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BS News September/October

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Building Services news

Celebrating 50 years of engineering excellence in Ireland

Special anniversary edition with guest editor Paul Martin ...



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Ciara Ahern, DIT



Sean Armstrong, DHPCLG



Derek Mowlds, PM Group



Seamus Homan



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Dr Kevin Kelly, CIBSE



Mona Holtkoetter, IWBI



Donal Finn, UCD



Jim O'Sullivan, OPW



Tim Dwyer, CIBSE



Hywel Davies, CIBSE

Comfort is...

Building Services News, Vol. 57 [2018], Iss. 5, Art. 1



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Welcome to this special edition of *Building Services News* marking the 50th anniversary of CIBSE Ireland. It is appropriate that we dedicate an entire issue to this milestone achievement given our long association with the Institution. Founded in 1961, *Building Services News* has been involved with, and has supported, CIBSE Ireland from day one, and indeed has been its official media partner for many years.

As Publisher and Editor I have personally served on the CIBSE Ireland Committee since the late 1970s and so have first-hand knowledge of the incredible contribution it makes, not just to building services and construction, but to Ireland's built environment as a whole.

As it is a celebratory edition, we are honoured that Paul Martin, the current CIBSE Ireland Chairman, agreed to act as Guest Editor. Rather than dwell too much on the past, Paul and I decided that we would use the occasion as a platform to highlight the challenges and opportunities that is building services engineering today, and to identify and predict what the future holds.

To this end we invited leading industry figures – representing a diverse range of roles and responsibilities within the sector – to give their views and opinions on where the industry is currently at, the key challenges it faces, and how these may/should be addressed. The response was overwhelmingly positive and I sincerely thank all the authors for their participation. It may be clichéd to talk of “roadmaps for the future” but, in this instance, I confidently proclaim this edition of *Building Services News* to be just that.

No matter what your involvement in building services, or indeed the broader built environment, you will be forever indebted to the industry figureheads featured here for the incredible insights they have shared. Read them, digest them, and then keep them close to hand for easy and constant reference. They will prove to be invaluable in your daily decision-making and, even more importantly, when charting future business strategies.

Pat Lehane
Publisher and Editor



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50-year history perfect future springboard

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Building services engineers now hugely influence how building is regarded in terms of energy-efficiency, comfort, air quality, health, BER rating and Wellbeing Certification.

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'Hot Air Club' foundation of CIBSE Ireland

Seamus Homan, industry father-figure and CIBSE Ireland founding member, reveals that its origins lay in the "Hot Air Club" and chat over a few pints.

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Fundamentals critical to engineering

Without a solid grasp of the core topics, engineering graduates will struggle to master any later-applied material, says Donal Finn.

Building Services news

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Kevin Kelly argues that research is a word that engineers should embrace, as every building project is a laboratory with lots of data readily available.

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Sean Downey says that building services engineers, installers and solutions providers must constantly challenge the norms and stay ahead of global competition.

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Despite some progress, we are still losing ground. Jim Gannon says we must redouble our efforts to be in the leading cohort of nations addressing climate change, not in the following pack.

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We can be sure that the future is digital

Hywel Davies says that the future is digital but, exactly how that digital technology develops is more uncertain. It will keep us on our toes though.

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Building design and operation focussing on health and well-being is a new topic. Mona Holtkoetter says this "second wave of sustainability" is essential for people to thrive.

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Design emphasis must be on buildability

The design of mech/elec services needs to focus on buildability, says Jim O'Sullivan, with contractors given the opportunity to plan the construction with purpose.

The opinions expressed by the various authors in this issue are their own personal viewpoints and do not necessarily reflect the opinions, beliefs and viewpoints of the publishers. No person, organisation or party can copy or re-produce any part of this publication without the written consent of the Editor, and of the author of the particular article, as applicable. The publishers and individual contributors reserve their rights with regard to the copyright of their work.

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Welcome

I am delighted to have been invited by our media partners Pressline Ltd to edit the Chartered Institution of Building Services Engineers 50th anniversary addition of *Building Services News*. Pat Lehane has been a member of the CIBSE Ireland committee for many years and his dedication to the building services industry in Ireland is greatly appreciated.

When we sat down to discuss the content of this special edition we drew up a list of the most influential people who have driven, and continue to shape, the building services industry in Ireland. We didn't want this magazine to say "look how far we have come, aren't we all great", with reams of photos showing receding hairlines and bulging waistlines, we wanted to look to the future.

Imagine for a moment if a building was a human body, then the structure can be seen as the skeleton and the facade as the skin. However, the building services elements are the most crucial parts the body – the heating system is the heart, the electrical system the nerve components and you don't really want me to go into the civil engineering side. Even though we are still using the same calculations for decades, the building services engineer's discipline and role has evolved more than any other building profession over the last 50 years.

On the other hand, mechanical and electrical design has evolved from open heating systems, fixed pumping, variable speed and pressure drives and analogue controls to the latest intelligent systems that allow the building adapt to changes in climate, occupancy etc.

Centre stage

Increased awareness of sustainable design has put the building services engineer at the centre of the design team.

Previously, we were drafted in at the last minute with promises not to ruin the architectural vision with pipes, ducting and conduits on view.

Our discipline now hugely influences how a building is regarded in terms of energy efficiency, comfort, air quality, health, building energy rating,

Paul Martin
Chairman, CIBSE Ireland

Well building certification, etc. Suppliers of mechanical and electrical equipment have more solutions than ever to help the designer achieve these visions.

Building Regulations have always been a great driver when it comes to building services evolution with building services engineers leading many of the changes in legislation such as with the recent edition of Building Regulation TGD Part J and Part L. These documents reveal the huge task of bringing our existing building stock up to the levels envisaged in the Regulations. When reading the Building Regulations you will see that CIBSE is one of the few organisations whose standards and guides are referred to throughout the suite of documents listed.

Quality of membership

As with all great organisations, it is the quality of the people who make up the membership that underpins their effectiveness. CIBSE Ireland has been extremely lucky in this respect with many individuals emerging who have been honoured both at home and internationally for their contribution to the profession.

Seamus Homan is just one example. A CIBSE Ireland founding member, he has received the highest engineering honours from renowned engineering bodies in Ireland, the UK and America. Seamus will receive the CIBSE Silver Medal at the CIBSE President's dinner this year, only the second person in Ireland to achieve this honour.

Seamus' article in this issue chronicles the history of CIBSE Ireland, name-checking the industry father-figures who put strong foundations in place for the Institution we have 50 years on.

CIBSE Ireland is now involved in writing industry standards with NSAI and joins forces with colleges to host awards nights for students. We also publish the annual *SDAR Journal* in partnership with DIT, and engage regularly with the other construction industry representative bodies.

That said, the CIBSE Ireland of today is much more than a technical engineering body ... it is also the glue that brings, and keeps, the industry together socially. The annual Christmas Lunch is now the biggest social gathering for the sector and this year's 50th anniversary dinner in November will see 750 plus in attendance.

Onwards and upwards

I hope you enjoy this edition of *Building Services News*. Who knows where we will be by the time CIBSE Ireland reaches 100 years? One certainty is that we will all have greatly influenced the progression and development of building services engineering for the betterment of mankind and, as today, the profession will be poised to provide leadership and direction into the following 50 years. ■

<https://arrow.tudublin.ie/bsn/vol57/iss5/1>

CIBSE Ireland ...
providing leadership
and direction into
the next 50 years



If a building was a human body, then the structure would be the skeleton, the facade the skin, the heating system the heart, the electrical system the nerve components and the civil engineering the digestive system.

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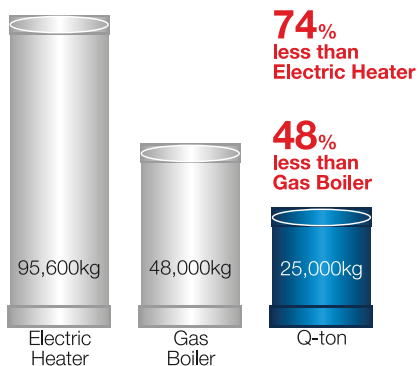
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Diamond Air Conditioning and Mitsubishi Heavy Industries (MHI) are synonymous in Ireland, Diamond principals Michael Clancy and Graham McCann both having a long association with the brand. MHI has captured a significant market share in recent years, thanks largely to the combination of its pioneering products incorporating innovative technologies, and the strong technical, design, commissioning and after-sales support provided by Diamond Air Conditioning. The range is extensive and extends from small cooling/heating systems to large modular systems for commercial buildings. Two of the latest introductions are the highly-acclaimed Q-ton air to water heat pump and the KXZ VRF Series featured here.

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Tool E-solution

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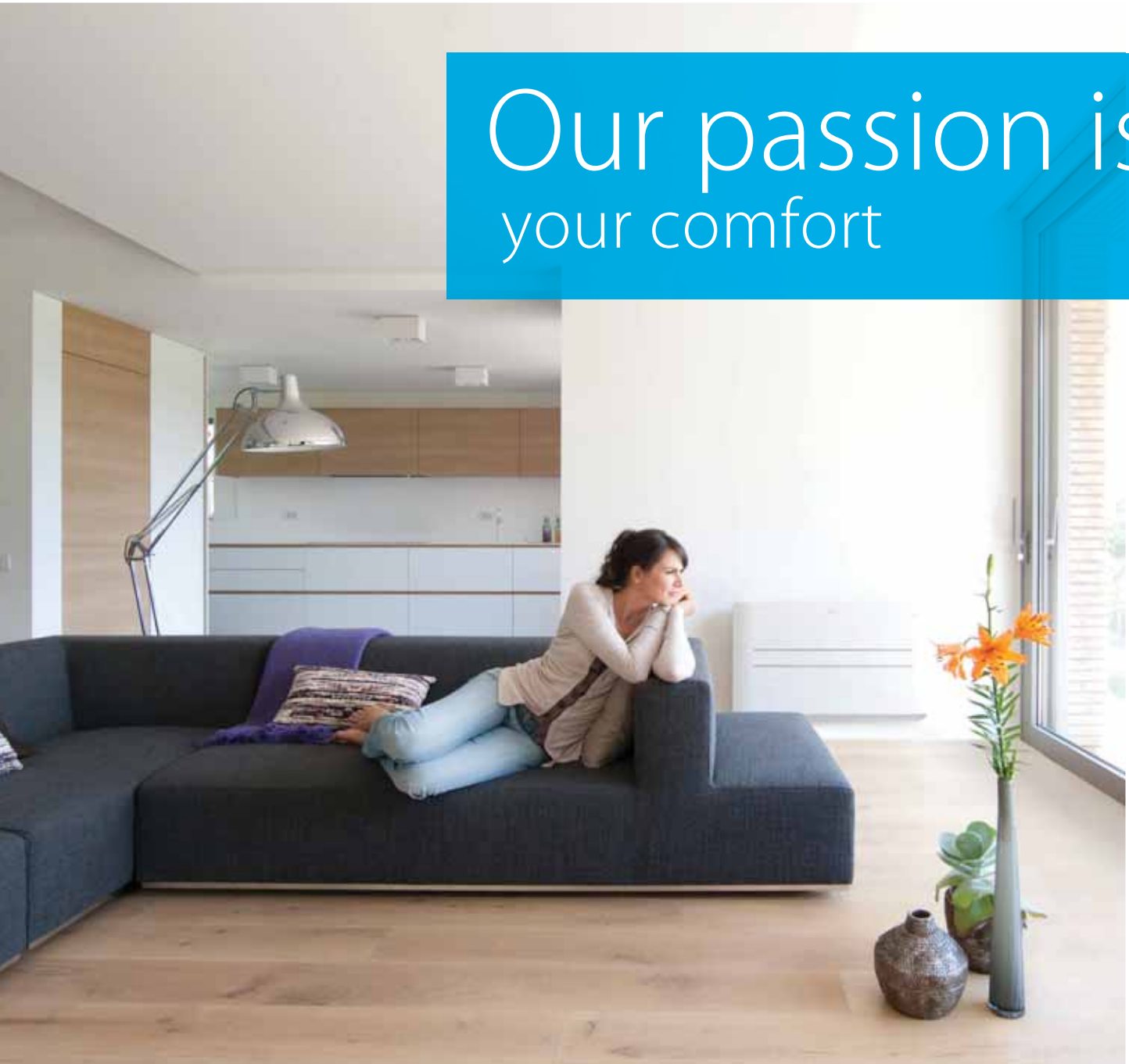
Emergency stop function

The new KXZ has control for emergency stop by external input, i.e. an alarm unit can be connected to the PCB.





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‘ Although it would be imprudent to attempt to forecast the future, it is certain however that CIBSE will be to the forefront of developments



‘THE HOT AIR CLUB’

– the foundation for 50 years of engineering excellence

Seamus Homan

Seamus Homan is a Chartered Engineer, a Fellow and past Chairman of CIBSE Ireland, a Chartered Fuel Technologist, a Fellow of the Institution of Engineers of Ireland, and a Life member of ASHRAE. Seamus is the recognised building services industry “father-figure” in Ireland and a founding member of CIBSE Ireland back in 1968. Down through the years he has pioneered many industry “firsts” and has received numerous accolades, including the Mullins Silver Medal from Engineers Ireland. He retired from practice in 2005 and this year celebrates 60 continuous years of membership with CIBSE, having joined a decade previously before the Ireland branch was established.

A 50 year (golden!) anniversary is a special occasion and to celebrate the event in relation to the formation of the Republic of Ireland branch of CIBSE, or as it was known then the IHVE, is certainly no exception. Few people would be aware that it all started in a pub! Well not quite ...

It started in the early 1960s as a result of a number of like-minded souls involved in the H&V industry – and later referred to as the “Hot Air Club” – meeting together on one night of each month in Powers Hotel, Kildare Street to enjoy the convivial company and swap gossip.

An issue of concern which continually arose was the complete absence of formal H&V-related technical training in Ireland. Up to that time, corporate membership of the IHVE was awarded either by the successful completion of a degree course in mechanical or electrical engineering, combined with what was deemed to be a suitable period of post-graduate training in a consulting engineer’s or contractor’s office.

As an alternative to the university degree route students, if successful in undertaking the joint Part 1 examination of the Engineering Institutions Examinations Board, could sit the Sections B and C external examinations of the IHVE. This led to Associate status which was later rationalised as member. This was an extremely difficult route as the courses offered by the College of Technology, Bolton Street, did not relate to the syllabus requirement of the British engineering institutions.

Hence, for non-university students in Ireland there was no direct part-time study route to IHVE qualification. Employees of the Dublin branches of the larger British contracting organisations enjoyed a much more comfortable route towards qualification under which they were transferred to offices in the UK and,

after successful completion of the ordinary National Certificate Examination, were then granted enrolment in the full-time, one-year, diploma course at the National College in London, with all expenses paid. This automatically led to Corporate Membership of IHVE.

For all others it meant that even after five years part-time study in Dublin, students emigrated to the UK of necessity. After pursuing a minimum one-year evening course study followed by success in the UK Ordinary National Certificate Examination, a right would be secured for entry to the full or part-time courses at the National College for HVR and AC in London.

Following discussions by representatives of the Powers Hotel group with senior staff at the Bolton Street College of Technology, it was

agreed that a City & Guilds H&V technology course would be provided by the college, provided suitably-qualified lecturers could be identified by the industry for the initial years. This resulted in myself – together with Eamon O'Brien, Tony Knott the late Don Byrne and the late Pat Benson – undertaking evening lecture sessions for three nights per week in preparing students for the City and Guilds 139 Design Technician Certificate. This was quickly upgraded to the 339 Senior Technician Certificate.

The course was of two years duration and the success rate for candidates undertaking the external City & Guilds examinations was very high. During the initial years, I lectured and tutored in air conditioning and heating and water services, Eamon O'Brien dealt with boiler-house practice and Dan Mooney, later followed by Tony Knott, dealt with drawing, design and other related topics. I can well recall a number of students from those early years growing into successful careers in the sector and becoming senior, and very senior, figures in the H&V industry.

With the passage of time the course developed on a more formal basis with Don Byrne, Tony Fortune, Pat Benson and others taking leadership roles. Later, under the guidance of Head of Engineering, Oliver McNulty and Principal, Michael O'Donnell, the course developed to the degree status it has today.

As a further initiative from the "Hot Air" Power's Hotel group, in 1966 a number of IHVE members decided to petition IHVE London for the establishment of an official branch in Dublin. To this end a ballot was prepared which resulted in the formation of a steering committee comprising the late Robert Jacob, the late Eoin Kenny, Tom Illingworth, Seamus Homan, Eamon O'Brien and Don O'Malley.



