The Importance of International Standardisation in the Electricity Industry

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1 Introduction

In our daily work, we use standards in many job tasks without fully understanding the monumental amount of work that goes in the background to create the standards. This paper intends to provide some background on why standards were formulated and the benefits in adopting them.

This paper provides an overview of the International Electrotechnical Commission (IEC), the world's leading organisation for the preparation and publication of international standards.

This paper also provides the perspectives of two young professionals who have attended the Young Professionals (YP) programme in the previous two years, an annual programme held in conjunction with the IEC general meeting. An insight will also be provided into provisions currently underway to bring a YP programme to New Zealand.

2 The Importance of Standardisation

The benefits of standardisation are often taken for granted. For example, we can purchase appliances from a local store with confidence that we can go home, plug it in, and it will be safe to use. We only need to travel outside of Australasia to find that suddenly our electric goods no longer plug in, and an adapter is required. This is a simple example as to the benefits of standardisation. Additional benefits include:

- **Safety.** Consumers have the right to buy safe and reliable goods. Standards provide confidence that products will meet commonly agreed requirements, rules and specifications, particularly when it comes to safety.
- **Regulation.** Standards provide technical frameworks, metrics and specifications that can be referred to in legislation. This protects designers and manufacturers who comply with these standards.
- **Global Trade.** As a country, we won't get rich selling to ourselves. Complying with internationally recognised standards ensures we develop and manufacture products that can be sold to the largest market possible. We are also able to weed out low-quality imports, which protects us, the consumers.
- **Cost Savings.** There is no need to reinvent the wheel each time. The basics have been thought through to provide reasonable boundaries without hindering innovation.
- **Environmental.** Standards regulate the use of chemical products and include recycling considerations, as well as ways of measuring the performance and efficiency of products or systems and set minimum levels that classify products according to their efficiency.

As a power systems engineer, Kieran predominantly designs high voltage substations for clients such as Transpower. Transpower have a large number of standards, many of which are based on international standards that are harmonised to suit Transpower's needs.

Standards provide benefits for both designers and asset owners. Following standards provides designers with the confidence that what they are designing is safe and environmentally friendly, such as defining minimum phase to earth clearances and designing oil containment systems, without the need for having to undertake their own tests within laboratories.

It also ensures that the key design philosophies that really matter to our clients are well documented and available for all designers to use. This saves asset owners costs for multiple reasons; not only can they minimise their technical input into designs and focus on being an asset management companies, but they can invite a range of design consultants to tender for packages of work against a common benchmark. This allows them to compare apples with apples and obtain a competitive price, which is what is best for all of New Zealand.

From an asset owner's perspective, most companies are committed to optimise cost without increasing operational risks or compromising reliability performance. Standards are constantly used in specifying for the purchase of equipment and electrical components. Standards allow companies to be compliant with the country's health and safety regulations, which is important given that their employees are exposed to safety risks while working.

For companies working in product development, to speed up their development work, the standards often became their best starting point. Given that many products are required to be compliant to the standards, it was easier to develop a product using the same theoretical foundations to ensure interoperability and compatibility. Standards also often provide references to top research discoveries in a relevant technical niche area. This provides an excellent starting point and makes it easier for a new researcher to do a good literature review in the early stage of a research without spending an excessive time. Using the same standards as the foundation to the development also creates a commercial opportunity that will allow products to be sold to other local or international companies which also adopts the standards.

3 Standard organisations

Given the importance of standardisations, there are many national and international standard bodies throughout the world. Standard activities in New Zealand is managed by Standards New Zealand, which had recently been reorganised under the Ministry of Business, Innovation and Employment. Standards New Zealand often collaborates with Standards Australia to develop new standards that can be further customised to suit each country's environments.

