Presidential Address

Chemical Engineering Matters – Bridging knowledge gaps for a safer more sustainable future

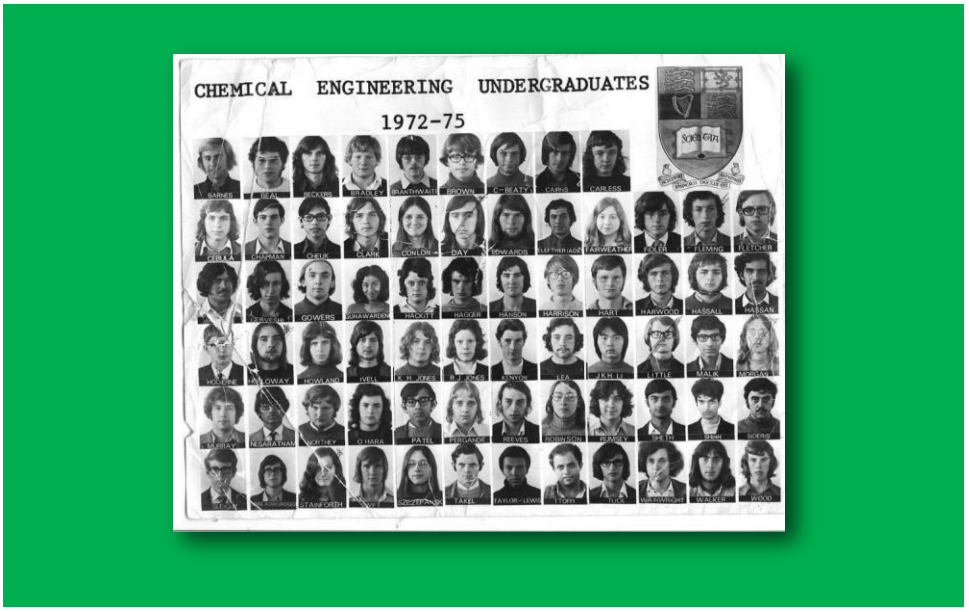
Dame Judith Hackitt

20 May 2013

Good evening ladies and gentlemen. Chemical engineering is an excellent profession and it really is an honour and a pleasure to address you tonight as the 73rd President of the Institution of Chemical Engineers.

Life on Mars

I have long believed that this is a great profession, and given the chance I wouldn't hesitate to follow the same path again. That said, my reasoning today would be rather different, because - and let's be perfectly frank here - back in the 1970s I was looked upon as something of an oddball. I can well remember the words of my headmistress, who, upon hearing of my intended career path, remarked: "Chemical Engineering - But girls don't do that sort of thing Judith!" And at that time she was mostly correct in her analysis.



The 1972 intake at Imperial College numbered 75 undergraduates. All bar five were male. And practically everyone I met on my first day asked the same question, "What makes a woman want to do chemical engineering then?" For me, the answer was simply that I wanted to become a teacher and I strongly believed that to be a good science or maths teacher you needed to be able to provide context to what you were teaching and that it would be good for me to spend a couple of years in industry after university before becoming a teacher. Obviously, the plan changed, but more of that later. So, as you might imagine, 1972 was something of a challenging climate for the aspiring female chemical engineer.

Life on Mars

Looking back it sometimes felt as if I was trapped in an episode of Life on Mars with Inspector Gene Hunt running the show. Women were only allowed in the Union Bar at Imperial College on Sunday nights - when the fire was lit; Fresher's week included a gathering where the girls were paraded in front of the boys for one to be selected as the 'Bo Belle'.

More (real) Life on Mars

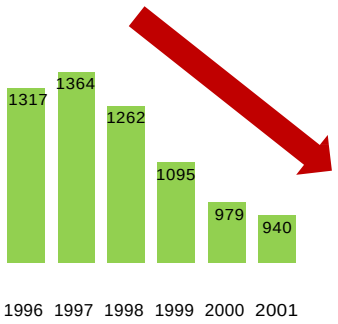
The lucky 'winner' was rewarded with the opportunity to look suitably decorative sitting in a 1902 James and Browne automobile on the annual London to Brighton veteran car run. And to be honest things weren't much better in the wider world of chemical engineering either, as this delightful advert from The Chemical Engineer reveals.

Chemical engineering… Why not?

Thankfully, we have moved on somewhat since those days and the undergraduate population here in the UK and around the world better reflects the diversity of world at large. There is still a way to go before what some might describe as 'equality' is fully realised, but I am happy to report that in comparison with engineering as a whole, chemical engineering is in a very good place.

To begin with, the undergraduate population today is very much bigger that it was in the 1970s. Many of you will be aware that the discipline hit something of a crisis in the 1990s and applications to study chemical engineering in the UK suffered a dramatic slump.

