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The Last of the Summer Wine

or

Red Bull (TM) Gives you Wings?

Were the good old days really that good?

Are we currently on our way to hell in a hand cart?

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Abstract:

This paper looks at various aspects of the power engineering industry and profession. It draws from the author's experience and viewpoint. Topics covered include health and safety, education and training, the role of the engineer, and the status of engineers, and what is the future for engineers?

The paper draws on personal experience and knowledge as well as other sources. Personal experience goes back to 1952 when aged 4 I first visited a substation and was instantly addicted to the smell of insulating oil!

Contents

1. Introduction:

The title is very broad, so firstly it should be noted that this discourse is primarily concerned with Power Engineers and the power supply industry. Secondly it reflects a personal view which will bring with it a set of biases and opinions based on my experiences - please consider it recognising your own!

The original trigger for the concepts was the recent funeral of my father, a Chartered Professional Electrical Engineer and Fellow of the IEE (Now IET). I reflected on how he became an engineer, then on my own experiences and then considered what happens now. The conference celebrates 125 years of Public Supply in New Zealand and considering this pushed my thoughts further back to the first engineers and their circumstances.

2. Reflections on the early years:

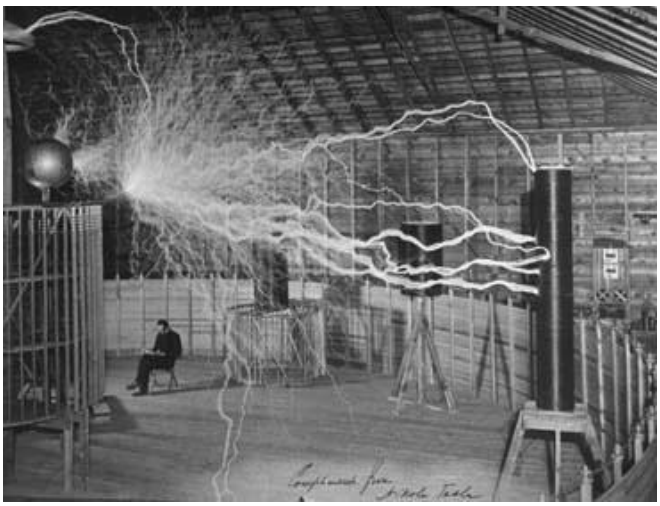
The story of the introduction of power to Reefton is well known and New Zealand is proud of the fact it had the "First public supply in the Southern Hemisphere", but what about the engineer - sometimes referred to as an "electrician" - who lead the installation , one Walter Prince?

He is recorded as originally being appointed by the New Zealand Electric Light Company in order to supervise the installation of lighting at the Lyttelton wharves , a contract that was not completed.[i]

He is recorded as visiting the then bustling town of Reefton whilst recuperating from an accident (but just happened to have a 1kw generator with him).[ii] His sales technique in using steam from the brewery to power the generator and then lighting four of the main hotels was a triumph, although the subsequent installation had problems that took another engineer to resolve.

2.1 Status

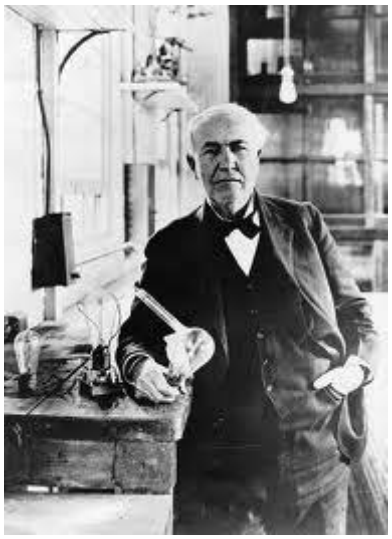
Other early electrical engineers are of interest. Tesla immediately comes to mind - described as a "certifiable genius and just plain certifiable."[iii] It is generally acknowledged that we owe our three phase power system to his concepts, but he is more often remembered for his showmanship.



A publicity photo of Tesla sitting reading under his artificial lightning

Turning to Edison, he has many inventions credited to him, but for us his establishment of a distribution system of supply (DC) is of particular interest: he had many battles and he was clearly accomplished at marketing (or promotion as it was called in older times).

Pearl Street Station New York



Thomas Edison

Across the Atlantic, Sebastian Ferranti established the first Power Station remote from the load, building the High Voltage AC transmission system between them with transformers to step up and step down the voltage. Perhaps because he is British (in spite of his name, he was born in Liverpool) he comes across as a little more restrained, however as Chief Engineer of the London Electric Supply Corporation , he had to promote his views and the project vigorously.

