying and solving issues associated with integration of renewables.

EirGrid plays a key role in delivering on the Irish government's economic recovery plan "Building Ireland's Smart Economy – A Framework for Sustainable Economic Survival". It is developing grid infrastructure in Ireland to put in place a grid which will be able to accommodate Ireland's renewable energy targets and be a platform for economic recovery in a timely efficient manner, balancing need for infrastructure with impact on price of electricity, the environment and the community. EirGrid is also building an interconnector between Ireland and Wales to strengthen Ireland's links with the Great Britain energy market, to facilitate competitive export and import of electricity and to increase security of supply.

## **ROLE OF ENGINEERING IN EIRGRID**

EirGrid employs over 150 engineers in a wide variety of roles. Engineers are involved in the planning of the Transmission network and in the planning of access to the network. Engineers are involved in the control and operation of the Power System and in the operation and development of the Single Electricity market. Engineers are involved in the protection and maintenance of the power system and in the management of large construction projects. Engineers are involved in management of customer connection to the Transmission System and in the commercial and pricing functions.

A wide variety of highly specific skill sets is required of its engineers, some of which are instilled by the universities, but much of which is developed through training and development within the organisation. For example, an engineer working in the control and operation of the power system needs advanced knowledge of power systems. An engineer working in the management of large projects typically needs strong project management skills and may need negotiation expertise and the ability to deal effectively with 3<sup>rd</sup> parties. Engineers involved in the commercial and pricing functions of EirGrid require contract management skills, knowledge of power systems and an understanding of the Electricity Regulatory environment. Apart from the technical skill sets required, EirGrid has identified a number of personal and interpersonal skills and behaviours which are required of all its professionals. These would include good analytical, data acquisition and problem solving capabilities and good communication and interpersonal skills, to name but a few. In addition, EirGrid looks for the ability to work effectively as part of a team, to be capable of self-motivation and, at the higher levels of the organisation, the ability to lead others effectively. The skills model that meets the needs of EirGrid as a business is closely aligned with the models discussed below.

Shuman et al (2005) outline and discuss the skills that ABET (the Accreditation Board for Engineering and Technology) defined originally in 1996 and updated in 2004. Along with the

“hard” skills such as those required to identify, formulate and solve engineering problems and the ability to use the techniques, skills and modern engineering tools necessary for engineering practice, a set of “professional” skills has been identified. These skills include:

- The ability to function on multi-disciplinary teams
- An ability to communicate effectively
- A recognition of the need for, and an ability to engage in lifelong learning
- An understanding of professional and ethical responsibility
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context and
- Knowledge of contemporary issues.

With special relevance to the last three points above, Professor Barbara Wright (2009) describes the need to truly attend to the gap between knowledge and training in the field of engineering. She believes that flexibility of approach and lateral thinking should be encouraged in all professional education. In addition, she believes that engineers, once established, should be more willing than has been the case so far to engage in politics, especially in the later stages of their careers. As she states “the complexity of decisions on which politicians are currently called upon to judge is such that there is a crying need for greater levels of expertise and competence. If engineers fail to rise to this challenge, the gap between the real and the ideal will continue to make itself felt and humanity will be the victim”.

It can be argued that engineers today not only need the technical tools of their profession, they need another set of tools that allow them to bring their technical skills into most effective and efficient use. It is our belief that these skills, while introduced at undergraduate level, will need a lifetime of development. We would feel that the recognition of the need for and the ability to engage in lifelong learning, plus a willingness to be self-reflective, are probably the most important indicators of a graduate’s potential to develop, and we look for these attributes in applicants. They are by no means universally present. We believe that EirGrid, by effective partnership with academia, maximises the opportunity for its engineers to develop in line with their own and with the organisation’s requirements. Charles M. Vest (2005) describes the new world of engineering pedagogy as preparing engineers for “ an understanding of what engineers actually do; they must write and communicate well; must think clearly about ethics and social responsibility; ...and must know how to conceive, design, and operate engineering systems of great complexity. They must also work within a framework of sustainable development, be creative and innovative, understand business and organizations, and be prepared to live and work as global citizens. That is a tall order . . . perhaps even an impossible order”. Our thesis, and one that we develop in this paper, is that this cannot be achieved by academic institutions alone, but that instead industry must play its part and be treated as a respected partner.

