Electrical Engineering and Computer Science

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Power, Energy and Control Engineering

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UQ Power, Energy and Control (PEC) Engineering

Academic staff

Professor Tapan Saha
BSc Eng., M.Tech., PhD,
Grad. Cert. (HE), FIEAUST,
CPEng, IEEE Fellow, RPEQ

Leader PEC Discipline, UQ Solar and UQ Industry 4.0 Energy TestLab, and Director of Australasian Transformer Innovation Centre

Tapan's research interests include integration of renewable energy to the national grid and condition monitoring of electrical equipment.

Professor Mithulananthan Nadarajah
B.Sc. (Eng.), M.Eng, PhD,
Grad. Cert. (HE), SMIEEE

Professor

Mithulan's research interests are grid integration of renewable energy, battery energy storage and electric vehicle charging stations.

Associate Professor Rahul Sharma
B.Tech, M. Eng Sc (Research),
PhD, SMIEEE

Associate Professor

Rahul's research interests include control systems, system modelling, fault diagnosis, real–time optimisation, monitoring of large solar farms and control applications to power systems and vehicle electrification.

Associate Professor Richard Yan
BEng, MEng, PhD, SMIEEE, CpENg,
FIEAUST, RPEQ

Associate Professor

Richard's research areas are solar PV and wind technology, power transmission and distribution system analysis, and network operation and control.

Dr Chandima Ekanayake
BSc Eng, Tech. Lic., PhD, SMIEEE

Senior Lecturer

Chandima's research interests are condition monitoring of power apparatus, alternatives for insulating oil, performance studies of HV insulators, high voltage engineering and impact of renewables on grid assets.

Dr Hui Ma
B.Eng, M.Eng, M.Eng (research),
PhD, SMIEEE

Senior Lecturer

Hui's research interests include modelling, sensing, signal processing and machine learning applications in power system, high voltage engineering and electrical insulation, and wireless sensor networks.

Dr Wayes Tushar
B.Sc, PhD, SMIEEE

Senior Lecturer

Wayes' main research interests include energy and storage management, peer–to–peer energy trading, renewable energy, smart grid, design thinking, and game theory.

Dr Feifei Bai
B.Eng., PhD, SMIEEE

Senior Lecturer

Feifei's research interests include solar PV integration to the power grid, PMU applications in distribution power networks, data–driven power system modelling and inter–area oscillation damping control.

Research fellows

Dr Feng An
B.S. and M.S. degree in electrical engineering, PhD (Tsinghua University)

Dr Arnab Bhattacharjee
B. Tech (Honours) in EEE
PhD thesis submitted (UQIDAR)

Dr Ramesh Naidu Bonu
B. Tech, M. Tech, PhD (IIT Kharagpur
Postdoctoral Research Fellow

Dr Gayan Lankeshwara
PhD (UQ), Postdoctoral
Research Fellow

Honourary/Adjunct Professors

Honorary Prof Jovica Milanovic

Dipl.Ing., MSc, PhD, DSc, CEng, FIET, FIEEE

Professor, The University of Manchester, UK

Honorary Prof Iqbal Husain

PhD (Texas A&M University, College Station)

Professor, North Carolina State University, USA

Honorary Prof Ian Hiskens

PhD (University of Newcastle, Australia)

Professor, University of Michigan, USA

Honorary/Adjunct Professors

Adjunct Prof David Allan (retired from Powerlink)

Adjunct Prof Debabrata Chattopadhyay (World Bank, USA)

Honorary Prof Firuz Zare (QUT)

Adjunct Prof Richard Harris (Excelonics Pty Ltd)

Industry Professor

Prof Neil Horrocks

Honorary Adjunct Fellows

Dr Daniel Eghbal (Energy Queensland)

Dr Nilesh Modi (AEMO)

Dr Nahid Al–Masood (Energy Queensland)

Dr Umberto Cella (DIgSILENT Pacific)

Dr Yi Cui (USQ)

Dr Mehdi Mosadeghy (Noja Power)

Dr Nadali Mahmoudi (EPEC)

Dr Negareh Ghasemi (Tritium)

Dr Phuong Nguyen (Powerlink)

Mr Yu Su (Energy Queensland)

Dr Rakibuzzaman Shah (Federation University)

Dr Olav Krause (Grid Qube)

Technical staff

Dr Shawn Nielsen (Manager, Australasian Transformer Innovation Centre)

Joseph Zhou (Supervisor of Power research labs)

Administration staff

EECS operations and research administration officers

Welcome

Power, energy and control engineering research activities are centred on Grid integration of renewable energies, Electrical asset condition monitoring and life assessment, Control applications in power engineering, and Energy management, microgrid and cyber physical systems.

Power system in most countries are transforming much faster than anticipated with a net–zero focus. With massive proliferation of renewable generations and retirement of fossil fuel based synchronous generators, there is a significant need for an improvement in the planning and operation of future power systems in the Australian national electricity grid. The group's research is specifically directed at the analysis and prediction of the dynamic behaviour of power systems for reliable and secure operations. Amongst the many options in this area, power system stability analysis tools and power systems control methodologies for the inverter based power systems are the most important foci. Researchers in these areas work closely with network companies, renewable generators, market operators, renewable energy service providers/consultants and state and commonwealth funding bodies including ARC, ARENA and other agencies.

A significant proportion of the electricity infrastructure in Australia and other countries is aged and requires special consideration. The focus is thus industry orientated research and aims to deliver next generation condition assessment techniques that comprise of accurate modelling and interpretative tools for power transformers, underground cables and other plant assets. Australasian Transformer Innovation Centre has been in operation since 2017 within the School of Electrical Engineering and Computer Science, which focuses on the asset management of power and instrument transformers and application of biodegradable insulating oils in the transmission and distribution networks. In this centre, we apply innovative research and industry experience together with professional training to help centre members operate their transformer fleets sustainably and efficiently. Researchers in this area works closely with industry experts in transformer asset management, as well as researchers and educators from leading Australian and overseas universities.

Our discipline has been actively engaged in commercializing our research outcomes through three start-ups. Our IP from transformer condition monitoring and life assessment was licensed to a start-up AURTRA, which was acquired by Schneider electric in 2022. Our ARENA funded work in the visibility of low voltage and medium voltage electricity distribution network has established a commercial venture GridQube to provide support to the utilities. Our work on Solar Farm Fault Detection and Diagnosis, which automatically detects and locates faulty/under performing photo-voltaic (PV) panels has recently established a new start-up SOLARIS[AI].

The Power, Energy and Control Engineering Research group is actively involved with industry oriented challenges and enjoys strong industry collaboration in research both nationally and internationally. We work closely with members of Australian Power Institute and Energy Networks Australia.

Solar research at UQ

University of Queensland has one of the largest university solar PV facilities in the world. In 2011, UQ installed 1.3 MW rooftop PV stations across several buildings at the Universities St Lucia campus. Since then, UQ St. Lucia campus Solar PV installations have significantly grown in many other building roofs and totals around 2.5 MW.

In 2015 UQ installed 3.3 MW Solar Research Facility comprising more than 37,000 thin-film photovoltaic panels, mounted on 10ha former airstrip at the university's Gatton Campus. This 3.3MW system comprises of 5 arrays: a dual tracking array, a single axis tracking array and 3 fixed tilt panel arrays. Multiple PV mounting technologies including fixed-tilt, single-axis and dual-axis tracker technologies are in operation side-by-side in the same field to investigate their performance. PV panels mounted on a single axis tilts from east to west throughout the day to maximize energy output. Dual Axis Tracking Array trackers are capable of a 340° slewing motion and 180° tilt that allow the panels to directly face the sun at all times and thus, maximize output power.

The University of Queensland is proud to be a leader in the renewable energy field and our infrastructure now includes the 64 megawatt Warwick Solar Farm, which is connected to the national grid. UQ is the first major university in the world which is capable of offsetting 100 per cent of its electricity usage through its own renewable energy assets.

These solar plant facilities along with the state of the art renewable energy laboratory are providing a unique research opportunity to Power and Energy researchers to understand the challenges and opportunities of solar PV integration to the electricity grid. These infrastructures facilitate a wide range of teaching, research and engagement opportunities with the electricity sector for UQ to solve some of the major integration challenges.

Industry 4.0 Energy TestLab at UQ

UQ has built an Energy TestLab focusing on Green and Smart Energy – an IoT enabled digital manifestation of the entire electricity network portfolio for energy management, power system analysis, and sector specific cyber security. The TestLab has been a point of engagement between electricity industry and UQ researchers to enable knowledge transfer through CPD deliveries and renewable energy integration research collaboration to facilitate in-depth power and energy system research, and research in cyber resilience. This lab has created engaging and deeply realistic teaching and learning experience for our students. The TestLab is developing collaborations with researchers from electrical and mechanical engineering, big data, cyber security, software programming, economics and policy design to UQ's current strong focus in multi-disciplinary energy research.

Research and discovery

Power, Energy and Control Engineering research has long been a strength of The University of Queensland

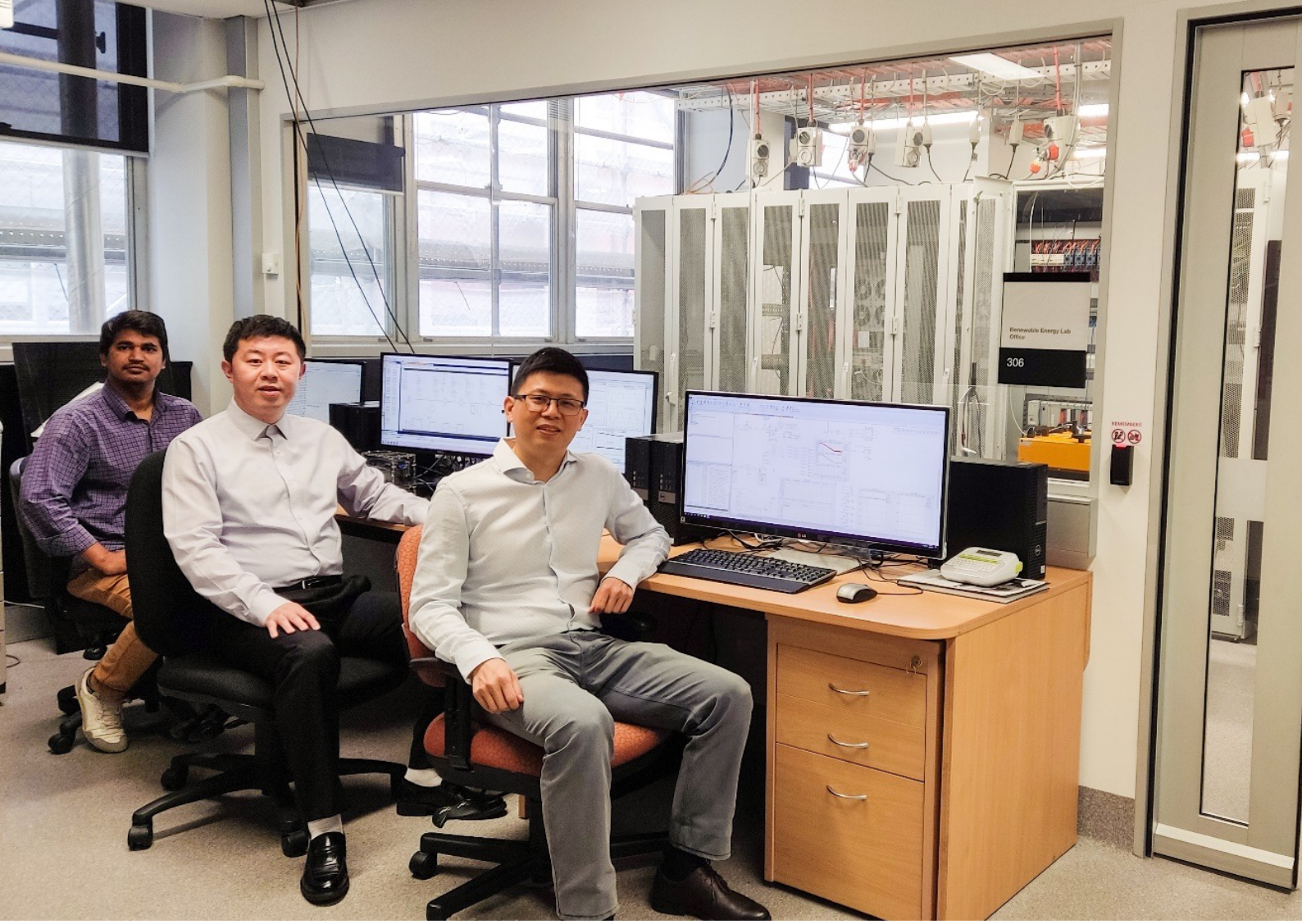
The strong research output has continued in recent years and the productivity of the group's research activities can be attributed to the close links and generous support provided by the group's industrial and academic research partners.