Depford AC Power Station London

Sebastian Ferranti

There are obviously other examples, but the underlying concept I see running through the earliest Power System Engineers is that they were no "shrinking violets", they were out promoting what they believed in and were not hidden away in a back office somewhere. They were recognised and

generally respected by society as the benefits of their work (lighting, electric trams and trains, even early home appliances) were readily visible.

2.2 Education & Training

Considering their education and training it is of note that the first degree courses in electrical engineering appeared as early as 1885 with the Technical University of Darmstadt (in Germany) founding the first department of electrical engineering in 1882. However, this was not the way for the examples quoted.

For example Edison had 3 months formal school teaching (his attention wandered so much he was called addled" by" his teacher) although it is clear his mothers teaching leading to a love of reading and books provided the foundation for an enquiring mind. However, for much of his education and training he was clearly self taught[iv].

Tesla – as we may expect – had a mixed education – he did go to a technical university, but ended up spending a couple of years gambling away his allowance and tuition funds – and then winning them all back - with the result he did no study. He did get a second chance later but for a number of reasons did not graduate. His real training was as a draughtsman for the Central Telegraph Office but he quickly identified several improvements such that within 6 months he was appointed chief engineer of the Budapest Telegraph Exchange.

Ferranti did enrol to study at University College London for an engineering degree at the age of 16 or 17, but only completed one year due to a family financial crisis. His first electrical invention was when he was 13 and it is noted that he installed an electric bell system at his secondary school.[v]

Thus I would propose that as a general principle the early engineers were self taught (and obviously self motivated), however it would also appear that they took a great interest in the growing knowledge of electricity, adding to it as they developed their own ideas and inventions.

2.3 Roles Held

Turning to the roles Edison, Tesla and Ferranti held they have a common feature - that of being the head of a company, and often at an early stage in their career. Whilst "back room", (or rather laboratory) work was of great interest, they clearly understood the wider issue of finance, accounting, and, as noted previously, marketing. Tesla may have lost the fortune he made, but this was a conscious decision on his behalf. What their management skills were like is somewhat difficult to be sure off, however they each appear to lead by example and their staff followed them from a perspective of respect, possibly tinged with a level of diffidence as they were all strong characters.

3.0 The Mid 20th Century

For this period I will draw on personal experience and knowledge.

Power system engineering was in major growth mode through much of the 20th century. In the UK the power supply systems were damaged during the war years, particularly WW2 where targeted

bombing severely damaged or eliminated much of the infrastructure that was already inadequate, in many areas, for the rapidly increasing load demands. A parallel situation was suffered in New Zealand as whilst the infrastructure was not physically damaged, key generation and other plant was lost when ships were sunk and development of the supply system was effectively put on hold whilst loads grew rapidly.

In the UK a clear break point was the nationalisation of the complete industry in 1948 establishing the Central Electricity Generating Board (CEGB) which ran generation and the grid (cf. NZED) and the 14 Area Boards.

London Electricity Board Truck - early 1950's

Detail of Logo - Normally with red wires around red LEB letters

3.1 Status

The role of an engineer (in the UK) was clearly established as a profession by this time, for example a Chartered Engineer was able to sign or witness documents in the same way as a Doctor, Lawyer, Chartered Accountant etc.

The UK was a very status conscious society – for example the Power Industry common employment rule book specified at what level of employment (i.e. Grade) an engineer was entitled to first class travel on the railways and to use taxi's rather than the bus. (Although it was officially noted that if an engineer was "accompanying" heavy test equipment then the use of a taxi was "permitted").

Within the professions even Job Titles reinforced this approach – after completing a degree and two years training as a graduate engineer the first appointment was as a "General Assistant Engineer" with the exciting prospect that within a year or two you would be promoted to "Fourth Assistant Engineer". Many engineers were in the 40's or 50's before finally dropping the "assistant" tag.

To the public, professional power engineers were generally viewed with respect and often a little "diffidence" as electricity was still viewed as somewhat of a black art. (Note that in 1948 some 25% of homes in the UK were still not supplied with electricity).[vi]

3.2 Education and Training

The requirements to be a professional engineer were steadily changing through the 20th Century, primarily influenced by the professional bodies, in the case of electrical engineers the Institution of Electrical Engineers (IEE, now IET). My father's experience was typical of many. Two full years at a Technical college from the age of 14 to 16 then into a junior role at a power company - the typical staring point was the drawing office as the print machine operator. The aim then was to continue studies (usually night school) to obtain a Higher National Diploma which provided exemption from the IEE's own lower level exams, and then if possible to do further studies to be able to sit the formal entrance exams for admission to the IEE. The grade of membership was also subject to suitable experience and a sufficiently senior role being held.