UK Undergraduate Intake
The Long Term Trend – Chemical & Process Engineering



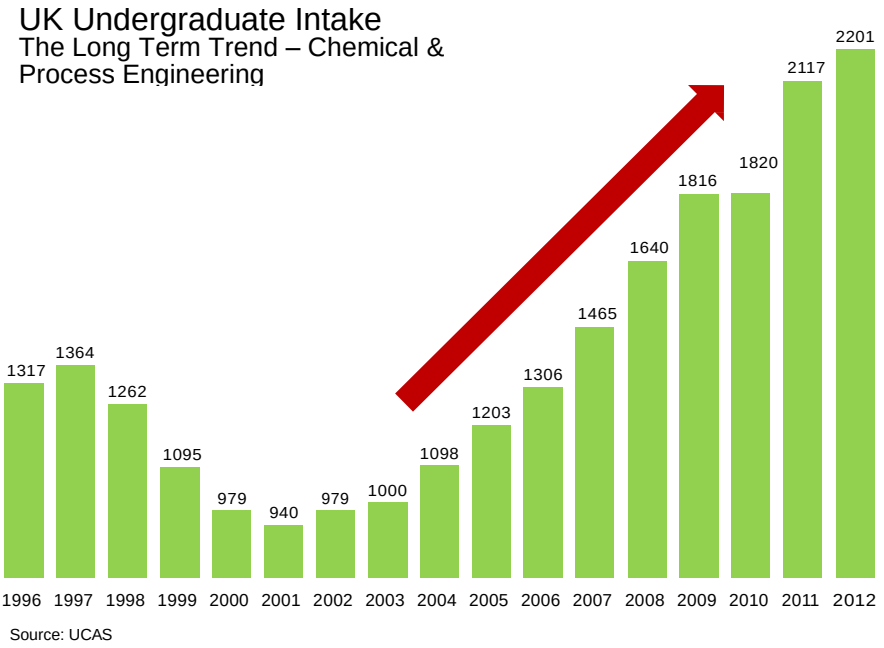
Source: UCAS

By the turn of the millennium the total annual intake had fallen below 1,000 raising serious concerns as to the viability of many departments. Quality was an issue too with many potential students failing to make the benchmark A-level grades required for an accredited degree programme. Fortunately, IChemE's leadership at that time had seen the challenge looming and Council had already initiated a response in the form of highly targeted careers campaign, which we recognise today as *whynotchemeng*.

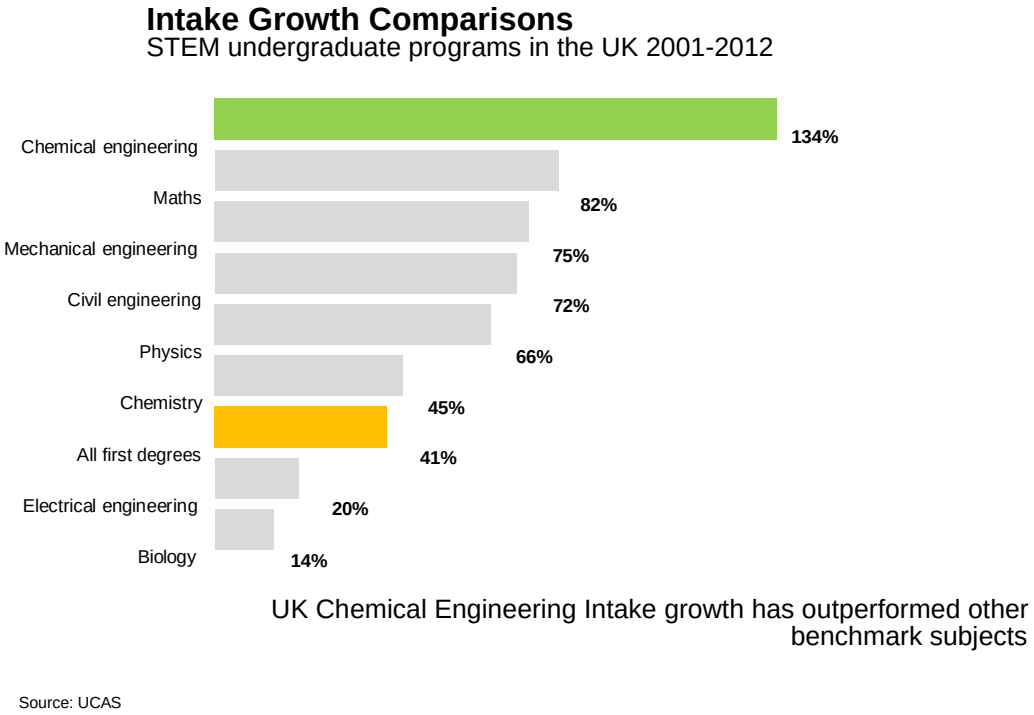
IChemE ADVANCING CHEMICAL ENGINEERING WORLDWIDE

The programme began in earnest in 2001. It portrayed chemical engineering in an entirely new light. Out went the focus on pumps and pipes and serious looking gents in hard hats gazing at distillation columns and in came a brighter and more youthful suite of promotional materials. These focussed on the diversity of chemical engineering career outcomes and the benefits that chemical engineers deliver. It proved

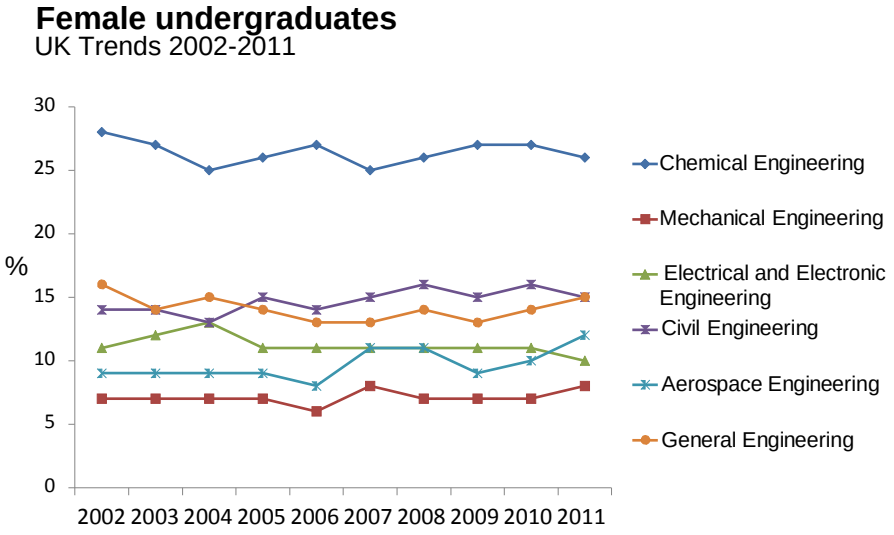
controversial at the time; indeed in some quarters there are still those who decry *whynotchemeng* - but the proof of the pudding, is as they say in the eating, and it works.



Last year, more than 2,200 students started on chemical engineer degree programmes in the UK – that's an increase of 134 per cent over the last decade. It's true that this growth came during a period that witnessed considerable expansion in higher education in the UK.



But the chemical engineering intake has grown at more than three times the average and we have outperformed all of the other mainstream engineering disciplines by a considerable margin. IChemE's research reveals that this success story can be attributed to a large extent to the w*hynotchemeng* effect.