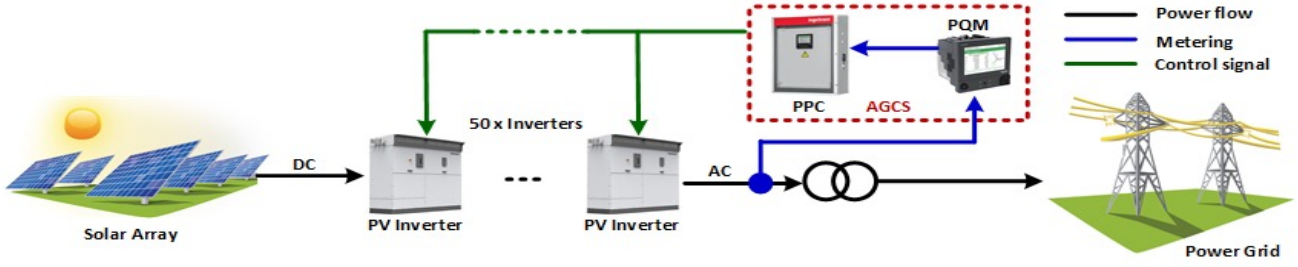
The group has two primary areas of focus in research. A number of academics are working on condition monitoring of ageing assets of electricity industry. This includes transformer, cables, overhead transmission/distribution conductors and other assets. The other is focused on renewable energy integration to the transmission and distribution grid. This includes power system analysis tools for solar PV, wind and other renewable energy integration into the national electricity grid.

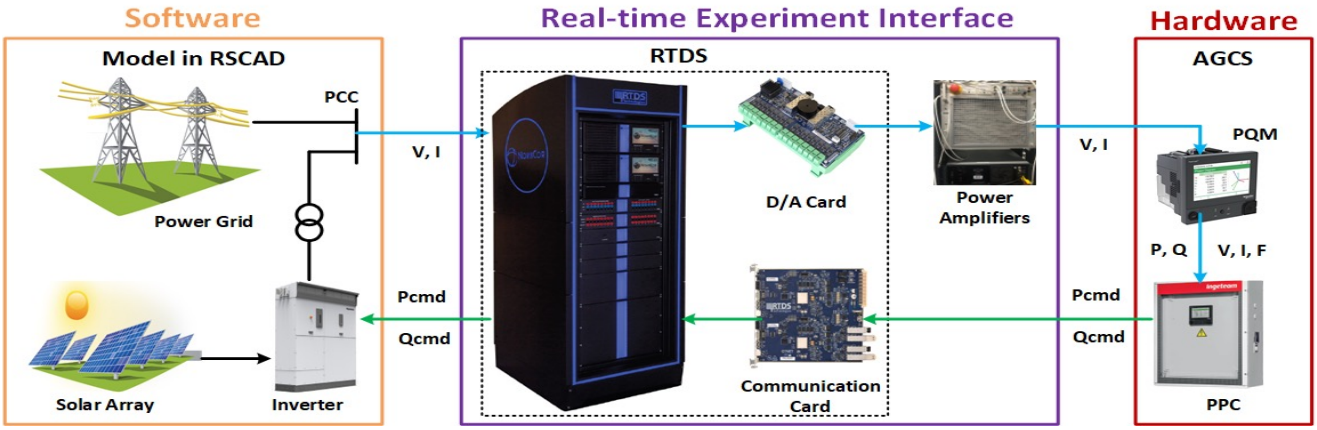
Significant research is in progress to address the challenges of rooftop distributed solar PV and commercial/utility scale solar PV integration to the grid. The group has obtained significant financial support from both the Australian Research Council and national and international research partners.

Platform for solar farm pre–commissioning

The industry standards and practice for the commissioning and connection of new solar farms only allow engineers three months to resolve any response mismatches between software models and real solar plants before they are allowed to connect to the grid and generate full energy output. Many engineering commissioning companies have experienced difficulties during solar farm commissioning before and suffered from lengthy delays and financial losses. They have identified the major source causing discrepancies is the AGCS–Aggregated Generator Control System of a solar farm, which based on the current industry practice can only be tested after the construction of a solar farm when the 3–month commissioning period has already started. To solve these challenges, the lead organisation, UQ will collaborate with EPEC Group as well as upstream and downstream industry partners to establish a new hardware platform for pre–commissioning the AGCS of solar and hybrid solar farms to ensure its performance before on–site commissioning. The new system enables the urgently needed early testing, which is currently not available in the market. The following outcomes will be delivered which will bridge a significant gap in the current solar industry– a new hardware platform for solar and hybrid solar farm pre–commissioning, standard procedures for testing AGCS performance, and a technology demonstration for pre–commissioning of renewable energy projects. This will provide significant benefits, such as reduction in commissioning risks, project delays and financial losses, improvement in business efficiency, competitiveness and reputation, and promotion in Good Electricity Industry Practices and higher renewables.




Power flow
Metering
Control signal
PQM
PPC
AGCS
50 x Inverters
DC
AC
Solar Array
PV Inverter
PV Inverter
Power Grid


Software
Real-time Experiment Interface
Hardware
Model in RSCAD
RTDS
AGCS
PCC
V, I
Power Grid
D/A Card
Power Amplifiers
V, I
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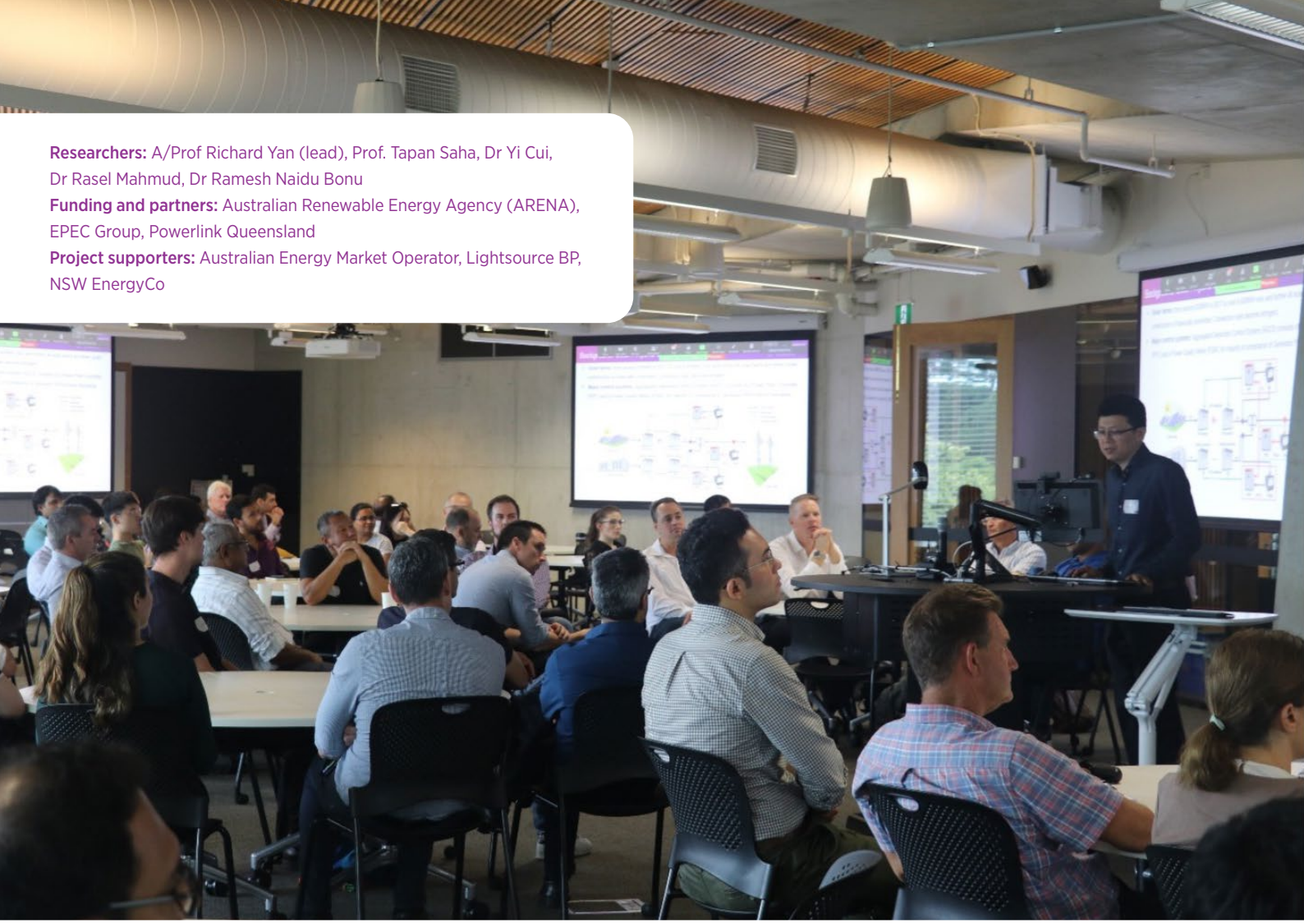
P, Q
V, I, F
Pcmd
Qcmd
Pcmd
Qcmd
Solar Array
Inverter
Communication Card
PPC



Researchers: A/Prof Richard Yan (lead), Prof. Tapan Saha, Dr Yi Cui, Dr Rasel Mahmud, Dr Ramesh Naidu Bonu
Funding and partners: Australian Renewable Energy Agency (ARENA), EPEC Group, Powerlink Queensland
Project supporters: Australian Energy Market Operator, Lightsource BP, NSW EnergyCo

Knowledge sharing workshop by UQ

Non–destructive testing for condition assessment of wooden poles

Over four million wooden poles in Australian networks account for over 80% of the total utility pole population. Most structures provide long, reliable service lives, relatively few fail unexpectedly posing serious risks to the public and negatively impacting network safety and reliability. Routine inspections are undertaken to assess structural integrity and to ensure poles remain fit–for–purpose. Sound, dig and drill (SDD) is the most common inspection method. It is reasonably accurate but intrusive, localised and less effective at identifying certain defects, such as “carrot” rot. Many non–destructive tools claim to detect degradation and/or estimate residual capacity; however, there are few comprehensive comparisons with traditional approaches. This project will develop a decision–making tool enabling utilities to identify the most appropriate NDT for specific inspection/pole types combining technical performance with analysis of OHandS, public safety, bushfire and other risk exposures, to consider whether the introduction costs justified. Development of specific selection parameters for NDT tools will help utilities determine the most appropriate technologies for their conditions to improve inspection reliability, thereby reducing risk of unassisted failures and maximising inspection value.

Researchers: Dr Chandima Ekanayake (UQ), Prof Tapan Saha (UQ)
Consultants: Michael Powell, Colin Lee, Jeffery Morell
Funding: ENA (Energy Networks Australia)
Industry Partners: ENA member organisations

Enabling the Queensland power system of the future

This project had two streams:

Stream 1 – Distribution network monitoring and control technologies: Globally there is an urgent need for a step change of the technologies for monitoring and control of electricity distribution networks to ensure safety, reliability, and support customer participation, in electricity supply and usage, including through distributed technologies such as household photovoltaics (PV), battery storage, smart appliances and electric–vehicle (EV) chargers. This project developed and trialled a scalable, estimation and control platform to enable associated distributed technologies across Medium Voltage (MV) and Low Voltage (LV) networks. Distributed technologies such as PV and batteries cause reverse power flows. This project enhances a proven LV network state estimation algorithm developed at the University of Queensland through an ARENA project, utilises sensors and big data to develop a New State Estimation Control Platform (NSECP). The enhanced algorithm can estimate the state of power flows and voltages across both LV and MV networks, enabling distribution operators to better plan and operate networks reliably, safely and cost–effectively in the 'new energy environment'. The project delivered a new control platform taking the output of the algorithm and, in real–time, managing maximum participation of distributed technologies, to support intensive, wide–scale adoption of distributed technologies. The tool has been refined, tested and deployed to continuously monitor the operational state of electricity distribution networks, assess their state against technical and operational limits and automatically determine save limits for connected customers to operate the Distributed Energy Resources (DER). The main collaborating DNSP for this work has been Energy Queensland (EQL). EQL is committed to full rollout of the developed solution and has been the primary partner for testing and IT integration work. SME involved in this project was QGE and GridQube.

Stream 2 – Power System Analysis Platform: Power system security risks associated with high penetrations of variable renewable generation have been highlighted by the Queensland Government Renewable Energy Expert Panel, the Finkel Review, and were starkly illustrated by the 2016 South Australian blackout. Development of a new power system simulation/analysis platform is critical to the security of Queensland's power system to support its transition to integrate new energy platforms and achieve 50% renewables by 2030.The analysis tool for power system security assessment of renewable energy dominated power systems was developed and extended upon and is available to study new transmission technologies and large–scale storage systems. Demonstration of the tool and its functionality was undertaken with staff from the Partners DNSPs at a full day workshop to conclude the project. Project partners in this stream were Powerlink Queensland and QGE. The project stream was supported by AEMO. For the mining application/ validation of 50% renewable energy, the analysis platform based on West Musgrave mine in Western Australia was completed. Various case studies are performed using the platform to study the renewable energy integration impacts for the mining microgrid. Project was strongly supported by West Musgrave mine through Mining3 (project partner).