The university degree route provided full exemption to the IEE's exams, but it was not a very common route for most practicing engineers, there was more of an expectation of staying in academia if you obtained a degree and the IEE had special rules to cover admission of such engineers.

Thus your average professional engineer had a very integrated education and work experience/training and usually had a good understanding of the wider issues of the workplace.

This situation changed in the 50's and 60's as the concept of improving the level of education for everyone started to flourish with many Technical Colleges initially being approved to offer degree courses under an existing University and then being granted the power to issue their own degrees.

A "Red Brick" University

Liverpool - Charter 1903

A "New University"("Concrete)"

The City University London. Founded 1891 as the Northampton Institute for working men and girls.

This lead to the rise of "new" Universities, sometimes referred to as " reinforced concrete" as opposed to the perceived to be superior "red brick" establishments – even though some of the new universities could trace their roots back further.

By the time I was ready to start the pathway to becoming a professional engineer the IEE had effectively stopped running its own exams and an honours degree was required to satisfy the educational requirements.

In parallel the industry had developed a much improved approach to training and however you studied for your degree there was a two year training course designed to expose the student engineer to the supply industry. Whilst I did a “thin” sandwich option (6 months University and 6 months training for 5 years) others did a “thick” sandwich one year training, three years University and a final year training, or simply went straight to University from Upper 6th and did a straight two years of training after completing their degree.

This approach ensured that all power engineers entering the industry had an overall concept of what was involved to keep the industry operating. Thus time was spent in a power station, with the grid and with design, construction and operations of the distribution system. But also working in a showroom selling appliances, out with the meter readers (even on disconnections for non-payment), in the legal and financial sections, with a manufacturer of equipment – as well as 6 months basic workshop training which ensured you understood what the craftsmen you would be managing were able to achieve (e.g. cable joining, lines work, electrical fitting).

3.3 Roles Held

Through the power of the web I have re-connected with many of my university classmates and their tales have been fascinating – especially as the world we were trained for was changed dramatically with the “commercialisation” of the industry. However, as a general rule they have ended up in senior roles in the industry with responsibilities across a range of functions, usually having gained experience in diverse roles – planning - design – operations and maintenance – construction. Most in senior roles have built on their initial education with such things as accounting, strategic planning, project management, etc all as add-ons to being an engineer.

4.0 Where are we Now?

4.1 Status:

The generic status of engineers in society has certainly taken a bashing over the last 40 or so years and power engineers have not been exempt. We are blamed for not keeping supplies on at all times on one hand and then blamed for wanting to build better systems to achieve what is requested. From Generation - love/loath wind power - to Transmission, where everyone seems to have a "better" alternative to additional circuits - to distribution, where we now are starting to see the effects of not having shutdowns and fixing everything at one hit but just fixing an individual item by live line work - it seems we are unable to please even some of the people some of time, let alone be regarded as a respected professional.

The UK Engineering Council set up a working group to consider the status and title of engineers in 2011, following an earlier review in 2003. In New Zealand IPENZ has considered the issue several times and over 10 years ago even introduced the "Ir" prefix (Ingenieur), but does not appear to have done much to promote it to the profession or the public.

In the 2012 Readers Digest List of the 40 most trusted Professionals we did not even get a mention - and the bottom four were sex workers, Car salespeople, door to door sales people and telemarketers![vii].

4.2 Education and Training

In the UK there is an ongoing debate about whether the full membership grade for the IET should require a Masters Level qualification although this is not yet the case. The experience requirements have generally been revised upwards over the recent years, and at the same time more "junior" categories of membership have been developed, although how successful these are is still open to debate.

Looking at degree courses there appears to be a much greater emphasis on theory and computer simulation than time spent in a laboratory with real machines and equipment. (This obviously varies between Universities). There also appears to be fewer lecturers than in the past who alternate between spending time working in industry and time working in academia, which is a two way loss.

In New Zealand IPENZ was keen to support the change to registration rules that requires regular re-application and review, using a system that requires electrical engineers (and some others) to interpret the requirement wording which appears drafted to suite other disciplines.

