IEEE PES 2025 GTD CONFERENCE & EXPOSITION

IEEE PES GTD ASIA 2025

Grand International Generation, Transmission & Distribution Conference and Exposition Asia

Abstract Book

PG Power Generation

T&D Transmission & Distribution

RE Renewable Energy

Accelerating The Energy Transition

Toward Carbon Neutrality – a Sustainable Energy Future for All

Conference
26-29 November 2025

Exposition
27-29 November 2025

Queen Sirikit National Convention Center (QSNCC)
60 Ratchadaphisek Road, Khlong Toei Sub-District, Khlong Toei District, Bangkok 10110, Thailand

EGAT

FOR THE WORLD, FOR THE PEOPLE

Mission to Sustainability

We are advancing power generation from renewable energy sources — solar, hydro, and wind — that are sustainable for the world, while also enhancing their stability through efficient energy storage systems and modern technologies. This strengthens the power system security and ensures a sufficient electricity supply for a sustainable future and happiness of all Thais.

MEA
Metropolitan Electricity Authority

MEA Ei

Renewable Energy: Your Direct Path to Clean Power Ownership

- Solar Rooftop EPC & PPA
- Energy Storage (ESS)

Smart Energy: Seamless Control for Sustainable Buildings

- Smart Energy Management
- Energy Audit & Efficiency

Customer Solutions: Tailored Innovation for Business Growth

- Customized Solutions
- Project Partnership

CHARGE SURE by MEA

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Ensure your charging station is 100% safe for every EV user.

Compatibility Sure
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More information Scan here

ENERGY VIBE SOLUTION

Developing innovations and new business models
in collaboration with partners to meet future market needs.

ENERGY VIBE SOLUTION

Products, innovations, and strategic partnerships
developed across three key business areas:

Infrastructure

Infrastructure EPC

Business Model

- EPC-M Business Model
- Electrical and Construction
- Nationwide
- Large Companies and Partnerships

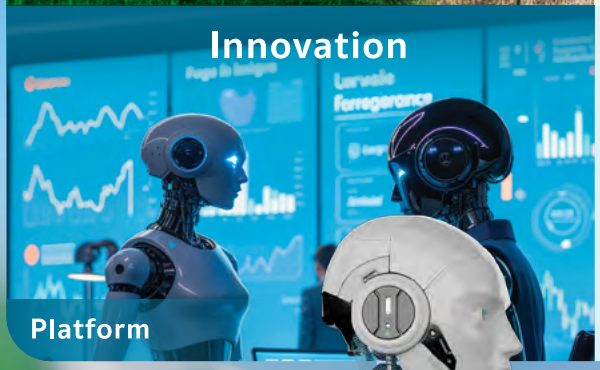
Green & EE

Sustainable Energy

Business Model

- EPC-M Business Model
- Renewable Energy , Energy Efficiency and Environmental Sustainability
- Nationwide
- Large Companies and Partnerships

Innovation



New S-Curve

Business Model

- Platforms and Solutions
- Support Customers' Goals: ESG, Cost - Effectiveness and Competitive Advantage

PEA
PROVINCIAL ELECTRICITY AUTHORITY

ptt

ปตท. แข็งแรงร่วมกับสังคมไทย
และเติบโตในระดับโลกอย่างยั่งยืน

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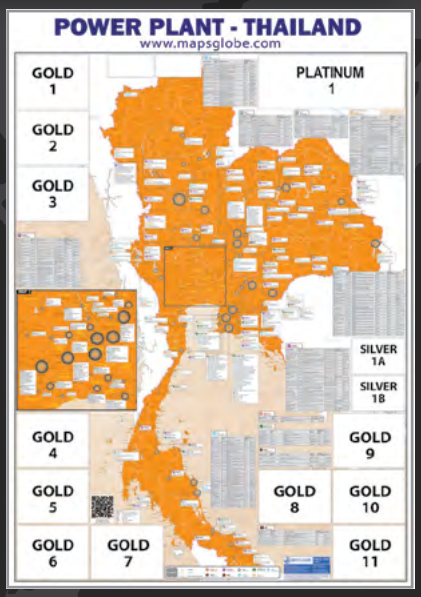