Seamus as he looked when first interviewed by Pat Lehane in 1978. At the time he was Chairman of CIBS, as CIBSE Ireland was then known before it got engineering status. Officers and Committee members were – Officers: Eoin O'Cionna, Vice-Chairman; Paddy Clonan, Hon Secretary; Jim Rogers, Hon Treasurer; Eamonn O'Brien, Regional Almoner. Committee: Joe Murphy, JJ Doherty, John Murray, Michael Buckley, Dan Cooney, Larry Kane and Ray Grimson.

Humidifying Ireland for over 30 years

Following subsequent representation to the Council in London, the Republic of Ireland branch of IHVE was officially inaugurated in 1968 with the late Sean Mulcahy as Chairman. The CIBSE Republic of Ireland web site lists the many chairpersons over the years, each of whom, in their own way, contributed to the overall development of the branch.

The branch thrived over the years, combining as it did a full programme of evening lectures with occasional sponsored site visits to buildings or installations of particular interest. In time the name of the institution was changed to CIBSE in order to embrace the many other engineering disciplines such as electrical, illuminating, IT, acoustics, fire protection etc with the growing awareness that these were essential in the proper, integrated design of increasingly-complex modern buildings.

It is a challenge at any time to attempt to forecast the future, and in a built environment context it is particularly so, given the number of disciplines involved. Who, for instance, 60 years ago when I first entered the industry would have forecast that the following developments would soon occur:

- (1) Solid fuel firing of boiler plant would quickly be replaced by oil and gas burners;
- (2) The unreliable flue thermostats which controlled the first phase oil burners would be replaced by boiler-mounted thermostats, and later by electronic photo electric controls;
- (3) The Criton belt-driven heating accelerators would evolve to become the sophisticated, efficient, electronically-controlled accelerators of today;
- (4) The drawing office boards, T-squares and Graphos pens would be replaced by the CAD systems;
- (5) The shape of office buildings would evolve from naturally-ventilated shallow structures to deep-plan efficient buildings which offer a high level of individual environmental control to the occupants.

Immense progress has been made over recent years in the evolution of a more energy efficient, effective and occupant-satisfied built environment. Items such as LED lighting, ice banks, wi-fi, etc have all been introduced in recent years and new frontiers are regularly created. Although it would be imprudent to attempt to forecast the future, it is certain however that CIBSE will be to the forefront of developments, together with the committed active support of its members.

It is a credit to all who have served IHVE and CIBSE down through the years that what is today known as CIBSE Ireland is such a vital, vibrant and dynamic force, not just within building engineering but in construction as a whole. The fact that they did so – and that present-day committee members continue to do so – in a voluntary capacity is nothing short of extraordinary. ■

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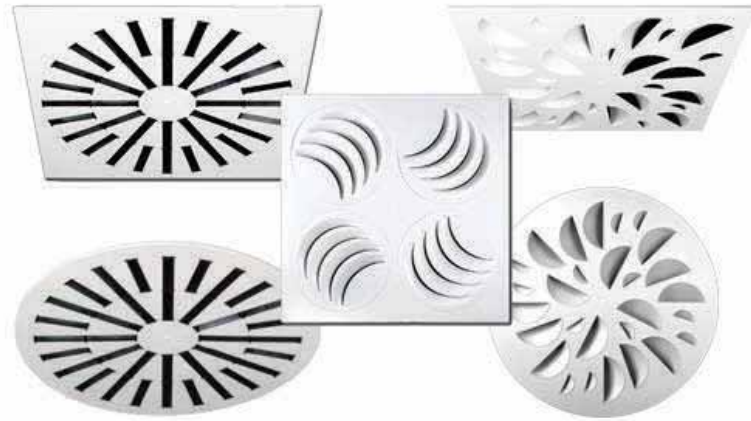


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Engineers must embrace NZEB design principles, and ensure their application

Seán Armstrong

Seán Armstrong is Senior Advisor in the Housing/Building Standards Division in the Department of Housing, Planning and Local Government. He is responsible for regulations and standards related to energy efficiency, the Energy Performance of Buildings Directive, Part L and Part F of the Building Regulations, and has led the development of Nearly Zero Energy Building Regulations in Ireland. He represents Ireland on the EU Energy Performance of Buildings Directive Committee and has led the development of several standards related to energy efficiency, including SR 54, the National Retrofit Code of Practice. He is a Chartered Engineer with a Masters in Engineering.

Ireland is committed to addressing the challenges of climate change with clear actions in the recently-published National Development Plan identifying the need to “deep retrofit” 45,000 houses a year to reduce heat loss, remove 170,000 oil-fired central heating systems, and to upgrade Building Regulations to Nearly Zero Energy Buildings (NZEB) performance.

The Sustainable Energy Authority’s 2017 *Energy in Ireland Report* identified that approximately 40% of Ireland’s energy use is in the residential, commercial and services sector, and it is against this scenario the Development Plan is set.

Improving the energy performance of buildings has significant positive effects on reducing carbon dioxide emissions and fuel poverty, and on improving the health of citizens.

Significant improvement

While the overall performance of dwellings is significantly lower than the average EU home, there has been significant progress in improving the energy performance of new dwellings in the last 10 years.

Part L of the *Buildings Regulations – Conservation of Fuel and Energy in Dwellings* introduced mandatory renewables for all new dwellings and airtightness testing in 2007, and advanced the performance of new dwellings by 60% over 2005 performance requirements in 2011.

Based on Central Statistics Office data, 45,199 dwellings have been completed since

2013. Most of these will have been constructed to 2011 *TGD L-Conservation of Fuel and Energy for Dwellings* performance provisions and will have achieved a typical Building Energy Rating (BER) of A3. This Part L of the Building Regulations performance requirement for dwellings is recognised internationally as a world-class standard, and the 2013 *Global Buildings Performance Network* international survey of energy performance regulations placed Ireland's energy performance regulations for dwellings in the vanguard of regulations internationally.

Introduction of NZEB

The introduction of these changes in Building Regulations over the last 10 years has left Ireland in a very strong position to introduce Nearly Zero Energy Buildings (NZEB) for new dwellings in 2018. The previous improvements mean that, on this occasion, the increase in performance to achieve NZEB is not so significant. Based on the models published for public consultation, the changes in performance required to achieve NZEB for a typical dwelling are a 10% increase in renewable solar energy footprint or the use of air source heat pumps; optimisation of hot water use in the dwelling; and the use of energy-efficient LED lighting in dwellings.

Probably the most significant change in the achievement of NZEB is the advancement of airtightness levels in dwellings. The improvement of construction skills and materials in this area means that new dwellings regularly achieve an air tightness performance better than $3\text{m}^3/\text{hr}/\text{m}^2$. This will require the installation and commissioning of effective ventilation systems to achieve adequate ventilation.

The installation of mechanical
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ducted ventilation systems in dwellings requires the inclusion of new mechanical systems which have not been traditionally installed in dwellings. This requires upskilling of design professionals, installers and assigned certifiers to ensure systems are installed and are commissioned properly. It is currently proposed in the draft TGD F-Ventilation of the Building Regulations that a competent independent certifier's scheme for residential ventilation schemes will be developed.

However, while the requirement for Nearly Zero Energy Buildings will significantly reduce any additional carbon dioxide emissions from new dwellings, the energy performance of existing dwellings still remains to be addressed. This is an area where there is significant opportunity to reduce the carbon dioxide emissions from the built environment, improve the health and comfort benefits for existing occupants, reduce the impact of fuel poverty and, at the same time, improve outdoor air quality for all by reducing solid fuel emissions.

SEAI has made progress in this area by running the Better Energy Homes grants scheme for the last 10 years, and more recently the Better Energy Communities and the Deep Retrofit Pilot programmes.

In addition, Part L of the Building Regulations will introduce a requirement that major renovations that affect more than 25% of the building envelope should achieve a performance requirement equivalent to $125\text{kWh}/\text{m}^2/\text{yr}$ or a B2 Building Energy Rating.

Typically, 0.5% to 1.5% of the building stock is renovated each year. Applying the major renovation requirement will have significant impact on dwellings which are renovated, and will significantly improve the existing stock.

However, in order to address

the urgency of climate change the rate of energy-efficient renovation, and deep renovation in particular, both need to be increased. Government policy has committed to this in the national development plan.

However, existing buildings are far more challenging than new buildings. There are many different construction types that have been modified over many years, and hidden issues unrelated to energy performance may need to be addressed during an energy retrofit. This has been recognised in the most recent review of the Energy Performance of Buildings Directive which requires long-term renovation strategies to take a holistic view of buildings, including fire safety and the health of occupants. In addition, we also need to be mindful of our architectural heritage to ensure it is protected in the future.

In the 2013 cost-optimal lifecycle costing analysis by the Department of Housing, Planning and Local Government the results showed that the performance requirements for new buildings other than dwellings could be significantly improved in the order of 60%. The review of Part L buildings other than dwellings took place in 2017 and new Nearly Zero Energy Building performance requirements and cost-optimal performance requirements will apply to works commencing on these buildings from 1 January 2019, subject to transition arrangements.

The design of these buildings will require energy-efficient services, renewables, advanced fabric and detailed design.

Reliant on skillsets

These Nearly Zero Energy Buildings in the non-residential sector will rely heavily on the skills of building engineers in the use of the non-domestic Energy Assessment Procedure (NEAP) published by

SEAI, dynamic simulation models and the specification of energy-efficient systems supported by the supply chain. The education of building professionals in the use of these regulatory and design tools is critical to achieving Nearly Zero Energy Buildings and major renovations to a cost-optimal level.

While some third-level institutes such as the Dublin Institute of Technology (DIT) are already providing post-graduate training, the demand for these skillsets will only increase going forward. It is clear that there will be a strong future demand for post-graduate courses for existing professionals in these areas. These skillsets are also being integrated into undergraduate courses across all built environment disciplines at third level.

There is also a need to be cognisant of the risks associated with advancing energy performance in buildings, including use of certified products, fire protection, indoor air quality, overheating, and protection of historic buildings. To this end the Department of Housing Planning and Local Government (DHPLG), the Department of Communications Climate Action and Environment, the Department of Culture, Heritage and Gaeltacht, the National Standards Authority of Ireland (NSAI), Sustainable Energy Authority of Ireland (SEAI) and Solas are working closely with industry to develop standards and guidance to address these risks.

In order to achieve ambitious and realistic goals it is important that the appropriate standards, training and skills are available to design and apply the new systems and technologies required. Existing standards and schemes that have been developed by NSAI in collaboration with stakeholders include Agrément
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Certificates, the SR 54 Retrofit Code of Practice, SR 50-2 Solar Thermal Systems, and registration schemes for airtightness testers and thermal modellers.

The further education of construction workers and crafts persons is also being addressed through third-level institutes such as Qualibuild skills for construction workers developed by LIT/Blanchardstown/DIT and, most recently, the development of a National Curriculum for Nearly Zero Energy Buildings skills for crafts persons by Waterford Wexford ETB (WWETB) and Solas. This training centre in Wexford is scheduled to commence delivery of NZEB skills for construction workers later this year.

The Wexford training centre, based in Enniscorthy and the National Curriculum for NZEB Skills will provide the foundation for a United Nations UNECE Centre of Excellence in Nearly Zero Energy Buildings, which will form part of a UNECE network to disseminate NZEB skills and learnings internationally.

However, many more standards, guidance documents and curricula need development for the implementation of both new and existing Nearly Zero Energy Buildings. Training courses need to be developed around these new standards and they also need to be incorporated into the existing apprenticeship curricula for trades and undergraduate courses at third level.

Professionals need to incorporate energy design at the early stage of design. They need to be familiar with the key aspects of regulatory tools, and especially those design elements that achieve good energy performance at a low cost such as thermal bridging detailing and airtightness detailing in dwellings, and efficient services design in

buildings other than dwellings.

Collaboration with stakeholders is a key tenet of achieving these goals and cooperation between Government Departments, public sector bodies, professional bodies and industry stakeholders plays an important role in achieving Nearly Zero Energy Buildings. Going forward, EV charging points will be incorporated into new buildings with more than 10 parking spaces and those undergoing major renovation. There will be a greater emphasis on smart buildings and integrating these into the energy system through the use of smart metering and dynamic response tariffs. ICT will play a greater role in managing buildings and making them more user-friendly.

The transition of the built environment has begun with the introduction of NZEB and major renovations to a cost-optimal level. However, there is much to do to continue this transition to apply it to existing buildings, and to integrate the built environment with the energy system as a whole, underpinned by system-wide ICT infrastructure that responds equally to changes in built environment demand and energy generation.

Never before has the skills of building services engineers been needed to address the challenges faced by climate change, and to develop innovative systems to integrate buildings, energy and ICT. While the past 50 years of CIBSE in Ireland has provided the foundation for building services in the built environment, the next 50 years is equally, if indeed not more, important. Building services engineers must now take a leading role in the integration of buildings into the energy system, and in achieving significant reductions in the carbon dioxide emissions of buildings. ■

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Like Van Gogh, ENGINEERS MUST ‘DREAM’ THE SOLUTION and then deliver it

Tim Dwyer

Tim Dwyer is visiting Professor of Building Services Systems at the Institute for Environmental Design and Engineering, University College London (UCL). He is Chair of the CIBSE Technical Symposium, Technical Editor for the *CIBSE Journal*, Managing Editor of *BSE&T* and an educational and technical consultant.

To create an image of the future that suitably anticipates the exciting transformations in the world of building services engineering needs the intellect, foresight and divergent thinking of a mind as wildly creative (and possibly eccentric) as that of Vincent van Gogh, famously cited as pronouncing that “I dream of painting, and then I paint my dream”. I do not assert that my depiction will be as inspired or have the mastery of a Van Gogh, but I will attempt to paint a future that is somewhat founded on something rather more than just a fantastical dream.

However, this is even a more challenging task than it would have been ten years ago as the technology – both information and material – as well as user expectations, are transforming at an ever-accelerating rate. Coincidentally, this is happening at a time when climate change has taken hold with a vengeance, a fact starkly highlighted in the UK with

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predictions of deaths from heatwaves that are likely to increase to 5,000 by 2040 (from the current 2,000). This figure will be only slightly mitigated by fewer deaths in the mild winters. [<http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/environmental-audit-committee/heatwaves-adapting-to-climate-change/oral/84908.html>].

The resulting swings in temperature and rainfall are likely to make long-term weather patterns hotter and sporadically wetter than has been experienced in recent history. Since the record-breaking heatwave in 1976, there have been four others that have rivalled it in magnitude – in 1995, 2003, 2006 and now 2018.

“Warming will continue and there will many more heatwaves, some with



greater severity than those occurring now, in the decades to come” (Professor Rowan Sutton, a climate scientist at the University of Reading) [<https://www.independent.co.uk/environment/uk-weather-heatwave-climate-change-prediction-future-hot-temperature-a8463391.html>].

Alongside this the effects of the elevated temperatures in summer 2018 have shown that water will be an increasingly-scarce resource, even in an Ireland that has hitherto enjoyed ample supplies to meet the essential needs of agriculture, industry and domestic consumption. [<https://www.irishtimes.com/news/environment/water-shortage-fears-as-temperatures-to-hit-22-degrees-this-week-1.3534553>]. New schemes to meet the growing demand for wholesome water will develop from tried and tested technologies, including sewage treatment techniques [<https://www.pri.org/stories/2016-12-15/recycling-sewage-drinking-water-no-big-deal-theyve-been-doing-it-namibia-50-years>] and solar-powered desalination plants that could become increasingly commonplace alongside the more thoughtful design and utilisation of water services in buildings.

It's your opportunity to load your palette with new, exciting colours that can sit aside those tried and tested hues, to create the masterwork that will define the built environment for a truly sustainable future.

The building services industry, as its principal commitment, is required to deliver buildings that economically maintain healthy and productive internal environments. To do this it will need to change from “business as usual” to meet future challenges so that it continues to provide suitable environments to meet the needs of the growing population. Air quality, both internal and external, will dominate the demands on the industry as the public becomes increasingly aware of its impact on long-term health and wellbeing [<https://www.cibsejournal.com/technical/opportunity-nox-testing-standards-for-air-filters/>]. As well as a tightening of vehicle emissions standards and the revolution in the



The Starry Night by Dutch post-impressionist painter Vincent van Gogh, 1889 (Museum of Modern Art, New York City)

[Source: https://en.wikipedia.org/wiki/The_Starry_Night#/media/File:Van_Gogh_-_Starry_Night_-_Google_Art_Project.jpg]

take-up of electric vehicles reducing particulates in the outdoor air, PM1 filtration will become standardised in urban ventilation systems to meet minimum requirements for IAQ.

