CIBSE Presidential Address 2014

Engineering a sustainable built environment

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“There has never been a better time to be a building services engineer!”
Honoured guests, ladies and gentlemen, we live in a rapidly changing world. The climate is changing; people are living longer; world population is increasing; resources are coming under ever increasing pressure; power prices are rising; and the world is shrinking. There has never been a better time to be a building services engineer!

Let’s start with that shrinking world. I stand before you this evening as the first “international” (i.e. based outside of the UK and Ireland) President of this Institution; however this fact should not come as such a surprise. Ten years ago we had banners made for a local Melbourne exhibition proclaiming 17,000 CIBSE members across 40 countries: we now have over 21,400 members, spread over 98 countries. Almost 30% of our membership lives and works outside of the UK.

CIBSE has come a long way in the 27 years since my home country, Australia, became a Region and remains very committed to continuing to improve the depth and relevance to its international membership.

Today, I would like to share my views with you on the challenging, exciting and vital role that our profession and our Institution should play in this rapidly changing world.

With the environmental uncertainties, threats from climate change, and the constraints presented by economic priorities and socio-political inertia, we need to be at the top of our game if we are to make big improvements in both the design and the performance over the operating life of the built environment.

We must be grounded in reality when proposing new solutions, avoiding “greenwash” while taking a genuine whole-of-life approach to both the new and existing building stock. We need to maintain and develop the professional knowledge which CIBSE provides, and enable the global CIBSE family to both use and contribute to that knowledge.

Sustainability and the cost and security of energy

Sustainability is an issue that I am sure is front and centre amongst most of you, and it knows no natural borders or lines drawn on a map. The initiatives that we can take to address it in one location can be transferred elsewhere. Closely related to this issue, and also borderless, is energy and if we look at the big picture of future energy supplies we are confronted by multiple challenges.

On the demand side, we have explosive world population growth, coupled with rapidly growing middle classes in developing nations, all rightly striving for a higher standard of living, and driving an enormous growth in energy consumption.

On the supply side, we appear to be facing a rapid decline in the production of oil and, in the foreseeable future, gas. Coal is still in abundance but it comes with significant environmental consequences.

The nuclear option is there but the accompanying health and safety and waste disposal issues make it a difficult option to implement. Besides these considerable obstacles, it also has the weight of public opinion against it, fearful of both the potential immediate effect of a system failure and the
insidious nature of the resulting after effects.

Renewables currently only play a minor role in the provision of energy; however this is growing and should be encouraged.

These factors make decisions affecting the future supply of energy very interesting and critical; energy has been a key issue in recent elections in my own country and in Germany, as well as being the subject of political debate in the UK.

What this very brief snapshot of energy supply tells us is that it will require acute and even visionary management both to encourage energy efficiency and to fully commercialise effective alternate sources of power, not only just to meet future demand but also to control and reduce the carbon emissions that threaten our very future.

I don’t pretend to have all of the answers but I do know that it will require a partnership between government, the community and relevant professionals, such as us, the world over.

Of course, closest to our hearts and of immediate relevance is the fact that buildings and their services play a very large part in a nation’s energy consumption and the resulting carbon emissions. Buildings are responsible for approximately 40-45% of aggregate energy demand. Delivering significant cuts in this demand and balancing the economic and the environmental imperatives will require very careful management.

This may seem out of the realm of our control, but we all have a voice, and if enough people shout, others will listen. Our Institution has the knowledge to deliver significant improvements in energy efficiency without compromising building performance. The urgency of acting on this now is that damage being done to the environment now is going to take many years to mitigate. The recent report from the Intergovernmental Panel on Climate Change underlines the degree of scientific consensus about the scale and urgency of the task we face.

Finally, sustainability has a social dimension. To address these issues effectively we must attract a wider and more diverse range of people into our global professional and Institutional family, and to continue to support our younger engineers as they develop into the next generation of CIBSE leaders.

Avoiding the “greenwash”

So what should be our role as engineers in this changing landscape? In my opinion, part of our role, is that while we push ahead with improving internal comfort and energy efficiency, embracing alternative and new
technologies, and encouraging governments and the public to do more, we have a duty to keep our feet grounded in reality.

Industry relies on engineers to provide a true and fair view of all aspects of engineering, so we need to maintain that balanced view, cutting through the hype that accompanies many products and systems and evaluating their real worth, and even more importantly, where they are appropriate and where they are not.