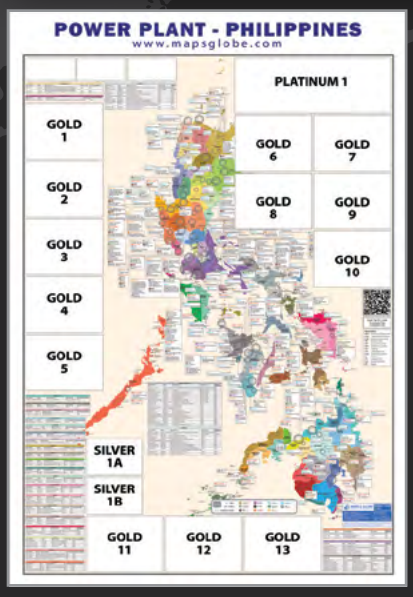

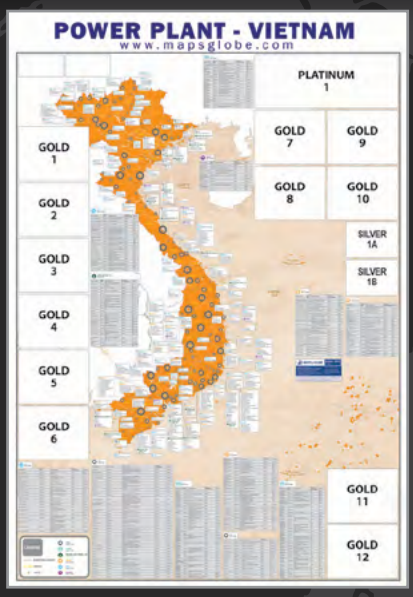

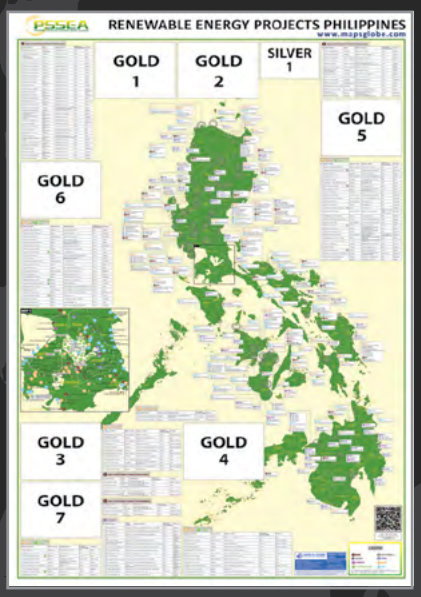

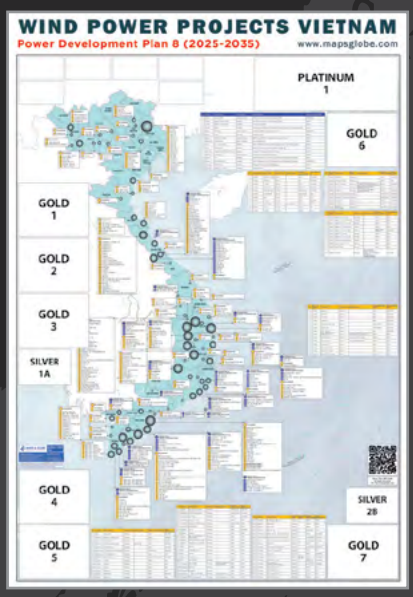

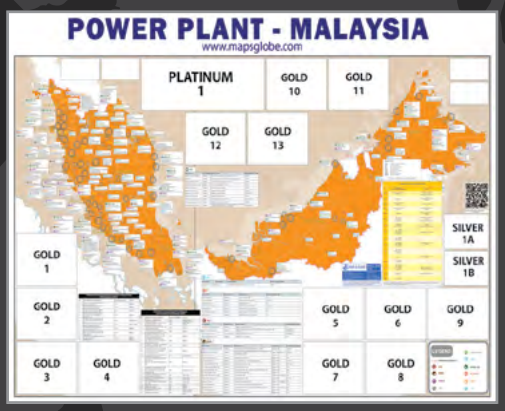

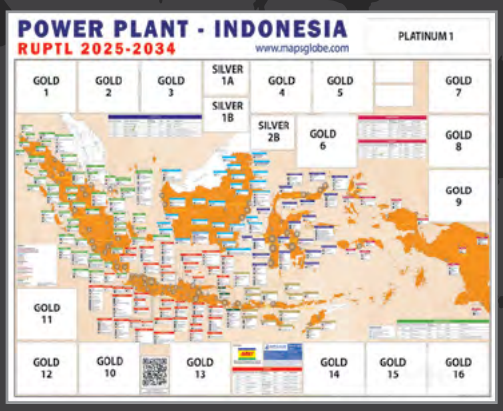

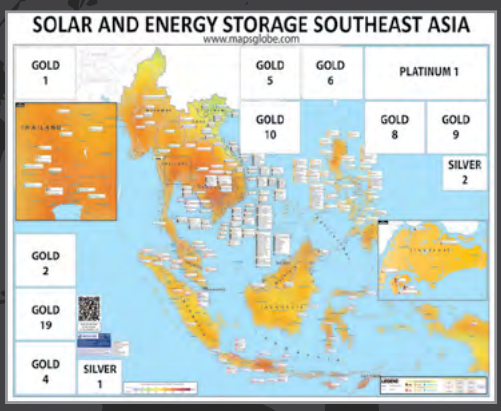

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VENUE LAYOUT

26 NOV 2025
[TUTORIAL SESSION]

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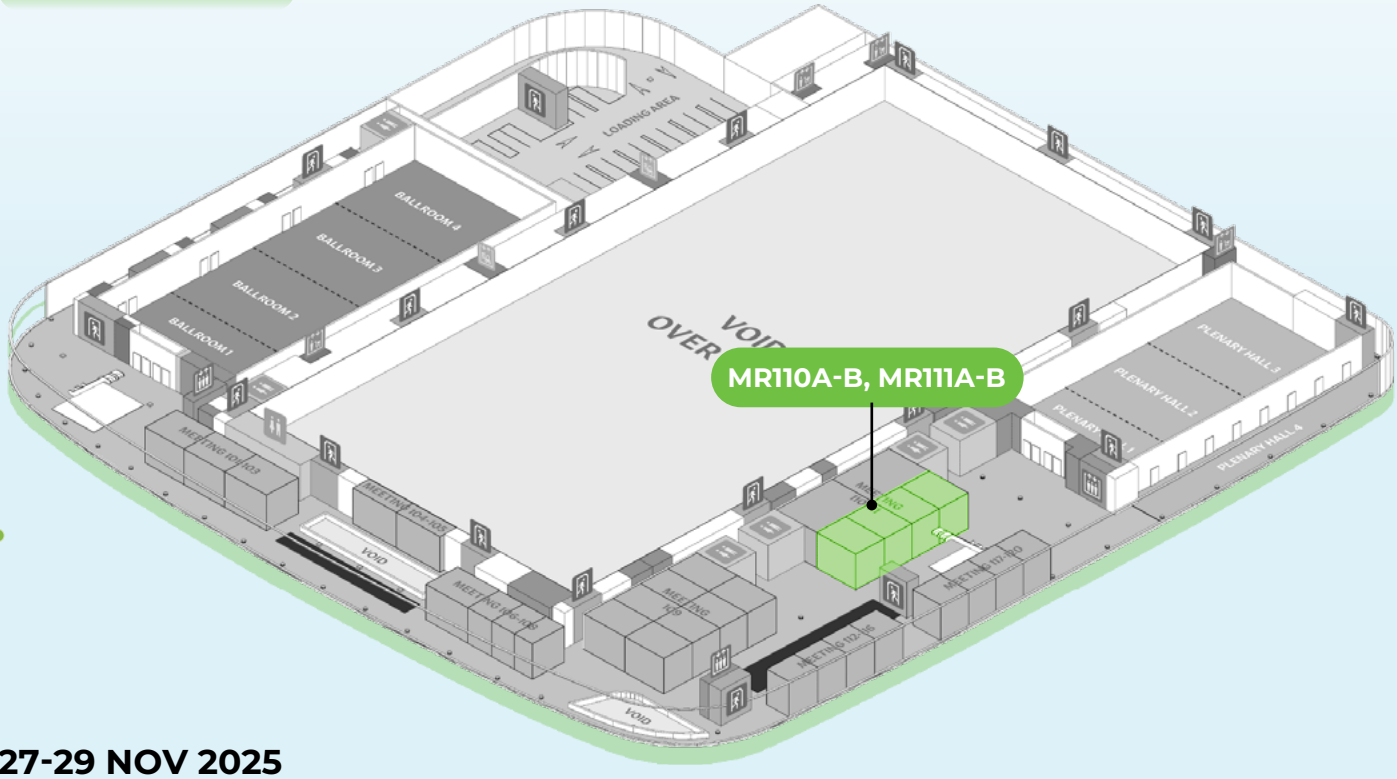

27-29 NOV 2025
[EXHIBITION & CONFERENCE]