Undoubtedly, the construction (and restoration) of buildings that are less profligate with resources and have a lower environmental impact will become the norm. What is currently seen by some as the eccentricity of bioclimatic design [<http://plus.usgbc.org/bioclimatic-design/>] will become *de rigueur* as the KISS (“Keep It Simple, Stupid” design principle – US Navy c.1960) principle will dominate. An improved understanding of what makes a building truly healthy and productive will provide opportunities for the development of improved, localised, task-based environmental systems as opposed to maintaining an homogenous-controlled internal environment.

The availability of meaningful operational data through the employment of cheap, wireless networked sensors will inform increasingly “intelligent” control systems that integrate inputs from the building and the wider information networks to sensibly predict the needs of the building or, more properly, its users, to enable effective system operation. It would be unrealistic to consider a future with no need for mechanical refrigeration technologies but their use can become increasingly benign through the improved use of “smart” sensing and control, and the widespread adoption of low environmental impact, non-combustible refrigerants [<https://www.contractingbusiness.com/residential-hvac/honeywell-announces-new-nonflammable-refrigerant-ready-market/>].

Advances in other materials and <https://arrow.tudublin.ie/bsn/vol57/iss5/1>

systems including thermoelectric walls [<https://www.nature.com/articles/ncomms13403>] that act as solid state heaters and coolers powered simply by DC power; windows that not only dynamically alter the transmission of daylight and solar gain but can also generate electricity [<http://www.sciencemag.org/news/2018/01/new-smart-windows-darken-sun-and-generate-electricity-same-time/>]; and translucent concrete walls that allow light transmission [<https://www.designbuild-network.com/projects/litracon/>] will contribute to the growing need for professionals that understand the demands of integrated building systems.

Newly-developed systems such as solid-state caloric refrigeration [<https://physicstoday.scitation.org/doi/abs/10.1063/PT.3.3022?journalCode=pto>], laser lighting [<https://www.thenakedscientists.com/articles/interviews/future-lighting-lasers>] and the numerous technology applications spawning from graphene and nano-technologies will also contribute to the blurring of the demarcation between the traditional disciplines and professions, while also reducing the thirst for energy.

Offsite and onsite factory production will increase with clear significant potential savings in cost, and improvements in quality (as well as health and environmental benefits) from the use of offsite construction techniques [<https://publications.parliament.uk/pa/ld201719/ldselect/ldsctech/169/169.pdf>]. As robotic tech matures further and the use of 3D printing becomes normalised, it will not only deliver adaptive and speedy structures [<https://www.weforum.org/agenda/2018/05/25-of-dubai-s-buildings-will-be-3d-printed-by-2025/>], but also escalate the routine use of onsite factory production of systems and sub-systems that enable greater

control and flexibility on the detailing and customisation of the HVAC&R components [<https://www.rehva.eu/publications-and-resources/rehva-journal/2017/032017/3d-printing-of-hvac-systems.html>].

Energy supply will become increasingly dominated by renewable electricity [<https://www.independent.ie/business/irish/irish-power-grid-sets-world-record-for-green-energy-use-36805359.html>] as off-shore wind farms and paintable photovoltaics (that readily generate 300W of power for every square metre of painted surface [<https://www.economist.com/science-and-technology/2018/02/03/a-new-type-of-solar-cell-is-coming-to-market>]) become commonplace. Bolstered by cheap domestic and centralised battery storage [<https://www.wired.com/story/building-a-better-battery/>], this will guarantee that rather than today’s scant 10% contribution, Irish renewable power will blossom to reduce reliance on costly interconnects with the UK and EU, and lessen dependence on high-emission fossil fuels. This will impact not only the cost to the nation but, I would suggest more importantly, also reduce the unnecessarily harmful impact of constructing, occupying and servicing of the built environment.

Although the overall picture painted in this brief article may appear somewhat fanciful, all the advances and shifts in direction that have been suggested are founded on current, or very near future, knowledge and practice. So, now it’s your opportunity to load your palette with new, exciting colours that can sit aside those tried and tested hues, to create the masterwork that will define the built environment for a truly sustainable future. ■



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Engineering fundamentals must continue to be central to all engineering education

Donal Finn

Donal Finn is Associate Professor, Mechanical & Materials Engineering, University College Dublin. In this article he reflects on present and future issues in engineering education, as observed at UCD, and how these might relate to broader building services education.

UCD Engineering has origins dating back to the establishment by John Henry Newman in 1854 of the Catholic University of Ireland, in combination with the Royal University of Ireland (est. 1880) and the Royal College of Science for Ireland (RCScl). University College Dublin (UCD) was created by the 1908 Irish Universities Act, and the first BE degrees in civil, and mechanical and electrical engineering were formally awarded under exclusive UCD auspices in 1919. This centenary will be celebrated by UCD Engineering in 2019.

As building services emerged as a discipline in its own right in Ireland during the 1950s, UCD engineering graduates established careers in this emerging sector, as well as the wider energy arena. Their contribution was significant and multi-faceted and ranged from founding contracting engineering companies to consulting engineering and the associated energy services industry.

The most significant recent development in the engineering education programmes at UCD has been the incorporation of the 3 + 2 Bologna degree structure. Currently, UCD has a Year 1 intake of approximately 280 students, under a single-entry denomination – engineering. Students can graduate after three years with a BSc (Engineering Science) degree, after four years with a BE degree or, after five years, with a ME degree.

The evolution of the ME programmes has been transformative in many ways. Students now have more autonomy and choice in choosing and customising their engineering education over the first three years at UCD. They evaluate carefully the various options and, based on informed decisions, make good choices.

Given this background – and bearing in mind the context of building services engineering education

– several current and future perspectives are identified, largely based on my experiences at UCD. These are summarised hereunder.

■ Core engineering

Engineering fundamentals should continue to be central to all engineering education programmes. This includes mathematics, science and engineering foundations. Without a solid grasp of



these core topics, engineering graduates will be challenged to master later applied material. Introduction of the fundamentals from Year 1 is critical in a well-formed engineering education programme.

■ Creativity, design and problem-solving

In parallel to engineering fundamentals, the inclusion of design and problem-solving perspectives is critical. It is essential to develop creative design thinking and problem-solving skills from the very beginning of engineering education. Often creativity, design and problem-solving is not introduced until later in engineering programmes, but this is a missed opportunity to engage students from the very beginning of their engineering journey.

■ Gender diversity

Engineering continues to be a male-dominated industry. Nevertheless, at UCD we have increased our Year 1 student female cohort from 19% to 30% between 2013 and 2018. Increased efforts to harness greater gender diversification in engineering is essential and must continue. In 2019, UCD Engineering will participate in the Athena Swan assessment process as part of this effort.

■ Industrial placement

The value of work-placement in engineering education has been evident for many years – the challenge was how to formalise it within a 4-year BE programme. The emergence of the ME programmes has facilitated the integration of a six to eight-month placement. All stakeholders – students, companies and faculty – agree that industrial placement has been extremely successful. The benefits are significant ... students gain not only industrial experience, but also learn to work as part of multi-disciplinary engineering teams. They are also exposed to the

diverse and complex challenges of the engineering world. Moreover, students return post-placement with proposals for their engineering project, which benefits all parties. In many cases students take up full-time positions with their placement companies, post graduation.

■ Five years engineering education

The extra year associated with the ME programmes not only allows students to gain industrial experience, but also facilitates deeper specialisation, e.g. energy systems engineering. Critically, the additional year, when coupled with industrial experience, also contributes significantly to the confidence and maturity of students, thus enhancing their transition from education to their engineering career.

■ Final engineering project

The additional year allows ME students not only to further develop their training by discipline specialisation, but also allows students to engage in more advanced, more challenging final engineering projects. Often the outcome of the industrial placement is an associated project that the students identify and propose. This means that students engage and drive a project about which they are passionate and committed.

■ Interconnectivity/interdisciplinary/integration

In the past decade, the need for interconnected, inter-disciplinary perspectives that lead to integrated solutions have been evident in engineering education. This perspective will continue to evolve and deepen. As educators, our challenge is to instill this vision in students, which can be challenging to convey within the intellectual demands of an already-full engineering curriculum. Nevertheless, communication of this essential agenda is critical and we must continue with our efforts in this direction.

■ IT evolution

Engineering and information technology go hand in hand. Although our students have comprehensive training in essential IT skills for engineering problem-solving, the emergence of the next generation of IT technologies will be transformative in our collective futures. Data analytics is one such emerging IT field that is likely to play a significant role in future engineering. Exposure to these technologies will significantly enhance our future engineering graduates.

■ Business/entrepreneurial skills

A significant number of engineering graduates gravitate towards business/management/consulting type careers. Some follow entrepreneurial routes. In recognition of this perspective, our ME Engineering with Business stream has captured this interest and is one of the most popular ME streams at UCD.

■ Joint courses

The importance of IT and business in engineering education has been highlighted. The establishment of inter-disciplinary courses and projects would allow these skills to be further developed and enhanced. As an example, in the past few years, my research group has collaborated with colleagues in Computer Science and Electrical Engineering, examining emerging issues in the nexus of buildings, the smart grid and data analytics. The experience for all, especially students, has been very positive.

■ International exchange

Internationalisation always has an essential aspect in engineering and students revel in the opportunity to spend one or two semesters abroad. This is normally facilitated in a manner such that full recognition is given for the exchange, thereby ensuring that graduation is not delayed. Between 10% and 20% of our students

currently spend at least one semester at a university outside Ireland.

■ **Engineers without borders**

EWB is an extraordinary opportunity for students to engage with communities in developing countries across the globe. Given the importance of engineering – and more specifically of building services – in the developing world, it offers a transformative life-changing opportunity for students during their college years.

■ **Research integration**

Giving students the opportunity to work in collaboration with university research groups, alongside PhD students and post-doctoral staff, offers the chance to work on innovative novel research, thereby harnessing the curiosity and creativity of students.

■ **Life-long learning**

A critical perspective in engineering education is the realisation that, even after five years of education, how little one knows. Emphasis on the fundamentals means that upskilling is achievable and feasible. Industrial experience brings not only experience and perspective, but also the realisation that continuous life-long training is essential.

■ **Policy/public engagement**

The impact of engineering on our world is enormous. Often as engineers we are reluctant to acknowledge our contribution. The need for public and policy engagement is crucial so that our message can be heard and understood. Instilling this perspective in our engineering education is critical.

In closing, at UCD approximately 60 (15 BE and 45 ME) students graduate

each year in either Energy Systems or Mechanical Engineering. A cohort of these choose building services as a career option. More choose the broader energy field. As we continue to develop and adapt our courses, all of the aforementioned issues are foremost on our minds as we prepare our graduates to face the energy challenges of the 21st century.

Buildings are central in the energy future. They are no longer entities with stand-alone internal services. Increasingly, they will be integrated with communities, IT networks, electricity grids and district energy systems. Such integrated systems need both inter-disciplinary and specialist solutions. The energy nexus, within which building services co-exists, faces a future with many questions and, as yet, undiscovered solutions. We need engineers to create and fashion these solutions! ■

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Embrace change and technology but remember, ‘ān quán dì yī’

Derek Mowlds

Derek Mowlds, MSc, is currently the Managing Director of PM Group Asia, with responsibility for offices in China, Singapore and India. He is a past Chairman of CIBSE Ireland and a past member of the CIBSE Council. Derek was also a founding Board Member and Vice-Chair of the Irish Green Building Council.

Reflecting on the industry since commencing employment as a designer approximately 23 years ago, the biggest change I have encountered is the rapid advances in technology and ICT. The fundamentals of building services design have not changed. However, how we work and communicate has completely transformed in the last two decades.

I have seen and been part of this transformation from my humble beginnings in a design office in Mountjoy Square in Dublin (pre-AutoCad!), to VMRA in Dartry Road, then PM Group and onto PM Group's Shanghai office in China. I am now the Managing Director of our businesses in Asia, and I felt that the best thing I could do for this piece is

to share my thoughts on some of the key focus areas to successfully compete in, and deliver, projects in today's exciting but sometimes unpredictable environment.

These are in no particular order, as they may be applicable to various stages of business development and the project execution lifecycle, or to various stages of your own career.

■ Remain agile and flexible

Building services engineers and the supply chain should remain agile and flexible in a very dynamic and changing environment. This may simply mean remaining open to different contracting models such as Integrated Project Delivery (IPD) or working with contractors on design and build projects; it may even mean an openness to travel for international experience, or work on projects with teams from multiple locations, or in a different sector.

■ Systems thinking

Engineers are best placed to apply a "systems approach" to both engineering design and overall project delivery. Any project can be broken down into a distinct number of systems, many of which will be common from building to building, despite the sector. Focussing on the critical/key systems early can help drive decisions and improve project delivery and efficiency.

The systems approach can also be used to identify key interfaces with other design disciplines and encourage early dialogue and design co-ordination. Outside of engineering, there is an interesting resource that I frequently refer to called the Systems Engineering Body of Knowledge (SEBoK – www.seebok-info.org) which provides key knowledge resources and references of systems engineering, organised and explained to assist a wide variety of users.

■ Lessons learned

Always strive to capture and transfer lessons from one project to the next.



Can't picture this at a "ground breaking" ceremony in Ireland. This image reflects the culture differences around the world and was taken at the commencement of the Zoetis Biopharmaceutical project. It shows Andy Huang, EDRI with Barry McFarlane, Project Director, PM Group; Jeff Pruis, Project Director, Zoetis; Derek Mowlds, Managing Director, PM Group, Asia; Roman Trawick, GMS President, PM Group; and Eric Zhang, Project Manager, PM Group. <https://arrow.tudublin.ie/bsn/vol57/iss5/1>

Also refer to lessons captured from other projects in your organisation. Do this early in the project, before you encounter a repeat issue that could have been easily avoided. Without a robust “lessons learned” system in your organisation, valuable knowledge will be lost across projects as the design team will change, and people move on, but the key issues and challenges remain!

■ Be open-minded

Always remain open to new technologies and innovations, and encourage innovation from all members of your team. Embrace the right technologies and approaches for your business and projects early, including BIM, LEAN, Construction Management IS (Information Systems) etc. However, remember that technology is an enabler, not the answer.

■ Continuous Professional Development

Stay in touch with your relevant engineering institutions, attend conferences and CPD events. Also, there is a huge volume of on-line CPD available. This raises another issue ... for many the challenge now is managing your time as we are now “data rich and time poor”, according to a famous quote from Dr Kevin Kelly. It is also of huge importance to mentor and train the next wave of graduates in our industry. As you progress through your career, share your knowledge and experience to build the competencies of those around you.

■ Culture and communication

Our clients, teams and colleagues now consist of a diverse mix of nationalities and cultures. This can actually improve team performance and efficiency based on the differing perspectives of individual team members. However, this requires leadership and mutual respect.

Building services engineers also need to integrate into multi-disciplinary design teams (often from multiple companies) to deliver projects requiring a huge dependency on soft skills in addition to technical acumen. There is a huge body of knowledge on culture and communications, plus regular seminars and workshops, that might be worth attending if you feel that improvement is needed in this area.

■ Safety first

Last, but by no means least, remember to keep safety at the heart of everything that you do. Think of safety in design and safety during construction. Then deliver safe assets and systems for those who will operate them into the future. In China we say “ān quán dì yī” ... safety first.

Stay positive and watch out for signs of stress. I say this to both employers and employees, particularly on demanding projects. Remember, this is a marathon, not a sprint. ■





Suppliers of high-quality, fully-integrated, heating system solutions

Over the course of the last 15 years Unitherm Heating Systems has emerged as one of the largest suppliers of high-quality, fully-integrated heating systems in Ireland. Key to its success is a total commitment to engineering excellence, and a driven philosophy to deliver design-led heating and hot water solutions that are tailored to the specific needs of each project. The fact that 14 of the 26-strong team are fully-qualified engineers bears testimony to this. Most are mechanical

engineers but two are qualified electricians who then completed electrical engineering degrees.

Complementing this top-level engineering support is a portfolio of the highest-quality products from some of the world's market-leading brands. Whether it is heat pumps, underfloor heating, low-temperature aluminium radiators or fan coil units, Unitherm Heating Systems selects the most appropriate model/brand to suit each individual application. This equally applies

to the main system components and all the related accessories and peripherals.