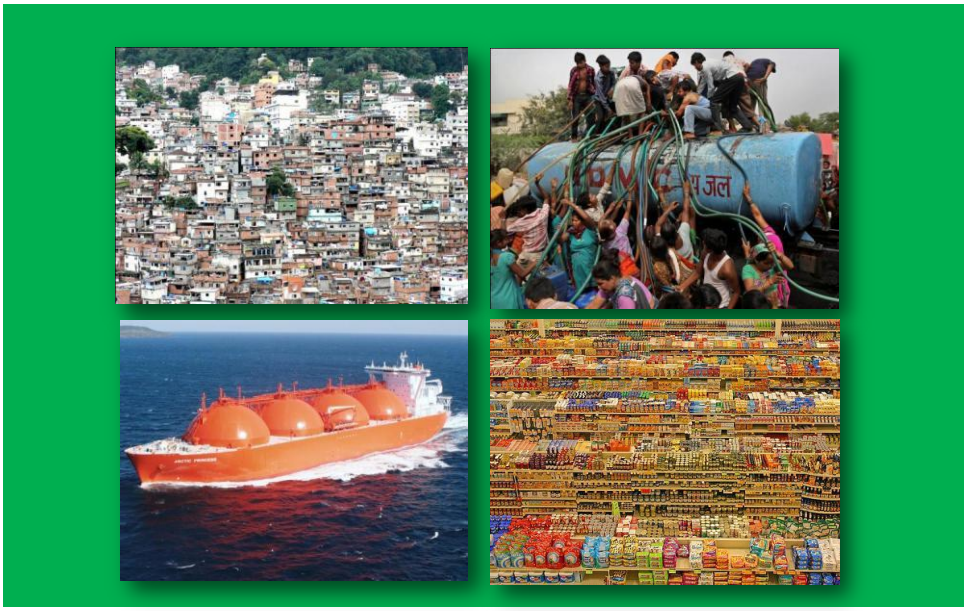
The proportion of women studying chemical engineering at first degree level is consistently 10-15 points ahead of benchmark engineering disciplines

Something else has changed since the 1970s. Chemical engineering has had the highest proportion of female applicants accepted in every year of the last decade. For each of those ten years, at least a quarter of all accepted applicants to chemical engineering have been female. There is still progress to be made but I would like to think that if my old headmistress – or rather head teacher - were here today, then she might say: "Chemical Engineering – good choice Judith!" And long may it continue; indeed *whynotchemeng* does continue, in the UK and further afield. IChemE is constantly on the lookout for opportunities to deploy a similar campaign approach in all parts of the world where the graduate pipeline gives rise to concern. It may be time to move the focus from getting people onto chemical engineering to persuading more to stick with the profession beyond graduation.

IChemE ADVANCING CHEMICAL ENGINEERING WORLDWIDE

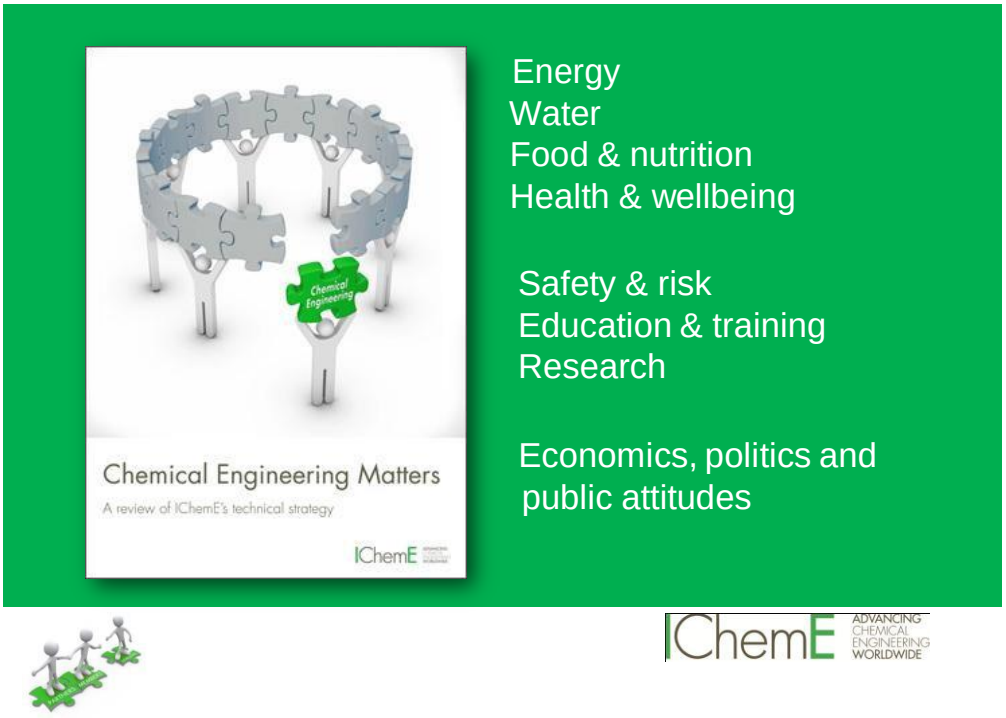
Being a young chemical engineer today offers tremendous opportunities. They're unlikely to be unemployed for very long and whilst we shouldn't be too concerned if some choose to work in very different fields from the moment they graduate, we do need more graduates to stay with the profession – going into industry and staying in academia. It is essential though that we have people with a solid grounding in systems thinking pursuing careers in the city, in consultancy, in finance and in teaching. The skill set is eminently transferable and if it all goes horribly wrong, don't worry, you're still a chemical engineer and we'll welcome you back!

Chemical Engineering Matters



So why should we be persuading young people to study chemical engineering and to enter a career in industries that depend on chemical processes? Population projections suggest that by the year 2050 the human population will grow from the current seven billion to nine billion - that's a 30 per cent increase on our already overloaded ecosystem. For nine billion people to stay alive they will need access to clean water, affordable food, housing, clothing, transport, healthcare and energy supplies. We must also respond to the challenge of climate change. And even if the population were to remain static over the next 40 years, achieving the sort of reductions in global emissions that are thought necessary to prevent climate change - 50 per cent or more - would be a challenge in itself. However, with 30 per cent more people demanding goods and services, which create greenhouse gas emissions, the challenge is even more demanding.

