



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Power Transformer—Condition Monitoring and Asset Management

Continuing Professional Development

Advanced Course

October-November 2020

The University of Queensland

Who Should Attend?

- Procurement, Asset Strategists, maintenance managers and engineers.
- Generation, transmission and distribution personnel.
- Consultants, designers and operations staff in the renewables, manufacturing, mining, industrial and infrastructure organisations.

Course numbers are **LIMITED.** **PRICING**

Book NOW to secure a place.

TIC MEMBERS \$300 AUD(incl 10%GST)*

REGISTER ONLINE or
VIEW PROGRAM :

<http://www.itee.uq.edu.au/TIC-cpd>

NON TIC MEMBERS \$600 AUD (incl 10%GST)*

* Group Discounts available:

Save 10% for 2,

Save 15% for 3,

Save 20% for 4 or more





COURSE OUTLINE- Power Transformer— Condition Monitoring and Asset Management

KEY LEARNING OUT- COMES

Understand power transformer losses characteristic, optimisation of initial cost versus losses.

Be able to identify methods to include loss value management, and lifetime cost evaluation

Effectiveness of monitoring Essential Elements which affect transformer reliability

Finding the effective balance of on-line and periodic monitoring, a function of the components involved

Important benefits to understand in the move from Time Based to Condition Based Maintenance

Understand the differences between fleet approach vs single transformer approach,

Learn ways to deal with reduced resources, Identify the linkage between transformer specification, maintenance strategy and re-investment

Understand the inputs required to determine number, sizes and vector groups for system spare transformers

Learn risk based approach to determine how many spare transformers can be justified

Identify trigger to update your system spare transformers

Identify key maintenance required of system spare transformers

Defining a Digital Asset Management strategy used by major Australian electrical utility

Understand about Digital Twins

Learn about Digital Asset Management in the context of the enterprise

Exposure to case studies of Digital Asset Management:

-Circuit breaker monitoring

-Switchboard monitoring

Ageing mechanism in cellulose materials

Higher moisture in ester isn't bad

Potential to extend asset life with retrofilling with ester liquids

DAY 1—28 Oct 2020

- Power transformer losses and their source, loss characteristic.
- Transformer efficiency and evaluation of losses. Optimisation of initial cost versus losses. Methods to include loss value management, lifetime cost evaluation
- Introduction to Monitoring & Diagnostics using the 5W's approach, with the focus on its contribution to Maintenance.
- Essential Monitoring (on-line & periodic) and the 80/20 rule,
- Transformer Maintenance Cycles how they can be reduced, or eliminated
- Case Histories with good and not so good results
- Response Plan and Actions resulting from monitoring outputs
- Communications and Situational Awareness
- Forecasting of condition degradation for power transformers - importance of linking all available condition information and of probability of failure curves-
Transformer Condition scores:
 - ◆ Difference between fleet approach vs single transformer approach,
 - ◆ Ways to deal with reduced resources,
 - ◆ linkage between transformer specification, maintenance strategy and re-investment strategy
- Digital Asset Management- Strategies by major Australian Electrical Utility - Western Power
 - ◆ Defining a Digital Asset Management strategy
 - ◆ Digital Twins
 - ◆ Digital Asset Management in the context of the enterprise

DAY 2—4 Nov 2020

- Case studies of Digital Asset Management
 - ◆ Circuit breaker monitoring
 - ◆ Switchboard monitoring
- Data required and process to determine adequate number of system spare power transformer
 - ◆ Identify inputs required to determine number, sizes and vector groups for system spare transformers
 - ◆ Risk based approach to determine how many spare transformers can be justified
 - ◆ Triggers needed to update your system spare transformers
 - ◆ Highlight key maintenance needed for system spare transformers
- Life extension, In service parameters and interpretation of DGA in MIDEL
 - ◆ Comparison of cellulose materials' ageing in mineral oil and ester
 - ◆ In-service parameters and limits for ester liquids
 - ◆ Adjustments required to interpret DGA results of an ester filled transformer
- Attendee meet and greet, networking session, where attendees share successes or issues with transformer condition monitoring and asset management. 5-10 min case studies can be presented?