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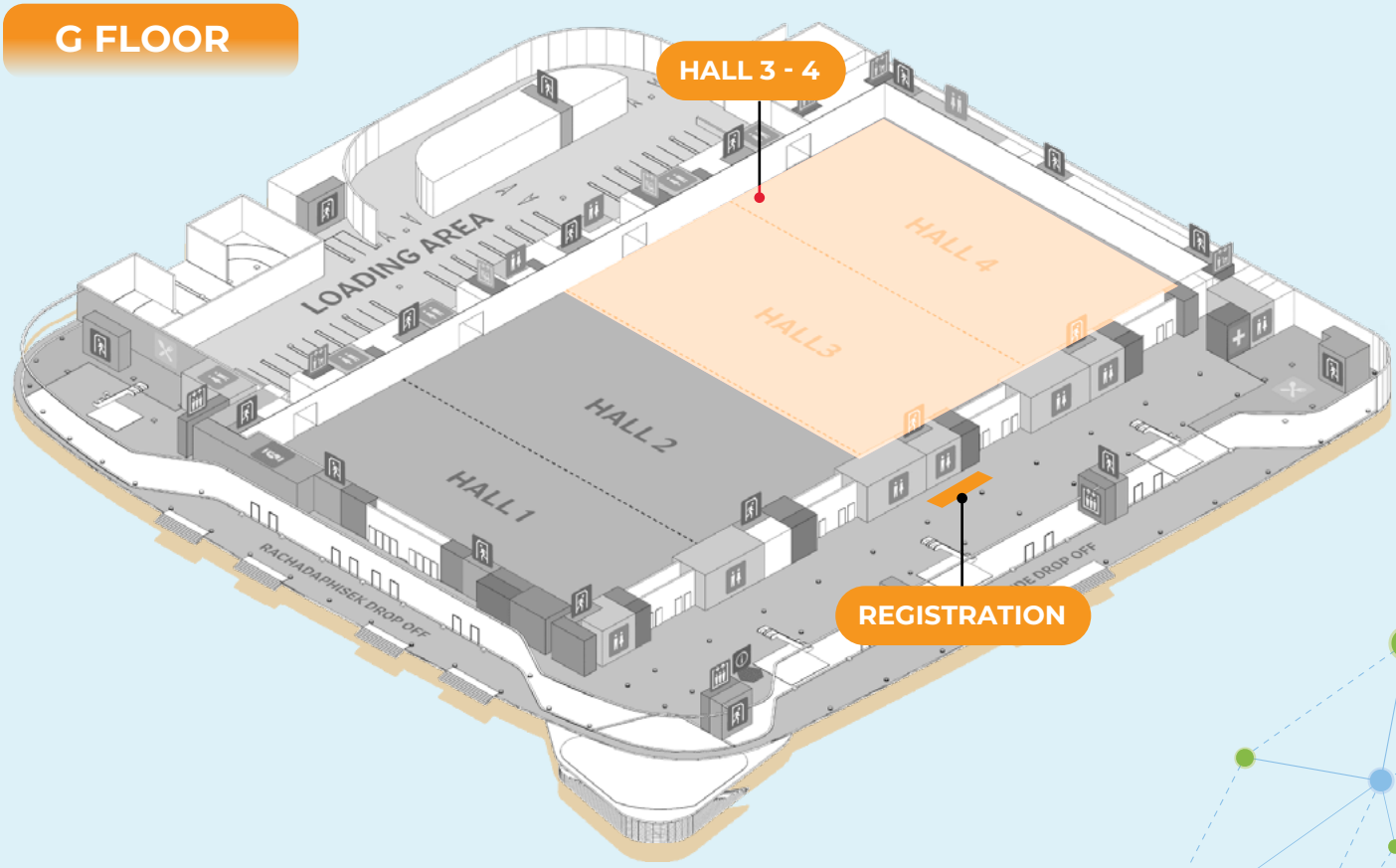

IEEE PES GTD ASIA 2025

CONFERENCE PROGRAMME

26 - 29 NOVEMBER 2025

WEDNESDAY 26TH NOVEMBER 2025

Room/Time	1- MR110A, Level 1	2-MR110B, Level 1	3-MR111A, Level 1	4-MR111B, Level 1
09.00-10.15	**Tutorial 1** Converter-Driven Stability Issues and Solutions in Power Electronics Defined Power Systems **Speakers:** • Dr. Shan Jiang, University of New South Wales (UNSW Sydney) • Dr. Ye Zhu, University of New South Wales (UNSW Sydney) • Assoc.Prof. Georgios Konstantinou, University of New South Wales (UNSW Sydney)	**Tutorial 2** Requirements and application of UHF PD Monitoring Systems for gas insulated systems and Increased operation reliability through continuous PD monitoring **Speakers:** • Dr. Wojciech Koltunowicz, OMICRON Energy Solutions GmbH	**Tutorial 3** Functional Performance Requirements for Grid Forming STATCOM (including E-STATCOM)- a perspective from the planning stage up to the project execution life cycle **Speakers:** • Mr. David Langner, Siemens Energy • Mr. Mikael Halonen, Hitachi Energy • Mr. Septimus Boshoff, DNV South Africa (Pty) Ltd. • Mr. Heinrich von Geymueller, Siemens Energy • Mr. Theuns van Staden, DNV South Africa (Pty) Ltd.	**Tutorial 4** Decentralised frameworks for Future Distribution Networks with High DER Penetration **Speaker:** • Dr. Daniel Eghbal, Future Network Strategy, Energy Queensland
10.15-10.30	AM Coffee Break			
10.30-12.00	**Tutorial 1 [continue]** Converter-Driven Stability Issues and Solutions in Power Electronics Defined Power Systems **Speakers:** • Assoc.Prof. Georgios Konstantinou, University of New South Wales (UNSW Sydney) • Dr. Shan Jiang, University of New South Wales (UNSW Sydney) • Dr. Ye Zhu, University of New South Wales (UNSW Sydne)	**Tutorial 2 [continue]** Requirements and application of UHF PD Monitoring Systems for gas insulated systems and Increased operation reliability through continuous PD monitoring **Speakers:** • Dr. Wojciech Koltunowicz, OMICRON Energy Solutions GmbH	**Tutorial 3 [continue]** Functional Performance Requirements for Grid Forming STATCOM (including E-STATCOM)- a perspective from the planning stage up to the project execution life cycle **Speakers:** • Mr. David Langner, Siemens Energy • Mr. Mikael Halonen, Hitachi Energy • Mr. Septimus Boshoff, DNV South Africa (Pty) Ltd. • Mr. Heinrich von Geymueller, Siemens Energy • Mr. Theuns van Staden, DNV South Africa (Pty) Ltd.	**Tutorial 4 [continue]** Tutorial 4 [continue] Decentralised frameworks for Future Distribution Networks with High DER Penetration **Speakers:** • Dr. Daniel Eghbal, Future Network Strategy, Energy Queensland