## **PARTNERSHIP OF INDUSTRY AND ACADEMIA**

Engineers experience a lifetime of learning in the course of their professional lives. The task of teaching engineers begins with formal learning in the schools and universities, and continues throughout their working lives in the form of continuing professional development (CPD), which will involve on-the job training, formal learning and further education, though this list is not exhaustive. Responsibility for enabling lifelong learning lies with both Industry and Academia. For the partnership of Industry and Academia to be successful, i.e. to produce the kinds of engineers capable of doing the job required, both sides of the partnership must have the same picture of what is required and must be very clear of its part in the process. For this to happen, there must be regular and open dialogue between all parties, and clear channels of communication. At the bottom line, industry needs to be able to access top quality graduates who not only have the basic technical skills of their specialism, but technical skills that are relevant to the future environment in which they will operate. In addition, graduates need to have an understanding of the professional and interpersonal skills they will need in order to make the best use of their technical skills. Industry needs to communicate to academia in a timely fashion its current and future needs of engineering graduates.

### **The current situation – EirGrid TSO and Academic Institutions**

EirGrid TSO has a number of planned parallel interactions with Academic Institutions across the academic time-frame which influence both the education of engineers and the direction and industry focus of research. There are interactions with universities at student placement level, graduate recruitment level and post-graduate Research & Development level. In addition, there are various contacts at different levels in the organisation, through, for example, personal contacts with alumni and individual lecture contributions,.

EirGrid TSO is a significant employer of engineering graduates. At the moment, we adopt a two-pronged approach to recruiting graduates. We hire newly-qualified graduates and we also provide placement opportunities for undergraduates that will identify suitable graduates for hire on graduation.

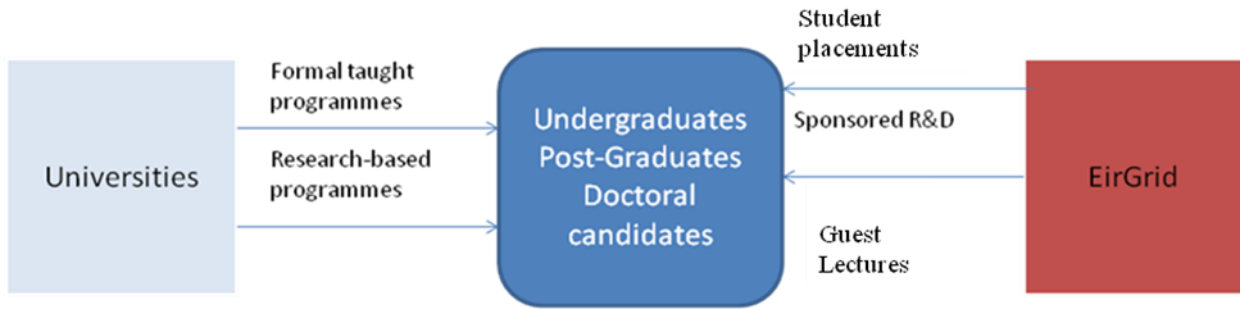
EirGrid TSO's hiring strategy is to hire top graduates across all engineering disciplines, and develop their Power System knowledge and experience in-house. One of the drivers of this strategy is the limited emphasis on Power System Engineering in undergraduate education. EirGrid TSO has implemented a Graduate Development Programme (GDP), which offers new graduates a number of placements across the organisation, a comprehensive training programme and an experienced mentor for the duration of the programme. A strong panel of engineers has been chosen and trained to act as a graduate hiring panel, contributing to their own professional development. Generally speaking, graduates, while excellent in overall quality, come to EirGrid TSO with very little Power System knowledge or experience, and the task of growing this expertise is undertaken by the organisation.