COURSE OUTLINE-Power Transformer— Condition Monitoring and Asset Management

KEY LEARNING OUTCOMES

Be exposed to benefits of condition monitoring of distribution transformers using TXpert digital distribution transformer

Understand transformer condition, sensing solutions and domain knowledge for power transformers using the TXpert Digital Ecosystem.

Understand the general methods of signal processing for extracting data from transformer condition measurement

Learn methods of data analysis for condition assessment,

Understand data and information fusion to determine transformer health index

Learn differences between Silver and Copper Sulphide, Detection methods, failure modes, mitigation actions.

Exposure to corrosive sulphur risk assessments based on MR's FLEETSCAN 2D methodology.

Be exposed to different perspectives for condition assessment and different approaches

Understand the benefits of a two dimensional approach for condition assessment

Be exposed to case study of condition monitoring and asset management practice in a German utility

Learn economic assessment of investments and optimal project timing, quantifying Transformer asset risks

Understanding risk in redundant systems

Learn joint versus conditional probability assessment, common-cause failure concepts and mitigation techniques

Background and the need for Digital Enabled Substations.

Learn about digitisation of transformer online data and information.

Practical application of transformer AVR in advanced VOLT-VAR control schemes in modern power systems with high penetration of renewable sources.

Transformer online data for power systems analysis using Artificial Intelligence (AI) and Machine Learning (ML).

Understand asset performance management of Transformers through Digitalization – the “TXpert Ecosystem”, highlight the steps to take advantage of the advancements in understanding transformer condition,

Learn sensing solutions and domain knowledge for power transformers using the TXpert Digital Ecosystem.

How choosing ester can influence asset management strategy

Differences for monitoring ester filled transformers in the field

How choosing ester can influence capital project cost

DAY 3—11 Nov 2020

- Condition Monitoring of Distribution Transformers using Digitalization
 - ◆ focus on the world's first TXpert digital distribution transformer to meet the evolving needs of today's grid with focus on low voltage (LV) network
 - ◆ required sensory technology and industrial computing integrated during transformer manufacture
 - ◆ TXpert increases transformer optimized utilization
- Effective signal processing for extracting data and information from sensor measurements;
- Transformation of data into useful information regarding the condition of transformer (i.e. fault type identification);
- Integration of online sensor measurement and other information (i.e. offline measurement, human experts' judgments, industry standards and practices, inspection) to determine transformer health index
- Transformer silver sulphide /copper sulphide
 - ◆ Introduction into tests to identify corrosive/silver sulphur in transformer oil
 - ◆ Field observations, failure modes
 - ◆ Mitigation by oil reclaiming
 - ◆ Case-study about corrosive sulphur transformer risk assessment based on MR's FLEETSCAN 2D methodology
- New challenges and trend in asset management
- Motivation for condition assessment of power transformers and requirements of different stakeholders
- Data for fleet management
- Case Study of a German utility

DAY 4—18 Nov 2020

- Asset Performance Management of Transformers through Digitalization – the “TXpert Ecosystem”
 - ◆ highlight the steps to take advantage of the advancements in understanding transformer condition,
 - ◆ sensing solutions and domain knowledge for power transformers using the TXpert Digital Ecosystem.
- Asset management principles
- Economic assessment of investments and optimal project timing
- Quantifying Transformer asset risks
- Understanding risk in redundant systems
- Joint versus conditional probability assessment
- Common-cause failure concepts and mitigation techniques
- Background and the need for Digital Enabled Substations.
- Digitisation of transformer online data and information.
- Practical application of transformer AVR in advanced VOLT-VAR control schemes in modern power systems with high penetration of renewable sources.
- Transformer online data for power systems analysis using Artificial Intelligence (AI) and Machine Learning (ML).
- Asset management strategy and S/S benefits with Ester
- Fluid choice impacts on Asset Management Strategy considerations
- Fluid choice impacts on total cost of ownership considerations



