TIC News Letter

The Australasian Transformer Innovation Centre focuses on the asset management of power transformers in the modern electrical network

February 2021
Issue 1

Message from the TIC Management team at UQ

Well 2021 is well underway. We are all geared up for an exciting year for the TIC education and research program.

Last year we delivered the first online CPD course, with 13 presenters, which ran over 4 weeks. A big change from face to face courses run over 2 days. This arrangement seemed to work with the industry, with the number of attendees (65 off) exceeded all our expectations. Our first CPD in 2020 at Sydney was a big success as well.

However, coordinating 13 local and international speakers during COVID-19 was a difficult task. A further refinement has now been adopted in 2021, where low cost ($60/hr) single presenter courses are underway. Two courses have been completed and two courses are yet to be delivered. The course duration is currently 1hr, 2 hrs and 4 hrs. The maximum session time is 2 hours/day. As of 8th Feb, 148 attendees have signed up for the courses and the combined income is less than $3k. Note that TIC members were offered these courses at no cost for these 4 courses. Initial feedback is that there is strong member benefit for zero cost courses. However continuing member zero cost courses for 2021 would significantly reduce the education income for the TIC. This aspect needs to be considered at the ASC February meeting.

Our Innovation and Education Committee is being consulted for member inputs to the 2021 primary research projects and CPD course content. We are waiting to hear from the committee.

Let us welcome our newest TIC Member AC Power.

We are still waiting to get our new PhD student, who has been waiting to travel to UQ.

We look forward to update you on a regular basis with more research and CPD information.

Ray is looking forward to spend more time with his family and friends, after he steps down from Manager TIC role . Ray feels proud of being part of a team that oversaw the progress that TIC made, in a short time. Ray wants to thank all the friendship and efforts of people who have assisted him personally and TIC.

We wish all the best for Ray in his future endeavour. Thanks Ray for all your dedicated work for TIC.

Our team

Prof Tapan Saha
Director

Mr. Tim Hart
Chair-ASC

Dr. Chandima Ekanayake
Deputy Director

Mr. Ray Holzheimer
Manager

Dr. Hui Ma

Mr. Sameera Samarasinghe

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THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Project Highlights

Retro-filling Transformers with Ester Fluids :

In the last couple of decades ester fluids emerged into the market as a replacement for mineral oil in transformers. Researchers have identified many advantages of ester fluids over mineral oil including higher flash point, lower calorific value, higher thermal conductivity, higher temperature stability, better ageing performance of paper insulation and biodegradability. Due to these advantages some utilities have taken initiatives to retro-fill the mineral oil transformers with esters. However, still retro-filling transformers with ester fluids is not a fully confident exercise for many Australian utilities as there is no specific guideline based on the local experience, which clearly describes the risks, issues and clear steps for thermal calculations of retro-filled units. Therefore TIC has initiated this project to cover the following objectives:

- Provide data associated with the risks of retro-filling various transformer types with ester fluids
- Develop a list of issues for transformer owners to consider before retro filling
- Seek to develop algorithms for thermal performance calculations based on transformer design and internal construction parameters

The aim of the project is to develop a guideline that helps for utilities to easily understand the pros and cons of retro-filling a specific unit. This project involves information gathering from various industries and Mr Kevin Newman a power transformer expert is working with TIC to develop the proposed report. TIC has formed an industry reference group committee, which includes both local and international organisations who have various experience on transformer retro-filling. The committee has determined the scope of works and met regularly to discuss the project developments.

The project is at its final stage on finalising the report based on the information gathered through various resources including environment agencies, fluid suppliers, component suppliers and publications available in CIGRE, IEEE etc. The inputs provided by the reference committee is also considered in drafting the final report.

This final report has highlighted the issues surrounding the decisions leading to and the processes of retrofilling mineral oil filled transformers with ester fluids. The subject is a complex one for users to consider with huge amounts of published papers and commercial information on ester fluids and retrofills available sometimes with conflicting data. Many of the published papers are not unnaturally sponsored or co-written by the major fluid suppliers as this is where the bulk of the expertise resides. Much research is continuing in CIGRE etc. and the world of standardisation is playing catch-up. It is hoped more objective information, particularly related to retrofills, becomes available soon from independent bodies including research institutes.

The full report on this project will be available for TIC members .

The TIC Team thanks the contributions of all members of this committee, with a special mention to Muhammad Daghrah for his assistance on this project.

Project Highlights

Guideline of Selecting External Mitigation Methods for Transformer Sound :

For transformers, one environmental concern is the audible sound generated and emitted into the surrounding, affecting nearby residents. Whilst transformer manufacturers can design and manufacture transformers to maintain transformer sound levels within limits, utilities still need to develop appropriate specifications and apply external sound mitigation measures to achieve appropriate overall sound levels.