Standards New Zealand also collaborates with international organisations like the International Electrotechnical Commission (IEC) and International Organisation for Standardization (ISO). IEC standards are often highly technical and confined to electricity applications whereas ISO standards cover other areas such as healthcare and food safety. Standards that had been developed via international collaborations are often adapted to form local standards. Even though standards are often used in industries with high public safety impacts such as electricity and construction, it is mandatory to follow a standard only if it is made obligated by the country's legal system.

4 The IEC

Early in the 20th century, it became clear following the World's Fair in St. Luois in 1904 (where electric energy was the main focus) that standards were needed. This would allow people to build on each other's research, create markets, and in turn stimulate further development of this new technology.

As a result, the IEC was founded in 1906, and is now the world's leading organisation for the preparation and publication of International Standards for all electrical, electronic and related technologies. These are known collectively as "electrotechnology".

The IEC family consists of 166 countries; 83 members and 83 affiliates. IEC members are known as National Committees (NCs) and there can be only one NC per country. New Zealand is a full member, and the New Zealand NC is Standards New Zealand.

Individuals participate in IEC work, such as developing standards, through their NC. This makes the NCs the absolute heart of the IEC.

The structure of the IEC is shown below in Figure 1.

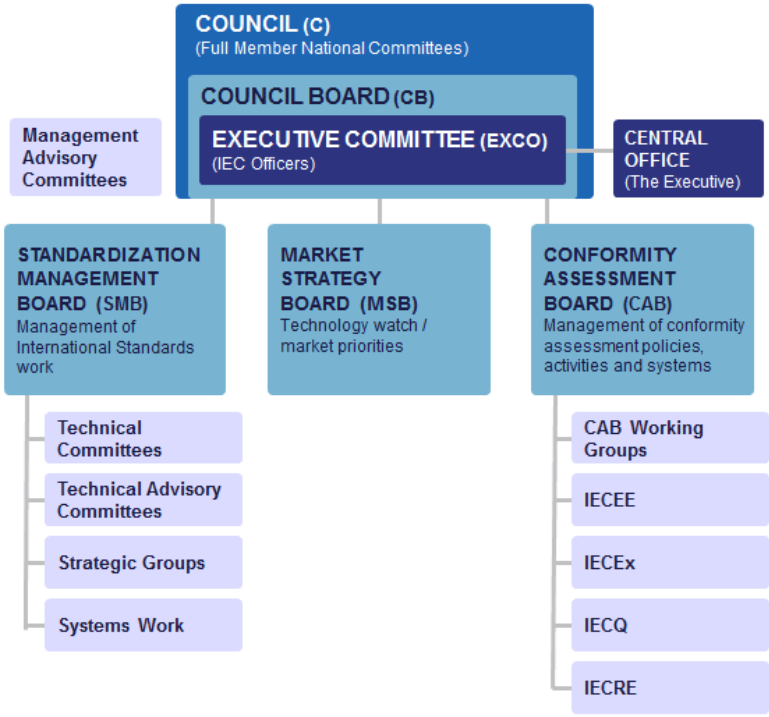

Figure 1: The Structure of the IEC

The IEC council is the governing body of the IEC, and comprises of IEC full members. The council board operates as the Board of Directors of a company would – and the executive committee brings together the Directors.

The Market Strategy Board (MSB) helps identify technology areas the IEC will need to cover in the future to stay market relevant.

The Conformity Assessment Board (CAB) covers the conformity assessment systems and activities of the IEC.

The Standardisation Management Board (SMB) covers the standardisation work of the IEC. This comprises of Technical Committees (TCs) and Subcommittees (SCs) which each develop standards within their scope. Standards development is discussed further in the following section.

4.1 Standards Development

The IEC's role is to facilitate the complicated process of reaching consensus amongst the many experts from countries all around the world, who volunteer to prepare the rules, specifications and terminology that allow manufacturers to build devices that work together, safely and as expected, anywhere.

For this, the IEC provides a platform, where representatives from industry, governments, research and testing laboratories, universities, etc. can meet. It also publishes the many so-called consensus-based International Standards for electrical, electronic and related products, processes and technologies – collectively known as electrotechnology - that result from these meetings and discussions.