Power Transformer—Condition Monitoring and Asset Management

13 off INDUSTRY & ACADEMIC PRESENTERS

PRICING

TIC MEMBERS

\$300 AUD (incl 10%GST)
Discounts available:
Save 10% for 2,
Save 15% for 3,
Save 20% for 4 or more

NON TIC MEMBERS

\$600 AUD (incl 10%GST)
Discounts available:
Save 10% for 2,
Save 15% for 3,
Save 20% for 4 or more

Rob Milledge
Technology Manager & Application Engineer,
Power Transformers
Hitachi ABB Power Grids

Rob has had over 40 years experience in Power Transformer electrical and mechanical design, manufacturing, test for voltages to 550kV and ratings to 1,125MVA. Rob is the Chair of EL/8 Committee Standards Australia and a member of CIGRE committee – AP A2 Panel.

Brian D. Sparling, SMIEEE
Dynamic Ratings Pty.



Brian D. Sparling, a Senior Member of IEEE, is a Senior Technical Advisor with Dynamic Ratings Pty. Brian has over twenty years of experience in the field of power and distribution transformers. For the last 29 years, he has been involved in all aspects of on-line monitoring and diagnostics and condition assessment of power transformers.

He has authored and co-authored more than 33 technical papers and has contributed to many guides and standards with the Canadian Electricity Association, IEEE Transformers Committee and, the CIGRÉ A2 Transformer committee.

Amra Alibegovic-Memisevic
Team Leader Substations Strategies
Powerlink Queensland



Amra has worked at Powerlink Queensland during the last 17 years. She has worked as Senior Transmission Line Strategies Engineer, Senior Substation Strategies Engineer and is currently Team Leader Substation Strategies in Asset Strategies group. Amra is responsible for development of strategies for high voltage equipment, lifecycle management, forecasting methodologies for end of life.

Carlos Gamez
Head of Function
Asset Performance
Asset Management
Western Power

Carlos has over 24 years in the electrical industry, as transformer designer, Substation field and workshop maintenance, transmission asset management, operational asset performance. Currently Carlos works as the Head of Function of Asset Performance at Western Power, managing the network of in-service Transmission, Distribution, SCADA and Communication assets that comprise the South West Interconnected Network of Western Australia.

Carlos has authored several magazine articles and papers, including two chapters on the “Power Transformer Condition Monitoring and Diagnosis” book published by the Institution of Engineering and Technology.

Bhaba Das
Lead Digital Business Developer
(Asia Pacific) Hitachi ABB Power Grids.

Bhaba graduated from the University of Canterbury, Christchurch, New Zealand where he completed his PhD on harmonics mitigation in HVDC transformer using current reinjection. He was awarded the “New Zealand Young Engineer of the Year 2017” for his work on design and development of the Smart Transformer. He is a senior member of IEEE, IEC Young Professional and has published various papers in academic journals and conferences worldwide. He has three transformer related patents in Australia & New Zealand. He is working as the Lead Digital Business Developer (Asia Pacific) for Hitachi-



CREATE CHANGE

REGISTER ONLINE or
VIEW PROGRAM :

<http://www.itee.uq.edu.au/TIC-cpd>

Power Transformer—Condition Monitoring and Asset Management

13 off INDUSTRY & ACADEMIC PRESENTERS

Dr. Hui Ma - Research Specialist
University of Queensland



Barry Myburgh
Reinhausen Australia



Alexei Babizki
Portfolio and Business Development Manager
Maschinenfabrik Reinhausen Germany



Chris Beckett
Primary Assets Manager - Stations
United Energy



Tuan Vu
Senior Digital Asset Strategies Engineer
Powerlink Queensland



Dr Hui Ma is a research specialist in condition monitoring, diagnostics, HV engineering & insulation and machine learning. Hui also is a lecturer at Queensland University School of Information and Electrical Engineering and researcher at the Australasian Transformer Innovation Centre.