One thing I am sure about is that chemical engineering is a vital part of the jigsaw that is the quest for sustainable living in the 21st Century - and beyond. Engineering has been the catalyst to industrialisation that increased the efficiency of production and access to all sorts of goods and services. I am confident that we can make the technological leaps required in the future because we have shown that we can do it in the past.



This argument is clearly set out in IChemE's latest review of technical strategy and positioning, *Chemical Engineering Matters* and I cannot emphasise enough the importance of this document. *Chemical Engineering Matters* is a driver for everything that IChemE is doing and will be the backbone of future activities. It's a rallying point and it is a powerful vehicle for engagement, both within the Institution's membership, and externally. The document makes it abundantly clear that chemical engineers have a pivotal role to play in creating, maintaining and improving quality of life in the developed and developing worlds alike.

The challenges are well rehearsed: energy, food & nutrition, water, health and wellbeing. But *Chemical Engineering Matters* also demands that several other key issues are taken into account. These include safety and sustainability as well as the need to collaborate with others. Education, training and research needs should also be assessed. *Chemical Engineering Matters* clearly identifies the essential role of the fundamental aspects of chemical engineering science and the systems thinking upon which our discipline is founded. It also calls upon engineers to capitalise on the opportunities presented by advances in 'biotechnology'.

Chemical Engineering Matters is important because it sets the agenda for our profession, for IChemE and for the membership for the next 5-10 years.

IChemE ADVANCING CHEMICAL ENGINEERING WORLDWIDE

A key consideration must be how exactly to we make *Chemical Engineering Matters* a reality? I know we have a wonderful story to tell. I know that there is some fantastic innovation going on right across the chemical engineering community, in industry and in academe. And I also know that we are continually making a difference. But I worry about the silo mentality. Here we all are, heads down, getting on with the job, generally doing great stuff. But failing to recognise the bigger picture, missing out on the opportunities to make the right connections and in so doing failing to unleash the full potential that exists within our profession and clearly and unambiguously demonstrating that chemical engineering really does matter. And so, over the course of my presidential term I plan to work with my Council colleagues, with our international boards and with the IChemE staff team to bring *Chemical Engineering Matters* to life. We will do this reaching out and engaging with three key constituencies.

First, IChemE is all about its members – because it's us – the members who shape the delivery of the strategy through what we do in our own jobs, but also in our interactions with one another. In IChemE's special interest and regional groups and in our interactions with governments, through research and development and so on. It is the member, perhaps more so that anyone else, who fully recognises that chemical engineering really does matter. They do it every day. And IChemE will engage with its members to bring the vistas described in *Chemical Engineering Matters* to life. Your institution will help you to tell your story and by sharing your experiences and your achievements with IChemE we can build a compelling case to project the value of the work that you are doing 24/7.

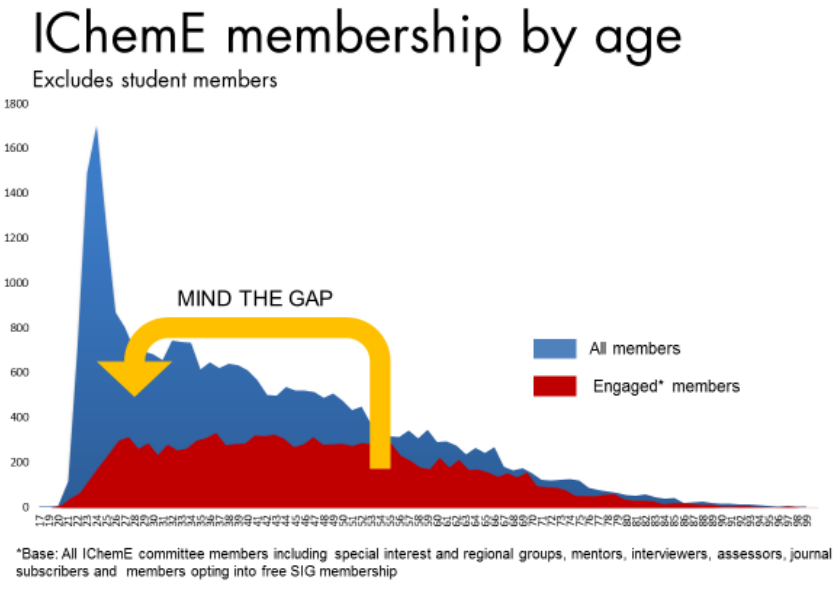
Second, IChemE is also about leadership, and be in no doubt that council owns and will lead on the implementation of *Chemical Engineering Matters*. But that leadership will be cascaded outwards to the international boards, to regional member groups and to our special interest groups. And with leadership comes responsibility - responsibility for delivery. That is why I have sent a signed copy of this address to every board and group chair asking them to share with me their personal ambitions and ideas for making *Chemical Engineering Matters* a reality. The overarching principles and concepts set out in the document can, and should be modified and adapted for local delivery.

And third, we must never lose sight of the fact that IChemE and we as chemical engineers don't exist in a vacuum. We need to use *Chemical Engineering Matters* as a vehicle to engage with employers, with educators, with the research community and with kindred organisations across the STEM landscape in order to find common cause. Clearly we can't do it on our own, but I would argue that the world can't do it without us. We have a unique and vital contribution to make. Our traditional strengths form a very firm foundation - the breadth of the discipline and the ability it gives us all to interact and work with many

other professions. *Chemical Engineering Matters* offers the potential to create some very powerful coalitions.