12.00-13.30	Lunch at MR109BCDFGH			
13.30-14.45	**Tutorial 5** De-risking the Energy Transition with Real-time Simulation and HIL Testing **Speakers:** · Mr. Kurtis Toews, RTDS Technologies	**Tutorial 6** IEC61850, Process Bus and Digital Substation: Concepts and Real-Time Simulation Testing **Speakers:** • Prof. Francisco M. Gonzalez-Longatt, The Leader of DIgEnSysLab. DIgEnSys-Lab	**Tutorial 3 [continue]** Functional Performance Requirements for Grid Forming STATCOM (including E-STATCOM)- a perspective from the planning stage up to the project execution life cycle **Speakers:** • Mr. David Langner, Siemens Energy • Mr. Mikael Halonen, Hitachi Energy • Mr. Septimus Boshoff, DNV South Africa (Pty) Ltd. • Mr. Heinrich von Geymueller, Siemens Energy • Mr. Theuns van Staden, DNV South Africa (Pty) Ltd.	**Tutorial 7** Real-Time Simulation for Power, Energy & Cybersecurity **Speakers:** • Mr. Benoit Marcoux, OPAL-RT Technologies • Ms. Piyaporn Sinnart, PTS Combination (Thailand)
14.45-15.00	PM Coffee Break			
15.00-16.30	**Tutorial 5 [continue]** De-risking the Energy Transition with Real-time Simulation and HIL Testing **Speakers:** • Mr. Kurtis Toews, RTDS Technologies	**Tutorial 6 [continue]** IEC61850, Process Bus and Digital Substation: Concepts and Real-Time Simulation Testing **Speakers:** • Prof. Francisco M. Gonzalez-Longatt, The Leader of DIgEnSysLab. DIgEnSys-Lab	**Tutorial 3 [continue]** Functional Performance Requirements for Grid Forming STATCOM (including E-STATCOM)- a perspective from the planning stage up to the project execution life cycle **Speakers:** • Mr. David Langner, Siemens Energy • Mr. Mikael Halonen, Hitachi Energy • Mr. Septimus Boshoff, DNV South Africa (Pty) Ltd. • Mr. Heinrich von Geymueller, Siemens Energy • Mr. Theuns van Staden, DNV South Africa (Pty) Ltd.	**Tutorial 7 [continue]** Real-Time Simulation for Power, Energy & Cybersecurity **Speakers:** • Mr. Benoit Marcoux, OPAL-RT Technologies • Ms. Piyaporn Sinnart, PTS Combination (Thailand)