Knowledge sharing workshop at Energy Queensland

Project funding: Department of Tourism, Innovation and Sport, State Government of Queensland, The University of Queensland, Mining3, Powerlink Queensland

Project researchers (UQ): Prof Tapan Saha, Assoc. Prof. Richard Yan, Dr Phuong Nguyen, Dr Nikhil Pathak, Dr Aobo Zhou, Dr Mollah Alam, Mr Gian–Marco Morosini, Mr Jiakang Yang, Mr Patrick Rossiter, Dr Yi Cui, Dr Lakshitha Naranpanawe

Supports from industry partners: Dr Olav Krause and Dr Frederik Geth (GridQube), Dr Terese Milford and Jaimee Hosking (Energy Queensland), Mr Cameron McLean (PowerLink), Dr Nilesh Modi (AEMO), Mr Michael Day (QGE), Mr Dharshana Muthumuni (PSCAD)

Project Partners: Energy Queensland (Ergon and Energy networks), GridQube, Powerlink, QGE, West Musgrave mine through Mining3, Mining3, Manitoba Hydro (PSCAD)

Project supported by: Australian Energy market operator

Project PhD students: Dr Indira Alcaide–Godinez (completed, now at AEMO); Emad Areed (PhD thesis submitted, now at AEMO), Yunda Xu and Hankun Cui (full time PhD continuing), Dr Gayan Lankeshwara (PhD completed and working at UQ)

BE/ME thesis students projects supervised relevant to this project during 2020–2023: 37 students


Workshop program-Morning Session

Funding: Department of Industry, Science and Resources, Australian Government, International Clean Innovation Researcher Networks through CSIRO, Iberdrola Australia, and the University of Queensland

Researchers (from UQ): Prof Tapan Saha, Assoc. Prof. Richard Yan and Dr Feifei Bai, Dr Feng An and Ting Kai Chia (PhD student)

International partners: Prof Jovica V Milanovic (the University of Manchester, UK), Prof Nilanjan Senroy (IIT Delhi, India), Prof Yilu Lu (the University of Tennessee, Knoxville, USA)

Project partners: CSIRO, Iberdrola Australia, Energy Queensland and TransGrid

Research Projects

Accelerating integration of renewables: addressing sources of instability (2024–2027)

New partnership with Iberdrola Australia

More variable renewable energy–based generators (VREGs) are integrated into the electricity grid each year. However, VREGs produce oscillations (periodic energy exchange across system components), which cause grid instability and are a roadblock for the growth of renewable energy. Such oscillations result in reduced VREG production or commissioning delays, which place technical and financial pressure on renewable generators.

This project will facilitate a researcher network, from the USA, the UK, India and industry partner Iberdrola–Australia developing innovative methods to identify oscillation sources and new solutions to accelerate the integration of renewables into the electricity grid, paving the way for Australia to reach net zero by 2050.

Comparing high voltage overhead and underground transmission infrastructure (up to 500kV)

The federal government has set a goal of more than 80 per cent of electricity coming from renewable energy by 2030, and one of the key pillars of this transition is the expansion of the grid to connect regional wind and solar projects, which involves new or upgraded transmission lines. A new research by Curtin University and The University of Queensland has provided insights into the trade–offs between overhead and underground transmission lines and the challenges of expanding Australia's grid for renewable energy initiatives. The research team of two universities investigated the complexities of this endeavour, recognising the technical, economic, environmental and social constraints that impact society's response. This research was funded by Powerlink, a Queensland government owned corporation that develops, operates and maintains the high voltage electricity transmission network in Queensland. This research outcome summarises the findings of an independent systematic literature review of high voltage overhead and underground transmission infrastructure, which was undertaken by The University of Queensland and Curtin University. Summary report for the study is complemented by more detailed reports provided separately in Chapters 1 to 8 which cover the themes and cases studies in more detail.

Summary report can be obtained from:
eait.uq.edu.au/files/47393/
00_Summary_Report–1.pdf

Researchers: Gary Madigan, Colin Lee, Audrey Cetois, Anupam Dixit, Xin Zhong, Andrew Knight, Sarah Rohl, Nasrin Aghamohammadi, Tapan Saha, Fran Ackermann and Peta Ashworth

Funding and partners: Powerlink Queensland, Curtin University and the University of Queensland

Stability analysis of power system with massive power electronic devices

The decarbonisation of Australia's power systems is to integrate massive renewable energy sources which are interfaced with many power electronic devices (PEDs). The fast and complex dynamics of PEDs have significantly changed the nature of the power system, which limits the applicability of existing tools and methods to assess its stability. The goal of this project is to gain a comprehensive insight into the stability of a futuristic power system with high penetration of PEDs. The intended outcomes will be a model and data jointly driven methodology for high–efficient and real–time stability assessment. The methodology developed in this project will support Australia's transition to a stable, secure, and low–carbon power grid

Funding: Australian Research Council Discovery Project

Researchers: Dr Guo Chen; Professor David Hill, Professor Mithulananthan Nadarajah

Project Partners: University of New South Wales, Sydney, Monash University, Melbourne

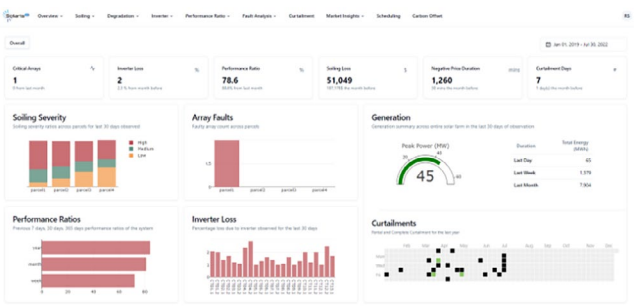
Monitoring and fault diagnostics of large scale solar farms using Solaris^{AI} O&M system

This project is about development of AI based tools for advanced diagnostic of faults and under performance issues in large solar farms. These tools are packaged as a solar farm monitoring system called Solaris^{AI}. The Solaris^{AI} O&M system is based on the physics associated with solar PV cells, their current–voltage characteristics and experimental observations. The technology is designed around the relationship of string current level fault types, fault location, number of panels per string and the panel types. It creates base and progression performance distribution mappings using advanced AI tools to foresee where maintenance work needs to be prioritized to minimize system unavailability times. The O&M platforms use advanced algorithms to help reduce the number of losses in grid–connected PV systems. The system can be used at sites without additional hardware by monitoring groups of PV panels at the array level. The system monitors fault detection, equipment under performance, PV soiling levels and performs predictive maintenance using AI.

Researchers: Associate Professor Rahul Sharma, Professor Tapan Saha, Mr Ajay Sampath, Dr Gayan Lankeshwara, Mr Derek Stephens (Solaris^{AI} Pty Ltd)

Funding: Uniseed Ventures, ARENA, UQ Solar, UniQuest, Weidmuller Australia

Industry Partners: Edify Energy, Weidmuller Australia, Uniseed Ventures



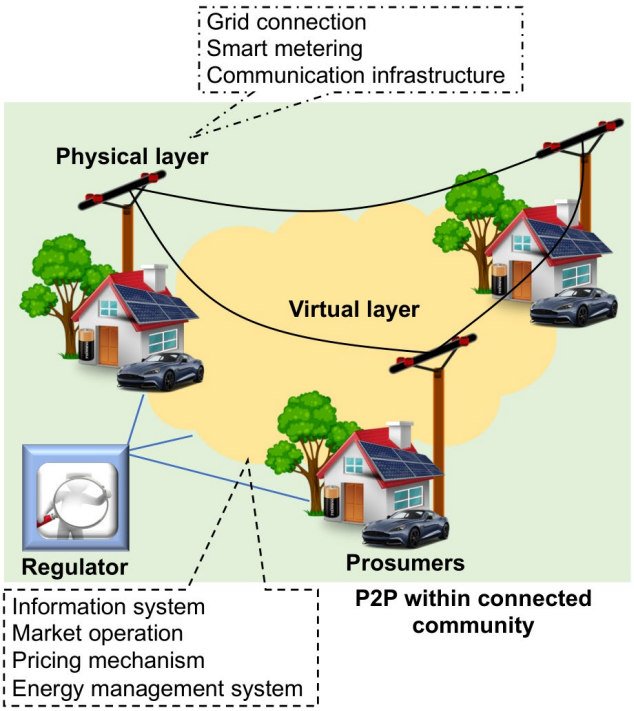
Solaris^{AI} platform

Peer-to-peer energy sharing energy users in connected communities

The utilisation of peer-to-peer trading in energy management represents an advanced technique that offers economic advantages to proactive consumers (known as prosumers) who exchange their energy for goods and services. Simultaneously, peer-to-peer energy trading is anticipated to assist the power grid by diminishing peak demand, decreasing reserve needs, and minimising network loss. Nevertheless, the widespread implementation of peer-to-peer trading in electricity networks presents various difficulties when it comes to modeling transactions in both the virtual and physical aspects of the network. This project's primary objective is to create tools that tackle these challenges by adopting game-theoretic and motivational psychology approaches.

Researchers: Dr Wayes Tushar, Dr Sohrab Nizami, Assoc. Prof. Rahul Sharma and Prof Tapan Saha

Project partners: Nanyang Technological University, Singapore, Princeton University, USA



Are power transformers hackable?

Leveraging security and reliability of large power transformers in Australia's power grids

Large power transformers are critical for power grids to supply electricity to Australian residents, industries and business. These transformers are connected to condition monitoring and management systems through various communication platforms. This opens potential pathways for cyber–attacks, and may lead to malfunction and damage of power grids. In partnership with Powerlink and Energy Queensland, this project investigates the components of the transformer which are prone to cyber– attacks, modelling potential attack routes and developing machine–learning techniques against these threats. This project paves the way for developing defence strategies to protect transformers from cyber–attacks, ensuring the security of Australia's power grids.

Funding: UQ Cyber Seed Funding 2023

Researchers: Dr Hui Ma, Dr Chandima Ekanayake, Dr Zhong Xia, Associated Professor Guangdong Bai, Dr Nan Ye

Industry Partners: Powerlink, Energy Queensland

Investigation of transient over voltage of transformers at modern substations

The overall aim is to investigate the effectiveness of existing controls in transformer management against transient over voltage in modern grids. The detailed objectives are:

- To investigate the situations, which can lead to generate transient over voltage at transformers.
- To identify the modifications required for existing transient models to simulate the generation and propagation of various transient over voltages in transformers and associated components connected to modern grid.
- To implement transient models of network components (transformers, surge arresters, cables, overhead conductors etc.) to simulate the interactions between the network and transformer at modern substations.
- To develop a criterion to identify the effectiveness of existing mitigation techniques for protection against transient over voltage.

Funding support: Australasian Transformer Innovation Centre, 2023–2025

Researchers: Dr Hui Ma, Dr Chandima Ekanayake, Professor Tapan Saha, Mr Shijie Yao (PhD student)

Industry partner: Energy Queensland, Powerlink

Transformer insulation thermal aging after retrofilling with ester fluid

The overall aim of this project is to investigate the temperature distribution and the paper insulation ageing in transformers retrofilled with ester liquids. The detailed objectives are:

- To study the ageing of paper insulation systems (using test setup in laboratory) in transformers retrofilled with ester–based liquids and model the remaining useful life.
- To quantify the time taken by ester–based liquids to impregnate the paper insulation and leach out the residual mineral oil after retrofilling.
- To investigate the oil flow rate and temperature distribution in transformers retrofilled with ester–based liquid as compared to mineral oil filled transformer.
- To propose some recommendations for the retrofilling of transformers.

Funding support: Australasian Transformer Innovation Centre, 2022–2024

Researchers: Dr Hui Ma, Dr Chandima Ekanayake, Professor Tapan Saha, Mr Anupam Dixit (PhD student)

Industry partners: Weidmann Electrical Technology, Mandl Materials, Energy Queensland, Powerlink

Physics–informed data–driven ageing and life modelling of power transformers (2023–2026)

This project proposes an innovative dielectric physics–informed data–driven methodology for transformer ageing modelling, which is based on the combination of dielectric physics and data analytics to accurately evaluate transformer ageing condition. The aims of this project are:

- To investigate how smart grid technologies and changed electricity usage patterns affect a power transformer's ageing condition.
- To develop dielectric physics–informed data–driven techniques to extract useful information from energy big data to improve the visibility of transformer's ageing condition.
- To develop a first of its kind transformer ageing and life model considering the impacts of renewables, active network management, and varying load patterns on transformers.

Researchers: Dr Hui Ma, Dr Chandima Ekanayake, Professor Tapan Saha

Industry partners: Energy Queensland, Powerlink

International collaboration network on renewable and EV grid integration

This project will establish a collaboration network between Australian researchers and an estimated 20 international researchers from the UK, USA, and EU. The researchers will collaboratively tackle some pressing challenges of renewable–rich power grids. The project will develop AI–based technologies for the efficient integration of renewables, such as rooftop photovoltaics, batteries, and electric vehicles, within the electricity grid. It will also develop a decision support tool to help customers make optimal decisions to invest in electrification and decarbonisation technologies. The project outcome will help to support increased uptake of renewables and support electric vehicles, whilst maintaining the reliability and security of the grid.

Funding: Department of Industry, Science and Resources, Australian Government, International Clean Innovation Researcher Networks (2023–2027)

Researcher: Dr Feifei Bai

Project Partners
Industry: Beyond EV, SpendWatt, Cirka Group
University: RMIT University, Monash University, University of Sydney, La Trobe University

International Collaborations
Industry: Innovating Governance, Oxford Sustainable Development Enterprise
University: Cardiff University, Teesside University, Texas AM University, Universidad Politécnica de Madrid, University of East Anglia, University of Portsmouth Association: International Association for the Advancement of Innovation

Business power flex: Business customer solutions to minimum demand

As rooftop solar capacity continues to expand across Australia, net demand for electricity during the day is falling. This creates a problem of 'minimum demand', whereby large generators are forced to switch off, affecting the stability, reliability and overall quality of the electricity system. Minimum demand limits the capacity of the grid to accommodate new renewable energy projects, including rooftop solar, and directly impacts customers through higher tariffs. Minimum demand also presents great opportunities, especially for business. By shifting demand to the middle of the day, businesses can take advantage of lower electricity prices and other financial incentives to reduce their bills, while helping to stabilise the grid. They can also look to offer services such as electric vehicle charging to both their staff and the public, using excess daytime capacity. However, the overall size of the minimum demand opportunity in Australia and its value across the energy value chain are not yet well understood. The project aims to address the problem of minimum demand by identifying, quantifying, and valuing minimum demand, and demonstrating minimum demand opportunities for commercial and industrial customers through several pilots.