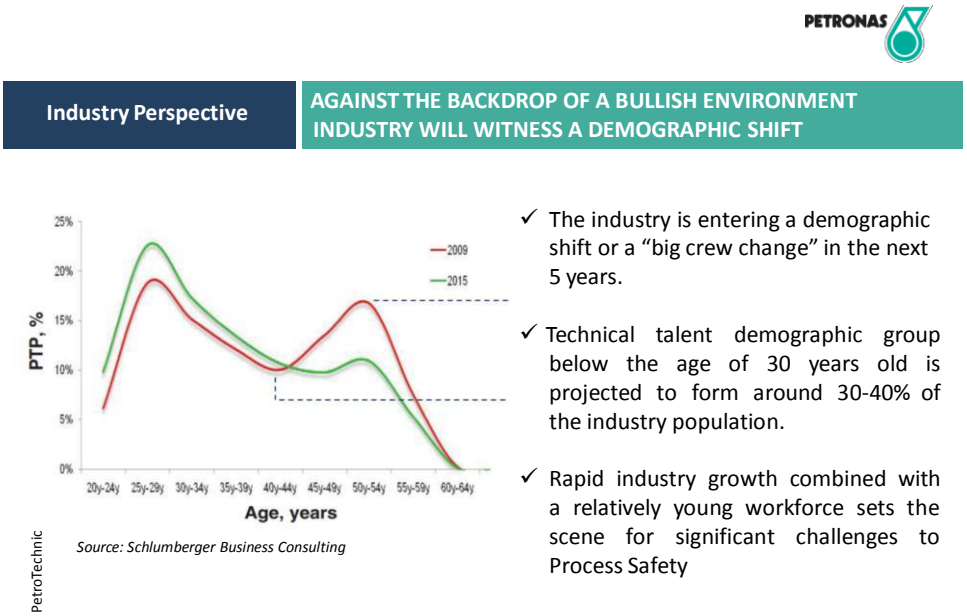
Mind the Gap

Now I will take it as read that you all share my enthusiasm for this agenda or very soon will do, but I also have to tell you that I have spotted a few obstacles to progress and these will, inevitably, require some careful thinking and navigation. Two issues require addressing; by this Institution and by the wider chemical and process engineering community. The fundamental problem seems to be that we are not terribly good at learning from past failure, or even past success, and there is a related difficulty in that even when we do learn, we seem to be pretty inefficient at passing knowledge on to our peers and to future generations.



I have observed these phenomena repeatedly over the last forty years, not least during my time as Chair of the Health and Safety Executive, where my pronouncements about the failure of industry to learn from previous mistakes are well known to many of you here tonight. But I worry that the problem is likely to become more acute as a result of both IChemE's age demographic and the pattern that prevails across much of industry as a result of that slump in numbers applying to become chemical engineers which occurred in the late 80s and 90s. The situation looks even worse if we look at the Institution's 'activist base', by which I mean those volunteers who organise things, turn up and make things happen – the lifeblood of the Institution.

This impending challenge can be seen across industry. Here's an example from South East Asia. Last month I had the pleasure of sharing a platform with PETRONAS' CEO Datuk Wan Zulkiflee. He was speaking about the process safety situation within his own organisation and one particular slide in his presentation caught my eye.



PETRONAS is a young company with an average age of 34 but you will notice 'twin peaks' in this histogram showing the age distribution for the workforce. Visible in the 25-29 age range and in the 55-54 age range. The implications of this are clear. Over the next ten years a lot of knowledge and corporate memory is going to walk straight out of the door with a gold watch, unless PETRONAS put in place a plan to retain it.

Knowledge Transfer – Three Challenges

Knowledge transfer is crucial to the success of the *Chemical Engineering Matters* initiative and the Institution will approach this from three different perspectives. First, we face a generational challenge. IChemE will work to secure effective knowledge transfer between the 'twin peaks' evident in our own organisation and in companies like PETRONAS. This is not as easy as it first sounds. We can't just tell members what to do. Times have changed, circumstances are different, and the challenges facing early career engineers today are different too. This means that our accumulated knowledge must be distilled before we can pass it on.

We have to find new ways of passing it on too. Efforts must be made to capitalise on modern communication and social networking tools. The next generation may want our knowledge but that doesn't mean that they are prepared to go to face to face meetings to get it – especially if they are not welcomed or encouraged to contribute.

Regional knowledge gaps also require bridging. I don't need to remind you that the process industries have gone global and much of the traditional downstream chemical processing is taking place outside the OECD economies. Increasingly, we find upstream exploration and production is taking place in more exotic, far flung and difficult locations as the quest for hydrocarbons intensifies and downstream industries increasingly locate closer to the growing market economies and where construction costs and labour costs are lower. How do we secure effective knowledge transfer from the developed to the developing world? How can we help to prevent tragedies like last month's building collapse in Dhaka? The death toll has passed 1,000 people and whilst this wasn't a process safety incident, in the traditional sense of the term as we would understand it, it provides a compelling illustration of what can happen when a manufacturing operation is transferred to the other side of the world. The shirts made in that factory were once made in Leicester. They are probably still being worn in Leicester. These are developed world supply chains and this is a developed world problem. It's our problem. And that's a good thing, not a bad thing, because we have the solutions within our grasp.

The third knowledge gap that we must confront is the gulf between technologies and sectors. Much of our process safety knowledge, particularly that which relates to asset integrity and secure containment, has been accumulated in the high hazard industries. We know a lot about risk management in the context of flammable materials, high pressure vessels, oxidising agents and the like. I would contend that we can add value, prevent loss and save lives through effective transfer of this knowledge to new areas. The new

generation nuclear industry, carbon capture and storage and biofuels are obvious example. Perhaps less obvious is taking knowledge of offshore operation in the oil and gas sector and passing it on to those who manage and operate offshore wind farms. And secure containment is of paramount importance when it comes to toxic pharmaceutical ingredients, bio hazardous agents and potentially disruptive nanomaterials. Chemical engineers are supremely well placed to ask the right questions, to ensure that risks are identified and addressed during the design and development phase of any process operation. Inherent safety is a primary consideration in modern process design. Techniques such as HAZOP, HAZID and LOPA are well understood by the professional chemical engineer and building competence in these risk reduction methodologies is central to IChemE's training offer.

I will be working with Council to secure progress in all three of these areas, but Council cannot do this alone. Knowledge transfer cannot be left to the staff in Rugby, or Melbourne or Kuala Lumpur. Again, it's the members who hold the knowledge and it's the members who will ultimately transfer it, so member engagement is critical and I want to see IChemE getting much better at scrutinising the Institution's work programmes to see if they pass two simple tests. Does the activity, or project or initiative improve member engagement? And will it bring about more effective knowledge transfer in one or more of the areas that I just outlined. Member engagement and knowledge transfer must be integral to IChemE's project management approach.

An Element of Luck?