Route to market is via a network of nationwide merchant outlets which are serviced from the Unitherm Heating Systems offices in Galway and Dublin. It is a unique trading partnership whereby Unitherm Heating Systems often wins the project and then works closely with the nearest merchant branch to team with a local contractor to deliver the required solution. Everything from system design to component selection is provided, along with full technical drawings, site support, commissioning and after-sales service. This same level of support is also provided when the project is contractor-initiated.

EDUCATION AND INFORMATION TRANSFER

Education, knowledge sharing and information transfer is another key component of the service provided by Unitherm Heating Systems. Given the pace of product innovation and advances in technology, it is difficult for specifiers and installers to keep pace with all of these developments. There is an identifiable

knowledge gap in the market and its comprehensive training programme is designed to bridge that gap..

This programme is delivered in a very flexible manner with the content tailored to suit, be it an installer or specifier. Training sessions can be conducted on site, at a company's own premises, at Unitherm Heating Systems'

training centres in Galway and Dublin, or at a separate more convenient location.

Content can also be tailored to cover everything from product selection through to system design, energy efficiency objectives, regulation compliance, industry best practice, commissioning and after-sales support.

unitherm HEATING SYSTEMS



COMMISSIONING AND SERVICE MAINTENANCE

Unitherm Heating Systems views system commissioning, and indeed after-sales service and maintenance, as critical in the delivery of best-performing heating and hot water solutions, especially those involving heat pumps. This is where it sees one of the greatest knowledge gaps in the sector and so has devised a comprehensive commissioning process, and after-sales maintenance and service package.

Unitherm Heating Systems commissions every project, no matter what the project scale, or whether it is a domestic or commercial application. However, it has a unique take on the process and involves two stages. First the engineer runs through the entire system and checks everything from the heating, hot water, comfort levels and controls.

Then, once the engineering and technical testing has been completed, the commissioning engineer runs through the operation and control of the

system with both the installer and the householder. Apart from the obvious benefits, where it is a new-build development both the installer and even householder are then in a position to share that information with neighbours. This not only gives the end-user confidence in the system but invariably minimises “nuisance” call backs.

Once the process is fully completed the commissioning engineer then issues a formal Commissioning Certificate. This verifies that the system is performing as designed and is also required for warranty purposes.

Service maintenance

However, Unitherm Heating Systems’ input does not end at commissioning. It has identified another major industry gap in relation to heat pumps and that is after-sales service support and maintenance. To date heat pump owners only contact the supplier when they have an operational/

performance issue. Perhaps this is because it is a relatively new technology so people think differently about it.

With established heating technologies regular service and maintenance is taken as a given. Indeed, it is essential when it comes to claims under warranty. Somehow this mentality seems not to apply to heat pumps and so Unitherm Heating Systems now offers a comprehensive suite of after-sales service and maintenance packages specifically designed to cater for heat pumps. So far it is being provided to installations with which it was directly involved, with the plan being to roll it out to all heat pump projects.

Photo above: Sean Hynes, New Site Business Development with Gareth Ramberg; Dermot Fahy, Service and Commissioning Coordinator; Welby Dix, James Folan and Matthew Guzik.

Energy efficient heating and hot water solutions

www.unithermhs.ie

The ‘pain-gain’ share model can drive innovation

Sean Downey

Sean Downey (MCI Arb, MRICS, MSCSI, FBEng) has over 20 years' experience in technical control, project, contract and development management roles in Ireland, the UK and mainland Europe. As a Chartered and Registered Building Surveyor, Sean is currently Director of Specialist Contracting with the Construction Industry Federation (CIF). His role primarily involves acting as secretariat for specialist contracting associations MEBSCA, ECA and ASCA, as well as the CIF's national Construction 4.0 Committee which is leading the industry's development of BIM, Lean and innovation initiatives. Sean's work also involves acting as a national representative on committees dealing with building regulations, the negotiation of new forms of contract/ sub-contract, and establishing appropriate dispute resolution mechanisms. He has a particular specialist focus on the adjudication process under the Construction Contracts Act.

Having reflected on the Mechanical & Electrical Building Services Contractors Association (MEBSCA) policy to date, and what our focus is on today, the issues always remain the same. Our mantra here in delivering policy objectives for our member companies in specialist contracting within CIF continues to be “getting work, getting paid and staying compliant”.

So where will the future of work be? When seeking out that opportunity, companies involved in the building services sector are at the forefront of technological change and have the best opportunity to assess where market share may grow, and what trends in client and consulting engineering choices will drive future opportunities.

If companies are looking ahead and trying to see where future policy is going, they can take stock of domestic economic trends and preferences displayed for different types of systems or the demands of particular building standards. NZEB is the biggest driver domestically. Another approach could be to take a perspective on the future from the European agenda. From a regulatory point of view the next big issues are the safety and quality of drinking water, and the safety and quality of indoor air. These regulatory issues may at first appear as challenges in requirements for technical upskilling, but are more likely to present significant opportunities for companies to find a specialist niche, and to add value to their professional services offering over the next 10 years.

Indoor air quality has been a major issue, particularly in the larger cities of other European countries. It may not necessarily appear to be such a big issue here due to the location of our largest city on the eastern seaboard and the natural benefits of the climatic conditions the city retains. However, with a drive towards lower carbon emissions and a total shift in the mode of energy used to drive private passenger vehicles and public transport in the next 10 years,



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the operation of commercial and residential heating and cooling systems will no doubt again come under focus. Together with agriculture and the old carbon-generating power stations, it will be the last major area of potential gain for the country as we try to meet our 2030 carbon targets.

NZEB presents challenges for those who are mid-construction and can't reach a point of substantial completion of the structure as the transition dates pass. This should be a red flag at this stage for both designers and installers. If structures are not future-proofed to allow for the additional U-value requirements in the envelope, then it may not be possible to complete conveyancing on those properties.

The Drinking Water Directive will force change onto the sector for new buildings and start to put demands in place for the upgrade of existing installations. Again, I would argue that this presents market opportunities for those who get in early, understand the technology, and develop their capability to deliver to the market.

It is likely that the next focus here in Ireland will be dealing with the results of narrowly-considered policy with regard to building fabric. The increased insulation and airtightness introduced in the last five years will present many health issues if not actively managed in residential buildings in the future. It needs to

be addressed now through the use of active ventilation systems. Indeed, the current draft of TGD F proposes to deal with over-heating in residential units. Only time will tell if European-type envelope and living unit layouts are suited to the Irish climate and way of living.

Traditionally, the mindset in the building industry is to resist change and technological advancement as it can cost more to deliver, and clients may not necessarily want to pay more for it. The building services sector is much better placed to interpret the specific changes and to present the best realistic outcome for clients that they can afford.

With respect to getting paid, the Construction Contracts Act was heralded as a milestone in payment protection legislation when it was introduced in 2016. I firmly believe that it has brought many significant benefits, but only to those who operate it. In the current economy companies are operating either at full capacity or at a level that they are comfortable with, perhaps with an unwillingness to grow anymore.

Cash flow is critical to the survival of construction enterprises and professional services firms. I believe that the low margins that exist currently are masked by the abundance of work available. I would fear for the point in the cycle when demand slows and the effect this may have on companies and their ability to continue to trade. The

solution is simple. Companies should price projects based on what they know they need to complete a project comfortably, including for the inherent risks they know are involved. It is surely now time to stand back and say no to certain projects, to look at market segmentation, and to manage the risk of the economic downturn in advance.

Staying compliant will be critical as we train new entrants and try to keep those of us still carrying imperial scale rulers around with us up to date. I'd expect that although the skills that our young tradespeople and engineers leave their college or apprenticeship with could be unrecognisable, there will always be a need for a strong core set of skills to understand how systems operate from first principles. Ireland's core strength and the major asset of our Irish specialist contractors has been the technical skillset and the can-do attitude of its directly-employed workforce. This is what has made Ireland a major centre for Foreign Direct Investment (FDI) and has also led to the export growth for our indigenous companies.

As we venture into a more diversified and fragmented supply industry, so too our people must be prepared to diversify. New methods of collaboration, including BIM and Integrated Project Delivery, demand a different mindset and may become the norm if more clients take the time to understand how the "pain-gain" share model can drive innovation.

In summary, the future is very bright for building services engineers and installers here in Ireland for the quality of the domestic supply industry that they have nurtured and developed. The big issue is to constantly challenge the norms, and to stay ahead of global competition. ■

The big issue for building services engineers and installers in Ireland is to constantly challenge the norms, and to stay ahead of global competition.

et al.: BS News September/October

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Mark have developed many new units and re-designed others with the advent of ERP. Adiabatic cooling is used widespread, along with integrated heat pumps. Further developments are a must to prepare for the upcoming electric economy.

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Mark have developed HVAC controls for modern appliances, including analogue and digital input and outputs, BAC Net, Modbus and Lon Works. In our manufacturing plant in Coolea, Macroom, Co Cork we have our own Controls Department where we can work with CIBSE members to do as they specify. This may include integration of BMS, fire alarm, sensors, Co2, humidification, dehumidification, etc. Mark have also developed a number of apps for remote control of appliances. BMS connectivity is available for all units.

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We're proud to have worked on projects all over Ireland and Europe, supplying certified systems to hospitals, pharmaceutical plants, clean rooms, food production, swimming pools, garages, paint shops, hotels, restaurants, warehouses, factories, shopping centres and many more.

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Mark welcomes CIBSE members to visit the factory and see that their units being manufactured to meet all requirements. We can set up leakage tests, air flow and whatever else is required to exceed customer requirements. We have Eurovent approval and can comply with the following:

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Building Services: how this ever-evolving profession can advance people's health and well-being

Mona Holtkoetter

Mona Holtkötter, Associate, Market Solutions, International WELL Building Institute (IWBI). Mona has extensive experience across the full spectrum of building services, and is currently Honorary Secretary of CIBSE Ireland.

The building services profession has long moved from pipe, ductwork and equipment sizing to a much broader and more complex role. Topics like sustainability, energy savings, renewable energy and BIM (building information modelling), just to name a few, have become a huge part of building services design, sales, manufacturing and construction. Renewable energy, for example, has been brought back to the top of our priority list through the recent release of Building Regulations Part L 2017 (NZEB), and sustainability rating systems such as BREEAM, LEED and the Home Performance Index are part and parcel of our daily jobs.

A new topic has recently entered the Irish market – building design and operation that focuses on the benefit of health and well-being of people. This “second wave of sustainability” is focused on providing the optimal working environments where people can thrive and fulfil their highest potential.

Why is this important?

There are multiple ways we, as building services professionals, can positively impact the health and well-being of people in buildings through our design and construction practices. Here are a few aspects to consider.

- A *ventilation system*, designed and built for optimal indoor air quality, has the potential to reduce the negative effects attributed to asthma, headaches, hay fever and the flu. Recent studies have also shown that improved indoor air quality has the potential to enhance individual cognition by up to 61%.¹ Attention to detail when selecting materials such as paints, ductwork sealants, glues, ceiling tiles, carpets and furniture can reduce the toxic off-gassing within the first year of installation and with that, potentially reduce the risk of cancer.

- Another aspect is the *design of water systems*. Legionella has been the key word in the design and construction of water systems within the last 20 years. While this is still an important topic that cannot be neglected, the design of water systems should also take other harmful contaminants into account. Project-based water quality testing and the design of a consequent filtration system that removes





Cundall's London office at One Carter Lane was the first workspace in Europe to be WELL Certified™.

all contaminants and optimises the testing of drinking water, should become part of our scope in the future. Providing employees with access to high-quality and good-tasting drinking water has shown to positively influence hydration and therefore concentration levels.

■ The *lighting environment* we design for the people inside our buildings, who spend 90% of their time indoors, can impact their visual, circadian and mental health. Presently, most spaces are fitted with lighting systems that meet the visual needs of individuals, but do not consider the effects of lighting on our internal body clock or mental health. Research and design provides huge opportunities in this area.

■ A building's indoor *thermal environment* not only affects its energy use, but also influences the health, well-being and productivity of the people inside. Thermal comfort is ranked as one of the highest contributing factors that influence our satisfaction with our buildings. While designs typically meet thermal comfort standards on paper, there is limited on-site verification to ensure that the space actually performs as intended.

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As landlords and tenants alike increasingly demand healthy workspaces, we would do well to shift the focus towards on-site performance testing when it comes to these design and construction practices. Certification programmes such as the WELL Building Standard™ (WELL™) already require testing for air and water quality, thermal and acoustic comfort, as well as lighting levels, propelling the industry to integrate this practice into the commissioning process and the day-to-day working lives of building services professionals.

Companies have already started to investigate the financial value of health and well-being interventions. A recent study by the World Green Building Council

outlines *The Business Case for Health and Well-being in Green Building*. The published study features Cundall's London office at One Carter Lane, which has claimed £200,000 annual savings based on reduced absenteeism and staff turnover.² This office is the first space to be WELL Certified™ in Europe and has seen huge benefits by focusing on human-centred design, construction and operations.

Arup's office in Cork, the first WELL Certified™ space in Ireland, has also generated significant interest in healthy office environments. IPUT's headquarters at St. Stephen's Green, Dublin is on track to become the first WELL Certified™ office in the capital.

With these and other exciting developments, building services professionals are now faced with their most important role: supporting the health of the people who use their buildings every day. ■

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The Arup office in Cork was the first Irish workspace to be WELL Certified™.



Water Passion



Calpeda 3-phase Imat booster sets

This very tidy Calpeda 3-phase IMAT booster set was one of seven Calpeda bespoke units designed for a specific plant room. This set comprises three MXV40-806 WRAS-approved stainless steel vertical multistage pumps, each one rated for 3.0ltr/sec @ 4.5bar. Each pump on the set is fitted with an IMAT variable speed drive to ensure maximum efficiency, with the pumps only running to maintain the constant pressure that is required. As soon as the desired pressure is reached the pump goes into standby until the next time it is needed.

Calpeda's IMAT inverters have one external pressure transducer per inverter/pump as standard; cyclic change-over over lead pump to ensure even wear across the set; volt-free contacts for remote alarm; auto-restart in case of power failure; and built-in safety start (hydraulic shock protection).

Calpeda IMAT (and Easymat) inverters don't require an app, remote or a "dongle" to configure or to see what they are doing. Everything can be accessed and configured directly from the display.



Calpeda Booster Sets for Unrivalled Quality

Over the last 20 years Calpeda Pumps (Ireland) has built a strong reputation for delivering customised pump solutions to meet the requirements of all types of projects. The range is extensive and caters for all applications, with bespoke solutions a speciality, particularly when it comes to booster sets. All are manufactured at Calpeda's dedicated workshop with quality control the key focus. Every pump has a full hydraulic and mechanical test at the end of the production process while the completed booster sets are also tested to the desired operating duty prior to dispatch.

Energy saving replacement

These images illustrate another quality job carried out by one of Calpeda's distribution partners and shows the replacement of an old inefficient pressure switch controlled booster set with a new Calpeda variable speed Easymat set.

The customer is now reaping the benefit of significant energy savings and unparalleled reliability thanks to Calpeda's WRAS-approved multi-stage pumps and advanced inverters used on the cold water booster sets. Designed, manufactured and fully tested to ISO 9001, 14001 and 50001.



Urgent booster set replacement

Calpeda can provide urgent booster set replacement at very short notice.

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- ✓ Delivered "plug and play".



Calpeda means 100% hydraulic test!

Something that sets Calpeda apart from other manufacturers is Calpeda's strict testing process. Every single pump and booster set produced is mechanically and hydraulically tested. In this image a MXV25-208 (vertical multistage) is being checked against the stated operating duty. Every pump undergoes a series of tests to ensure that it meets Calpeda's exacting standards to guarantee the customer that, when the pump reaches site, it works perfectly.



Easymat booster set

This image shows a recent install of a Calpeda 3-pump Easymat booster set. There are very good reasons for choosing Calpeda's Easymat variable speed drive, including:

- ✓ Non water-cooled;
- ✓ External transducer per Easymat;
- ✓ No remotes, Apps or generational changes.

Many different applications

Calpeda pumps are used for many different applications. On this bespoke purification system there is a single pump Calpeda Easymat booster set utilising WRAS-approved horizontal multi-stage pumps, an Easymat variable speed drive to control the pressure, and an AGAP tank. In fact, Calpeda works very closely with many OEMs to find solutions for moving water.



Calpeda CAT 5 Booster

This Calpeda CAT 5 booster set was designed to prevent possible contamination of water into the mains supply, while keeping a pressurised cold water supply to equipment.