Funding: Reliable Affordable Clean Energy (RACE) for 2030 CRC (2023–2026)

Researcher: Dr Feifei Bai

Project partners
Industry: Powerlink, Seeley, AGL, Sydney Water, SwitchDin, Viotas, EnergyOS, NSW government and Queensland government
University: Griffith University, the University of Technology Sydney and the University of South Australia

Demand management of V2H and V2G using microgrid and energy storage based EV charging systems

V2H/V2G based charging stations are integrated with microgrid (including solar PV systems and energy storage systems) which can magnify the intention of EV usage. Along with the system reliability evaluation, a microgrid controller will be developed to measure the reliability of the EVs in the system. The combined effects of V2H/V2G based EV charging systems and microgrid and its energy management system will play an important role in the future network and distributed energy resources. The aim of this project on Microgrid with ESS–based V2G EV charging systems is to provide an intelligent EV charging system that can reduce the peak demand, avoid significant network and generation investment, enhance the network stability and security, and minimise infrastructure costs.

Funding: Reliable Affordable Clean Energy (RACE) for 2030 CRC (2024–2026)

Researcher: Dr Feifei Bai

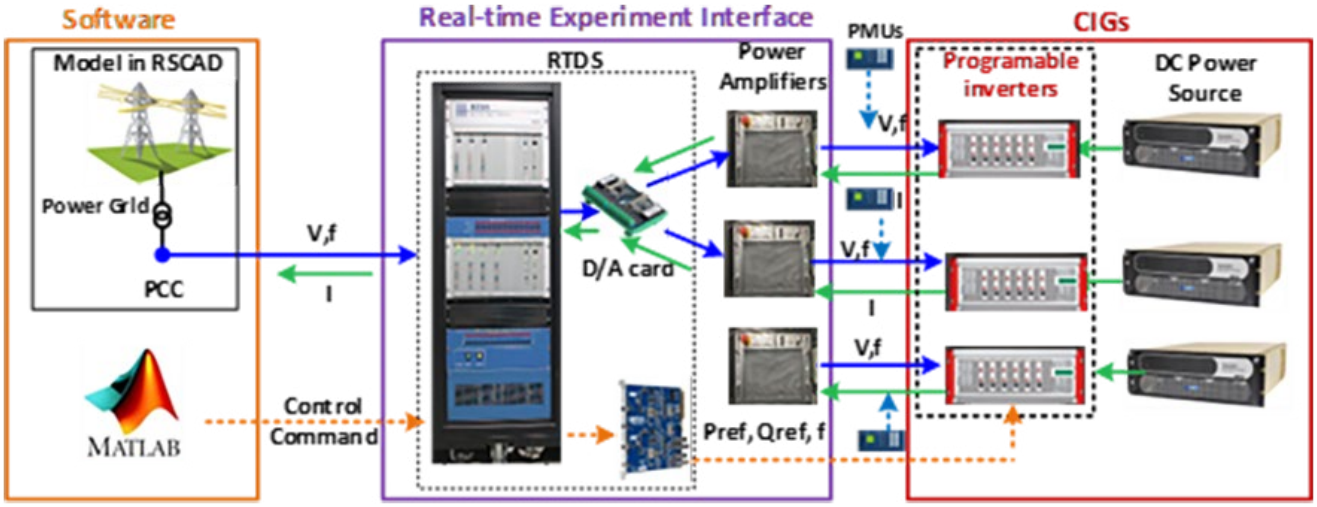
Project partners
Industry: Planet Ark Power
University: Griffith University

Adaptive control of oscillations caused by renewable generators

This project aims to develop innovative techniques for eliminating oscillation stability problems caused by converter–based solar/wind farms. This project will overcome the limitations of existing technologies in controlling of the variable oscillations in real–time. Expected outcomes include experiment platform for converter–driven oscillation studies, and model–free oscillation control strategies. The outcomes of this project will contribute fundamental knowledge and practical technologies to enhance the operating security of power networks with high renewable energy integration, as well as promote a low–carbon emission economy in Australia.

Funding: UQ New Staff Research Start–up Funding (2024)

Researcher: Dr Feifei Bai



Strategic EV integration: Embedding research in EV demonstration projects

This project will investigate a selection of early–stage use cases for EVs in Fleets, Precincts, and Regions, through a process of co–design and collaborative implementation with industry partners over three years. These early–stage use cases will be investigated through demonstration projects which have been identified and scoped by the research teams project managers during Stage 1 of the MyV2X project, and further developed by bringing together RACE for 2030 Partners to collaborate on project design and implementation.

Demonstration projects will be undertaken across multiple states and will feature a diverse mix of customer types (both fleet and private vehicles), a range of business and operating models, options for managed charging (and bidirectional charging when available), and interaction with a variety of co–located stationary battery systems of different scales. This industry–led research is essential to inform our understanding of how EVs can be effectively, efficiently, and equitably integrated into the electricity grid, the wider built environment, and society as a whole. This research at demonstration level will then inform the development of a set of larger scale CRC projects in this area in a subsequent set of projects.

Funding: Reliable Affordable Clean Energy (RACE) for 2030 CRC (2023–2025)

Researcher at UQ: Dr Feifei Bai

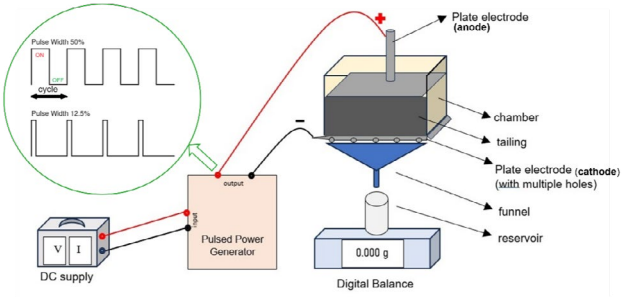
Partners
Industry: Planet Ark Power
University: Curtin University, Griffith University, Monash University, RMIT, University of South Australia, University of Technology Sydney

An emerging pulsed power technology for dewatering mineral tailings

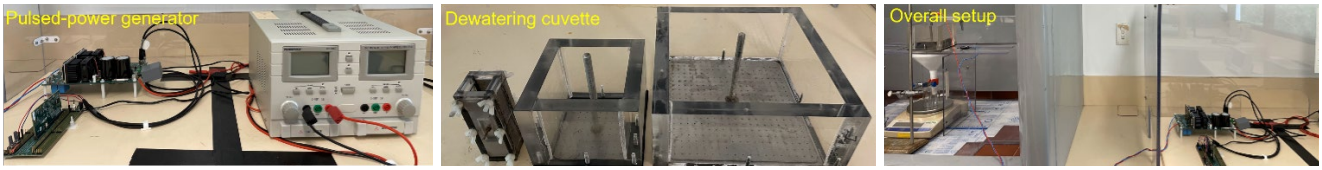
The overall aim of this project was to design a tailing dewatering system using pulsed–power technology as an emerging technique for separation of water and solid of mine tailing and deliver technologies for industrial applications in future. The concept was pioneered by Prof. Firuz Zare and Dr Negareh Ghasemi at UQ. This interdisciplinary project aims at the laboratory demonstration of the technique and quantify energy savings. Samples from two mine sites were used for testing. The samples sizes of 1L and scaled up size of 5L were considered. The results showed the energy savings of 8% to 16%. In addition, pre–treatment chemical analysis were carried out on the extracted water revealed decrease in anions (Cl and SO4) and an increase in cations (Na) indicating capability to water purification benefits. The technology will be pilot trialled to enhance the technology readiness for industry use.

Funding: The Australian Coal Industry's Research Program (ACARP)

Researchers: MirHojjat Seyedi, Associate Professor Rahul Sharma, Associate Professor Mansour Edraki, Dr Negareh Ghasemi, and Professor Firuz Zare



Experimental setup



UQ's pulsed–power lab, dewatering experimental setup

Network–aware coordination of distributed energy resources for demand response under the dynamic operating envelopes framework

This project aims to develop control schemes that allow for dynamic operating envelopes–aware demand response in low–voltage distribution networks. The project looks into the demand response capacity as well as the customer adoption of dynamic operating envelopes (social license) through comprehensive socio–economic analyses in Australian suburbs. The proposed control schemes ensure privacy and separation between end–users, distribution network service providers, and demand response aggregators, along with coordination among them aligned with policy frameworks. Also, the proposed control schemes are validated through software–in–the–loop studies in real–time digital simulators. Compared to current industry practices where static import/export limits are imposed on household connections, the adoption of dynamic operating envelopes maximises the utilisation of behind–the–meter distributed energy resources in low–voltage distribution networks.

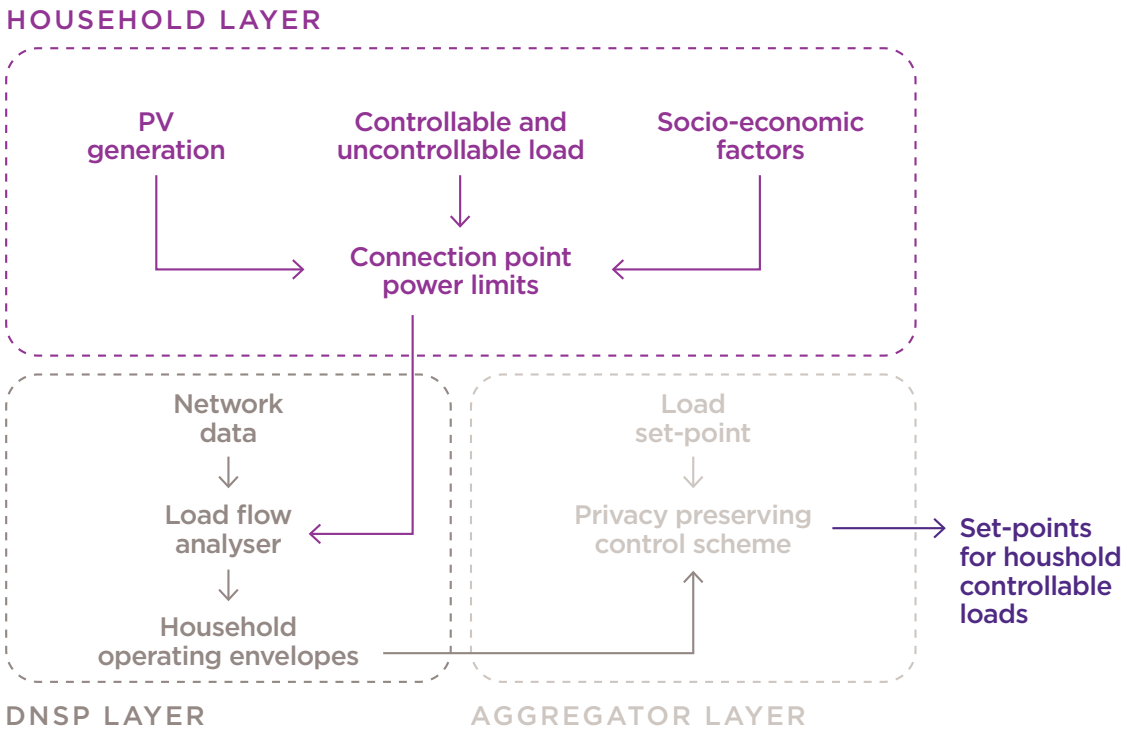
Researchers: Dr Gayan Lankeshwara, Associate Professor Rahul Sharma, Professor Tapan Saha

Effects of rooftop photovoltaics on the load profile and ageing of distribution transformers

In this study, over one–year measurement data from more than 20,000 distribution transformers in Southeast Queensland are collected for investigating the effects of rooftop PV on the load profile and ageing of distribution transformers. The measurement data includes annual energy consumption, number of small and large connected customers, number of customers with rooftop PV on a feeder, rooftop PV inverter capacity, etc. This data is used to evaluate the change of load profiles due to roof top PV penetration and effect on of increasing rooftop PV penetration levels on the ageing of distribution transformers.

Industry partners: Greg Caldwell, David Fink (Energy Queensland)

Researchers: Xin Zhong, Chandima Ekanayake, Hui Ma, Professor Tapan Saha



Developing and trialling a tool to provide a quantitative assessment of the operating risk and replacement priority for ageing power transformers using Australian and New Zealand failure statistics

A web–based software tool has been developed to identify the transformers, which are in–operation beyond the mean failure age calculated from the failure statistics of Australia and New Zealand transformer failure statistics. Also, software allows to identify the replacement priority of the transformers based on the age, current condition, application, and load. Software allows user to select the critical parameters based on the network requirements.

Industry partners: Transformer Innovation Centre

Researchers: Xin Zhong, Hanjun Jiang, Chandima Ekanayake, Professor Tapan Saha

Effect of renewables on transformers

In many studies, investigations were performed to find out the power quality characteristics of single PV inverter model. However, there is a lack of comprehensive studies on how these individual inverter models will perform when they are aggregated with non–linear loads. The continuous integration of these inverters into the power system will result in considerable changes in the network impedance, which can lead to undesirable phenomena like harmonic resonance, which can amplify the harmonic voltages and currents magnitudes to a level that could malfunction the devices including transformers connected to the system. These amplified voltage and current harmonics can also cause extra eddy–current and stray losses in a transformer. In this project we are looking at these effects in simulated and field environment to understand the effect of renewables on operation and ageing of transformers.