So why me? Why am I standing here before you tonight calling on you to help me, to help your institution, to make the world a better place? Maybe I should have ended up in a classroom after all, but something happened that made me change my mind. When I found myself in industry, I couldn't leave because I enjoyed it so much. But whilst I was still at Imperial I received my first lesson about process safety and knowledge transfer.

Flixborough had a dramatic effect on me and probably on every single individual who had a connection with the British chemical industry at that time. But nowhere near as dramatic at the effect that it had on the wives and the children, the mothers and the fathers, and loved ones of the 28 people who never returned home in June 1974. The explosion that ripped through the plant just before five o'clock changed lives forever.

After graduating I joined Esso Chemicals at Fawley as a Process Engineer. I was given my first production process to run after 2 years, manufacturing butadiene and managing the storage of in excess of 10,000 tonnes of various C4 streams – very much a top tier COMAH facility. During my fifteen years with Esso/Exxon I worked in several different business groups always in manufacturing and always very heavily involved in Health and Safety matters – I had no difficulty at all buying into the company philosophy that all incidents and accidents are preventable. I then moved on to work for the speciality chemical company, Elementis, also in operations, before becoming Group Risk Manager – working to spread health and safety culture into businesses as diverse as inorganic chemicals, animal feed, flour mills and timber and building supplies. In 1998 I joined the Chemical Industries Association and became its Director General in 2002 – at the same time I also became a Health and Safety Commissioner. Having spent some time in Brussels working for the European Chemical Industry in 2007 I became chair of the Health and Safety Executive and have just been reappointed to serve until September 2015.

Now I readily appreciate that in most cases we create our own luck, but I really do consider myself to be rather fortunate, if not lucky. I've been properly trained by some great companies. I've benefitted from the professional development framework that is part and parcel of becoming a Chartered Engineer. I have learned lessons from personal experience and from my exposure to wider events in industry. Industries that are often beyond my own direct sphere of involvement. But in many ways I'm no different from anyone else. I am a living, breathing, body of knowledge. I am the sum of all of my experiences and lessons learned, but I won't last forever. None of us will last forever, and this prompts a truly difficult question.

Do we really want the next generation to learn our lessons all over again? From scratch, learning the hard way, with all of the catastrophic consequences that are recorded in the annals of the process industries.

I certainly don't. That's why I remained involved in my institution and that's why I am standing here tonight. Because it's not about luck. It's about learning, and it's about taking responsibility for ensuring that things move in the right direction; not just in process safety, but in energy and resource efficiency, environmental protection, materials conservation and all of the issues addressed in Chemical Engineering Matters, including the effort that we put into communicating with policymakers and the wider public.

History Repeating Itself?

It's very timely, and underlines my concerns that this month's copy of The Chemical Engineer magazine, was described to me by the editor as the saddest issue of tce that had been put together in many years.

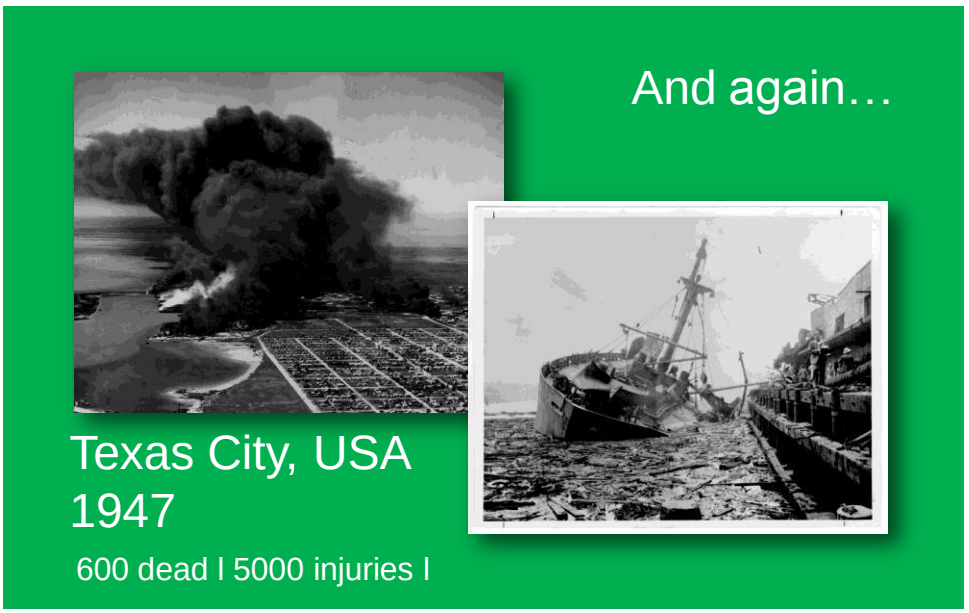
Catastrophic incidents, involving fatalities and serious injuries coupled with consequential loss and adverse environmental impacts are described on several pages. This is the twenty first century but we are still seeing the same things going wrong and one of the incidents reported illustrates this point well.

Ammonium Nitrate has been in common use for many years, both as a fertiliser and – as an explosive. It is generally marketed as small white spheres or granules and appears harmless, although it is an irritant and harmful if swallowed. Nonetheless, it is also a strong oxidising agent and it will decompose explosively, if it is subjected to heat, extreme shock, confinement and in some instances contamination. Terrorists have known this for a long time, which is why the chemical industry puts careful measures in place to ensure that the product is only sold to bona fide people, yet it is still widely available all over the world, especially in farming areas. Anyone with a broad knowledge of the incidents that have come to define process safety over the years can be in no doubt as to the violent potential of ammonium nitrate.

IChemE ADVANCING CHEMICAL ENGINEERING WORLDWIDE

In September 1921 two violent explosions rocked a BASF plant at Oppau in Germany. The blasts destroyed the plant and approximately 700 houses nearby. 430 people were killed. The cause was attributed to the use of blasting powder to break up piles of a 50/50 mixture of ammonium sulphate and ammonium nitrate. Records show that the workforce had carried out this operation many times without incident. But on that fateful day, over 4,000 tonnes of a simple inorganic chemical detonated creating a crater 75 meters wide and 15 meters deep.