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Every Project is an Engineer's Research Lab

Kevin Kelly

Dr Kevin Kelly is an emeritus researcher at DIT, shortly to become the Technological University of Dublin, and supervised the lighting research projects described here. He is Vice-President of the Chartered Institution of Building Services Engineers (CIBSE), Past President of the Society of Light & Lighting (SLL), Editorial Board Member, *Lighting Research & Technology* (LR&T) and Editor of the *Journal of Sustainable Design & Applied Research*: <http://arrow.dit.ie/sdar/>

After 50 years of CIBSE in Ireland, what challenges do the next 50 years offer us as a professional community? Climate change must surely be the biggest challenge globally, and in this regard, Ireland is not doing well.

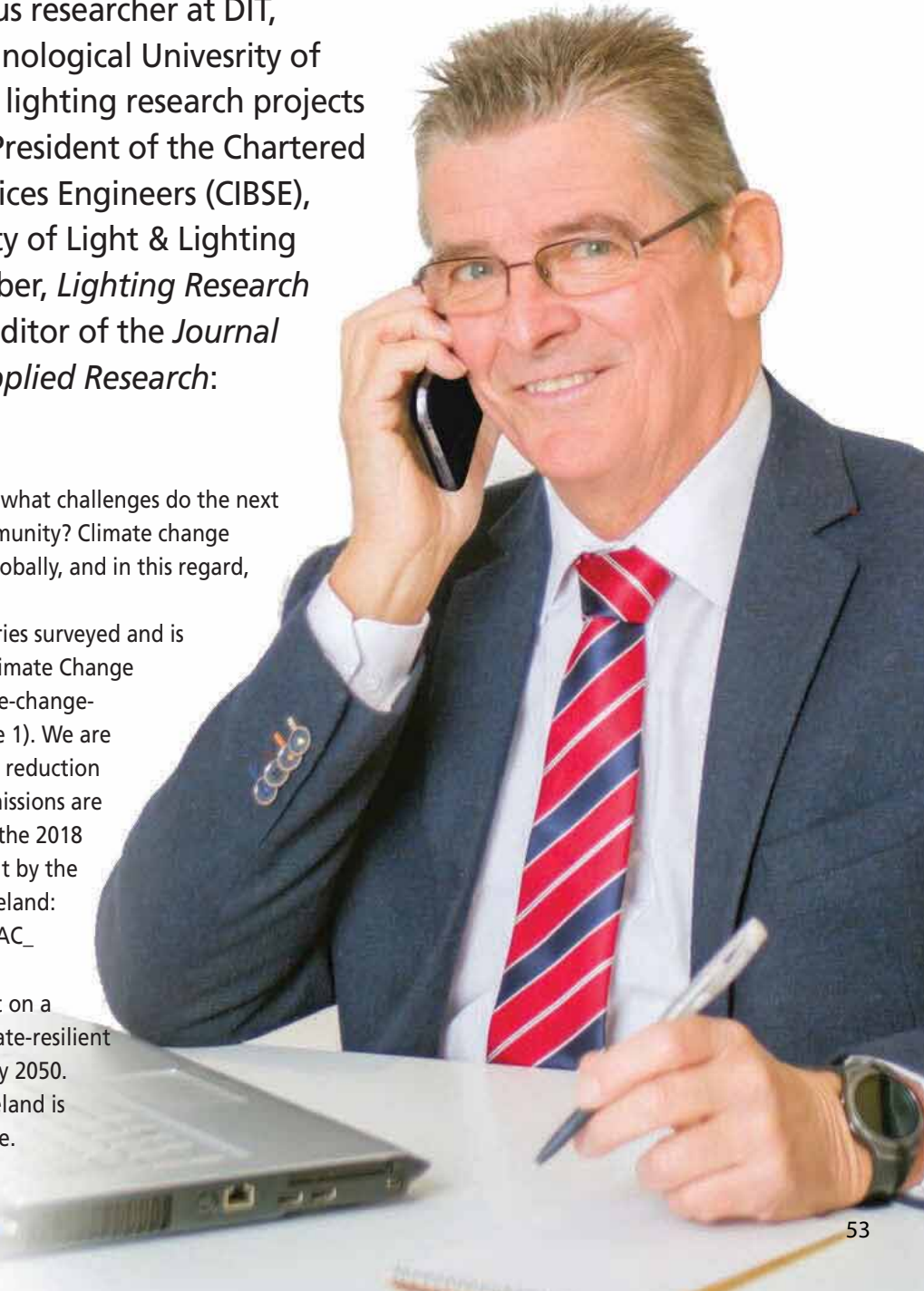
Ireland is ranked at 49th of 59 countries surveyed and is the worst-performing country in the Climate Change Performance Index: <https://www.climate-change-performance-index.org/> (see also Figure 1). We are almost certain to miss our 2020 mission reduction targets. In fact, our Greenhouse gas emissions are rising rather than falling, according to the 2018 annual report submitted to government by the Climate Change Advisory Council for Ireland: http://www.climatecouncil.ie/media/CCAC_AnnualReview2018.pdf

This goes on to say that Ireland is not on a pathway to achieve a low-carbon, climate-resilient and sustainable economy and society by 2050. Major new initiatives are required if Ireland is to meet its objectives on climate change.

The building services industry cannot wait for government policy. We have
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a big role to play if we are to address this issue and we can contribute by helping develop near zero energy (NZEB) buildings. In this regard we can advise on passive design, reducing thermal demand, minimising lighting energy and increasing the use of renewable energy with increased energy storage, while all the while ensuring human centric buildings.

There is plenty of evidence of innovative practice and leading-edge design in our industry, but what is sometimes lacking is the scientific evaluation of those innovations. How can we be certain that these innovations are



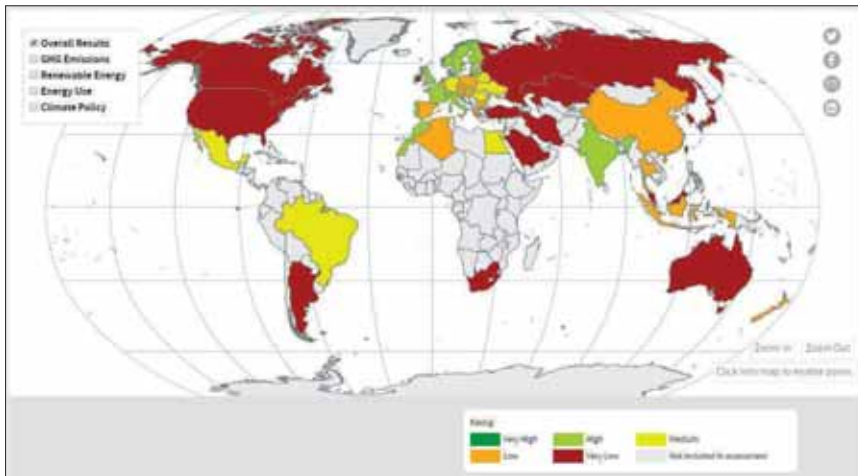


Figure 1 – Map of performance by country in Climate Change Performance Index by Germanwatch.

not just “bling” and effectively bad investment advice to clients? This is why designers, engineers and consultant practices have to be careful to evaluate their innovations with respect to energy performance and user satisfaction. In other words, they must work and evidence must be provided of this.

Research

Research is a word that engineers sometimes think applies to others. “We have no laboratory facilities in our company and anyway we don’t have the time to do it and nor can the company afford it,” they claim. I would argue that every building project is a laboratory with lots of data readily available in utility bills and other energy data. Additional metering for data gathering

purposes is increasingly important. Occupant satisfaction is critical and is not just a nice extra any longer.

The wages/salary cost of an average office employee can be estimated at between 40-200 times the construction costs over a building life cycle (Figure 2). This means that increasing construction costs to provide a quality building is a sound investment and many of the IT and similar companies coming into Ireland hiring high-end workers are recognising this fact. Ensuring user satisfaction with new buildings should be part of every construction project and this process can be achieved by means of post-occupancy evaluation surveys.

Evaluation research is not performed by people in white

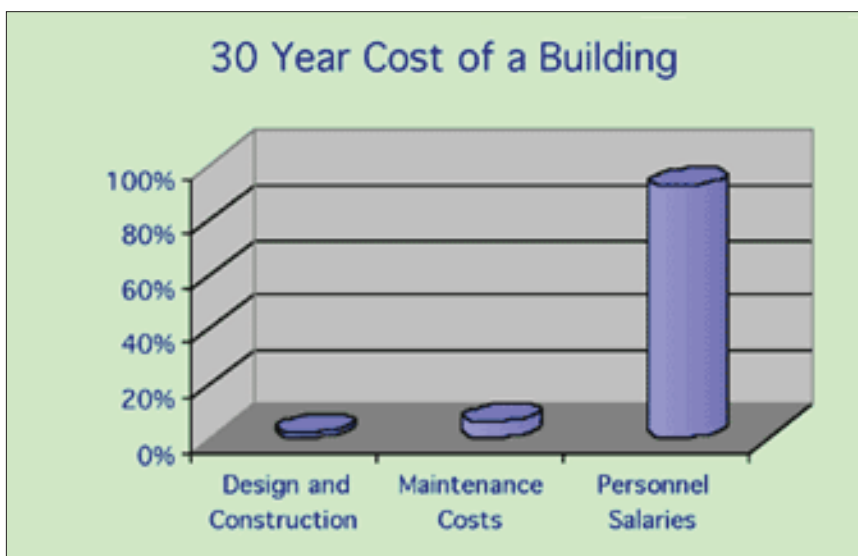


Figure 2 – Building cost analysis (wages/salary cost of an average office employee). <https://arrow.tudublin.ie/bsn/vol57/iss5/1>

laboratory coats but by practising engineers objectively evaluating their innovations and using feedback to improve them. In other words, evaluation research allows closed-loop control as opposed to open-loop control where innovations are applied and then forgotten about, regardless of how much they cost or how they performed. This is a no-brainer. Research offers value to clients and repeat business for engineering companies who add this evaluation layer to their service. There is a cost but I would argue that the alternative of installing poorly-performing technologies will be even more costly in the longer term to company reputations.

Publication of post-occupancy evaluations enhances an individual engineer’s, and a company’s, reputations and is achievable for any study that objectively evaluates adequate evidence. CIBSE alone offers multiple publication opportunities:

- *SDAR Journal* <https://arrow.dit.ie/sdar/>
- CIBSE annual symposium <https://www.cibse.org/cibse-technical-symposium-2018>
- Building Services Engineering Research & Technology (BSERT) <http://www.cibse.org/Knowledge/Online-Access>
- *Lighting Research & Technology Journal* (LR&T) <http://journals.sagepub.com/home/lrt>
- CIBSE Building Performance Awards <https://www.cibse.org/building-performance-awards/about>

Where to start

To begin with, practising engineers need to engage with these opportunities by firstly reading papers published in their area of expertise, and thinking about the questions that need to be addressed as part of the evaluation of their buildings. Literature reviews are the



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beginning of any research project. Who has done this before and published interesting findings? Don't make the same mistakes they say they did and evolve the process to improve it. Test the outcome and report it using objective evidence. Present data succinctly in an easily-understood way.

For companies

Companies in the UK, and Ireland to a lesser extent, are increasingly sponsoring PhD studies or employing PhD graduates. PhD sponsorship, in partnership with universities, allows companies have a say in the research questions and allows access to these researching students and their findings. Engineers can be hard-pressed for time but have many questions they would like answered. PhD studies can address these questions. Working engineers can act as industry supervisors alongside primary academic supervisors, thus allowing

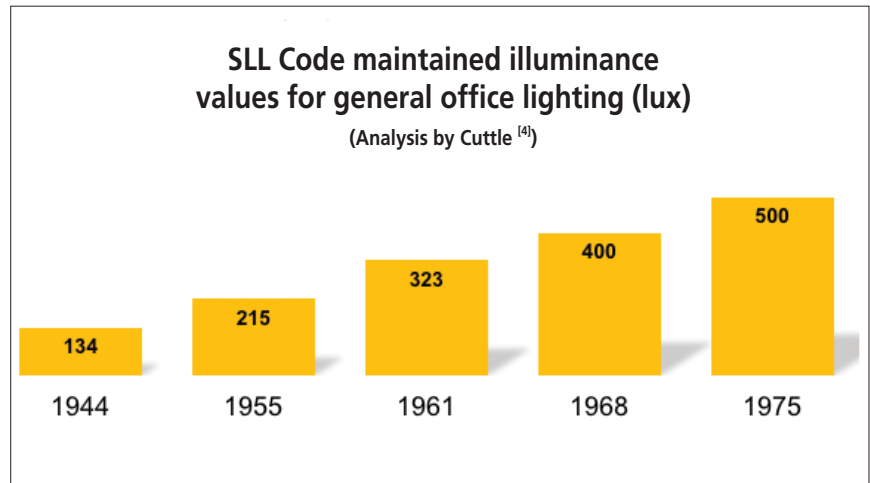


Figure 3 – (SLL) Code maintained illuminance values for general office lighting.

them realign research questions in the study as their innovations develop and new challenges are met.

A small proportion of such graduates or students within a company can bring research expertise into design teams. It can also breed innovation in design and a more critically-reflective design and evaluation ethos into the workplace, and all this at minimal cost. Quite simply, this offers

potential for extraordinary value to forward-thinking companies who can then produce convincing evidence of high performance to future clients. It is investment for the future.

A research example

As a researching academic, my interest in recent years has been supervising multiple PhDs in interior lighting. Is it not surprising as an industry that most lighting designed by consultant engineering practices is based on a 100 year old^[1-2] design system? This entails designing lighting using the “Lumen Method” that focuses light on the desk plane, usually achieved with a regular array of ceiling luminaires. Cheap and cheerful and compliance with the Code for Lighting and European standards is the key objective in this regard.

The authors of the *Society of Light and Lighting Code for Lighting*^[3] admit that compliance with the code does not ensure good quality lighting. Presently, using recommended procedures ensures only avoidance of bad lighting and does nothing to lift the spirit as co-author of the Code, Professor Peter Boyce says.

Cuttle argues that up to 1944, specified values of illuminance were based on visual performance and other scientific evidence.^[4] He concludes that in the quarter century up to 1975, required levels of



How can we be certain that innovations are not just “bling” and effectively bad investment advice to clients? ... designers, engineers and consultant practices have to be careful to evaluate their innovations with respect to energy performance and user satisfaction.

illuminance increased significantly (Figure 3) in response not to visual performance needs, but for reasons other than visual performance. Of course the reason light levels increased in the third quarter of the 20th century was to do with peoples' desire for buildings to appear brighter. However, if we want buildings to appear brighter then dumping extra lumens onto the horizontal working plane is not the way to do it.^[5]

What has changed in the last quarter century are user needs in workplace buildings. Figure 4 (a and b) shows typical workplace practice

in the 1930s and 1970s. Designing to the Lumen method of lighting then may have been appropriate. But is this appropriate for today's workplaces? Figure 5 shows a modern interactive classroom in DIT Bolton St. The lighting has been designed to the Code for Lighting and achieves the specified light levels on the desks. Is this a good quality lighting installation? Well, it might have been before the widespread use of screen technology, but this is not an appropriate lighting installation for today's modern student.

Imagine the difficulty here for students to see the main projector

screen and the other screens provided, not to mention their own devices. Disability glare was a major issue here, to the extent that lighting was not used by the students ... even at night.

Research around Cuttle's theories^[9-14] has been part of a series of PhD projects in DIT since 2011. Cuttle's metric Mean Room Surface Exitance (MRSE) was proven by Duff to be a better way of evaluating interior lighting than horizontal illuminance.

The metric MRSE was tested as part of PhD research in DIT completed by Duff in late 2015.^[9-11] Respondents in his research found MRSE to be a good measure of brightness and in turn, for this measure of brightness to relate closely to the subjective evaluation of Perceived Adequacy of Illumination (PAI), as shown in Figure 6.

When compared to responses evaluating horizontal illuminance as a measure of perceived adequacy as shown in Figure 6b, MRSE performed significantly better.

The MRSE metric measures the perception of people to light exiting the room surfaces. Cuttle's own PhD research^[4] in DIT showed that efficient lighting in this type of modern installation became more about delivering light onto the higher reflectance room surfaces first and providing indirect lighting, rather than dumping all the light on a horizontal plane.

There is nothing new about uplighting of course, as this became common when computer screens



Figure 4a – Open plan office, Larkin Administration Building, Buffalo NY, 1930s; Figure 4b – Drawing office practice in the 1970s.