I have seen many products claiming huge benefits to energy efficiency or the environment, but when looked at in more detail deliver very little and sometimes they can do more harm than good. Some are incredible, such as using a fan to drive a wind turbine to give back “free” energy. How does anything like this get off the drawing board let alone through the production and marketing stages?

I was at a large HVAC exhibition recently and was surprised at how many products displayed special exhibition labels marked “Green Product”. One such item was a water pump, so I looked more closely to see if I could work out what the initiative could be. The truth was that someone walked around the exhibition stands with a wad of labels asking who would like one. So why did this pump deserve a label? Well it was very apparent afterwards, it was because this pump was painted a Kermit the Frog shade of green!

There are, of course, many great examples of true innovation that are underpinning the drive to greater sustainability, and I am sure you can all think of examples in your local cities. Some of these also have features that do not necessarily make economic or practical sense.

Improving building performance

We have a landmark building in Melbourne, known as Council House 2, or CH2, it was built about eight years ago and was featured in the CIBSE Journal. The project incorporated many tried and tested initiatives such as special provision for natural daylighting, the incorporation of usable thermal mass, a high performance façade and the provision of shading. It also included many other less tried and tested features such as shower towers, black water recovery, phase change materials, micro generation with an absorption chiller and wind turbines. The project was used primarily as a demonstration of all things possible rather than practical, and I am more than happy with that philosophy. In fact I applaud those amongst us who are able and willing to experiment and to push the boundaries.

Unfortunately, and as expected by some, despite having a lot of the smarts, the results of performance monitoring have shown that this building has not lived up to its lofty aspirations. The building’s owners have always been open about the buildings successes and failures and are planning control changes and upgrades to improve its performance.

It is critical that our profession ensures that the promised benefits of measures that we incorporate into a building’s performance are delivered. If for some reason they are not, then we must investigate the reasons why not and then share the lessons learnt so as to improve our collective knowledge base. We have an obligation to ensure continual improvement and to minimise the repetition of the same mistakes.

I believe that everyone here this evening is committed to providing a
better built environment. Whether we are building services engineers or if we have another role, most of us directly influence the planning, design, construction, commissioning or operation and management of our buildings.

For those of us that are involved in the design or construction, we should be aware that most commercial buildings have an expected life of over fifty years and a large part of the inefficiencies built into a building’s design now will stay with the building for the rest of its life. I am sure none of us want to hand down an unnecessary legacy of poor performance to the next couple of generations.

So how can we ensure that buildings continue to improve and how can we accelerate performance improvements? I believe that it requires a mix of mandatory and voluntary measures. Measures that address the differences between the public and private sectors, and given the difficulties of providing motivation and rewards to both landlords and tenants, the unique challenge of multi tenanted building stock.

Governments, besides directly and indirectly owning and occupying a large number of buildings, control the codes and regulations in our industry and therefore they naturally have a big part to play in actively planning for the future, in cooperation with industry and professional institutions. While recognising the economic reality under which building owners and developers operate, and the expected lifespan of a building, there needs to be mandatory and economically justified minimum standards which are subject to periodic review.

Through their regulatory control, governments have the power to mandate for more efficient buildings. It is imperative that these measures are clear, unambiguous and enforceable, and not left open for intentional or unintentional misinterpretation. Again, this is a balance between the up-front cost of construction and the cost of operating and maintaining that building. As new technology improves in energy efficiency whilst decreasing in capital cost, and energy prices continue to rise, the economic balance point changes making more measures viable. This encourages a more regular review period, however this in turn brings in another aspect that needs some balance, the market needs confidence that the target is not going to be constantly moving, but subject to regular, planned review. I suggest that this should currently be every three to five years.

For mandatory efficiency measures to become the norm, they need to be enforced and checked for compliance. Some countries have several compliance checks, certifying the design, the installation and then going forward, reviews of the existing buildings. Self-certification must be carefully and constantly monitored; otherwise it can blur compliance and dilute the intended outcomes.

In terms of voluntary measures affecting building performance, in Australia we have had two main sources - a suite of rating tools under the Green Building Council’s auspices, and a rating tool administered by the New South Wales government gauging emissions caused by the use of a building.

These have inspired a huge change, particularly over the last ten years, in raising the quality and energy efficiency of buildings. Perhaps greater than the immediate effect on the actual buildings is that they have also raised the profile of building services to other professions and to the interested public.