Let's jump forward to a place called Texas City. But it's not 2005 it's only 1947 and a freighter, the SS Grandcamp, has docked in the port. As well as carrying a variety of combustible materials including cotton, sisal and peanuts, the cargo also comprised a quantity of small arms ammunition and over two thousand tonnes of ammonium nitrate. A fire has started, possibly due to a discarded cigarette, but attempts to extinguish the fire failed; a red glow persisting after successive dousing with water and then steam. A crowd of spectators gathered along the shoreline and watched the water around the ship beginning to boil. The SS Grandcamp's hold and deck began to bulge as the pressure of the steam increased inside, until shortly after 9 o'clock in the morning the freighter exploded and the worst industrial accident in US history ensued.



The entire dock complex was destroyed, along with the nearby Monsanto chemical works, smaller industrial installations and storage facilities. A tidal wave four metres high was created. A thousand buildings were destroyed. Every member of the local fire brigade was killed. The initial explosion also started a fire on another vessel, which was also carrying ammonium nitrate. This ship also exploded, adding to the mayhem, but only after it had been towed away from the original conflagration. One of the ship's propellers was found over a mile from the site of the second explosion. In total, five thousand people were injured and almost 600 died. All as a result of the mismanagement of a simple, widely used and perhaps over familiar inorganic chemical.

Then in September 2001, a huge explosion ripped through the Azote de France fertiliser plant on the outskirts of Toulouse, France.

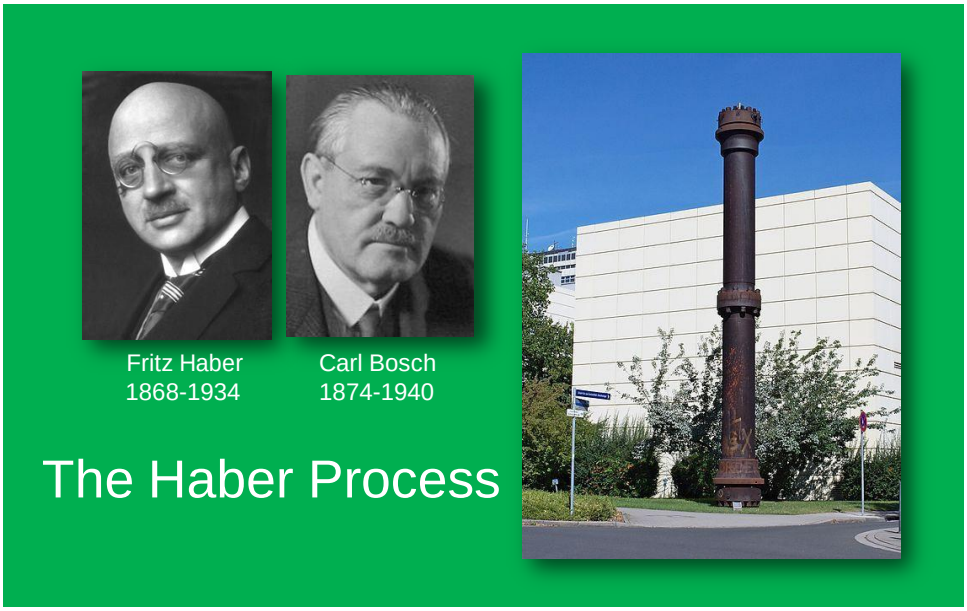
Thirty people were killed with more than two thousand injured. Five hundred homes were rendered uninhabitable. Eighty five schools and colleges were damaged disrupting the education for eleven thousand students. Secondary explosions shook adjacent chemical plants and the wreckage was piled ten metres high in some places. Once again this was an explosion in a storage facility rather than a chemical process incident. Experts still dispute the cause, with some citing an electrical failure and others chemical contamination with unstable nitrogen trichloride. Around four hundred tonnes of off specification ammonium nitrate was detonated but things could have been much, much worse. The installation also carried a further six thousand tonnes of solid ammonium nitrate, thirty thousand tonnes of fertiliser and up to six thousand tonnes of liquid ammonia, rail wagons carrying chlorine and a phosgene pipeline. Fortunately for the people of Toulouse, this inventory was not compromised by the explosion.

Last month, whilst I was attending IChemE's second Hazards Asia Pacific Symposium, news came in of the tragic incident which occurred in West, Texas.

BASF global safety vice president, Hans Schwarz, had quite literally, just given a keynote presentation in which he had described the events at Oppau in 1921, when the story broke. And whilst the full facts are still not clear, there seems little doubt that ammonium nitrate is involved once again. What we do know is that fourteen people died and two hundred were injured when its explosive power was unleashed again. Are there lessons that should have been learned and passed on? Has corporate memory loss in any way played a part in this saga of incidents involving the same inorganic compound?

Changing the World

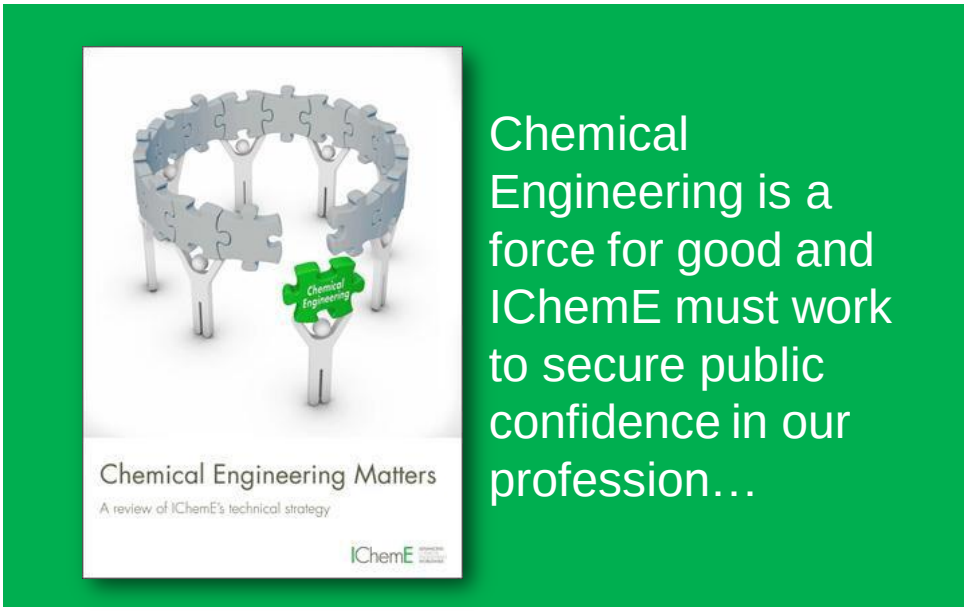
On the basis of hazard alone there are plenty of people who would argue that the substance should be banned. Even a risk based approach could lead to the same conclusions based on the stark facts a presented here. But we all know that this is not the whole story. The very same inorganic compound has also brought life and prosperity and human progress on a massive scale. *tce* is also a source of good news, not least via the series of features, *Chemical Engineers who Changed the World*, which has been running over the last few years.