Researchers: Anuradha Abeysekara, Chandima Ekanayake, Hui Ma, Professor Tapan Saha

Insulation failure analysis of sealed power transformers

The number of sealed power transformers in service has continuously been increasing in the Australian electricity supply industry after they have been introduced in 1980s. According to industry experts, insulation condition of these transformers is generally much better than the open breathing units in similar age and no major insulation failures of sealed power transformers in Australia has been recorded so far. Currently, these units are monitored and regularly tested through regular transformer tests including oil analysis. In the case of evaluating the condition of paper insulation of these units, current practice is highly reliant on oil test results and furan analysis. However, furan measurements through existing furan–based paper quality estimations are not specifically referred for sealed transformers. The overall aim of this project is to accurately identify ageing indices to determine the insulation ageing of sealed power transformers. The detailed objectives are:

- To investigate national and international experience on ageing of sealed power transformers.
- To identify the suitability of current industry practices in determining the insulation ageing state of sealed power transformers.
- To develop accurate insulation ageing indices for sealed power transformers.

Project partners: Transformer Innovation Centre, Amra Alibegovic–Memisevic (Powerlink Queensland)

Researchers: Chandima Ekanayake, Hui Ma, Shawn Nielsen, Professor Tapan Saha

Commercialisations

Our research discipline has a long history of successful commercialisations. During the last ten years, we have been involved with 3 SME/start-up establishments.

AURTRA to Schneider Electric

Based on 25 years of transformer research at the University of Queensland (UQ), some IPs developed by Prof Tapan Saha, Dr Dan Martin, Dr Hui Ma and Dr Chandima Ekanayake were licensed to a new start-up AURTRA. AURTRA was established in 2016 upon a foundation of hardware and software technology transfer from UQ for transformer monitoring and asset management. After five years of strong performance and successful commercial usage of their developed technology in many utilities locally and internationally, AURTRA was acquired by French multinational Schneider Electric in a multi-million-dollar deal in 2021.

Details about this can be obtained from:
uq.edu.au/news/article/2022/03/french-multinational-acquires-uq-startup-established-monitor-power-networks

Aurtra CEO Terry Woodcroft (right) and UQ's Professor Tapan Saha (left)

GridQube

UQ Power, Energy and Control Engineering Discipline researchers with Dr Olav Krause as the lead researcher have been involved with an ARC Linkage Project and an ARENA funded project-'Increasing Visibility of Distribution Networks to Maximise PV Penetration Levels' with an extensive industry participations from Energy Networks Australia (ENA), Australian Power Institute (API), Energex, United Energy, TasNetworks, Springfield Land Corporation and Aurecon. This project, known as Solar Enablement Initiative (SEI) developed an improved visibility tool (Distribution System State Estimation-DSSE), which is a scalable and expandable system for understanding of electricity network performance to avoid undue restrictions being placed on the capacity of new Solar PV installations and their export into the Australian grid, thereby enabling an increase in the percentage of renewable energy connected to the grid.
The project's demonstrated outcomes are a PV Connection Assessment Tool, Capacity Constraint Analysis and Capacity Constrained Optimisation, which are all integrated into the SEI system and executed automatically on available network state estimates. Based on the outcome of these projects, GridQube was established in 2019 to commercialise the Distribution System State Estimation (DSSE) system developed by the UQ's Solar Enablement Initiative (SEI). GridQube DSSE is currently in large-scale deployment at two Australian DNSPs and has been successfully tested at two more and has entered a partnership with Itron as a first means towards expansion into international markets. Dr Olav Krause-Chief Technology officer of GridQube and a former UQ academic and his team are closely working with the PEC Discipline academics on important research applications.

Details about GridQube can be obtained from:
gridqube.com/about

Work done in SEI project can be obtained from:
energynetworks.com.au/miscellaneous/astp-api-progress-report-2019/

SOLARIS^{AI}

Under performance detection in large-scale solar farms is a major challenge. Solar Farm Fault Detection And Diagnosis (Solar F2D2) algorithm has been originally developed at UQ to provide prompt detection, location and identification of under performance in solar farms. This work started with a PhD project with Amit Dhoke in 2015 with Prof Tapan Saha and Assoc. Prof. Rahul Sharma as PhD advisers. Later on, an international patent was submitted and approved for the developed technology. One of the main features of Solar F2D2 is that it relies on data that is readily available in solar farms and does not require any additional dedicated hardware. After a series of funded research projects, with the IP generated from researchers at UQ, UniQuest has established a start-up SOLARISAI in 2023. Uniseed Ventures has stepped into Solaris AI to support developing innovative software technology that will increase the operational efficiency of large solar farms. The team is led by UQ researcher Associate Professor Rahul Sharma, at the School of Electrical Engineering and Computer Science.

Details about SolarisAI:
uniquest.com.au/available_technology/solaris-ai

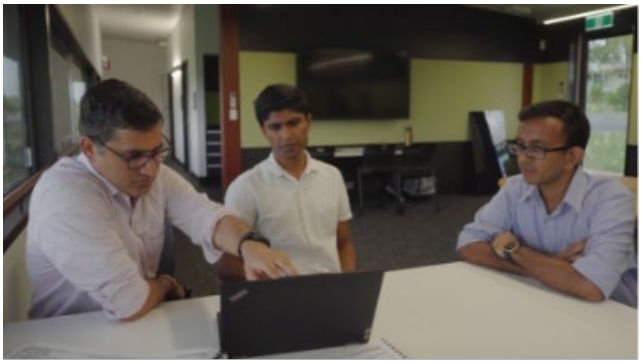


Image source: uq.edu.au/news/article/2024/02/uq-start-help-solar-farms-power

Recently completed projects and their funding sources

1. Synchrophasor measurement data applications for distributed energy resource connection and distribution system management (ARENA Project)
2. Monitoring and management system for smart distribution networks (ARC Linkage Project 2013–2018)
3. Peer-to-peer energy trading schemes for sustainable cities, advance Queensland research fellowship (2017–2020)
4. Enabling high photovoltaic penetration in power distribution networks (2018–2020)
5. High-precision condition monitoring of critical equipment in modern distribution networks
6. Advance Queensland industry research fellow project 2019–2021
7. Addressing challenges for the future grids – harmonics standardization, ARC future fellowships (2016–2020)
8. Preventing transformer failures caused by silver sulphide (2017–2020)
9. Power quality monitoring of grids with high penetration of power converters, ARC linkage project (2018–2020)
10. Sustainable operation of transformers with better understanding of technical and economic constraints (ARC linkage project 2014–2019)
11. Development of smart power transformers with intelligent monitoring, diagnostic and life management systems (ARC linkage project)
12. Investigation of stability and power quality issues from the wide spread photovoltaic integration into electricity distribution networks, (ARC linkage project)
13. Queensland Geothermal Energy Centre of Excellence (Queensland Government)
14. Evaluation of the impact of demand response program on transmission network planning (TransGrid)

The Australasian Transformer Innovation Centre

Australia's leading transformer research centre: Filling Australia's critical need for transformer innovation and education. Collaborative initiative by Australia's transformer experts from research and industry. Over $1 million jointly committed and being invested to establish the centre including:

- Wilson Transformer Company donated natural ester oil filled research transformer
- Dynamic ratings state-of-the-art online condition monitoring system
- Reinhausen's latest generation tap changers and education
- University of Queensland new Long Pocket transformer laboratory with state-of-the-art research equipment
- Collaborative effort by UQ, QUT, and Griffith researchers.

The **research programme** is designed to create innovations that meet the evolving needs of industry including:

- Decreasing the risk of transformer failure during normal and contingency events
- Reducing maintenance costs and extending life with improved condition monitoring
- Investigating improved operation, performance, and risks with natural esters oil
- Increasing transformer utilisation and working transformers smarter
- Investigating effects of renewable generation on transformer life and cyclic rating.

Some examples of **currently conducted R&D projects** including:

- Transformer insulation thermal aging after re-profiling with ester fluids
- Investigation of transient over voltage of transformers at modern substations
- Deployment of a software a tool to provide a quantitative assessment of the operating risk and replacement priority for ageing power transformers using Australian and New Zealand failure statistics
- Asset management of network power transformers in the presence of high penetrations of solar and wind generation.

The Centre houses:

- Research–grade power transformer donated by Wilson Transformer Company
- Sensory technology, provided by Dynamic Ratings.

Other commercial grade equipment to carry out testing and research include:

- Omicron DIRANA (FDS and PDC combined)
- Frequency response analysis equipment
- Partial discharge monitoring
- Ageing facilities
- Polarisation/depolarisation currents and return voltage measurement
- Frequency domain spectroscopy
- Vaisala water activity measurement probes
- Fibre optic equipment to measure temperature and water content of insulation
- Thermal infrared camera for studying heating and temperature rise.

More information can be found at:
eecs.uq.edu.au/research/australasian–transformer–innovation–centre

The Centre offers innovation and CPD programmes purpose built for the industry's future needs and delivered by acclaimed transformer experts. The programmes bring a total focus on best practice asset management and high performance. Member organisations will reap the benefits of this focus through reduced costs, increased asset performance, reliability, and asset management breakthroughs.

Basic transformer courses will include transformer theory and applications, procurement, design, operation, maintenance, and condition monitoring techniques.

Advanced courses will include transformer ageing, failure analysis, specifying for requirements, dynamic loading, and condition–based maintenance. Courses will be delivered by transformer experts from universities, transformer manufacturers and transmission and distribution companies.

In these intensive courses the delegates will be given an overview on how to make the best use of their transformer assets. The course has been set up to be delivered jointly by industry and academic staff, where the delegates enjoy the best of both worlds in course relevance, depth and structure. In general, academic staff will discuss the fundamental background to the various concepts while industry staff show how to apply these concepts to real–life situations.

Some examples of delivered CPD courses including:

Power transformer tap changers–design, maintenance and testing (20–21 July 2023)

- Understand the basic principles of tap changers, including oil and vacuum
- Learn the basic arrangement of regulating windings, benefits and issues of oil and vacuum diverters
- Become familiar with OLTC maintenance for oil and vacuum types
- Be informed of innovative condition assessment of tap–changers using acoustic measurements, signal processing techniques used and results from field trials, case study.

Course was delivered by: Tim Farrell (Reinhausen), Florian Predl (OMICRON), Philippe Reboul (Molekulis), Dan Warn and Tara–lee MacArthur (Energy Queensland), Antony Giacomin (TJH2b Analytical Services), Hui Ma (UQ)

Impact of renewables on electrical network asset performance (1–2 December 2022)

- Grid visibility, advanced demand response
- Ageing status of assets and current trends of condition monitoring
- Impact of harmonics on asset
- Impact of renewables on aged assets
- Maintenance programs in a new paradigm of renewables
- Changes to the operational landscape due to renewables.

This two–day technical seminar was presented by several industry professionals as well as several academics that focused on the future of asset condition assessment in a renewable dominated and aged power system.

Some examples of delivered CPD courses continued:

- Grid visibility, advanced demand response
- Ageing status of assets and current trends of condition monitoring
- Impact of harmonics on assets
- Impact of renewables on aged assets
- Maintenance programs in a new paradigm of renewables
- Changes to the operational landscape due to renewables.

This two–day technical seminar was presented by several industry professionals as well as several academics that focused on the future of asset condition assessment in a renewable dominated and aged power system:

Olav Krause (GridQube), Terese Milford (Energy Queensland), Seamus Allan (Dynamic Ratings), Brian Sparling (Dynamic Ratings), and Bhaba Das (Hitachi Energy), Marius Jansen (Optimised Network Equipment), Greg Caldwell (Energy Queensland), Chandima Ekanayake (UQ), Inocencio Grilo Solteiro and Carl Beste (Hitachi Energy), Dan Warn (Energy Queensland), Fraser Hampton and Andrew Wheatlan (SA Power Networks) and Tim Farrel (Reinhausen).

Researchers: Professor Tapan Saha (director), Dr Chandima Ekanayake (deputy director), Dr Shawn Nielsen (manager), Dr Hui Ma

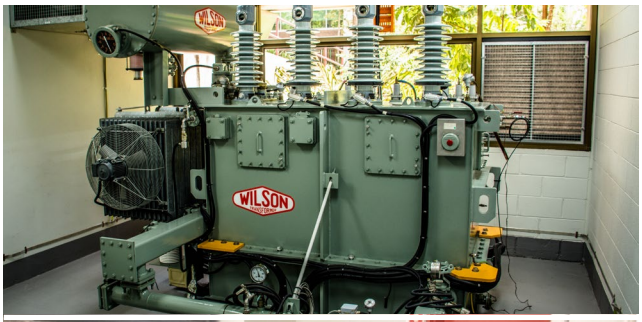
Oils for application in transformers and tap changers (16 February 2024)

- Understand the basic principles of oil, its manufacture, specifications, and properties.
- Learn the basics of oil storage, precautions for transformer/tap changer filling.
- Become familiar with oil sampling and testing for condition monitoring purposes.
- Be exposed to the experience of transformer manufactures and utilities when it comes to oil and oil testing.

This course explored the theoretical background information necessary to understand the basic chemical structure of oils for application in transformers as well as the testing and specification of these oils. Industry experts discussed the practicalities of using, testing and specifying oils in a modern power system. This course was tailored for procurement, asset strategies, operations and maintenance managers and engineers in generation, transmission and distribution, renewables manufacturing mining industrial and infrastructure organisation.