The Green Building Council’s Green Star rating scheme has an extensive range of tools aimed at different segments of the construction market from educational facilities through to shopping centres, but it has predominantly been used for its office design rating tool. This tool is much wider than an energy rating tool and looks holistically at how a building impacts the environment, aiming to make both its construction and use more sustainable. It has been widely adopted and few commercial offices are built today without assessment, either formally or informally, of the star rating.
NABERS is the other main rating tool that assesses the greenhouse gas emissions of existing buildings; it can also be used to assess water usage and waste. It provides a normalised rating so that similar buildings are able to compare how they are performing against each other. It also provides a means whereby a base rating, or a tenancy rating, or even a whole building rating can be provided. This goes someway to mitigating the effects of a bad landlord or a bad tenant negatively skewing the resulting rating. An official rating can only be achieved when the building has been in use and occupied for a full year and has full disclosure of all energy used in that period. A large part of the existing commercial office market had already voluntarily adopted NABERS before it recently in part become mandatory. The mandatory component requiring all office buildings over 2000m² to have a NABERS rating as part of their Building Energy Efficiency Certificate, before being offered for sale or for lease. It offers valuable insights for the introduction of Minimum Energy Performance Standards in the UK in 2018.

In the pursuit of greater levels of energy efficiency and higher ratings, we should never lose sight of the main purpose of having building services, which is to provide the occupants with a healthy and productive environment. The need to focus on building performance is already recognised by CIBSE in our annual awards but leadership in building performance will be further highlighted by our CIBSE Conference and Exhibition in October

**Whole-of-life building performance**

Of course everyone here tonight appreciates that a high performance building starts off with its shape, orientation, and façade design. Whilst there are some excellent examples, it is disappointing that there are still so many significant buildings being constructed with few, if any, passive measures to reduce the heat loads. Managing those loads with energy using systems will incur a cost, and almost certainly a rising cost, over the whole life of the building. We cannot continue to divorce design and construction from operation.

A whole-of-life approach to building performance requires us to consider the ongoing management of a building’s services. There needs to be a level of synchronicity and co-ordination between the design, construction and operational phases in a building’s lifespan.

Design intent needs to address the intended operational requirements to deliver performance over the whole life of the building. There is also a continuing need to nurture that design intent, which can be lost along the way. A change of design teams, not that uncommon, means there is the potential for items to slip through the cracks and for part of the original design intent to be diluted. Design intent can also suffer when the contractor, who has to find money in the project, attempts to find economies along the way. Some of these economies are good and have no effect on the outcome, but some can have unintended consequences.

Controls are another area where the intended outcomes can go astray, as the interpretation from specification to functional description can leave a lot to be desired. The devil is in the detail, there are so many links between initial design through to operation, and it only takes miscommunication or a misunderstanding at any of these links to affect the overall outcome.

A significant issue can be the complexity of a building’s services and controls, these need to be appropriate to the buildings’ intended use and to the people who are likely to operate the building.
These factors should primarily determine whether the building should employ a more complex control system that could, in an ideal world, deliver greater comfort and energy savings, or a more robust and simpler system.

The former may be appropriate where there is a long-term client with a strong Facilities Management (FM) team. If this is not the case, such as when the building is likely to have a substantial turnover of operators, then as the level of complexity increases so does the probability that things will go wrong and, at worst, for energy efficiency measures to work in reverse. In these cases a simpler more robust system needs to be considered at the outset.

**Changing times**

I have been in the industry long enough to have witnessed a change in the relative influence of architects and builders and the resulting impact on the quality of some buildings. In some cases, value engineering changed in definition from improving the value by finding alternative and better suited solutions to simply reducing the quality and delivering a cheaper and inferior project.

In Australia, this movement of influence from architect to builder took a further step with influence shifting towards the FM team in public-private partnerships (PPPs) or private finance initiatives (PFIs), particularly because many such projects have operational commitments for periods of 25 to 35 years or even longer.

As far as the building of substantial infrastructure projects is concerned I would expect the rise in the use of PPP/PFIs to continue. The financial aspects of paying for a project over the extended period is an obvious incentive for governments to initiate these projects, as are the emphasis on achieving the functional objectives and the accompanying abatement structure. But if PPPs are to deliver value over the whole life, we have to get the design, construction, installation and operation better integrated.

The earlier PPPs were not necessarily very well structured or managed, the result being that a lot of the good intentions of constructing a building built to last, which provided good comfort conditions, a productive environment, be adaptable for future changes, be maintained, serviced and efficiently use energy, were left by the wayside as the design and construction teams either didn’t involve the FM team or chose to ignore their advice and went off to build in the same manner as had been the case for the last twenty years or so. The FM team inheriting a similar building as they had in the past and a golden opportunity to do much better was missed.