Since 2007, EirGrid has hired ten engineering graduates for our Graduate Development Programme, and will hire two more graduates this year. The standard of graduate is excellent, and the placements and the mentor are seen as particularly developmental by the graduates. EirGrid has also hired a number of engineering graduates into specific roles, but is committed to providing mentors to these graduates. In addition, it is recognised in the organisation that rotating less experienced staff around the organisation bears dividends in both personal and organisational terms, and is committed to providing rotational opportunities when and where possible, though it is not guaranteed within a specific timeframe.

Since 2007, EirGrid TSO has adopted a more proactive and focused approach to bring placement students into the company. A placement scheme was developed offering undergraduate engineers the opportunity to work with EirGrid for six months as part of their degree courses. College lecturers supervise the students and visit both the student and EirGrid TSO to make sure that the placements run smoothly. The panel of engineers referred to earlier also acts as student supervisors for the duration of the placements. This in itself has offered development opportunities for the panel members. In each of the past two years up to ten students from a variety of universities have spent their placements in EirGrid TSO. These placement opportunities allow undergraduates to begin to develop their own professional skills, in terms of working in teams and communicating effectively, in understanding the impact of engineering solutions and in beginning to understand contemporary issues. In addition, it has provided an opportunity for EirGrid to give feedback to the academic supervisors on the content of the course and on the quality of the students. There is enormous value for students in being able to participate in engineering practice, and bringing that understanding back to their formal studies.

EirGrid TSO has a number of Research & Development interactions with Academia and is sponsoring post graduate research in universities in areas such as grid integration of renewables and improving system modelling. In deploying the funding, one objective is to collaborate with Irish academic institutions with active relevant research schools, to influence the direction and industry focus of research and stimulate interest in these fields among students. We interact with a number of institutions including U.C.D., U.C.C. and D.I.T., usually by finding individual research projects, or by sponsoring prizes in particular programmes such as U.C.C's Masters programme in Sustainable Energy.

Figure 2 below demonstrates the ways in which EirGrid TSO interacts with undergraduates and post-graduates who are actually within the education system.



**Figure 2**  
Interaction of EirGrid with  
Universities on Undergraduate /  
Post-Graduate students

### **The current situation – CPD in EirGrid TSO**

Through CPD, EirGrid TSO encourages its engineers to take personal responsibility for their own rounded, professional development, while ensuring that the organisation will have in place the skills and knowledge to continue to meet its responsibilities and objectives. EirGrid TSO is a CPD-accredited organisation with Engineers Ireland. In order to achieve accreditation, EirGrid TSO has demonstrated the existence and efficacy of a number of systems that together support ongoing professional development of all staff. These systems include a Graduate Development Programme, a commitment to Knowledge Management and a Performance Management system. EirGrid has developed a Staff Competency framework and is currently implementing a wide-reaching staff development programme covering all competencies on the framework. Through CPD, we hope to encourage more of our engineers to achieve CEng status. Many of our engineers would be working towards MEng or equivalent programmes, and our challenge with CPD is to encourage our engineers to focus more on seeking and using developmental opportunities that are work based or soft-skills based, rather than relying solely on academic development.

Ongoing Education Support is widely provided. As well as supporting a range of technical Post-Graduate diplomas and Master's degrees, EirGrid TSO is supporting both PhD and MBA students. EirGrid TSO invests enormously in ongoing technical training sourced from a wide variety of providers in the industry and across the globe. Knowledge sharing throughout the organisation is facilitated by internal seminars, Power Hours and by programmes such as The Introduction to Power System Operation (IPSO), designed, developed and delivered by subject matter experts across the organisation. A mentor programme for graduate engineers is in place and mentoring is being rolled out across the organisation. A CPD re-accreditation audit was carried out by Engineers Ireland in December 2008. Engineers Ireland spoke with a number of engineering staff, and evaluated EirGrid's CPD systems. They concluded that CPD is core to EirGrid's Business Strategy

with maintenance and development of EirGrid's organisational capability a key element of the current Business Strategy.