Course was delivered by: Philippe Reboul (Molekulis), Tony Tuong Ngo (Powerlink Queensland), Tara–lee MacArthur (Energy Queensland), Damien Kruger (Energy Queensland) and Anupam Dixit (UQ)

Contact: transformer@eecs.uq.edu.au



The Australasian Transformer Innovation Centre members

PEC discipline industry collaborations (present and past)

Energy Queensland

Australian Energy Market Operator (AEMO)

Powerlink Queensland TransGrid

AusGrid CS Energy

Stanwell Corporation Ergon Energy Energex

The Australian Power Institute
CIGRE Australia Maschinenfabrik
Reinhausen TasNetworks

Nynas Weidmann ActewAGL

Wilson Transformer Company Aurecon

TRUenergy Pty Ltd

Vestas International Wind Technology

Hydro Tasmania United Energy ABB

Essential Energy Maxivar

K–Bik Power Pty Ltd Budin, Philipp Partners
Dynamic Ratings Endeavour Energy

SA Power Networks Siemens

University collaborations (present and past)

University of New South Wales,
Sydney Australia, QUT, Brisbane, Australia

Jadavpur University, IIT Delhi, IIT Kharagpur,
IIT Bombay, India

Xi'an Jiaotong University, Xi'an, China South
West Jiao Tong University, China Hunan
University, China

The University of Manchester, UK, The
University of Tennessee, Knoxville, USA

TU Dortmund University, Germany,
University of Texas at Austin, USA,
AIT, Bangkok

University of Michigan, USA

Griffith University, Brisbane, Australia,
SUTD, Singapore

University of Oxford, UK, Princeton
University, USA

Recently completed competitive fellowships

Professor Firuz Zare
ARC Future Fellow (now at QUT)

Addressing challenges for the future grids: Harmonics standardisation

Associate Professor Richard Yan
ARC Discovery Early Career Researcher Award (DECRA) Fellow

Enabling high photovoltaic penetration in power distribution networks

Dr Wayes Tushar
Advance Queensland Early Career Fellow

Peer–to–Peer (P2P) energy trading

Dr Feifei Bai
Advance Queensland Early Career Fellow

Monitor and predict equipment conditions by NOJA power high–precision distribution phasor measurement units

Teaching and learning

The Power, Energy and Control Engineering discipline is actively involved in teaching in undergraduate and postgraduate engineering programs

Coursework

Academics contribute specialist courses in power systems and broad power engineering areas of electrical engineering based specialisations.

ELEC3310 Energy Conversion and Utilisation

ELEC4310 Power Systems Analysis

ELEC4302 Power Systems Protection

ELEC4410 Advanced Electronic and Power Electronics Design

ELEC4320 Asset Management and Condition Modern Monitoring in Power systems

ELEC7309 Power System Planning and Reliability

ELEC7310 Electricity Market Operation and Security

ELEC7313 Renewable Energy Integration: Technologies to Technical Challenges

ELEC7051 Transformer Technology Design and Operation

Further information can be obtained from:
eecs.uq.edu.au/future-students

Scholarships

API Bursaries

The UQ Power, Energy and Control Engineering discipline is one of the founding university partners of the API's Undergraduate Bursary Awards Program. This is a collaborative program between the API, universities and industry that has supported hundreds of outstanding power engineering undergraduates during their university course encouraging them to study and pursue subjects to pursue a career in the power engineering industry. The API has changed the name of Bursary Program to the API Power Up Program:
api.edu.au/bursary-program

ES Cornwall Scholarships

The UQ Power, Energy and Control Engineering discipline is also proud to be an integral part of managing the ES Cornwall Memorial Scholarship, which for more than 60 years has underpinned the early career development of aspiring industry engineers though supporting and mentoring their overseas employment in the electric power industry.

$3,500 per month for up to 18 months.

Some recent winners of ES Cornwall Scholarships:

- Eugene Ma from Powerlink
- Neha Moturi from Energy Queensland
- Mitchell Tap from Energy Queensland
- Alice Fleetwood from Energy Queensland
- Christopher du Plessis from AEMO
- Tara-Lee MacArthur from Energy Queensland

Further information can be obtained from:
escornwall.com.au

UQ Graduate School Postgraduate Scholarships for Higher Degree Research

The UQ Graduate School offers a number of scholarship opportunities that provide financial support for Higher Degree research students tuition fees, living costs and travel to enable research candidates to focus on their research and achieve the best results.

Further details about the scholarships:
scholarships.uq.edu.au/scholarship/graduate-school-scholarships-uqgss-%E2%80%93-includes-rtp

National and international collaborations

The Power, Energy and Control Engineering discipline has strong links with the local electricity industry and active research collaborations with a number of national and international universities

Professional activities (IEEE, Engineers Australia and CIGRE)

The Power, Energy and Control Engineering discipline is an active contributor to the world's leading technical forums for the electric power industry. This includes:

- CIGRE, the world's leading technical association for large electric power systems, covering 90 countries.
- IEEE and IEEE Power and Energy Systems Society– with more than 426,000 IEEE members in more than 160 countries
- Engineers Australia– national forum for the advancement of engineering and the professional development of members.

Professor Tapan Saha and Dr Chandima Ekanayake are Australian CIGRE Panel member of A2 Transformer, Dr Hui Ma is a CIGRE Panel member of D1 Materials and Emerging Test Techniques. Associate professor Richard Yan is a CIGRE Panel member of C6 Active Distribution Systems and Distributed Energy Resources, and C4 System Technical Performance committee and Dr Chandima Ekanayake is a CIGRE Panel Member of B1 Insulated Cables. PEC research group academics regularly publish papers at the CIGRE biennial Paris Sessions.

The group is a strong supporter of the Queensland Chapter of IEEE–PES with a number of members serving on the IEEE Queensland Section Committee and many technical papers are published at IEEE–PES international conferences. Dr Chandima Ekanayake is the current Chair of IEEE Queensland Section, where Assoc. Prof. Rahul Sharma is the Vice Chair and Assoc. Prof. Richard Yan is the Treasurer and Dr Feifei Bai is the PES Queensland Chapter Chair. Prof Tapan Saha has served the IEEE Queensland Section as Chair for two terms, Chair of IEEE Australia Council, UQ Students Branch Counsellor and PES Queensland Chapter Chair/ Vice Chair on numerous occasions. Dr Chandima Ekanayake has served IEEE PES QLD Section as Chair and Vice Chair.

Group members are also active contributors to Engineers Australia. Professor Saha has served as the Chair/Vice Chair and Member of the Queensland Electrical Branch for many years. Currently, Associate Professor Richard Yan is serving as a Member the Queensland Electrical Branch. Assoc. Prof. Rahul Sharma is an Editorial Board Member of AJEEE Journal published by Engineers Australia.

International collaboration with IIT Kanpur and IIT Kharagpur, India: solar PV based hybrid microgrid system for efficient building energy management

With ever–increasing adoption of renewable energy sources into the distribution network of a power system, the microgrid architecture is gaining popularity for integrating these energy sources. Moreover, many of the renewable sources, modern customer loads and storage devices are DC in nature, which leads to the concept of Hybrid AC/DC microgrid. The present project aims to develop the necessary technologies for efficient and reliable operation of a hybrid microgrid system. In this project, in conjunction with a building energy management system, a real–time optimal energy management for an HMG system will also be developed for the optimal active and reactive power scheduling, voltage and frequency control, islanding detection, disconnection and resynchronization based on a hierarchical decentralized control structure. A predictive and transactive control test–bed will be developed for end–to–end automation of the proposed microgrid. The project will have academic exchange visits from both sides, workshops and research scholar visits.

Funding: Scheme for Promotion of Academic and Research Collaboration (SPARC): A Government of India Initiative

Partners: Indian Institute of Technology, Kanpur and Indian Institute of Technology, Kharagpur

Researchers
UQ: Professor Tapan Saha, Associate Prof Rahul Sharma, Dr Wayes Tushar, Dr Ramesh Naidu Bonu
IIT Kanpur: Associate Professor, Prabodh Bajpai
IIT Kharagpur: Prof. Ashok Kumar Pradhan, Dr Ashish R. Hota

UQIDAR

The University of Queensland–IIT Delhi Academy of Research (UQIDAR) is a transnational collaborative joint–PhD program that supports research in multi–disciplinary areas. PEC Discipline academics are involved in this joint PhD programs. Through this program, Prof Tapan Saha has established strong collaboration with Prof. Sukumar Mishra Prof. Ashu Verma and Prof. Nilanjan Senroy. They have jointly supervised three students, who have recently submitted their PhD thesis through UQIDAR.
They are:

- Akshay Bhyri
- Arnab Bhattacharjee
- Bhamidipati Venkata Suryakiran

The University of Queensland (UQ) and the Technical University of Denmark (DTU)

DTU and The University Of Queensland (UQ) have signed an exciting joint partnership research project on Electrical Control of Hybrid Power Plants connected to Weak Grids. The joint alliance project has employed one PhD (Fatemeh Shahnazian) in DTU working on control systems for hybrid power plants and another PhD (Ashan Imantha M.H. Bandara) in UQ working on converter–based generation in weak grids. In order to ensure close collaboration in the joint project, each of the two PhD studies will have supervisors in both universities and visit the collaboration university for a minimum of 6 months. This is a joint PhD scheme between UQ and DTU. DTU Wind Energy is a world–leading wind energy department that puts knowledge to work through cutting–edge research, innovation, and development of technology. UQ will offer the state–of–the–art Renewable Energy Laboratory to support this research project. This joint supervision team includes Prof Poul Ejnar Sørensen and Dr Kaushik Das from DTU and Prof Tapan Saha and Associate Professor Richard Yan from UQ.

Transformers

The power transformer condition monitoring group has been supported by the Australasian Transformer Innovation Centre. The Centre is supported by many utilities, national and international manufacturers and universities. Current centre members include Wilson Transformer, The Australian Power Institute, CIGRE Australia, Reinhausen, United Energy, Dynamic Ratings, SA Power Networks, Powerlink, Essential Energy, Energy Queensland, WEIDMANN, Hitachi Energy, Transmission and Distribution Publisher and Ergon Oil.

The group focusses on developing the technologies required by the industry to optimise the management of their transformer fleet. This is becoming even more important since the industry is under pressure to reduce costs.

UQ supporting the Australian Power Institute (API)

The API is an Australian National Organisation, strongly supported by the Australian Power Industry and committed to working collaboratively with Australian Power Engineering Universities to ensure that the Power industry has access to the required quantities of power engineering graduates with the necessary engineering skills to meet industry's needs now and into the future.

The API, together with the University of Queensland and Powerlink Queensland, established the API/ Powerlink Australian Chair in Electricity Transmission at the University of Queensland, which ended in 2017.

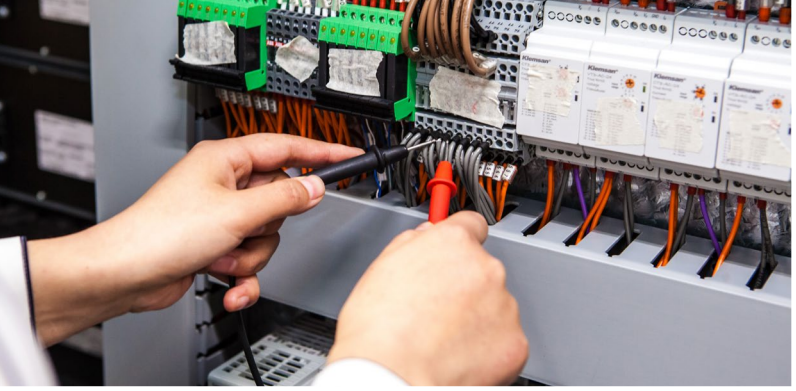
UQ's Power, Energy and Control Engineering Discipline researchers have closely worked with API Members in the development of research projects nominated by API and Energy Networks Australia. API is a member of UQ's Australasian Transformer Innovation Centre.

University Transformer Research Alliance (UTRA)

The University Transformer Research Alliance (UTRA) was established in 2019 by internationally leading transformer research groups from the UK, Germany, Australia, and China. The University of Queensland is a founding member of this virtual alliance. The aim of this alliance is to develop a strategy to advance transformer research in alignment with low carbon Energy requirements. It intends to work closely with the wider transformer community, including manufacturers, power utilities, materials providers, and test/service businesses to deliver fundamental and engineering research and to provide high quality postgraduate education/ training of students and engineers. Two associate Members are now added from Malaysia and Canada in this alliance. Current UTRA members include the following universities:

- University of Exeter, UK
- The University of Manchester, UK
- The University of Queensland, Australia
- University of Stuttgart, Germany
- Tsinghua University, China
- Xi'an Jiaotong University, China
- Universiti Putra Malaysia, Malaysia
- Université du Québec à Chicoutimi, Canada.

Photo courtesy of Powerlink Queensland




Facilities

The teaching and research in Power, Energy and Control Engineering is supported by sophisticated laboratory facilities.

Renewable energy laboratory

The Power, Energy and Control Engineering discipline has developed a state–of–the–art renewable energy laboratory with funding from AGL Solar Flagship Education Infrastructure Fund and from the University of Queensland.