Standards are developed by TCs and SCs. These are made up of NCs and liaison organisations, comprising of participating members (P-members) and observing memebers (O-members). P-members nominate experts to participate in the standardisation work.

For a standard to be published:

- At least 75% of participating experts must have agreed on the content of the Standard.
- A 2/3 majority vote of P-member NCs approve.
- Not more than 25% of all votes submitted (including both P-member and O-member NCs) are negative.

Each NC has one vote, regardless of the size of the country. While there is no single model for the structure of a NC, on becoming a member of the IEC, each NC agrees to open access and balanced representation from all private and public electroctechnical interests in its country. This all helps to ensure that a balanced, international consensus is reached when developing standards.

5 The Young Professionals Programme

In 2010, The IEC initiated The Young Professionals Programme to enable the IEC and its National Committees to reach out to the younger generation of experts, managers and leaders, encouraging their long term participation in standardisation and conformity assessment activities, which in turn ensures the continuity of high quality leaders and experts in IEC. In conjunction to the programme, an annual Young Professionals (YP) workshop was held during the IEC General Meeting to educate the selected YP on how IEC works. The workshop approach combined the method of lectures by experienced IEC experts and previous YP, interactive forum with IEC leaders, group activities, break-out sessions and practical sessions where the YP observed a Technical Committee meeting and either a Conformance Assessment Board (CAB) or a Standardisation Management Board (SMB) meeting. This provides them the opportunity to become more familiar with the IEC and hopefully contribute to shaping the future of international standardisation and conformity assessment.

The benefits of participating in the YP programme are:

- You get the opportunity to have your voice heard in the international arena and help shape the future of global standardisation and conformity assessment.
- You can enhance networking opportunities and help cultivate a long-term environment for the involvement in international standardisation with your peers from all over the globe.
- You can help ensure the future of technology transfer.
- You can develop an awareness of the IEC's work and maximise benefits from being involved in international standardisation.

IEC National Committees from each participating country have a selection process to nominate Young Professionals each year. In New Zealand, two young professionals had been selected each year, one by Standards New Zealand and one by the Electricity Engineers' Association (EEA). Standards New Zealand advertise the opportunity to young professionals who are already involved in their standard activities and the New Zealand's National Committee will select a candidate from amongst the applicants. The EEA selects the YP candidate via the Young Engineer of the Year Award. This award is presented to a young engineer who is judged to have demonstrated great achievement and leadership within the electricity supply industry, community and stakeholders, who not necessarily had been involved with standard activities previously.

5.1 The 2014 Young Professionals Programme – Thahirah Jalal

The IEC YP 2014 workshop was held in Tokyo, Japan and was attended by a 67 participants from 33 countries. New Zealand was represented by Daniel Chen and me. During the workshop duration, I attended all the scheduled workshop events including the social events during breakfast and dinner. The schedule was packed with activities and involved a steep learning curve where many activities ended with the YP presenting their understanding of the respective session. The IEC GM in Japan was attended by about 1500 delegates (IEC GM in Minsk was attended by around 700 delegates) and hence there were more options of technical committee activities to attend. Due to Japan's strong technical industry, there were also many industrial visits to choose from.

The workshop was officially launched by Dr Junji Nomura and Frans Vreeswijk, the President and General Secretary of IEC. The first day of the workshop covered further details on IEC history, structure, objectives, long term strategy and activities. The importance of IEC and the YP programme quickly became apparent even on the first day itself. Participation in international standard developments is important to a country because it can determine the outreach of the national products. The YP programme is also important because it was obvious that most of the General Meeting attendants are of the older generation and their knowledge and experience need to be transitioned to the next generation.

I had the opportunity to observe either the Conformity Assessment Board (CAB) or the Standard Management Board (SMB) meetings. I attended the CAB meeting and found it interesting. I enjoyed watching the interaction between countries and how some countries tried to influence the meeting's outcomes.