Figure 5 – Modern classroom

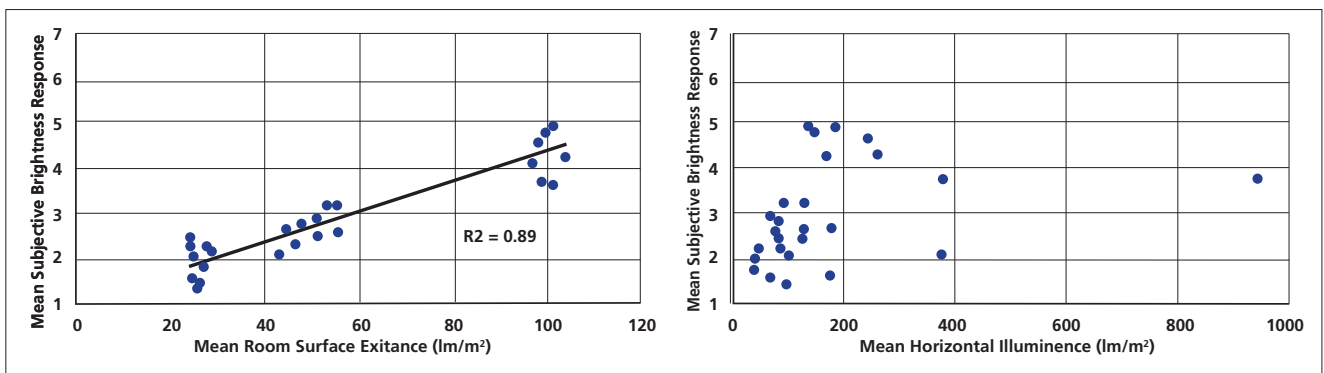


Figure 6a – Yes responses for varying levels of MRSE against PAI; Figure 6b – Yes responses to PAI against horizontal illuminance.



Figure 7 – Updated lighting using TAIR, full output on left and dimmed on right.

were first introduced into offices. But back in those days lighting was still evaluated using horizontal illuminance and this was inappropriate. Cuttle's MRSE metric now solves this problem. Duff's research^[12] not only suggested that MRSE was a better metric, but also proved that this metric could be measured easily using High Dynamic Range imaging (HDRi).

The present PhD project is further developing MRSE but is also focusing on Cuttle's second proposed metric Target Ambient Illuminance Ratio (TAIR). This refers essentially to illumination hierarchy. In the same classroom as in Figure 7, lighting has been retrofitted with wall-mounted uplighters. Even at high output, disability glare is eliminated allowing students see their screens. When dimmed the main projector screen is at a higher light level than the surroundings. The speaker position beside the projector is also highlighted. Determining the desired ratios and hierarchies is part of ongoing PhD research by Durante (Figure 5).

Conclusion

Just as innovation in lighting needs to be evaluated, other engineering innovations also need to be evaluated. Quite often such engineering innovations can be aligned with existing industry research to ensure that problems experienced by others are not duplicated, and also to allow further refinement, development and evaluation of low-energy solutions that also improve user experience of buildings.

Modern engineering companies who encourage their employees to engage with research will encourage a culture of innovation and deliver better-performing buildings. Research is part and parcel of every modern chartered engineer's work and applicants for chartered engineers are asked directly about their research. This is no longer something done by others. ■

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SDAR Journal for Evidence-based Research Data



The *SDAR Journal* provides a source of information and evidence about best practice with respect to energy reductions in the built environment and in the use of renewable energies. It is a peer-reviewed, free and open-access journal (<https://arrow.dit.ie/sdar/>) that has had papers downloaded over 22,000 times from over 100 countries worldwide.

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h Hevac

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ICI Caldaie designs and manufactures domestic and commercial hot water boilers with energy saving and environmental protection fundamental to the basis of the boiler design and research. The range includes steel boilers for the commercial market and LTHW boilers that are provided fully-assembled or in un-assembled kit form. They are available in modular form, both side by side and stacked, with cascade control. ICI Caldaie also offer a comprehensive range of electric, gas, oil and dual fuel **LTHW, MTHW and Steam reverse pass or three pass boilers**.

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WATER HEATERS

Industrial Division

Hevac's Commercial & Industrial Division's guarantees to offer specifiers and clients a formidable armoury of solutions and service, irrespective of the application, fuel or specific heat requirement they may have. The composition of the commercial and industrial division's product portfolio has been carefully structured to ensure that all project needs can be satisfied with high quality, brand-leading products from some of the world's foremost manufacturers.



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FLOWAIR is a renowned expert in LTHW warm-air heating with a range divided into two distinct groups: LTHW Unit Heaters and Electric or LTHW door and gate Air Curtains. Their products are characterized by: energy-efficiency, user-comfort, a high level of functionality, easy mounting and assembly.

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WE NEED TO LEAD

Ireland must be in the leading cohort of nations addressing climate change, not in the following pack

Jim Gannon

Jim Gannon has been Chief Executive of SEAI since 2016, and has overseen the growth of the organisation from a budget of €75 million to €150 million, initiating a change process across a range of incentive programmes and delivering SEAI's policy advisory and statutory functions for the Government of Ireland. Prior to this role, Jim spent 15 years in the private sector with RPS working in energy and environmental consultancy on both policy and infrastructure projects.

The time for talking about a realistic future for sustainable energy is over. It is now abundantly clear that we will miss our 2020 renewable energy and energy efficiency targets. That is the very real and very worrying short-term future. Furthermore, we will soon have sight of our 2030 targets, which are likely to be at least as challenging. An unfortunate truth is that for most people, these targets are intangible and meaningless, and this makes it difficult to get people engaged in the journey towards a cleaner and healthier environment. Despite this, there is a lot of hope for the future with the range of cost-effective

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sustainable energy technologies, and design options, increasing at a pace we have not seen before.

There are several reasons for our current level of performance, not least the sustained recession from which we are finally recovering. We need to realise though that whatever constraints existed before are less material now, and our collective performance must improve or we will pay a heavy price. If we are serious about moving to a low-carbon economy, then we must focus on a genuine transformation of our homes, businesses and society. It's about having a dependable, affordable and sustainable energy supply so that industry can continue to flourish. It's about creating a clean energy future for our people and our economy.

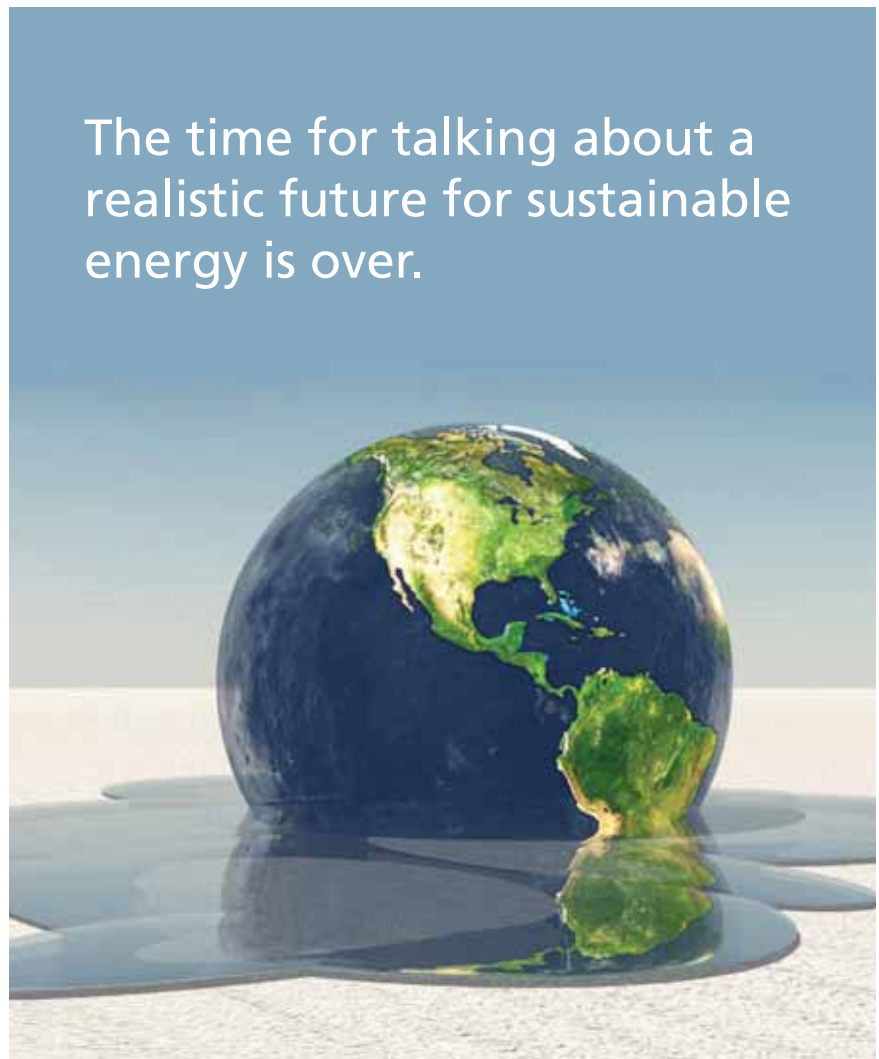


For businesses across the globe, sustainability is now a major strategic driver. It's no longer just a progressive environmental fad, and is increasingly core to business competitiveness as clients and supply chains continue to bring a greater focus on environmental performance. Some can differentiate their product or service in the marketplace, attracting customers willing to pay a premium for a more sustainable product. Others may be trying to attract ethical investors who can often remain more loyal to an organisation. Finally, there are those who just see a smart business decision in front of them, where an investment in more sustainable practices goes directly to the bottom line, providing a better return than other options.

This level of business leadership is now reaching a tipping point and must be met by the supply chain of manufacturers, design professionals, contractors and installers. Previously, this was the preserve of a number of niche "green" companies. Now we have a large number of major multinational organisations vocally addressing climate change and, critically, changing their own practices as well as those of their supply chain. They also have a direct and meaningful impact on the behaviour of their customers.

Ireland has long had very advanced building regulations and 2018 will be marked as the year that Near Zero Energy Buildings (NZEB) finally made it into Ireland's statute books. They substantially raise the bar for efficiency and renewables, particularly in non-residential buildings. More than ever, the regulations envisage buildings as holistic systems with interrelated

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The time for talking about a realistic future for sustainable energy is over.

and dependent components which must be designed and operated as such. This type of systems thinking in building design has long been central to the identity of building services engineers. On this, the 50th anniversary of CIBSE Ireland, the building services engineer has become more central than ever to addressing our energy and climate challenges.

In addition to the challenge that the Building Regulations set out for us as an industry, they have continued to expand their reach into the retrofit of our existing building stock. As we approach the complex and challenging retrofit of our widely-varying building stock, it is more important than ever that lessons are learned and solutions shared.

Without building services engineers, and the knowledge brokering and CPD provided by representative organisations such as CIBSE Ireland, we will not be in a position to meet the challenges we face.

Our innovative spirit in Ireland is our strength, and increasingly it is being directed at identifying the opportunities that both strengthen business and decarbonise our economy. But we are losing ground, and must redouble our efforts so that we are in the leading cohort of nations addressing climate change, as opposed to being in the following pack. After all, as engineers and engineering professionals, it is nothing more than our citizens, and society as a whole, expect from us. ■



EURO GAS LTD

Tackling nZEB with Euro Gas

Euro Gas Ltd is the leading supplier in the commercial HVAC sector in the Republic of Ireland. Established in 1985, Euro Gas is committed to providing customers with the highest degree of technical service and sales support. It has an extensive portfolio of market-leading brands with innovative products which tackle the design criteria of the day.

The biggest topic currently has to be nZEB (nearly Zero Energy Buildings). This requirement can make the design of heating plant a tricky one. Products on their own are one thing, but how we integrate the technologies is the key part. This is not a simple "box ticking" exercise and cannot be solved by merely incorporating a heat pump or CHP into the design. This has to be a holistic approach involving a mixture of renewable technologies along with more traditional-type products.

At Euro Gas we offer a suite of products which, when combined together in the right design configuration, will help meet the criteria that nZEB entails. We also offer product selection advice and design support to ensure that the right mix is used to achieve a fully-functional and efficient system.

At Euro Gas we offer a suite of products which, when combined together in the right design configuration, will help meet the criteria that nZEB entails

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Since the early 1990s HidROS has manufactured a range of high-efficiency heat pumps that have been specifically designed for the commercial market. Incorporating scroll compressors that are equipped with EVI technology (Economised Vapour Injection), they offer a versatile method of improving system capacity and efficiency.

Features and benefits include:

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- Utilising high-performance scroll compressors;
- Available in super low noise options.



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Options include:

- Remeha's latest Quinta Ace 160kW wall-hung condensing boilers are available to cascade up to eight boilers, either inline or back-to-back;



- The new Remeha Gas 220 Ace has an innovative design meaning that makes it manoeuvrable and adaptable to space-saving configurations. Available in models ranging from 160kW to 300kW in a single boiler, the units are easily cascading to give huge outputs with the smallest of footprints.



- Rendamax has upgraded its R3400, 3500 and R3600 EVO range of boilers. Ranging from 600kW through to 2058kW, these Class 6 NOx boilers give large outputs with extremely high efficiencies.

Fortes Heat Interface Units

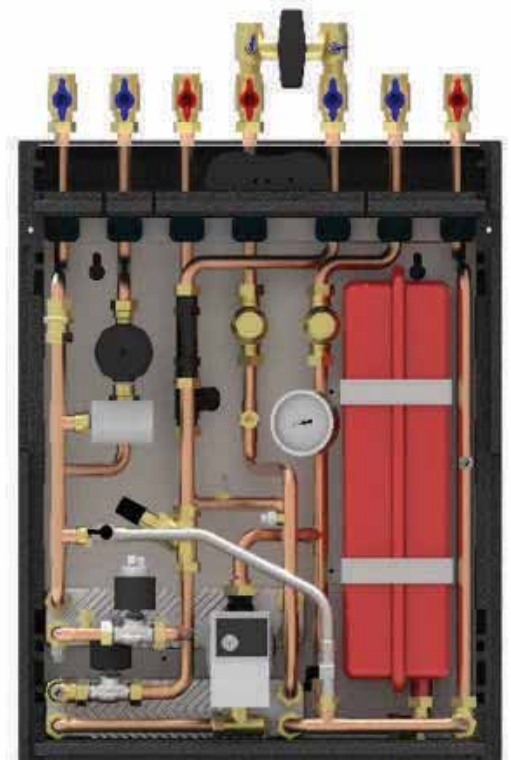
Fortes Energy Systems is a company that was founded in 1999 and has since grown to an internationally-operating producer, supplier and partner in the construction and installation sector that guides and advises on energy issues and sustainable solutions

It offers a vast product portfolio, ranging from district heating scheme substations through to individual heat interface units for consumer properties.

Euro Gas has delivered the AquaHeat Arctic 420 twin plate HIU from the Fortes Energy Systems portfolio to a number of student accommodation projects in Dublin where it has proved especially successful.

The Arctic 420 utilises an electronic control unit which allows for optimisation of the heat network efficiency using:

- Frese Pressure Independent Control Valves (PICVs) for self-balancing flow;
- Fast-acting regulators to immediately respond to changes in energy demand.



Design of M&E needs greater emphasis on buildability

Jim O’Sullivan

Jim O’Sullivan is Head of Mechanical and Electrical Services in the Office of Public Works (OPW). He has worked for most of his career with the organisation, which has a large and varied property portfolio, including everything from laboratories and data centres to offices. He has extensive experience in the full life-cycle of buildings, new-build design and construction, maintenance, and deep refurbishment. As an organisation, OPW faces many challenges delivering a quality service within budgetary constraints and public sector rules. Mechanical and electrical services are central to all this in making buildings work for people and processes.