THURSDAY 27TH NOVEMBER 2025

Room/ Time	POWER HUB [EXHIBITION HALL 3]

09.00-12.30	**OPENING CEREMONY**
	• **Welcome Remarks by** Dr. Narin Phoawanich, Governor, Electricity Authority of Thailand (EGAT)
	• **TCEB Supporting Remarks by** Dr. Supawan Teerarat, President, Thailand Convention and Exhibition Bureau (TCEB)
	• **Reporting Remarks by** Prof. Dr. Weerakorn Ongsakul, Conference Chair, IEEE PES GTD ASIA 2025
	• **Opening Remarks by** Mr. Auttapol Rerkpiboon, Ministry of Energy
	• **VIP - Exhibition Visit**
	
	KEYNOTE LECTURE
	• **Keynote 1: Advancing Innovation for Resilience in a Dynamic Energy Landscape**
	  • Mr. Raj Beasla, Senior Director Transmission and Substation Engineering at Pacific Gas and Electric Company
	
	• **Keynote 2: Solar and wind integration in Southeast Asia**
	  • Dr. Peerapat Vithayarichareon, Senior Energy Analyst, Internation Energy Agency (IEA)
	
	• **Keynote 3: Accelerating the Energy Transition toward Carbon Neutrality - a Sustainable Energy Future for All**
	  • Dr. Narin Phoawanich, Governor, Electricity Authority of Thailand (EGAT)