The idea of an engineer spending time after graduation purely doing training went out of favour when widespread commercialisation and corporatisation first came in, however it is encouraging to see some large employers bringing back such schemes. It is however, very difficult now for a developing engineer to experience all aspects of the power industry without a determined effort to move employers and deliberately change roles.

4.3 Roles

We still see professional engineers holding senior roles in many power industry organisations, however we appear to be in an age of "specialists" taking over roles' that were previously discharged by engineers. For example I have had statements reported to me of senior people in one power industry organisation saying "I want engineers back in their own box - we are managing projects and that is the role of a Professional Project Manager".

I do not dispute that there are a specific set of skills and a required approach to project management, and for someone to be a successful PM they need to learn them - preferably both the theory and practice. But I believe the best person to be PM of an engineering project is an engineer who has been suitably trained.[1] I accept that not every engineer has the approach, etc, to be a PM, but where they do then they should be managing engineering projects. There are several other areas, such as procurement, where engineers also appear to be being squeezed out by generic "professionals" with engineers being seen as a back room resource, rather than leading the area.

[1] Similarly if I am in hospital for an operation I would much prefer to have this be Project Managed by a medical professional.

5. What of the future?

5.1 Status

The cliché' "the future is in your hands" is a applicable for all aspects of engineering in the years ahead. The power engineering community in NZ is a relatively small one with many specialisations, the challenge is for us to find a common voice to promote to the wider public how they benefit from our efforts. Perhaps there is a role for the EEA to play here, but possibly we need to look to using the social media to get our message across.

Whilst I am not suggesting we seek a "Gangham" type of saturation/viral self promotion, (which is almost always short lived), just as companies are using the new media channels to promote their image as well as their products could we find ways to disseminate our "good news"?

Status is not a "single hit" issue, it needs constant monitoring and input. Changes can be both good and bad - being a "Geek" was originally a derogatory term, but (probably as the result of a few B grade movies) it has changed completely. The post Christchurch Earthquake inquiries have certainly raised the profile of engineers although the media concentrations on the tragic failures has over-ridden the positive aspects of all of the buildings that performed as designed.

So it is up to us to set how we are perceived in future.

5.2 Education and Training

There has been pressure for many years from employers of engineers to have knowledge and skills added into the undergraduate curriculum to make graduates more useful (read "chargeable") when they start work. This has placed pressure on the time available for teaching the fundamentals of engineering - as well as trying to provide a balanced education through encouraging exposure to non-engineering subjects. The original concept of going to University to "read for a degree", with the implication that it will help the person mature, is pretty much gone under the pressure of tests, assignments and very full course contents. I believe our Universities have achieved much, but perhaps the industry needs to step back and review how the best education and training should take place.

Whilst there is a clearly spelt out requirement to continue to learn and to keep up to date under our registration system, perhaps we should be looking at our professional colleagues, the Chartered Accountants, and their system that sees University courses concentrate on the fundamentals of their discipline but followed by a more rigid and examined post graduate system of training.

5.3 Roles

Put in box as an "ask when needed specialist" or leading the game? As noted some employers are able to look to the future and provide opportunities for engineers to broaden their experience and thus make themselves more eligible for management roles when they arise - should that be their aim. Similarly there are some enlightened employers who recognise the need for experienced engineering skills and knowledge and will reward for that without requiring a move into management.

However, I would suggest it is the responsibility of all of us already in engineering roles in the industry to encourage new graduates to both consider the future and to take advantage of the various ways to learn about themselves and what will satisfy them best in a career. Clearly not everyone wants to do the same things, not everyone likes managing people, not everyone has the natural desire to be minutely detail conscious as required for some critical technical roles, and the quicker an individual finds out about themselves the sooner they can focus their efforts to find a satisfying and productive career path.

I am not suggesting the engineers need to rule the world, just take their place in all areas of business (and society) where their skills and knowledge will bring benefits.

6. Health & Safety

The issue of safety is a complex one and requires consideration of both society expectations as much as any cold set of statistics. It is also harder to put into "Then" and "Now" categories as there has been a fairly solid record of improvements over time - with step changes every so often usually reflecting the development of materials.

Consideration of any early major engineering works clearly illustrates the relatively low level of value placed on injuring or killing a worker. For example, whilst the project was carried out well before the start of the power industry, the world's first tunnel under a river built by the Brunels cost at least 6 lives as well as resulting in many injuries and infections - but society was quite happy to visit and party in the tunnel. But then this needs to be considered in relation to the general mortality rate of the time with high infant deaths and regular outbursts of plagues.