The lab is equipped with modern renewable energy research facilities including:

- Real Time Digital Simulator racks
- 6 Power Amplifiers and 6 Voltage Amplifiers
- Solar Emulator
- STATCOM
- Numerous Inverters
- PLCs
- Programmable Loads
- Battery Storage
- Battery simulator
- Wind turbine control setup (With dSPACE)
- Most commercial power systems analytical tools

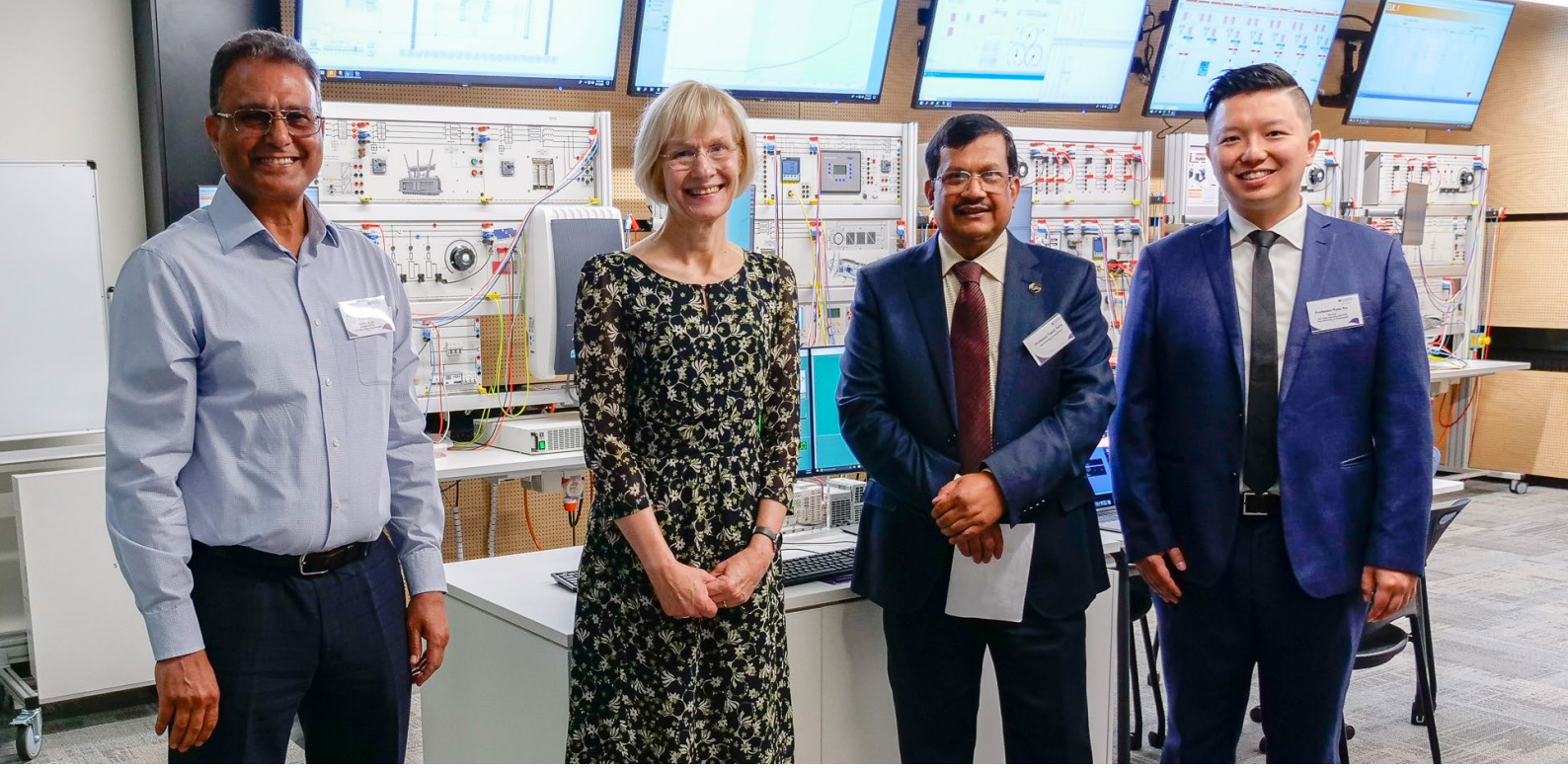
Power systems and power quality laboratory

The power system simulation laboratory has analytical software tools to simulate, plan, design and control complex interconnected power systems with state–of–the–art solutions.

The analytical tools available at PSS–L can solve power system problems in wide range of time frames, from micro seconds to steady state and study impact of renewable energy integration, Custom Power devices, etc.. Some of the software tools available at the PSS–L are listed below.

Apart from the above tools, the powerful server located at the PSS–L carries a number of test power systems, both at transmission and distribution level typically used for research in power and energy system research.

- PSS/E
- DSAT tools
- PowerWorld
- DigSILENT Power Factory
- PSCAD/EMTDC
- PSS SINCAL



UQ Industry 4.0 Energy TestLab

The Industry 4.0 UQ Energy TestLab has been established to help enable the widespread adoption of digital Industry 4.0 technologies into the production and processing of Australia's energy and resources. The University of Queensland is one of six Australian universities selected for the National Industry 4.0 TestLab initiative.

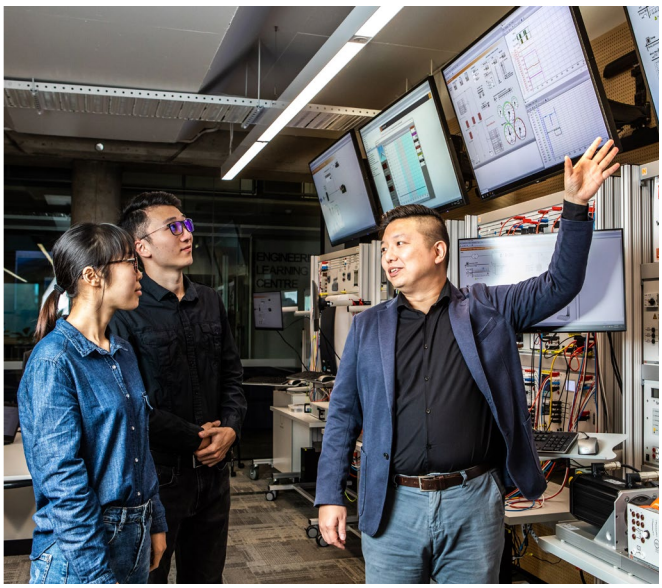
The Industry 4.0 UQ Energy TestLab has been established at UQ with funding from Commonwealth of Australia and the University of Queensland. Siemens has provided equipment and software. The Commonwealth of Australia and Siemens are foundation partners of The Industry 4.0 UQ Energy TestLab. The UQ Energy TestLab established UQ as a "living laboratory" in keeping with UQ's objective of being a world leader in carbon neutrality and energy efficiency. UQ TestLab provides UQ researchers with a new and powerful platform for innovative research in power systems analytics and security and demand side management strongly supported by Siemens Energy related software tools. This flagship capability attracts local and international students interested in engineering, energy economics, security, data science, and sustainability.

Facilities include:

- Cyber security test facilities, PLCs: Siemens, Schneider, and Rockwell with Human machine interfaces, and Ruggedcom switches and firewalls
- Siemens Equipment: PSSE®, PSS SINCAL, Navigator Software, DIGSI 5, SICAM Toolbox II, SICAM SCC HMI, SIPROTEC 5
- SICAM A8000 Microgrid Controller
- Lucas Nülle Machines: Synchronous machine, Wind power plant, PV emulator and inverter, Transmission systems, Battery energy storage, Energy Meter, SCADA systems

The research focus of the Industry 4.0 UQ Energy TestLab spans power and energy systems, microgrid, energy management, and cyber security. The TestLab has facilities and capabilities for conducting research in power and energy system analytics, microgrid control, energy management, artificial intelligence, and critical infrastructure cyber security automation.

Teaching The Lab is equipped with power system hardware and software provided by world–leading manufacturers, Siemens, and Lucas Nülle, which form the perfect platform for teaching. It offers a unique experience for students, as they're able to combine theory from lectures with practical skills developed in this real–life learning environment.

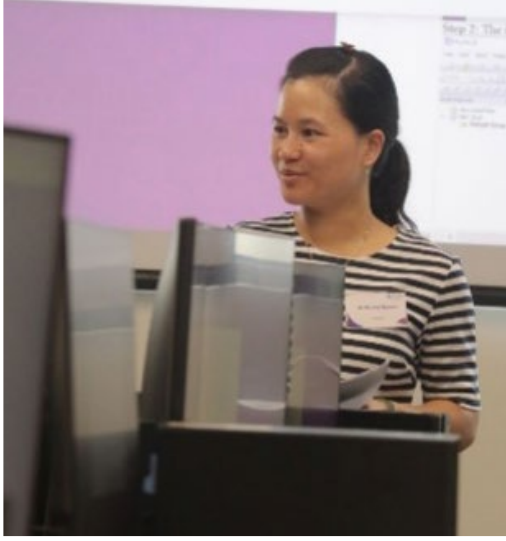


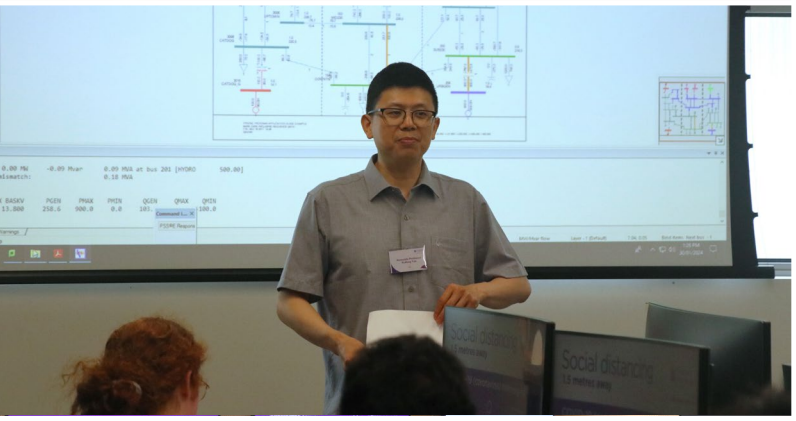
UQ Springfield City Industry Chair in Energy – a new initiative (closely aligned with Energy TestLab)

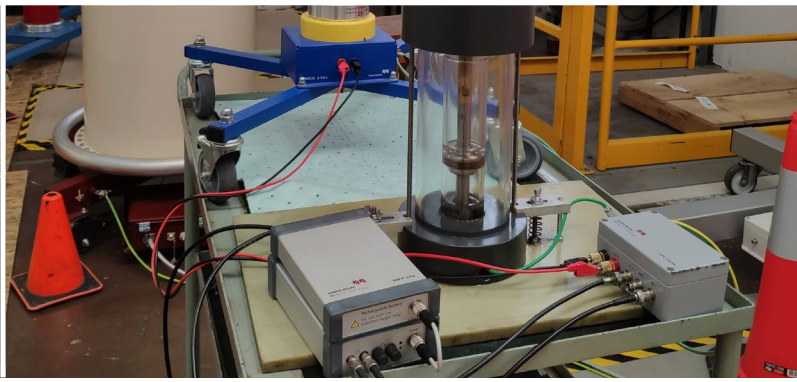
The UQ–Springfield City Industry Chair in Energy will be primarily responsible for further developing and building on existing relationships with both industry and community partners in Springfield. Whilst primarily a research–focused academic role, there will be a strong focus on engagement, as well as innovative thinking to build creative energy–based initiatives with industry, government, and the Springfield group. The Chair Professor will lead a sustainable program of applied and translational engineering research in the application of big energy data and AI applied to Distributed Energy Resources Management and will provide senior leadership with a strategic vision for developing and implementing research strategies, building research capability and capacity, and demonstrating impact. The Chair professor will also play a pivotal role in turning the proposal of the Living Laboratory into a tangible reality, making significant strides toward the development and implementation of the Laboratory in Springfield. The Chair Professor will work closely with researchers from the Power, Energy and Control (PEC) Engineering discipline – one of the leading power engineering research groups in Australia with over sixty academic staff, researchers, and PhD students – dedicated to deliver cutting–edge technology solutions for the energy industry and community.

Continuing Professional Development (CPD) courses for industry professionals

PEC Discipline has delivered 2 CPD courses in 2024 at the Industry 4.0 Energy TestLab. First CPD on the fundamentals of power systems focuses on the theoretical background information necessary along with the “hands–on” experience through industry standard simulation platforms and experimental test benches to understand the fundamentals of power systems. The second CPD focuses on the renewable energy integration, which will bring industry professionals together for dialogue and knowledge sharing to better understand the renewable energy technologies and their integration regarding renewable generator modelling, control techniques, frequency and voltage regulation aligning with grid codes. Both CPDs are aimed at engineers/ professionals from both electrical and non–electrical background working on power systems, specifically for the personnel from industries aligned with power system planning, operation, management, and maintenance. Twenty–one professional engineers attended the CPDs from a wide variety of electricity industry organisations. 10+ UQ students and staff also participated in the CPDs. Course lecturers were Prof Tapan Saha and Associate Professor Richard Yan. Hand on laboratory experiments and simulations were conducted by Dr Ramesh Bonu and Dr Phuong Nguyen.







Intelligent plant diagnostics laboratory

A well–equipped insulation diagnostics laboratory, which is very actively used for insulation degradation and over–stress measurements.

This lab includes a lightning impulse voltage generator, single impulse current generator, 450kVA 300kV variable–frequency resonant high–voltage testing system and 18kVA 300kV AC Dielectric Test Set, Recovery Voltage and Polarisation/Depolarisation current measurement system, frequency domain dielectric spectroscopy equipment with HV variable frequency power supply, Partial Discharge Measurement System, thermal imaging camera and Frequency Response Analyser. Intelligent Plant Diagnostic laboratory has a special accelerated ageing experimental facility at Long Pocket.

This laboratory is suitable for long term ageing experiments under controlled moisture and temperature for transformers and other insulation materials.