However, that was early days and the very fact that there are long operational commitments means that the whole-of-life costs are up for consideration again and are getting much closer scrutiny. Even if a piece of equipment is twice the initial price of its alternative, if it works better, lasts longer, is more reliable, costs less to maintain, or uses less energy then it will be considered.

As with maintenance issues, correct commissioning is so important but has at times been neglected, again I feel that this is changing with a growing recognition that a properly commissioned building is more likely to meet its performance targets in terms of energy and comfort. This is particularly so in large PPPs, where clients are acknowledging its importance and much greater emphasis is being placed on the adherence to commissioning codes, commissioning plans, staged sign offs and witnessed testing.

Contracts appear to be getting more watertight, limiting the ability for contractors at all levels to gain substantial benefits on potential changes or additional works. In the foreseeable future, the largest potential for contractors to make money from their projects will be for them to deliver a quality product but in a much quicker timeframe than has been the norm of the past. The delivery period from initial design concept through to occupation needs to be reduced. The advancement of 3D drawing capability, enabling a much higher level of coordination of services and structure is a big enabler to this, as
is the resulting progression of offsite manufacturing.

Many of the benefits in the adoption of offsite manufacturing are well known and understood. There should be substantial improvements in the level of quality between working on site to working in a factory environment, an increase in productivity, a reduction in health and safety issues, a reduction in waste and of course a quicker installation period enabling the expensive construction period to be shortened. This does however require some adaption from the design team of all disciplines to ensure that the design stage is finished earlier.

In the UK, the Construction Strategy anticipates significant reductions in cost, time, resources used and carbon emissions over the whole-of-life. It sees the adoption of BIM as being a key to this, and CIBSE is very actively working with other professions to deliver integration and contribute to achieving the very ambitious goals being set out by government for built environment assets.

**The elephant in the room**

We know that a large proportion of the buildings that will be here in forty years’ time are here already. We cannot just wait till they’re knocked down to make their replacements better, and so the existing building stock needs to be upgraded. Payback periods on energy efficiency measures are of course longer than on new build, but can still be very clearly justified.

Huge improvements can be made to these buildings and there are many successful examples of refurbishments that have drastically reduced energy usage yet at the same time have improved occupant comfort and productivity. Refurbishing an existing occupied building can be a very expensive and difficult exercise taking a higher degree of detailed planning and staging, particularly given that it often remains occupied with services needing to be kept live and disruptions kept to a minimum. It’s easy to say, but a lot harder to achieve in practice. It can be likened to changing your underwear without taking your trousers off. Think about it for a minute, it can be done, but it’s pretty difficult and far less than perfect. However, if we want to make significant reductions in energy use and carbon emissions, we need to address this challenge.

If some forethought is used during the original design to provide for future adaptability, subsequent changes of use or refurbishments can be made so much easier, better and quicker. Again it is critical to ensure that this flexibility is not compromised during the “Value Engineering” stage. Building some degree of redundancy/adaptability into a building can pay for itself several times over the very first time that substantial works are undertaken.

It certainly helps in the planning and decision process of what to replace, repair or redesign, if there is a detailed up to date report on the building and its services. The resulting planning can then provide for more effective upgrades as existing equipment reaches the end of its economic life, or when a tenant moves out or if the building is temporarily vacated.

Once again, this underlines the very core of my presentation, CIBSE members have a key role to play in maximising the long-term performance of our building stock. Essentially, we need to encourage all players in building design, construction and operation to take a whole-of-life approach to ensure that our buildings continue to provide occupants with a healthy and productive environment.

**A knowledge bank for the future**

Probably the most important role of a modern professional organisation
is to maintain an authoritative and up to date body of knowledge that supports the work of the whole membership. The CIBSE Knowledge Portal has broken new ground in the deliverance of information containing all published CIBSE guidance and is accessible to all of our members, wherever they are in the world, as a benefit of their membership subscription. Maintaining the relevance of the Knowledge Portal is a vital role that our members can play a large part in. With over 21,400 members in almost 100 countries; our membership already possesses a huge wealth of information before we start to consider the rest of the people in the industry.

How good would it be if we could carry the design engineer through the project from initial design until a couple of years into operation? Yes, there is a cost associated with this, but this needs to be weighed against those projects that have not delivered on their promises and have either suffered poor performance for many years or required substantial costs to put right.

BSRIA’s Soft Landings framework is one of several welcome initiatives in this respect, encouraging meaningful early and continued contact between the design team, client and eventual building operators. Not only does this result in a better building, it creates a forum for the sharing of information that can be used in other projects.