In Australian utilities, sound mitigation methods have evolved to suit legislation and local practices and therefore vary from location to location and between the utilities. The installation of sound barriers is normally driven by complaints from nearby properties. The characteristics of a transformer's sound emissions may change with time due to ageing, increased load or the introduction of harmonics from external sources. Existing sound enclosures may be less effective over time.

Therefore, we initiated a project with the aim of providing a guideline of selecting external mitigation methods for transformer sound. The objectives of this project are:

•To analyse current Australian legislation for permissible substation noise and industry practices for transformer sound specification and mitigation.

•To identify the main factors that need to be considered by Australian utilities for transformer sound specification and mitigation based on current legislation, and utility practice, emerging issues with audible transformer noise generated by harmonics from inverter connected devices, and recent worldwide R&D outcomes.

•To develop a guideline to select suitable sound mitigation methods for transformers.

Under this project we have investigated various legislations under federal, state and local government for controlling the environmental noise level which applies for controlling the noise level of substation transformers. The Australian utilities have taken measures to comply with the current standards when installing new units whereas in the case of existing units, customer complaints are the major driving factor for introducing sound controls. The approaches taken for sound mitigation of existing units are highly based on the individual experience of each utility and overall cost. Installing noise barriers or replacing the transformer is quite common among the utilities. This study is further analysing the effectiveness of available solutions including noise barriers, active noise control and virtual sound barriers.

In this project TIC is closely working with an industry reference group comprises of local utilities from New South Wales, Queensland and Victoria. The project involves data collection from the industry. The data received from the TIC members were analysed to identify factors need to be considered in a guideline to select suitable sound mitigation method for transformers.

Dr. Hui Ma is currently working on finalising this report and will be available for TIC members by mid March 2021.

Continuous Professional Development

CPD and Education 2020

The first 2020 CPD course was titled "Power Transformer Tap Changers- Design, Maintenance & Retrofit" was held on 24-25th February, 2020 at TransGrid's Eastern Creek.

The course presenters were:

Anders Hakansson ABB Singapore, Rob Milledge ABB Australia, Dr.Thomas Smolka Reinhausen, Australia, Barry Myburgh Reinhausen Australia, Dr. Wenyu Guo OMICRON, Dr Hui Ma University of Queensland, Dr. Dan Russell Energy Queensland, Mike Elms Western Power, Ross Kempnich Essential Energy.

This was the first TIC CPD course to be fully booked out, with twenty-four delegates from generation, transmission and distribution companies, heavy engineering, consulting groups, services companies and power transformer manufacturers.

The feedback from the course:

- 100% of delegates said they would recommend this course to others.
- 75% of delegates rated the course "Excellent".

A big thank you goes to all the presenters for taking the time off their busy work schedule, take the time to prepare slides, travel, deliver their presentation(s) and absorb costs. A big thank you to Anders Hakansson (ABB) who travelled from Singapore to present at this tap changer course.

Upcoming CPD

Advanced Webinar on Phase Shifting Transformers:

10th February 2021 3.00pm to 4.00pm Brisbane Time (AEST)

Topics covered:

- The purpose of a phase shifting transformer
- Standards
- Types of Phase Shifting Transformers - Single Core versus Dual Core, Symmetric versus Asymmetric versus
- Important Parameters and their impact on the design
- Design Considerations
- Manufacturing challenges/testing

Presenter: Iain Mackay
GE Grid Solutions

Cost $60 (incl GST) for Non TIC member
Free for TIC members

For more news and updates visit : **https://www.itee.uq.edu.au/tic-news**

Upcoming CPD

Advanced Webinar on Final Acceptance Testing: Scope, Techniques, and Result Assessment for Power Transformers

Part 1: Date 25th February 2021 2.00pm to 4.00pm Brisbane Time (AEST)

Part 2: Date 4th March 2021 2.00pm to 4.00pm Brisbane Time (AEST)

Topics covered:

- Key design parameters for generator transformers
- Differences between generator transformer and other power transformers
- How to deal with stray flux in windings, core/clamping, tank and turrets
- Special cooling considerations and ratings
- Induced Core circulation Currents
- Special Aspects of Dual LV's for Renewables Applications
- Circulating Currents in windings
- Special Considerations for Short Circuit Withstand

Presenter: Rob Milledge, Hitachi ABB Power Grids

Cost $200 (incl GST) for Non TIC member
Free for TIC members

Our Facility

The state of the art natural ester filled transformers with numerous sensors enhances the research capability not only for present but also for Future.

Transformer insulation ageing facility and state of the art diagnostic systems for transformer condition monitoring.

The Australasian Transformer Innovation Centre