Brunel - Thames Tunnel, 25 Mar 1843 - six lost lives plus many injuries and infections to build

The early days of electrical distribution were clearly a high risk time as the materials and techniques available were very limited. For example some early DC supply systems used copper rods enclosed in a wooden trough filled with bitumen - when this failed and an arc occurred fires and explosions resulted with loss of life as well as severe burns and other injuries.

The risks to workers was very high both from the electricity system and the from the tools and materials they used -for example pressurised paraffin blow lamps to heat metal to a molten state to join cable conductors or to plumb lead sheaths.

By the middle of the 20th century equipment was generally much more reliable and there was a much better appreciation for the need to work safely, although traditional methods were still the norm for many activities. There was still a general acceptance that "things happen" - for example much of the central London area was supplied by a distribution system that was designed to provide high reliability - if a cable fault occurred the available fault current was so high that the cable "burnt back" inside the sheath until it re-resealed itself. The 240/415 volt fault level was in the region of 45 MVA - this was demonstrated on the occasions that an underground link boxes failed and exploded when the concrete and steel footpath cover (which two men struggled to lift) was observed passing third floor windows.

We have seen dramatic improvements in health and safety over the last 50 years - paralleling the rapidly increasing expectations of society to ensure death and injuries do not occur. These improvements reflect several factors:

- changes to work methods eliminating the need for using tools or materials with high risks
- changes to the materials and equipment used that eliminate or reduce risk
- changes to the materials and manufacturing methods available for Personal Protective Equipment (PPE)
- major improvements in the knowledge of how people work and how to reduce human error or reduce its impact.
- recognition by companies of the financial impact of "accidents" as well as the human cost
- a change in the culture of some work groups - this reflects society expectations, as well as management and family pressures
- improved means of analysing events to understand failure modes
- improved means of disseminating information

Through all of these changes Engineers have contributed to the push for improved safety in many different ways - often driven by seeing (or suffering themselves) from the effects of an incident that should not have occurred! In terms of the development of safety rules the EEA has consistently worked to ensure they are kept up to date and take note of new learning.

Looking to the future we can only expect society to have a further reduced tolerance for avoidable injury and death (which is an interesting contrast to the trend to extreme sports and other activities -

but which are voluntarily undertaken). As engineers we should be constantly examining what we do and looking to anticipate potential safety issues.

7. Conclusion

Reflecting back from the start of the Electrical Power Industry sees pretty much constant change in being a power engineer and I believe we should expect that to continue. But it is up to us to take control and look to how we expect the profession to be viewed and the roles that we should take in the future, if we are to avoid being shut away in a back room and only sought out when something goes wrong.

I would promote the idea of creating some type of forum to share ideas on how we can best shape and influence the role of the engineer and then using the information and ideas generated to target the bodies and individuals that control what we are and can be. The power of social media is well proven and some interesting debates have taken place in some of the existing technical forums, but they often seem to get captured by recruiting agents seeking candidates, so a new forum will be needed. - Perhaps this is an opportunity for the EEA to develop its services to members?

On one hand it would be quite satisfying (and very smug) to think my generation were the "last of the summer wine", we had experienced the industry in the "good old days" and the future was all downhill for our caffeine fuelled younger engineers. But on reflection the good old days were really not always that good and we actually have lived through a time of great change which shows no signs of changing and our new engineers will have lots to challenge them. Let us learn from the past and not make the same mistakes, but let us also take a greater interest in the future of our profession and find ways to promote the benefits we can provide.

Disclaimer:

This paper is purely the views of the author and does not necessarily reflect the views or opinions of his employer, LineTech Consulting Ltd.

Endnotes

[i] New Zealand Historic Places Trust - Reefton Power House Foundations http://www.historic.org.nz/TheRegister/RegisterSearch/RegisterResults.aspx?RID=5002
[ii] Reefton Power Station - first public supply in NZ, IPENZ Proceedings Vol 14 (Feb 1988), Issue 2(E).
[iii] Tales of Future Past - http://davidszondy.com/future/tesla/tesla.htm
[iv] Wikipiedia - http://en.wikipedia.org/wiki/Thomas_Edison
[v] Oxford Dictionary of National Biography - http://www.oxforddnb.com/view/printable/33115
[vi] Britain since the 1930's http://www.chiddingstone.kent.sch.uk/homework/war/changessince.htm
[vii] New Zealand's Most Trusted Professions 2012, - http://www.readersdigest.co.nz/new-zealands-most-trusted-professions-2012