It's impossible to recount the story of chemical engineering without a mention of Fritz Haber and Carl Bosch. This German pairing were responsible for the Haber process, arguably the most recognised chemical process in the world, capturing nitrogen from air and converting it to ammonia largely for fertiliser production. Haber developed a high temperature, high pressure, catalytic process to break the nitrogen triple bond. Bosch took care of the scale up and the process economics. Ammonia was first manufactured on an industrial scale in 1913 and the process is still used throughout the chemical process industries today a century after its introduction. Given the impact of fertilizers on food production and consequently on nutrition, health and population growth, in 2011 Fritz Haber and Carl Bosch topped a *tce* readers poll of chemical engineers who changed the world.

Humankind's capability to 'fix' nitrogen on an industrial scale is just one of many chemical processes that have made life markedly better for millions of people. But the world at large generally doesn't know that, and even when it does, the negative connotations associated with the word 'chemical,' and sometimes 'engineering' too, outweigh the positive. In one US survey, people were asked what came to mind when they hear the word, 'chemical'. The results are dominated by negative imagery with frequent associations including, 'death', 'toxic' and 'dangerous'. Equally worrying are the findings of a Canadian survey in which a regular public response when prompted by the word, 'risk', was 'chemical'. We must recognise that we and many of the industries we work in have an image problem and that there is a general lack of trust in us and what we do. *Chemical Engineering Matters*, fully acknowledges this.

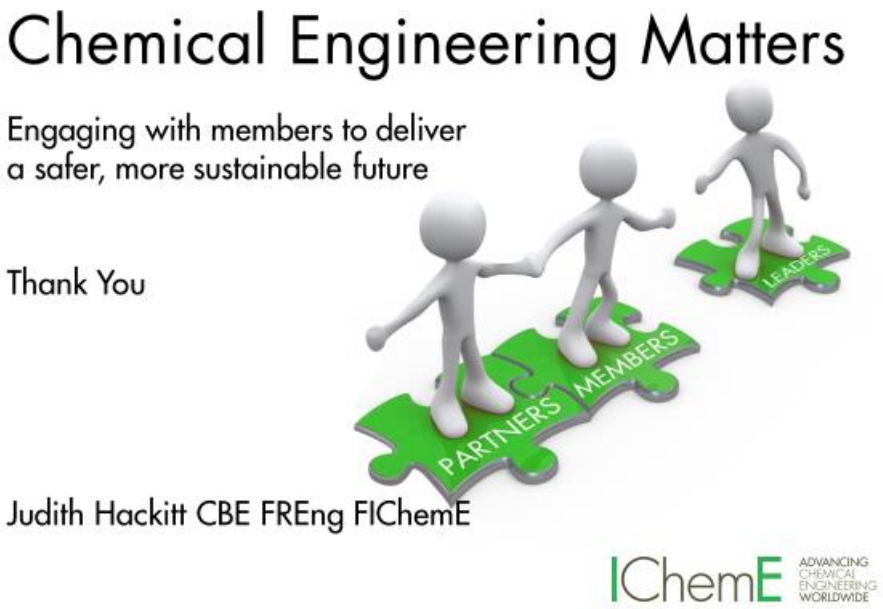
We must actually take some responsibility for this state of affairs. Engineers are great at talking to one another but awful at conveying messages about our profession, what we do, the benefits of our work and how we manage risk to the public, politicians and key influencers including the media. There are some notable exceptions of course, I like to think I am one of them, but you can judge that for yourselves; but engineers who are also good public communicators are unusual.



I firmly believe that chemical engineering is a force for good. Chemical process technology has delivered massive improvements in quality of life for many decades and that work continues in all parts of the world. This requires us to strive for greater public understanding, acceptance and support. IChemE will work to secure public confidence in the profession and tirelessly promote the message: 'chemical engineering matters', but we need our members to tell us about their success stories and their achievements in order to deliver this goal. We all have to get better at communicating, not just with one another but with others who will give us valuable feedback and insight as well as being recipients of our knowledge and our messages. We must keep reminding ourselves that good communication is about listening as well as talking!

Adapt, Change and Transfer Knowledge

And so to conclude. Succeeding to the role of IChemE President gives me a great platform to do many things. As the chair of the HSE I work across a broad range of industries and lately I have been involved in the important job of busting myths around health and safety. But wearing the 'IChemE President's' hat, my focus will be sharpened and on the major process safety issues and the broader context into which that fits. The issues that are set out in *Chemical Engineering Matters*.



Chemical Engineering Matters is the start of a new phase in IChemE's history. We are now in our tenth decade and the centenary year approaches rapidly. I am proud; we can all be proud of what the Institution, our profession and the industries that we serve have achieved in the last century and in this one. Be we must recognise the need to adapt and change in today's fast paced environment. IChemE must work to use all of the knowledge that has accumulated since our foundation in 1922 only months after the explosion that devastated Oppau. We must nurture and preserve the vital lessons that have been learned through success and failure in the process industries. And we must ensure that we have the mechanisms to build upon, to share and to actively transfer our knowledge to the best advantage of our profession, in pursuit of the public interest and for the benefit of the next generation.

Ladies and gentlemen, friends and honoured guests, I will make it my mission in my Presidential year and thereafter to help prepare the next generation of engineers and leaders to deliver against *Chemical Engineering Matters.* Members, leaders and partners, together.

Thank you

Judith Hackitt welcomes comments and ideas prompted by the 2013 Presidential Address. You can contact her via president@icheme.org