Conference and Industry engagement

IEEE PES USGT Asia 2021

EEE PES ISGT Asia 2021 (5–8th December 2021): Queensland PES Chapter has successfully hosted the IEEE PES ISGT Asia conference in hybrid mode in Brisbane. Chair of IEEE PES Queensland Chapter Prof Tapan Saha was the General Chair of the ISGT ASIA 2021. The conference was attended virtually and in person by 325 registrants. More than one hundred fifty persons attended the conference in person. Two tutorials took place on 5th December 2021. We had two plenary sessions and a leadership forum attended by Australian and global industry leaders. Keynote session speakers were IEEE PES President Dr Jessica Bian, the Vice Chancellor of the University of Queensland Prof Debbie Terry, President, and CEO of EPRI Dr Arshad Mansoor, and Dr Imre Gyuk, Director from DOE, USA and Mr Peter Price EGM, Energy Queensland. This conference was a great success in the midst of the pandemic. The conference industry advisory committee was headed by Dr Nilesh Modi and Dr Daniel Eghbal, both are very active volunteers of IEEE PES Queensland Chapter. Publications and program were managed by Dr Chandima Ekanayake (who was the past Chair of IEEE PES Queensland Chapter) and Prof Mithulan Nadarajah.

Leadership forum was moderated by Mark Paterson, Managing Director of Strategen. Leadership forum speakers were Prof Paul Simshauser (CEO of Powerlink), Dr Alex Wonhas (Executive of AEMO) and Mr John Cole, (CEO of Edify Energy). We have received strong industry/academia support for sponsorship, paper submission/review, planning of program and participation in the conference. Survey conducted after the conference has reported an outstanding outcome for the volunteers of the conference. Twenty–one paper prizes were awarded to IEEE Members, Students, Women in Power, and Young Professional members of PES.

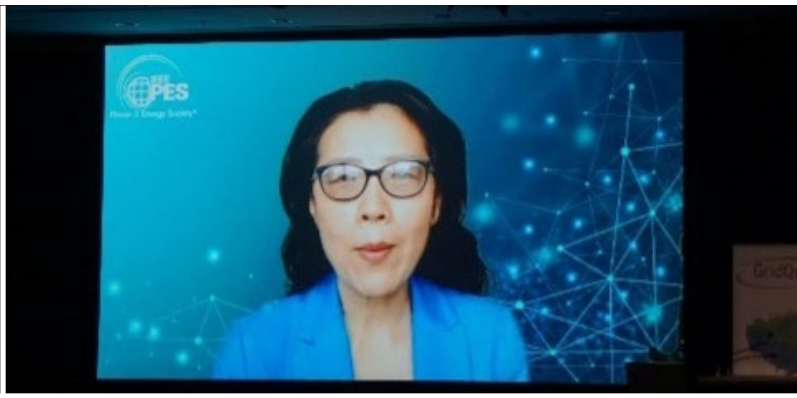
Number of awards

Best paper award (IEEE Members): 10

Best student paper award (IEEE PES Student Members): 6

Best paper for Women in Power: 5

Top left – Professor Debbie Terry (UQ Vice-Chancellor and President), **top right** – Dr Jessica Bian (IEEE PES President), **bottom left** – Dr Arshad Mansoor (CEO and President, EPRI, USA), **bottom right** – Professor Tapan Saha (General Chair – IEEE PES ISGT Asia 2021, UQ)



Professor Tapan Saha

Leader of PEC discipline

Professor Tapan Saha is a Fellow of the IEEE. IEEE Fellowship is the highest recognition of his research impact and industry contribution from the largest and most prestigious professional organisation in his area of research.

Tapan has been a Professor of Electrical Engineering since 2005 and has published more than 650 papers in journals and peer reviewed conferences. He has been very fortunate to work with many bright minds including his 85+ current and past HDR students and more than 30 Post–Doctoral fellows. He has been awarded with more than $50 million research grants from Australian Research Council, Australian Renewable Energy Agency, Queensland State Government and Commonwealth Government agencies and directly from the Australian Electricity Supply Industry. He has established two Professorial Chairs at UQ, with joint funding from Powerlink, Australian Power Institute, Springfield City Group and UQ.

He has received numerous awards and recognitions for his contributions in academia and industry based applied research:

- **MA Sargent Medal** by Engineers Australia 2022. The MA Sargent Medal is awarded jointly by the College of Electrical Engineers and the College of ITEE Engineers, Engineers Australia for long-standing eminence in science or the practice of electrical engineering, and is the highest award of the Electrical College Board of Engineers Australia
- **ARC College of Experts Panel Member** (2020–2024)
- **Engineers Australia Electrical College Board Member** (2015–2020)
- **ACPE–CIGRE Outstanding Academic Award.** This recognition is awarded to a recipient selected by Australasian Committee for Power Engineers (ACPE) in consultation with CIGRE (International Council on Large Electric Systems) Australian Board. The ACPE–CIGRE Outstanding Academic Award is recognised to an exceptional Australasian academic for outstanding career–long contributions to teaching and research in electric power engineering as well as outstanding contribution to industry.
- **UQ Research Higher Degree (RHD) Excellence Supervision Award** (2014)
- **Australian Learning and Teaching Council (ALTC) Citation** by Australian Commonwealth Government (September 2009)
- **The University of Queensland Partnership Excellence Award** (2022). Transformer condition assessment industry linkage to a successful commercialisation has been recognised with a ‘Partnership Excellence Award’ for a partnership with Powerlink, Energy Queensland, Ausgrid and TransGrid.
- **IEEE PES Distinguished Lecturer** since 2015

Current editorial roles:

- Editorial Board Member, IEEE Transactions on Power Delivery
- Editorial Board Member and Senior Editor, IEEE Transactions on Sustainable Energy
- Associate Editor, IEEE Transactions on Dielectric and Electric Insulation
- Senior Editor, IEEE Access

Professional engagements:

- Served IEEE Queensland Section for more than 25 years (two terms as Chair)
- Served IEEE Power and Energy Society Queensland Chapter for more than 20 years (Chair for 6 years)
- Served as Chair, IEEE Australia Council
- Served as Students Councillor, IEEE UQ Students Branch and UQ PES Students Branch
- Faculty advisor of IEEE HKN Chapter (Mu Kappa Chapter of UQ)
- Served as the Chair and committee member of Queensland Electrical Branch of Engineers Australia
- Served as Panel Member, CIGRE A2 and D1 for many years

Higher degree research students

Recent Awards

Power, Energy and Control Engineering

1. **ISGT Asia–2021, Best Paper Award**
   Emerging Frequency Control Mechanisms in IBR Dominated Power Systems: **Mr Nicholas Maurer**
2. **ISGT Asia–2021, Best Student Paper Award**
   Dynamic VAr Planning in large–scale PV Enriched Power Grid: **Dr Saeed Alzahrani**
3. **ISGT Asia–2021, Best Paper in WIP Award**
   Fast Frequency Response Effect on RoCoF for Networks with Solar PV Integration: **Dr Indira Alcaide–Godinez**
4. **ISGT Asia–2021, Best Presentation Award**
   An investigation into alternative causer pays methodologies for the recovery of regulation FCAS costs in the national electricity market: **Mr Joel Bulow**
5. **ISGT Asia–2021, CIGRE NGN Best Presentation**
   Award PMU–based condition monitoring of critical equipment in modern distribution networks: **Dr Feifei Bai**
6. **Travel award (to AUPEC–2023) from IEEE PES QLD Section: Hankun Cui**
7. **AUPEC–2023 second best paper: Hankun Cui**
8. **Student and Young Professional Best Paper Award at IEEE conference**
   Power Electronics and Motion Control, 25–29 April 2021: **Edi Matijevic**
9. **Best Paper Award of IEEE IAS Industrial and Commercial Power System Asia Conference 2022: Ge Zhang**
10. **IEEE PES Travel Award for attending the conference of IEEE ETFG 2023 in Wollongong, Australia 2023: Ge Zhang**
11. **IEEE PES Outstanding Chapter Volunteer Award2023: Ge Zhang**
12. **Best Student Paper Honour Award**
    The 9th IEEE International conference in the domain of Sustainable Engineering and Technology (ICOSTE 2023), Shangri la Island, Fiji: **Rajvikram Madurai Elavarasan**
13. **IEEE PES travel awards from IEEE APPEEC 2022**
    Ning Ma
14. **IEEE PES Chapter Travel Award**
    IEEE ETFG conference at University of Wollongong (November 2023): **Jiajie Feng**
15. **IEEE IAS CMD Workshop Travel Grant**
    IEEE ETFG conference at University of Wollongong (September 2023): **Jiajie Feng**

Higher degree research students

Current higher degree research students (full time)

Mrs Punam Pawar
Ms Ning Ma
Mr Ge Zhang
Mr Hankun Cui
Mr Yunda Xu
Mr Anuradha Abeysekara Hettiarachchige
Mr Shijie Xu
Mr Ali Sunbul
Ms Amita Singha
Mr Taolue Shen
Mr Shijie Yao
Mr Ashan Imantha M.H Bandara
Mrs Hasini De Silva
Mr Adland Pradana
Mr Junya Luo
Mr Saif Ullah Shafiq
Mr Jiajie Feng
Mr Rajvikram Madurai Elavarasan
Mr Fadi Almaghrbi
Mr Pinto Anugrah
Mr Ching Hong Tam
Miss Yuli Astriani
Mr Ting Kai Chia (Adrian)
Ms Yue Qu

UQIDAR higher degree research students

Mr Arnab Bhattacharjee
Mr Venkata Suryakiran Bhamidipati
Mr Akshay Bhyri

Current higher degree research students (part time)

Mr Qiu [Wilson] Jin

Recently completed higher degree research students

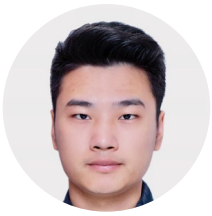
Dr Zhong Xia
Dr Xin Zhong
Dr Jiakang Yang
Dr Vinh Hao Le
Dr Jakob Pallot
Dr Gayan Chaminda Lankeshwara
Dr Thanuja Gawasingha Arachchige
Dr Arash Moradi
Dr Indira Alcaide Godinez
Dr David Amoateng
Dr Emad Areed
Dr Lei You
Dr Amir Ganjavi
Dr Saeed Alzahrani
Dr Aobo Zhou
Dr Mohammad Imran Azim
Dr Kiarash Gharani Khajeh
Dr Yu He
Dr Abdulrahman Alduraibi
Dr Mohammad Habibullah
Dr Shanshan Shan
Dr Muhammad Abdul Halfeez Ansari
Dr Davood Solatialkaran
Dr Weerasinghe Samarasinghe
Dr Ruiyuan Zhang
Dr Anupam Dixit
Dr Edi Matijevic
Dr Junya Luo

Mrs Punam Pawar

Designing and operating large scale PV plants beyond business as usual: Electricity to ancillary Services

Ms Ning Ma

Coordinated frequency control for power networks with high inverter-interfaced energy resources



Mr Ge Zhang

Analysis of power system stability with both grid–following and grid-forming renewable energy sources

Dr Anupam Dixit

Condition assessment of transformers retrofilled with ester liquids

Mr Hankun

Role of synchronous condensers and HVDC link interconnections for renewable dominated power systems stability

Dr Edi Matijević

Active front end power electronics converter: Modelling, control and analysis

Mr Yunda Xu

Energy storage for first frequency response to maintain power systems stability

Mr Anuradha Abeysekara Hettiarachchige

Impact of distributed energy resources (DER) on the life expectancy of transformer

Higher degree research students

Mr Shijie Xu

Data analytics to improve the visibility of power system asset health condition

Mr Ali Sunbul

Efficient rectifier topologies and their control

Dr Emad Areed

Impact of battery ramp rate limit on virtual synchronous machine stability during frequency events

Ms Amita Singha

Sensing, modelling, signal processing and data analysing for transformer/ OLTC/circuit breaker health management

Mr Taolue Shen

Dielectric physics–informed data–driven health management of power system assets

Mr Shijie Yao

Novel data analytic techniques for power system asset management

Mr Ashan Imantha M.H Bandara

Electrical control of hybrid power plants connected to weak grids

Mrs Hasini De Silva

Improving the power quality of grid connected microgrids at low voltage distribution network

Mr Adland Pradana

Most suitable smart grid implementation for Indonesia with anticipation of electric vehicle and internet of thing

Dr Junya Luo

Generic condition monitoring on distribution systems

Mr Saif Ullah Shafiq

Integration of electric vehicle charging stations in active distribution networks

Mr Jiajie Feng

Develop virtual inertia and estimate the optimal location of microgrids in Australian grid using machine learning

Higher degree research students

Mr Rajvikram Madurai Elavarasan

Investigations on the role of solar photovoltaics and enhancement of solar energy consumption to achieve SDG 7

Mr Fadi Almaghrbi

Implementation of peer–to–peer energy trading in the Kingdom of Saudi Arabia: Challenges and solutions

Mr Pinto Anugrah

Role of smart grid towards a 100% renewable energy integration in ASEAN power sector

Mr Ching Hong Tam

Modelling and optimisation of steady–state operation of residential power grids with PV, EV and BESS

Miss Yuli Astriani

Planning and operation of renewable energy parks with green hydrogen production

Mr Qiu [Wilson] Jin

Data–driven adaptive control of converter–driven oscillations with multiple converter–interfaced generators

Mr Ting Kai Chia (Adrian)

Identification of power oscillations from variable renewable energy–based generators

Ms Yue Qu (New)

Dr Arnab Bhattacharjee

Advancing energy system modelling and cybersecurity through holistic ai development

Dr Venkata Suryakiran Bhamidipati

Optimal scheduling in active distribution system under uncertain conditions

Mr Akshay Bhyri

Enhancing the grid support capability of wind farms

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

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Professor Tapan Kumar Saha
FIEEE, FIEAust, CPEng, RPEQLeader
Power, Energy and Control Engineering Discipline

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