One of the important activities that involve every YP is the breakout session. It refers to sessions where YP are split into smaller groups and were each given three questions to

answer. The answers have to be presented immediately after the third breakout session. The presentation was attended by top IEC executives - Dr Nomura, James Matthews, Dr Shu, Frans Vreeswijk and Ulrich Spindler. They provided feedback and took note of suggestions provided in the presentation.

I also had the chance to observe the TC14 (Technical committee on transformers) in session. I use the standards often and found the observation insightful. I got exposed to a new type of transformer for underwater subsea applications. There was a presentation by China on a new power electronic technology that can be used to protect transformers from direct current faults. It was wonderful to note that the presentation mentioned that the technology has already been used by Transpower in New Zealand, confirming my understanding that New Zealand is often an early adopter of technology. Besides learning the technical details, it was interesting to observe how countries interact with one another. The chairman, Paul Jarman from the National Grid United Kingdom, was impressive in the way he handled the discussions.

On one of the evenings, IEC invited all the YPs to the YP dinner. The dinner finished with the submission of YP 2014 Leaders election form. Through the election, the 2014 YP have the opportunity to elect three leaders to lead them for a year. The leaders will coordinate projects that can be done after the YP workshop.

The last day started with breakfast with the TC14 chairman. I enjoyed having the opportunity to interact with Paul Jarman who not only spoke to us about how TC works but also on career development. I also learnt that given the complexity and multidisciplinary nature of transformers, standards on transformers are developed by various technical committees depending on their components.

The interactive session I chose to attend was on Smart Energy and the session was conducted by Dr Richard Schomberg, who was the TC8 chairman. He divided us into three groups and gave us a group assignment on how to organise multiple technical committees to develop multi-disciplined standards for smart energy. After we presented our solutions, Dr Schomberg shared with us the solution he proposed to IEC and updated us with the approval status.

Industrial visits have been kindly arranged by the Japanese Ministry of Economy, Trade and Industry (METI). I chose to attend the visit to Sumitomo Electric. There I visited a demonstration of a reduction flow batteries that were used with concentrated solar photovoltaics. The specialists there explained how the technology worked and described its advantages and disadvantages. They also gave us a group assignment on using standardisation as a commercialisation strategy. The workshop ended with a dinner, kindly sponsored by METI.

5.2 The 2015 Young Professionals Programme – Kieran Kennedy

The 2015 Young Professionals Programme was held in Minsk, Belarus, in conjunction with the 79th IEC General Meeting. I attended it as a Young Professional, having received the eea Young Engineer of the Year Award for 2015.

Over the course of three days, I had the pleasure of attending presentations from a wide range of speakers, observing meetings such as a technical committee meeting of my choice, and participating in interactive breakout sessions and conducting a site visit to a local Belarusian gas turbine power plant.

Of particular value was the opportunity to learn how the IEC is structured, works and gain an understanding of the standardisation development process. As a substation design engineer I use IEC standards regularly and to understand the process around their conception, development and maintenance was really interesting.

A presentation from R. Baillif, the IEC Technical Department Manager, was invaluable in clearly defining the IEC Standardisation Management Board (SMB) structure and how it operates to develop standards. I was able to observe the SMB meeting and a TC99 meeting (the TC for System engineering and erection of electrical power installations in systems with nominal voltages above 1 kV a.c. and 1.5 kV d.c., particularly concerning safety aspects) and TC I am particularly interested in as a substation design engineer. It was very insightful to gain an overview of the projects currently being undertaken by this TC.

To further cement my understanding of the standardisation process, I participated in an interactive mock standard development session which was arranged by B. Opatsuwan, another Young Professional, to simulate a technical committee meeting for a new Electronic Baby Robot standard.

We were split into multiple groups, each representing different parties with different interests at heart, such as safety, manufacturing, and end users. The purpose of this technical meeting was to reach a consensus on the Committee Draft version of the standard, which was great fun and a valuable experience in collaboration and compromise.