12.30-14.00	Lunch in Exhibition Hall

Room/ Time	Energy Exchange [Exhibion Hall 3]	Spark Room 1 [Exhibition Hall 3]	Spark Room 2 [Exhibition Hall 3]	Spark Room 3 [Exhibition Hall 3]	Spark Room 4 [Exhibition Hall 3]
14.00-15.30	**Super Session 1** Ancillary Services and Technologies; Opportunities for Thailand's Power Grid **Session Chair:** Assoc. Prof. Naebboon Hoonchareon, Ph.D, Faculty of Engineering, Chulalongkorn University **Speakers:** • Dr. Chanchai Amornvipas, Energy Regulatory Commission of Thailand • Asst. Prof. Dr. Piti Eiamchamroonlarp, Faculty of Law, Chulalongkorn University • Dr. Areeporn Asawinpongphan, Thailand Development Research Institute (TDRI) • Mr. Warit Rattanachuen, Electricity Generating Authority of Thailand (EGAT) • Dr. Somchai Songsiri, Provincial Electricity Authority (PEA) • Dr. Knathip Spuntupong, Metropolitan Electricity Authority (MEA) • Dr. Worawut Waruttamapornsu, Hitachi Energy (Thailand) Limited • Mr. Pierre-Louis Dardenne, Schneider (Thailand) Limited	**Panel Session 1** Energy Transition is not going as fast as initially intended, what's the impact on global decarbonisation objectives and power systems? **Session Chair:** Mr. Dean Sharafi, Energy Transition Australian Energy Market Operator (AEMO) **Speakers:** • Mr. Ali Nami, Tracey Brunstrom & Hammond, Australia • Mr. Greg Elkins, Global Power Energy, Austra • Mr. Pierluigi Mancarella, The University of Melbourne, Australia • Mr. Mongkhon Tangsiriwit, Schneider Electric - Thailand, Myanmar and Laos	**Oral Session 1:** Track 1 Advanced Generation, Transmission, and Carbon Management Technologies **Session Chair:** Asst. Prof. Dr. Komson Daroj, Ubon Ratchathani University **Speakers:** • **Solving Large Scale Multi-carrier Energy Systems –** Buu-Van Nguyen (15 min) • **Vlsi Based Multi-zone Smart Home Controller with Fsm-driven Automation Using Round-robin Arbitration and Power Optimization -** Pavan Kumar (15 min) • **Thermal Models for Transformer Overload Management: Implementation Challenges and Solutions -** Chong Soon Peng (15 min)	**Oral Session 2:** Track 4/1 EV Integration and Distributed Energy Management Systems **Session Chair:** Assoc. Prof. Sanchai Dechanupaprittha, Kasetsart University **Speakers:** • **Optimal Siting of Pv and Bess Under Varying Ev Penetration Levels in an Ieee 37-bus System Considering System Line Capacity –** Joseph Leo Veterana (15 min) • **Optimal Online EV Charging with Discrete Rates and Phase Unbalance Constraints -** Can Berk Saner (15 min) • **Energy Flow Pathway and Economic Impact of Grid-connected Smart Home Pv–battery Systems Under Tou Tariff -** Thatree Mamee (15 min) • **Benefits Of Applying Point-On-Wave Closing Fault Interrupters In Distribution Networks -** Roxanna Partow (15 min)	**Oral Session 3:** Track 7/1 Advanced Renewable Energy Integration and Conversion Technologies **Session Chair:** Dr. Noppada Teeraachariyakul, Kasetsart University **Speakers:** • **The Role of Battery Storage in Accelerating Large-scale Offshore Wind Deployment –** Nathanael Silava (15 min) • **Technical Insights Into Net Metering for Distributed Solar Photovoltaics -** Abhay Pandey (15 min) • **Impact of Bess State of Charge on the Reliability of an Archipelagic Power System with Increasing Pv Penetration -** Alina Quiñones (15 min) • **Control of the Negative Sequence Component for Ride-through of Asymmetrical Faults in Grid Forming Inverters -** Ruben Inzunza (15 min) • **Evaluation of Peak Shaving Demand Charge and Greenhouse Gas Reduction with Photovoltaic Systems in Medium General Service -** Natchapol Ruangsap (15 min) • **System-Based Protection Testing Considering IBR and Negative Sequence Current Injections -** Francisco M. Gonzalez-Longatt (15 min)