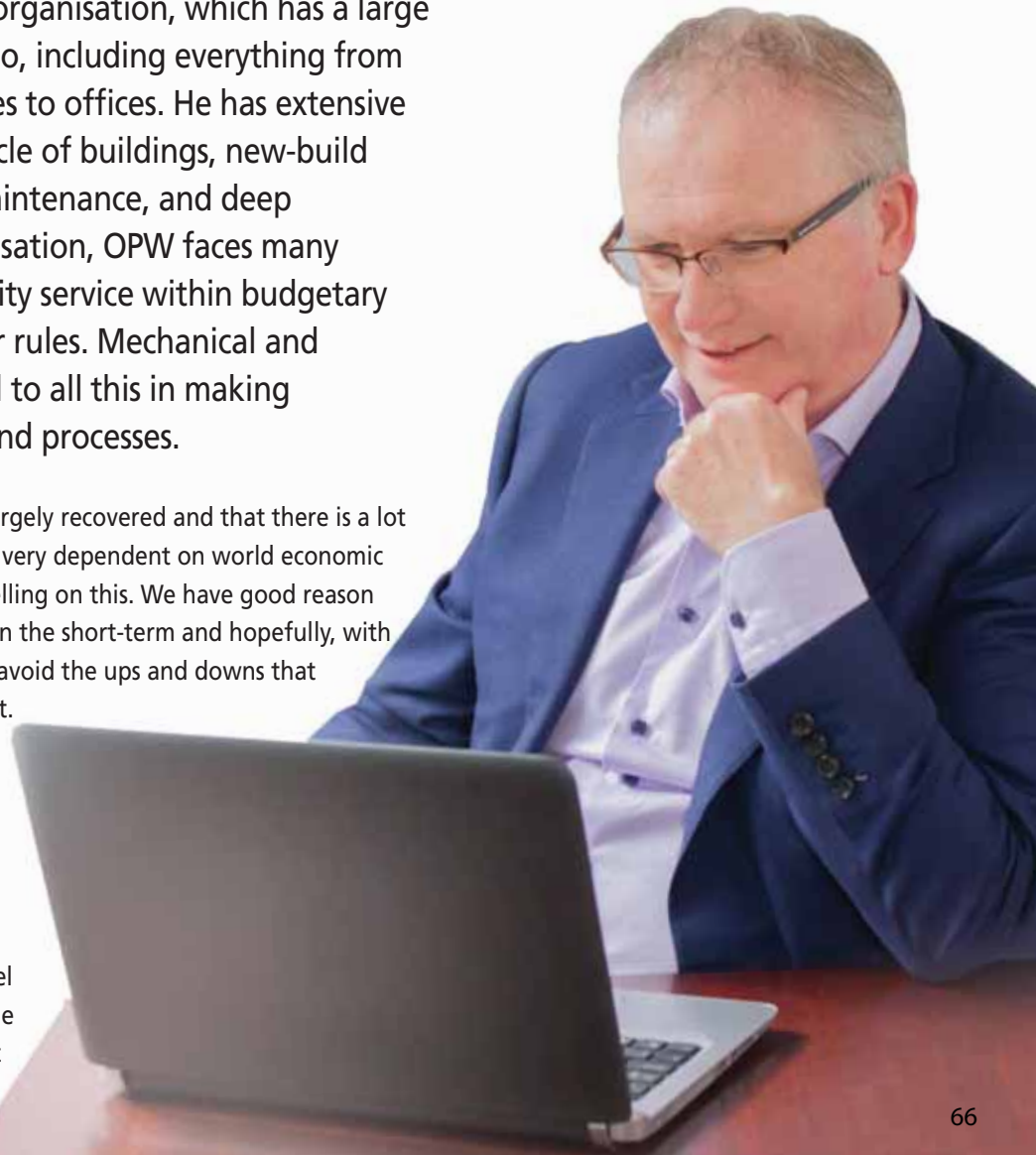
It is great that our industry has largely recovered and that there is a lot of activity in the market. We are still very dependent on world economic trends but there is little point in dwelling on this. We have good reason to think that the outlook is positive in the short-term and hopefully, with some degree of planning, we might avoid the ups and downs that have affected the industry in the past.

Even with the current level of activity in the market there is a squeeze on resources and a shortage of experienced people which will continue for some time. There are segments of the industry which still have to get back to a reasonable level of investment and I would include the State in this. The State sector has not been a big investor in buildings over

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the last number of years, maybe with a few exceptions. Unfortunately, the State spends when everybody else is spending – when tax income is high – and cuts back when the market slumps. As the economy continues to improve the State will invest more in buildings. There will also be other investors in the industry feeding the demand for buildings. We should plan for increased activity.

I see the mechanical and electrical sectors of the construction industry as being particularly strong, in both capacity and capability. The investment in complex industrial projects, mostly from foreign direct investment, has had huge benefits for the industry. In this respect the mechanical and electrical sector is central to the development of the country as the work undertaken is so important to our economy. Once investment decisions are



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made the delivery horizon is short and so we need to be able to deliver on time, and for a reasonable cost.

The larger contractors have made very significant advances in productivity through investment in people and processes. This has led to a trickle-down to other parts of our industry, including to the likes of the commercial and State sectors. Although there has been progress in all these areas, there are still significant improvements that could be made. There are the limitations set by the commercial realities though. In many instances the client is unwilling to pay more for the longer-term benefits ... the reality is that it is still a very competitive market.

The mechanical and electrical content of projects has grown in both complexity and relative volume terms in nearly all of the built environment. Regulatory change, BCAR and NZEB, for example, is good for consulting engineers and construction in general. These changes should drive improvements in the quality of our buildings and deliver real and sustainable efficiencies.

Oftentimes change involves a host of stakeholders and this can lead to frustration and a sense of helplessness. However, let's concentrate here on a few things that are in the control of the mechanical and electrical industry, the CIBSE family really, that could and should change as part of the normal progression and improvement. There are many issues and challenges but, for the purposes of this article, let's just take three:

- Designing for low energy;
- Improving design to reduce on-site labour inputs;
- Improving cost control.

Designing for low energy

The design of low-energy buildings requires the earliest involvement of the building services designer in the whole design process. It requires the

engineer to have the knowledge and expertise to advise on options. I had great hopes with the introduction of NZEB that there was a new opportunity for engineers to contribute much more to the building design in terms of energy and other aspects. Unfortunately, from what I have seen recently I am not convinced that we have grasped that opportunity.

I had envisaged a significant step-change but that has not materialised. The basic knowledge and understanding of the requirements, and the necessity for the design engineer to feed into the design process, is not evident in many cases. As an industry and as a professional group we need to intensify our efforts to rectify this. Of course there are exceptions, where some have invested in training and the development of their people and systems, but much of the design fraternity needs to step up to the mark. CIBSE and other professional organisations have a central role to play in this.

That said, the construction industry in general has made significant strides in building more efficiently in recent years. It is worthwhile also to recognise the work Lean Construction Ireland and the CIF plays in furthering training and development in this area. The much-talked about BIM is certainly making an impact and it is worth considering how the mechanical and electrical industry might change to get the best out of all this.

My premise is that the design of mechanical and electrical services needs to be done with a greater emphasis on buildability, that contractors are given the opportunity to detail and plan the construction with the purpose of moving more construction activity offsite, and that this process is done with better certainty on costs.

Awareness of buildability

In terms of the design there is no huge change needed, provided of course the design is completed according to the normal terms of engagement. Unfortunately, that is not always so. This is not a criticism of designers but rather just a statement of the reality ... many designs go to tender which are not as detailed as they should be. Raising awareness among designers of buildability is a big challenge.

The main change for contractors is that, having arrived at the position of preferred bidder, they are given some time to develop the design sufficiently to allow for early ordering of equipment, and for planning to do a significant proportion of the installation offsite.

In all this the development of the BIM model is largely with the contractor. The designer may provide the basic model but it is not practical for most design firms to gear up to provide a model that is sufficiently detailed for construction purposes. The skillset is not with the designers at present. While it is with some contractors. it needs to be with more.

There is nothing earth-shattering in all this. The designer does a decent job of the design and the successful contractor is given sufficient time to take the design and develop a BIM model so that large parts of the installation can be manufactured offsite. As an industry we have to clearly define this process for ourselves. If we do not do it then others may impose something that is not the most efficient and may not align with the skillsets and other practicalities in our industry.

Some would say that there are procurement processes which encourage efficiencies, such as the design build (DB) model or the guaranteed maximum price (GMP) contract. I have no direct experience of the GMP approach but have lots

of DB experience. It might be a subject for another article but, in summary, in DB there is simply too much uncertainty in the contract to ensure any reasonable quality. More particularly for the mechanical and electrical industry, we are too far down the chain in most contracts to be able to have any meaningful input or control over the process.

Thankfully, the industry is moving back to the more traditional model where the employer provides the design, the specialist mechanical and electrical packages are separately tendered, and then the best applicant is appointed into the contract. It is within this scenario that I believe there is room to tweak the process in order to gain efficiencies.

Bills of quantities

Finally, the mechanical and electrical industry is not good on bills of

quantities and this affects cost control in projects. I doubt if any quantity surveyor will read this but only a very small complement of them are in any way competent in the production of mechanical and electrical bills. That said, there are probably more of them competent than there are engineers. I see the lack of expertise in this as a very serious shortcoming in the industry.

I also think that the existing agreed rules of measurement are not reflective of the way mechanical and electrical work is priced. Engineers representing the client need to be competent and have the tools to control costs. This requires design firms to take control of the pricing document and that requires an expertise in the production of bills. It also requires our industry to revise the current rules of measurement. Again, this is

entirely within our control so there is an opportunity to simplify the measurement. This will save on tendering costs and provide improved cost control.

Conclusion

The mechanical and electrical construction industry lacks a forum to tackle issues such as the examples above. Last year the CIF and ACEI mechanical and electrical groups had a joint conference, which was well attended and very worthwhile. We should consider a more permanent and structured forum – drawn from the clients, designers and constructors – to progress improvements in our industry. We should take more control of the direction we need to travel. Ultimately, everybody benefits from better and more efficiently-built buildings and we can work together to do that. ■



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Ciara Ahern

Ciara Ahern, Head of Building Engineering in DIT, is passionate about inspiring others to reduce the energy consumed by our built environment and is published widely in the area. She is also a member of the admissions and registrations board of the Construction Industry Register Ireland (CIRI).

Human beings are reported to spend 90% of their time in buildings.^[1] Human beings use energy, therefore it is not wholly surprising that buildings, at 41%, are the largest end-user of energy, followed by transport (32%), and industry (25%). Together they account for 36% of CO2 emissions in the EU.^[2] Building engineers are therefore at the vanguard of the battle against climate change, responsible for creating comfortable environments at the lowest energy cost for the betterment of society, and the well-being of people. So, how is it that the role of the building engineer is not inherently and generally understood by society at large?

As a group of professionals, we don't carry a brand that generates an association with our role in society, certainly when compared to architects,

doctors and barristers, for example. Simply put, society at large is not aware of us. This may be because we are called by many different names. The *lingua franca* globally for our discipline is "Building Engineering" (Australia, India, Canada, Africa). In the US we are called "Architectural Engineers".

In the UK and Ireland we are called "Building Services Engineers" by our respective societies, yet we tend to call ourselves mechanical or electrical engineers or simply M&Es.

Why is this a problem?

It is a problem because "brands" (components of which include identity, voice, style, mission, attributes, etc) increasingly influence human decisions and especially purchasing choices. Choosing a career is no different in this respect.



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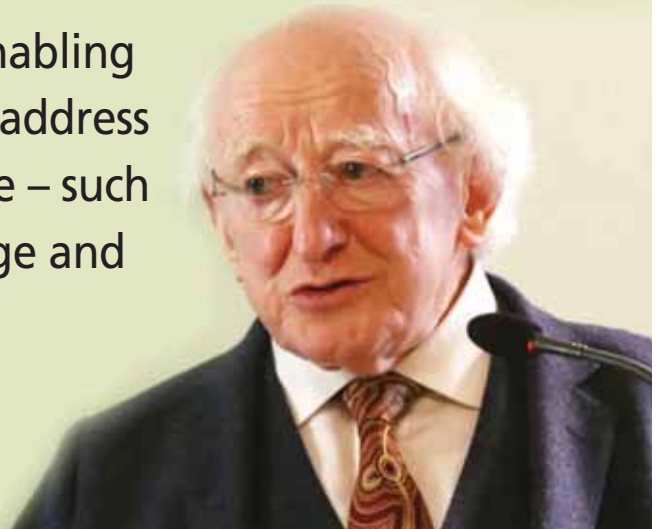
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Good Thinking

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“The role of the university in enabling citizens to develop the tools to address the great challenges of our time – such as global poverty, climate change and sustainability – is vital.”

**President Michael D. Higgins
(2016)**



Research by Professor Brian Bowe of DIT finds the primary influencers of students in their choice of programme of study to be teachers, not career guidance teachers, but maths, engineering, construction and science teachers. The secondary influencers are parents and other family members (and then, to a lesser albeit important extent, it is friends/peers). This research is borne out with our experience on the ground where traditionally students choosing to study building engineering have come to know the discipline through a family relation working in the industry (in my case it was my father).

Our organic reach of influencers has sustained us until now but is not viable in the noisy, highly-competitive, market-driven higher education landscape of today.

Student choice of college course correlates strongly with labour-market trends. Notwithstanding the current recovery of the construction sector, student course choice trends tend to lag boom/bust cycles. As shown in Figure 1, the number of students choosing building engineering therefore tracks, but lags, the boom/bust cycle of the construction industry.

<https://arrow.tudublin.ie/bsn/vol57/iss5/1>

The collapse of the construction sector in the mid 2000s saw students shun courses associated with construction, and certainly those titled with “building”. The low student numbers that resulted became self-reinforcing, thus stymieing internal word-of-mouth marketing efforts.

Analysis by DIT predicted that if the market was left to natural forces, it would be 2022 before student numbers recovered their peak level of 2009/10. Thus, in October 2016, using expert input from the marketing school in DIT, we embarked on a journey to find out (a) why we were not attracting students into building services engineering in greater numbers; (b) whether we had a problem with the external perception of our programme; (c) the key influences of student choice; and (d) what we could change to enhance the attractiveness of the discipline.

One of the issues identified as needing to be addressed was the course name, aka the brand. “Building Services Engineering” has been used since the course(s) inception in the 1970s and what it seeks to describe has evolved from a relatively unglamorous “pipes,

ducts and wires” paradigm to today’s leading-edge discipline within a hi-tech digitised global construction sector.

In early 2017, DIT carried out a high-level review looking at the perception of the name “Building Services Engineering”. The word “services” was redolent of general property repairs/janitorial services in the minds of those tested, while also giving the impression that the discipline was somehow narrower or more niche than other engineering disciplines, e.g. mechanical engineering.

Today’s students who wish to keep their options open for as long as possible tend to avoid specialising early in their education career, so their perception of the building engineering “brand” was hindering recruitment efforts. Thus, in September 2018, we retitled our course Building Engineering, placing us on par with other engineering disciplines (civil, mechanical, structural and chemical which have no tertiary qualifying word in their title). This allowed us market the discipline more broadly.

Having retitled, the next step was to engage students and their influencers, the main challenge

being how to reach them? Each require a different, but targeted, approach to communication.

Research suggests that career-decision choices are made by boys around age 14 and, if we wish to alleviate negative perceptions of engineering by women, we need to influence girls before they turn 11 years old (before their transition to secondary school and choice of subject solidifies the gender gap^[3]). Thus, if we are to see sustainable growth in the number of students choosing this profession we need firstly to increase awareness, and secondly understanding, of the role of building engineers among secondary and primary level students.

Today's 12 to 18 year olds (Generation-Z) are socially minded, self-reliant, digital mavens who do not consume print media or watch television (in the traditional sense). For them something like 80% of media consumption is via a mobile phone. Video consumption (YouTube) for this generation is also huge.

To engage this cohort we need to consolidate a coherent brand vision and USP for our discipline. This needs to be prepared in the

context of the generational qualities of our prospective audience (students and parents/ teachers). We need to create on-message informative marketing collateral that conveys the broadness, opportunities and benefits of our profession to society and human well-being. This material needs to be promoted via a dedicated digital presence using social media activity around events to build reputation and more awareness.

This costs money!

High unemployment rates during the recession saw higher than usual numbers of people returning to education (+24 % between 2008 and 2015). This trend coincided with a decade of cutbacks in state funding (-34 % between 2008 and 2015). While the Institute of Technology (IoT) sector responded to the needs of society, it has reached crisis financial levels (deficit of €9.7 million predicted for 2018/19) in doing so.^[4]

IoT sector is effectively broke

With no financial resources available internally, DIT approached industry seeking financial support to create marketing collateral to

promote, and frankly save, the course from suppression.

Thankfully, our industry readily got behind the programme with 24 companies so far donating a total of €111,000 to DIT's philanthropic body, *DIT Foundation*, for this specific purpose. DIT is profoundly grateful and heartened by the willingness shown by industry to support this initiative.