The programme had a great variety of social events, starting with a welcoming reception the night before the programme began. This provided a great opportunity to break the ice with my peers from around the world and meet the IEC Executives.

The IEC General Meeting opening ceremony was also a wonderful experience that all Young Professionals were invited to attend after the conclusion of day one. I was able to meet the New Zealand National Committee members, network further with my peers, and experience some fantastic Belarusian cuisine and entertainment.

The Young Professional's dinner was held after the conclusion of day two, so we were starting to known each other well enough to have a great time and discuss our professional and personal life's further. It was very encouraging to hear many young engineers were heavily involved, or keen to become involved, in the standardisation and conformity process.

The final day consisted of breakout sessions, where we were broken into groups and discussed ideas for answering the following questions:

1. How can participation in the works of standardization make you become a better leader for your company and industry?
2. How can Standards or participation in the standardization process be used as a competitive advantage for companies?
3. How do conformity assessment and certification affect product development and market entrance, and what role does the development of international standards play in the process?
4. How to convince your employers to sponsor your on-going involvement with IEC? What are employers concerns and how can these be addressed?
5. What are the activities that can attract YPs to increase their involvement in IEC?

Members then reported back to the group, and volunteers produced reports to be shared with the IEC Executives. It was great to have the opportunity to have my opinions shared.

Finally, we conducted a site visit to a Minskenergo gas turbine power plant, Belarus' biggest energy producer.

5.3 A New Zealand Young Professionals Programme

There are now more than ten YP from New Zealand who had attended the IEC YP workshop since 2010. There is now a strong interest in forming a New Zealand YP programme to ensure that there will be the involvement from the next generation in IEC standards activities. However, there is a lot of thinking that still needs to be done in setting up this programme.

In Australia, the Standards Australia started the Young Leaders programme where ten young professionals are selected each year for training on standard activities. The young professionals are from all sectors. Then, two young professionals from that batch and who work on the electrotechnical area will be selected to attend the IEC YP workshop. Is this a model that will work for New Zealand? Do we need to create a local YP programme just for IEC or for Standard New Zealand other activities as well?

There are also a lot of professional bodies for young professionals in New Zealand like the Young Professional branch for Institute of Electrical and Electronic Engineers, the Next Generation Network for CIGRE and Engenerate for IPENZ. How do we set up a new programme that will offer something different to existing programmes?

For a local YP programme to be successful and sustainable, these questions need to be resolved. It will be useful to receive feedback and ideas on forming the correct solution that will benefit the industry.

6 Conclusion

This paper has provided some background on why standards are formulated, and a perspective of companies which adopt or participate in standards activities. Adopting standards provides confidence that designs and products will be safe, environmentally friendly, meet regulations (if noted in legislation) and able to be sold on a global scale. There are also significant cost savings as we do not need to "reinvent the wheel" each time, we can build on each other's developments and innovations.

A range of standards organisations have been discussed and an overview provided of the IEC, who facilitate the process for developing consensus based international standards. These standards are produced by TCs/SCs that are made up of experts from NCs and liaison organisations from around the world. For standards to be published there needs to be consensus from all NCs involved and each NC gets one vote, regardless of the size of a country. This all helps to ensure that a balanced, international consensus is reached when developing standards.

This paper has provided the perspective of two young professionals who have attended The YP programmes in 2014 in Japan and 2015 in Belarus, an IEC initiative held in conjunction with the IEC general meeting each year. These programmes provide the opportunities to develop an awareness of the IEC and their activities, have your voice heard in the international arena, enhance networking opportunities, and help ensure the future of technology transfer.

Finally, an insight has been provided on provisions currently being considered to bring a YP programme to New Zealand. There are already other young professional bodies within New Zealand and we need to consider what a New Zealand YP programme will offer that is different to these existing programmes in order for it to be successful and sustainable.