THURSDAY 27TH NOVEMBER 2025

Room/ Time	Energy Exchange [Exhibion Hall 3]	Spark Room 1 [Exhibition Hall 3]	Spark Room 2 [Exhibition Hall 3]	Spark Room 3 [Exhibition Hall 3]	Spark Room 4 [Exhibition Hall 3]
15.30-16.00	PM Break in Exhibition Hall				
16.00-17.30	**Super Session 1 [continue]** Ancillary Services and Technologies; Opportunities for Thailand's Power Grid **Session Chair:** Assoc. Prof. Naebboon Hoonchareon, Ph.D, Faculty of Engineering, Chulalongkorn University **Speakers:** • Dr. Chanchai Amornvipas, Energy Regulatory Commission of Thailand • Asst. Prof. Dr. Piti Eiamchamroonlarp, Faculty of Law, Chulalongkorn University • Dr. Areeporn Asawinpongphan, Thailand Development Research Institute (TDRI) • Mr. Warit Rattanachuen, Electricity Generating Authority of Thailand (EGAT) • Dr. Somchai Songsiri, Provincial Electricity Authority (PEA) • Dr. Knathip Spuntupong, Metropolitan Electricity Authority (MEA) • Dr. Worawut Waruttamapornsu, Hitachi Energy (Thailand) Limited • Mr. Pierre-Louis Dardenne, Schneider (Thailand) Limited	**Panel Session 2** Innovative Optimization Techniques for Smart Grid Operation and Planning **Session Chair:** Dr. Hiroyuki Mori, Meiji University **Speakers:** • Dr. Hsiao-Dong Chiang, Cornell University, NY, USA • Mr.Yukitoki Tsukamoto, Mitsubishi Electric Power Products, Inc., PA, USA • Dr. Yutaka Sasaki, Hiroshima University, Japan	**Oral Session 4:** Track 2 Dynamic Line Rating (DLR) Innovations and HVDC Technologies **Session Chair:** Prof. Jai Govind Singh **Speakers:** • **Var Compensation Sizing and Placement to Enhance Voltage Profile and Reduce Losses in Bhutan Grid –** Samten (15 min) • **Polarity-Dependent Dielectric Behavior of XLPOInsulated PV Cables under High-Voltage AC and DC Stress: Leakage Current and PRPD Analysis -** Khomsan Ruangwong (15 min) • **Corona Discharge Pulse Shape Analysis for Sphere Plane Configurations -** Pradeep Kumar GUPTA (15 min) • **MTDC for Connecting Indonesian Islands Enabling Renewable Energy Generation -** Sanjay Kumar Chaudhary (15 min) • **Geospatial Potential Assessment of Dynamic Line Rating: A High-level Methodology for Early-stage Planning. -** Robinson Maswedza (15 min) • **Experimental Study of Partial Discharge in High-voltage CTs and Bushings -** Noppada Teera-Achariyakul (15 min)	**Oral Session 5:** Track 4/2 EV Integration and Distributed Energy Management Systems **Session Chair:** Assoc. Prof. Dr. Dulpichet Rerkpreedapong, Kasetsart University **Speakers:** • **Realistic Assessment of PV and EV Hosting Capacity in Low-voltage Networks: a Comparative Study of Deterministic and Time-series Methods –** Tapparit Bangtit (15 min) • **Frequency-dependent Behavior and Field-evaluation of Voltage Transformers for Power Quality Applications -** Felix Feustel (15 min) • **A Stackelberg Game of Demand Response from the Aggregator's Perspective -** Seangleng Khe (15 min) • **Feeder Power Disaggregation Using Pmu and Smart Meter Data in Distribution Systems -** Chaowanan Jamroen (15 min) • **Adapting Power Distribution Infrastructure for the Expansion of Data Centers : Challenges and Solution in the Thailand Metropolitan Area -** Pinpong Nuimannate (15 min) • **Large-scale Application of Permanent On-line Partial Discharge Monitoring -** Sam Roe (15 min) • **A Multi-parameter and Barrier-based Approach to Gis Modernization Planning in Kuwait's Transmission Network -** Majdi Alomari (15 min)	**Oral Session 6:** Track 7/2 Advanced Renewable Energy Integration and Conversion Technologies **Session Chair:** Assoc. Prof. Dr. Keerati Chayakulkheeree, Suranaree University of Technology **Speakers:** • **Assessing the Wind Energy Potential of the Bay of Bengal Using CMIP6 Climate Models -** Ahnaf Rahman (15 min) • **Evaluating Break-even Costs of BESS in PV-integrated Systems Across Diverse Load Profiles and TOU Tariff Scenarios in Thailand -** Pranuda Jivaganont (15 min) • **Economic Feasibility of Power Generation by Integrating Floating Photovoltaics on Sea and Small Wind Turbines at Samui Island in Southern Thailand -** Kittisak Chaisuwan (15 min) • **Factors Affecting the Accuracy of Ai-based Forecasting Models for Renewable Energy Generation in Asean -** Apichai Sarnthong (15 min) • **A Comparison of Impact for Various Biomass Utilization in Indonesian Cofiring Coal-fired Power Plants -** Rachmat Hermawan (15 min)