In my year as President I aim to achieve three goals, and to put the wheels in motion for others.

As the first international president of CIBSE it should come as no surprise that I would like to develop CIBSE’s influence worldwide. It is so important that CIBSE guidance is relevant not just to the UK market. Good engineering principles that are good here, are good in Australia and New Zealand, are good in China, India and the Gulf Region – they are good the world over. Wider relevance of our knowledge can be a major catalyst in the growth of CIBSE internationally. As authorities around the world, particularly the developing nations, look for appropriate guidance for reference purposes, the more relevant the CIBSE guidance is to their requirements, the more often it will be adopted, and the more international members will join. The feedback that we then can gain from these members will in turn assist in ensuring that CIBSE guidance continues to spread its relevance elsewhere.

I also want to promote a more comprehensive feedback loop. If we are to gain the most out of our buildings, designers need to consult and listen to FMs, and FMs need to use the designers. The information path is a two way street, the designers need to know what works and what doesn’t work, how the building is actually operated, and the FM people need to understand how the building was planned to work in the first place.

The feedback should include relevant information found during the commissioning process, but predominantly a lot of the feedback would come from the FMs and occupants. Many would claim that this is already being done, but realistically it is not done as widely or as deeply as it should be. FMs have a huge impact on the efficiency and effectiveness of a building’s services and their effect on the internal environment, and they possess a wealth of information from all types of buildings and services. This information needs to be captured and turned into knowledge, which can then be shared far more widely to drive improved building performance.

Associated to this is a drive to provide in depth studies of recently completed buildings, in order to find out what worked well, what didn’t work so well and what should be done next time. This process is vital to shorten the more usual learning cycle and speed up the spread of information. It is a process that CIBSE seeks to help and promote through the CIBSE Building Performance Awards, in which we seek to recognise and share knowledge about the best performing buildings and people behind them, in the UK and around the world.
I am under no illusions that this is an easy task; most buildings have unique aspects that require consideration so initiatives are not always transferable. There are also the practical aspects of companies being protective of their valuable assets, and so being cautious of potentially poor feedback, however this type of information is very valuable to property companies with a substantial portfolio of buildings. There is also the potential for such studies to be tied to the availability of any future grants.

Finally, I would like to see more benchmarking of energy use in buildings, making it increasingly possible to accurately evaluate how your building is performing in various aspects in relation to similar buildings, and enabling recognition for those buildings that do perform well. CIBSE will be updating our own benchmarks in CIBSE Guide F. We will also be publishing shortly the results of a three year EU funded project, iServ, in which CIBSE has been a partner. The project formally ends today and has studied energy consumption in a wide range of buildings across Europe, so this also contributes to my first aim of growing CIBSE’s influence worldwide.

**CIBSE is a global family**

Some of you may not fully appreciate just how CIBSE is perceived as a global and dynamic organisation around the world. We are a family. If a CIBSE member from, say, the UK finds themselves in, say, Australia, they only need to make contact with the local Chapter Chair to be introduced to a huge group of like-minded professionals who can assist in a range of issues including advice on local codes and standards. If, for example, someone wanted to find out something more about a skyscraper in Hong Kong, the chances are that a CIBSE member was involved and direct contact may only be a couple of phone calls away.

We have the power of numbers and global spread in our professional Institution; this is our era to make a real difference in this world through our expertise, experience and networks to help deliver a built environment that meets the challenges of the years to come.

Amongst the uncertainties of the future, our profession can only grow in stature and relevance. These are exciting times and we need to project this fact, not only to our potential customers, stakeholders and the general community but also to those considering a career in engineering. We work in a truly dynamic environment, in which we physically get to see the fruits of our efforts not tethered to the one project indefinitely and we cooperate with a moving parade of great professionals. We need to get this message of diversity and variety out to those considering a career in building services. This is a great time for people who want to make a difference to get involved in our industry.

In closing, I would like to take this opportunity to give thanks to some of the people that get little recognition for their efforts. There is a large core of our membership that is passionate about providing better building services, better building performance and a better future for coming generations. Many are involved in voluntary roles as presenters, organisers and on committees throughout our Regions. It is their enthusiasm that is invaluable. It is their knowledge that is invaluable. It is their passion that is invaluable. They show us every day that together with CIBSE we have an important role to play and can achieve major improvements in this fragile world of ours.

Honoured guests, ladies and gentlemen, as I said at the opening of this presentation, there has never been a better time to be a building services engineer.