EirGrid TSO participates actively in CIGRE, the International Council on Large Electric Systems. This is one of the leading worldwide organizations on Electric Power Systems, covering their technical, economic, environmental, organisational and regulatory aspects.

Over the years, EirGrid TSO (and its former embodiment ESB National Grid), has had a history of providing senior experts to serve on CIGRE committees and many staff members have also been involved in the work of its working groups, thus providing development opportunities for staff at all levels in the organisation.

Figure 3 illustrates how over time, universities and industry have important roles to play in the long-term development of engineers engaged in a key industry. The message of the figure is that over time, an employer such as EirGrid has increasing responsibility to provide development opportunities for engineering staff.

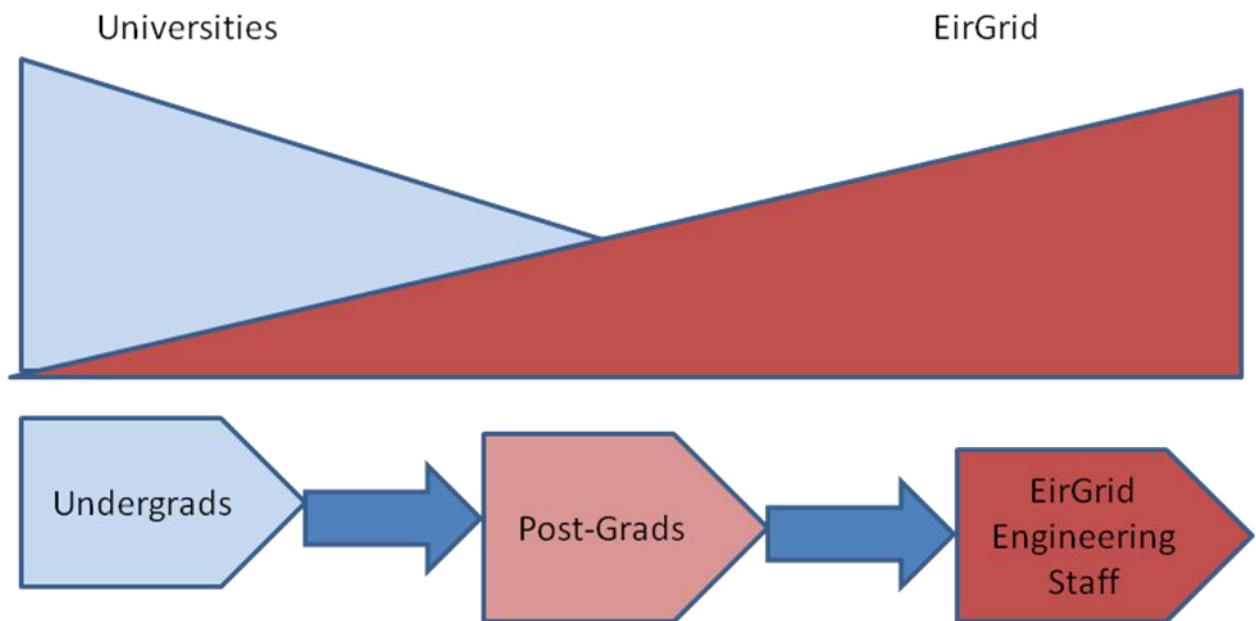


Figure 3  
Overlapping influences over time

## CONCLUSION

Education of the new engineer involves a long-term partnership of academic institutions and industry. EirGrid TSO's approach is to work in tandem with relevant academic institutions to both influence curricula and support research and development, to provide job opportunities for graduates, and to build capability to meet the wider needs of the Island of Ireland in the arena of energy and power. It is vital that academic institutions and organisations like

EirGrid TSO understand their respective roles in this partnership and regularly question the effectiveness of the partnership in meeting the wider needs of the island of Ireland.

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