A dedicated steering group of industry and academic representatives (breadth of expertise and gender balance were key considerations) was formed to govern the disbursement of funds. Over the 2017/18 academic year the steering group oversaw a spend of €73,000 on a three-phase marketing campaign (tied into key CAO milestones) that included digital, radio and PR campaigns. Video collateral was created, along with website collateral and a dedicated YouTube channel. While it will take at least three years for the results of our efforts to be realised, the immediate objective of the steering group in Year 1 was to reverse the continual decline in students opting to study building engineering. Referring to Figure 1, we are delighted to report that we

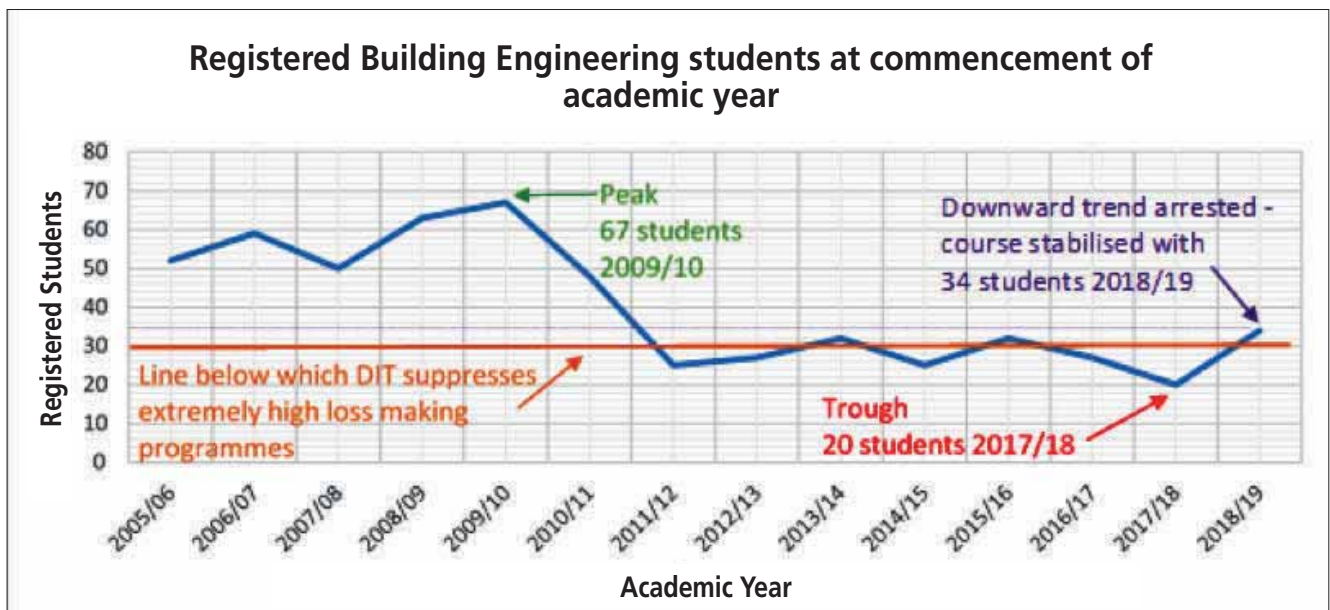


Figure 1
Published by ARROW@TU Dublin, 2018

have filled and stabilised our programmes for this year.

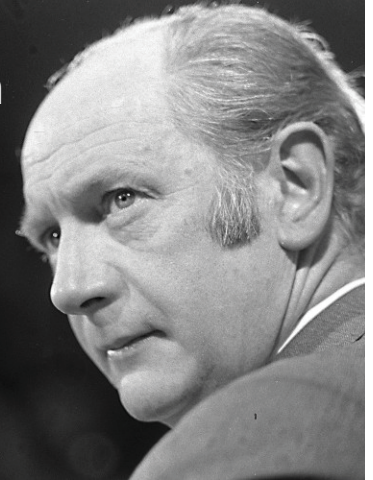
While we have reversed the decline, we are still by no means out of the woods. With most students looking to a Level 8 higher degree, the Level 7 (formally diploma and now ordinary degree) market is a cratering market. Encouragingly, within the College of Engineering and Built Environment in DIT, the Building Engineering programme is the *only* Level 7 programme to show a concurrent increase in points (+ 10) and student numbers (+ 250%) in 2018, although it must be acknowledged that we started from a critically low base-point.

Boding well for the next academic year, our social media platforms recorded a high level of engagement by younger second-level students who will be entering the CAO market within the next couple of years.

We are very focused on maintaining this very positive momentum. To ensure continuity of works, DIT has drafted a request for a public tender to be published in September. Some key missions will be to employ a specialist agency to (1) brand our profession, identifying our core values and our unique selling points that will appeal to male and female students; and (2) design a three-year phased strategy that seeks to engage latter-stage secondary level students but also early-stage second level students, and then primary level (Generation-alpha?) students.

Disappointingly, no girls chose to do our Level 7 in Building Engineering this year. When it comes to girls, 82% want a career where they can help people, yet they don't see how engineering can facilitate that.^[5] Building engineering is an attractive option
<https://arrow.tudublin.ie/bsn/vol57/iss5/1>

Former Taoiseach Jack Lynch used to say that it was not that Ireland was too poor to invest in education; it was that it was too poor not to invest in it.



for women and we tend to see a proportionally higher number opting for this discipline from our common (Level 8) engineering second year. The strategy created will include development of marketing collateral aimed specifically at girls. Once created, we need to engage with fantastic school outreach programmes such as STEAM (primary), STEPS (secondary), and iWish (girls), to help get the information to our audience.

Investment in education is investment in the future. In the 1960s the then Taoiseach Jack Lynch used to say that it was not that Ireland was too poor to invest in education; it was that it was too poor not to invest in it. The same rationale applies to saving the building services engineering courses across Ireland. Due to concerted petitions from industry (as represented by Seamus Homan and his fellow industry colleagues), the first course was pioneered by DIT in 1974.

The same cohort of people moves around the industry ... from consultant to contractor, from contractor to main-contractor, from consultant to specialist supplier etc. This pipeline of talent is critical to the sector as it affects all stakeholders and at all levels of the value chain.

Neither are regional education providers in competition with one another. Rather, we are all in the same boat and a rising tide will float us all. Thus, while this particular initiative is led from Dublin's soon to be Technological University, the steering group is acting for the sector as a whole and one would hope that programmes across Ireland will be revived.

Together we have achieved a great deal, but there is more to accomplish. It is only by coming together for the good of the industry, and ultimately for the good of society, that we will realise our professional potential. ■

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Looking ahead to the next 50 years of building services we can be sure that ...

THE FUTURE IS DIGITAL

Hywel Davies

Hywel Davies is Technical Director of CIBSE. Before joining CIBSE Hywel worked for many years at the Building Research Establishment. He is responsible for managing the technical activities of CIBSE, and is closely involved in the development of legislation relating to energy and buildings.

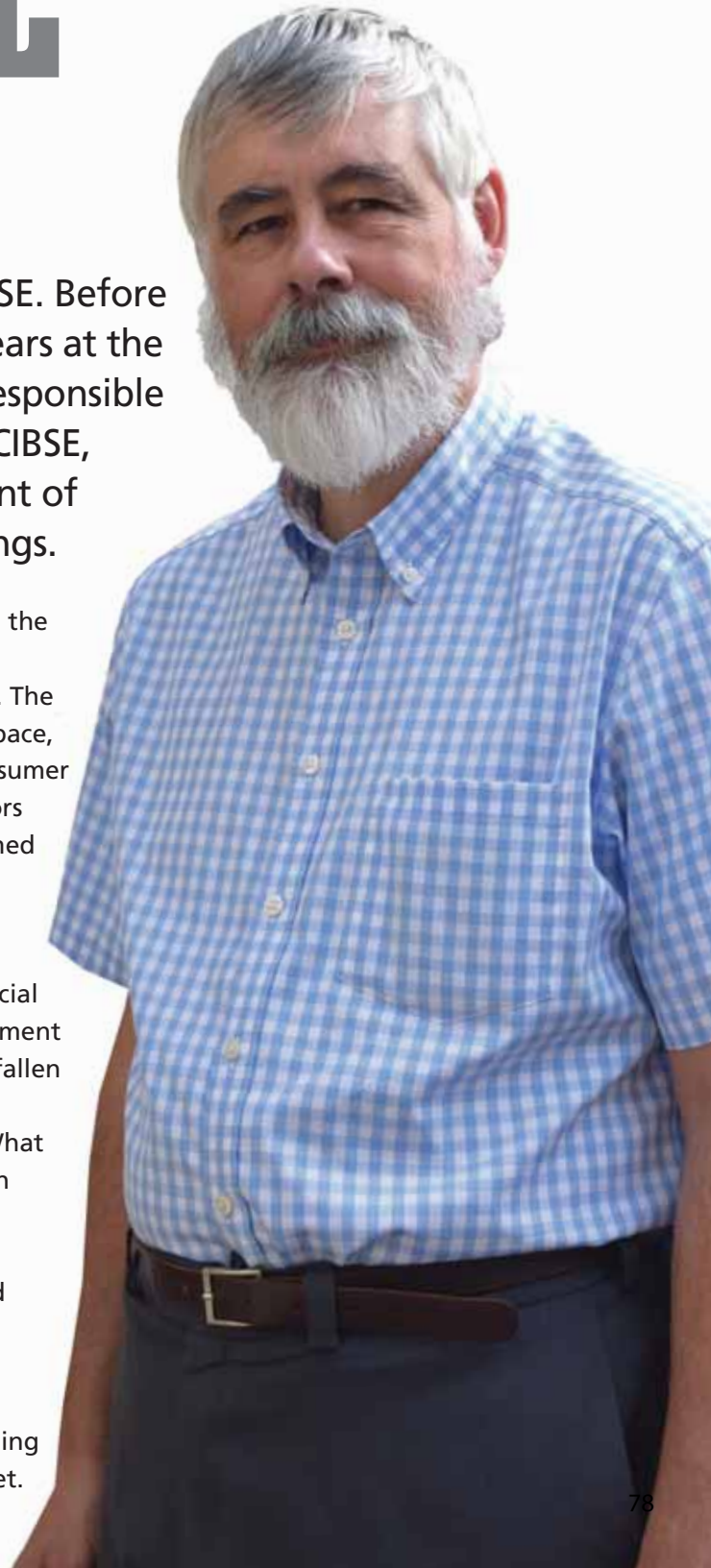
Building services, construction and the built environment have changed dramatically over the past 50 years but, what might the next 50 years hold? Can we identify some of the likely trends that will continue to change the way we work and the assets we deliver?

In 1968 calculations needed slide rules and log tables. The 1970s saw scientific calculators, the 1980s personal computing and in the 1990s something called the “internet” emerged. Around the millennium mobile phones and computing emerged, and since then internet-based activity has transformed the economy. So, what might the next 50 years hold for CIBSE in Ireland.

We are living through the <https://arrow.tudublin.ie/bsn/vol57/iss5/1>

digital revolution, in the throes of rapid and accelerating change. The process plant, aerospace, automobile and consumer manufacturing sectors have been transformed by the adoption of digital technology, robotics and early applications of artificial intelligence. Employment in these sectors has fallen dramatically and productivity risen. What could that revolution mean for the built environment, for building services and for CIBSE and its members?

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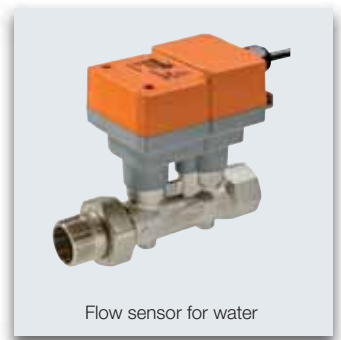
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As we look ahead to the next 50 years of building services, we can be sure that the future is digital. Exactly how that digital future will develop is more uncertain and will keep us on our toes for many years to come.

The world's largest hotel company and taxi firm do not own cars or buildings – their dominance is built in cyberspace and relies on their digital systems and processes. Retailing is convulsed by a move from physical markets to the cloud, as logistics providers track deliveries and drivers remotely in real time to deliver new levels of customer service.

So what about building services? A 2016 report by the World Economic Forum identifies construction engineering as the last major industry sector to embrace the digital revolution. At its best our sector delivers outstanding success: the high-speed channel tunnel link, the refurbishment and extension of St Pancras Station and the 2012 Olympics projects all show what can be achieved. CIBSE also regularly recognises projects that deliver exceptional performance through our annual Building Performance Awards, and of course, this year's inaugural CIBSE Ireland Awards. However, that has to become far more the normal outcome, and not an exemplary exception.

The recent announcement that the opening of the new Crossrail service in London, the Elizabeth Line, is delayed by nine months due largely to the challenges of integrating the new signaling and software systems shows the scale of the challenge we face in delivering complex, software-dependent projects.

While we have an array of software to support design, construction and operation, the overall digital picture reflects the overall characteristic of the sector – fragmented, often adversarial and not very collaborative. That is changing, and the pace is hotting up.

In the world of BIM (Building Information Modelling) – which perhaps with hindsight should have been called AIM (Asset Information Management) as this far more accurately reflects what it is all about – we are about to see the launch of new international standards. *ISO 19650-1 BIM Concepts and Principles* and *ISO 19650-2 BIM Delivery Phase of Assets* are due to be published before the end of the year, and to be adopted by CEN as European Standards. These will be followed by further

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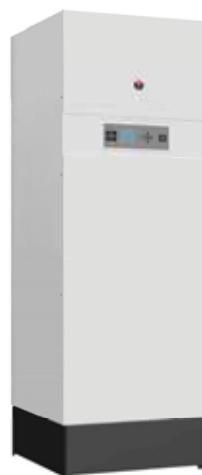


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standards covering the operational phase of the asset and security aspects of information management in a BIM world.

These standards will help to drive the wider adoption of collaborative information exchange through the life of built assets. In the UK this is timely. The recent review of building regulations and fire safety, part of the response to the tragic fire at Grenfell Tower, highlights the need for a “golden thread” of information, a digital asset model to be passed down through the life of a project, to ensure that asset operators and managers know exactly what they have to operate, maintain and manage.

Many property managers around the world want to take advantage of digital technology to improve their ability to deliver the buildings and other constructed assets that their clients require, and to understand the performance of their buildings and those who deliver, operate and maintain them.

Nor is it just about BIM. We must broaden our view and ask how digital tools and technologies will revolutionise our sector, and how we are preparing to respond to the changes. Ride-hailing apps have transformed the mundane business of providing taxi services. Other software platforms have changed the way we travel and book our accommodation, whether for business or pleasure. Other leading digital businesses are looking to use their data analysis skills and tools to break into the buildings and construction world and digitise it, and us.

We need to think about the potential of artificial intelligence
<https://arrow.tudublin.ie/bsn/vol57/iss5/1>

to replace routine and mundane roles in professional services, in the legal, accounting and financial sectors. They are first in line in that particular advance, but routine building services design will not be far behind. Some larger practices already use software tools that automate routine design tasks, reducing their costs and releasing skilled engineers and technicians to do more valuable work. Again, this trend will accelerate in the years ahead.

Multinationals run global design centres using lower-cost regions to deliver design activity for projects around the world, sometimes enabling work on a project to continue 24 hours a day, with core data stored in the cloud and access from wherever in the world the current design shift is working. How will this affect the smaller consultancies and how might they respond to this trend?

Digitisation will also change relationships with our clients. More extensive monitoring and analysis of performance data, often automatically, will challenge the supply chain over the performance of what we build. Data and analytics will help enable performance-based specification and procurement, exposing the sector to a spotlight on the performance of the systems we design, deliver and operate.

There will be increasing focus on digital records of buildings, including what they contain, where things were made, how often they need maintaining and standard maintenance schedules. This will challenge manufacturers to deliver the data clients want, not just what regulators say must be provided

to comply with minimum health and safety requirements. If a global property manager says it will only buy ventilation or air conditioning equipment that comes with full maintenance schedules in a format that they can import to their asset management system, it will be a courageous manufacturer who says “sorry, we only provide the data required for CE marking, in any format you like as long as its XML!”

Talking of HVAC equipment, we will see an evolution in refrigeration as we move into a lower global warming potential world, while an increasing proportion of that world wants air conditioning and refrigeration. So we will have to embrace new refrigerants and new protocols for use and maintenance. As with the digital revolution, the pace of change will accelerate, and the two trends will intersect with more stringent monitoring and data collection for refrigeration systems coming into effect in future.

These trends will also change the skills and knowledge needed in the sector, where we seek new staff and how we train them. For CIBSE they will also generate new demands for the knowledge to support those who have to adopt new tools and techniques, and to work in new ways. We need to be alert to identify changes and agile in our responses, which are easier to say than to deliver.

As we look ahead to the next 50 years of building services, we can be sure that the future is digital. Exactly how that digital future will develop is more uncertain and will keep us on our toes for many years to come. ■

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