Barry has 28 years international experience (Eskom (RSA), Alstom Transformers (RSA), ABB, Select Solutions SNC Lavalin (UAE), Doble Engineering (UAE). Barry joined Reinhausen Australia in March 2019 as Area Sales Manager, focussing on the transformer service portfolio, asset management, automation & control, and transformer components. Barry is an experienced high voltage specialist with key expertise in the power transformer field up to 800MVA & 765kV; field maintenance & repairs ,manufacturing; installation & commissioning; advanced diagnostic testing and condition assessments.

From 2006 Alexei worked for LEONI AG development engineer. After joining Maschinenfabrik Reinhausen as Project Manager of Corporate Technology in 2010 he became Manager of Grid Integration in 2012. Mr. Babizki was responsible for the technical analysis of current and future requirements of electrical grids in order to optimize the present MR solutions in these application fields.

In the recent years, his focus was development and commercialization of fleet assessment and management solutions for power transformers in cooperation with various utilities and universities.

Chris has more than 10 years of experience in power transformer and switchgear life cycle activities, including specification development, condition assessment and failure investigation. He is currently employed with United Energy as Primary Assets Manager - Stations. His current focus is developing substation risk quantification models, and approaches to optimizing network investment. He is a member of the Institution of Engineers Australia and was a member of CIGRE WG A2.49, and has recently published a paper on common cause failure considerations in power transformers at CIGRE e-Sessions 2020.

Tuan Vu has more than 23 years of experience in Asset Management, Digital Asset Strategies, SCADA, Secondary Systems, Power Systems Voltage and Reactive Power control, SVC and STATCOMs. He is currently undertaking PhD research in Power System Harmonics. He is a Fellow Member of the Institute of Engineers Australia, a member of Standards Australia, CIGRE Australia B4 (HVDC and Power Electronics) and IEC TC 57 WG 10. Tuan provides technical training courses and consultant services to utilities in Australia and Overseas.

PRICING

TIC MEMBERS

\$300 AUD (incl 10%GST)
Discounts available:
Save 10% for 2,
Save 15% for 3,
Save 20% for 4 or more

NON TIC MEMBERS

\$600 AUD (incl 10%GST)
Discounts available:
Save 10% for 2,
Save 15% for 3,
Save 20% for 4 or more



CREATE CHANGE

Power Transformer—Condition Monitoring and Asset Management

13 off INDUSTRY & ACADEMIC PRESENTERS

PRICING

TIC MEMBERS

\$300 AUD (incl 10%GST)
Discounts available:
Save 10% for 2,
Save 15% for 3,
Save 20% for 4 or more

NON TIC MEMBERS

\$600 AUD (incl 10%GST)
Discounts available:
Save 10% for 2,
Save 15% for 3,
Save 20% for 4 or more

Dr Attila Gyore –
Senior Engineer M&I Materials
MIDEL (UK)



Attila Gyore has a PhD from the Budapest University of Technology and Economics (BUTE), with a focus on superconducting transformers. For 10 years he was an Assistant Professor at the Department of Electric Power Engineering at BUTE, and from 2011 he worked with CG Hungary as an active part design engineer of power transformers. Dr. Attila joined M&I Materials in 2012 as a senior application engineer, where he is an expert in the applications of natural and synthetic ester liquids and refilling of transformers.

Attila is an active participant in conferences worldwide and is a highly engaged member of IEEE, CIGRE D1 as well as IEC TC10 and TC14.

James Reid – Technical Manager – MIDEL
Applications M&I Materials



James Reid is a chartered Chemical Engineer and holds a MSc Reliability Engineering & Safety Management from Heriot Watt University and a BEng Chemical Engineering from University of Edinburgh. With over two decades of solving problems in Technical Support and Operations Management roles with leading specialist oil, water utility and chemical companies before joining M&I Materials as Technical Manager – MIDEL Applications in September 2019 he is well placed to understand customers, consultants and industry challenges and help them develop their MIDEL applications.

Ray Holzheimer
Manager Australasian Transformer Innovation
Centre The University of Queensland



Ray has over 40 years experience in the electrical industry, including power transformer design, manufacture and test, mining, water resources, transmission substation design, procurement and HV substation maintenance.