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Room/ Time	Energy Exchange [Exhibition Hall 3]	Spark Room 1 [Exhibition Hall 3]	Spark Room 2 [Exhibition Hall 3]	Spark Room 3 [Exhibition Hall 3]	Spark Room 4 [Exhibition Hall 3]
09.00-10.30	**Super Session 2** Grid Modernization – Transitioning Power Systems to Sustainable Power Society with High VRE Penetration (Opportunities & Challenges) **Session Chair:** Mr. Vishal Devarajan, McKinsey & Company **Speakers:** • Mr. Jakgree Sirimaneewattana, Electricity Generating Authority of Thailand (EGAT) • Dr. Peerapat Vithayasrichareon, Internation Energy Agency (IEA) • Prof. Iain MacGill, The University of New South Wales (UNSW) • Dato' Ir. Ts. Abdul Razib Dawood, ASEAN Centre for Energy (ACE)	**Panel Session 3** Hydrogen in Power Systems: Integration Strategies and Global Perspectives **Session Chair:** Dr. Kanchit Ngamsanroaj, Ph.D. (E.E.), Committee of the IEEE Power & Energy Society, Thailand Chapter **Speakers:** • Dr. Sumittra Charojrochkul, The National Science and Technology Development Agency (NSTDA) • Mr. Pariya Phuaksuk, Electricity Generating Authority of Thailand (EGAT) • Mr. Milan Padhi, Siemens Energy Pte. Ltd. • Mr. Jerin Raj, Black & Veatch • Mr. Sarawut Phongphairat, Hitachi Energy (Thailand) Limited	**Panel Session 4** Green Hydrogen in Power Generation: Strategic Integration or Market Hype **Session Chair:** Asst. Prof. Dr. Jirawadee Polprasert, Naresuan University **Speakers:** • Professor Dr. Pavich Tongroach, Chairman of Ronitron Co., Ltd. • Dr. Yosapol Rathamarit, Electricity Generating Authority of Thailand (EGAT) • Mr. Nutthapong Puangmanee, PTT Public Company Limited	**Oral Session 7:** Track 4/3 EV Integration and Distributed Energy Management Systems **Session Chair:** Asst. Prof. Dr. Thongchart Kerdphol, Kasetsart University **Speakers:** • **A Reliable Islanding Detection Solution for Grids with Distributed Energy Resources -** Od Naidu (15 min) • **Smart Microgrid Simulation and Techno-economic Optimization for Phuket Island Using Matlab -** Sakrapee Khunpetch (15 min) • **Improving the Integration of Distributed Energy Resources (DERs) in Thailand's Power Grid Using Automatic Voltage Regulator Distribution Transformers (AVRDT) -** Ling Leong Yiing (15 min) • **Impact Analysis of Single-phase and Three-phase Electric Vehicle Charging Stations on Power System Operation and Quality -** Supakan Janthong (15 min) • **Practical Testing Approaches for Lpit in Digital Substations -** Gilje Woo (15 min)	**Oral Session 8:** Track 7/3 Advanced Renewable Energy Integration and Conversion Technologies **Session Chair:** Asst. Prof. Dr. Nidchabendha Chandanachulaka Roekrai, Kasetsart University **Speakers:** • **Performance Evaluation of Biomimetic Turbines Inspired by Ash Tree Seeds and a Conventional Horizontal-axis Wind Turbine -** John Russel Sajol (15 min) • **Sizing Of A Battery Energy Storage System (BESS) Under A Voltage Regulation Application On A Solar-Penetrated Distribution Network Considering Battery Degradation -** Erison Peñaflor (15 min) • **Enhancing Transformer Performance for Renewable Energy Applications with Natural Ester Dielectric Fluid -** Kin Yu Lam (15 min) • **Towards Streamlined DG Interconnection Criteria: A Fast Risk-based Hosting Capacity Estimate Method -** Munyaradzi Justice Chihota (15 min)

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Room/ Time	Energy Exchange [Exhibition Hall 3]	Spark Room 1 [Exhibition Hall 3]	Spark Room 2 [Exhibition Hall 3]	Spark Room 3 [Exhibition Hall 3]	Spark Room 4 [Exhibition Hall 3]
10.30-11.00	AM Break in Exhibition Hall				
11.00-12.30	**Poster Session (In front of Spark Room 2)**				
	Super Session 3 Enabling SMRs in Thailand: Policy, Technology, and Partnerships **Session Chair:** Dr. Kampanart Silva, National Energy Technology Center (ENTEC) **Speakers:** • Mr. Arin Temeyakul, Electricity Generating Authority of Thailand (EGAT) • Dr. Pantip Ampornrat, Office of Atoms for Peace (OAP) • Mr. Benjamin Robert MC Intosh, Nuclear Competitiveness Team, U.S. State Department, Bureau of Arms Control and Nonproliferation • Mr. Soon Kil Jung, Korea Hydro & Nuclear Power Co., Ltd. (KHNP)	**Workshop 1** PCS - Key to Provide Resilience for Future Grid (Invitation Only) **by Hitachi Energy**	**Panel Session 5** Powering the Carbon-Neutral Future: From Ambition to Action in a Decentralized, Digital Energy World by IEEE PES in collaboration with Schneider Electric (Invitation Only) **Welcome by :** Assoc. Prof. Dr. Somporn Sirisumrannukul, King Mongkut's University of Technology North Bangkok **Moderator:** Assoc. Prof. Nopbhorn Leeprechanon, IEEE Power and Energy Society (Thailand) **Speakers:** • Mr. Mongkhon Tangsiriwit, Schneider Electric • Ms. Nancy Lin, Schneider Electric • Mr. Daren Gong, Schneider Electric • Mr. Warit Rattanachuen, Electricity Generating Authority of Thailand (EGAT) • Mr. Pisanu Tantitavorn, Metropolitan Electricity Authority (MEA) • Dr. Somchai Songsiri, Provincial Electricity Authority (PEA) • Mr. Shatetha Terdprisant, McKinsey & Company • Dr. Natthakorn Kraikul, PTT Public Company Limited • Ms. Ann Moore, AVEVA • Dr. Worawut Waruttamapornsu, Hitachi Energy • Mr. Tanapong Ittisakulchai, NTT DATA, Inc. (Thailand & CLM) • Mr. Chanwut Limpichai, Eco Plant Services	**Panel Session 6** Thailand's Demand Response Journey: Pilot Lessons and Pathways to Automation **Session Chair:** Assoc. Prof. Nipon Ketjoy, PhD, Naresuan University **Speakers:** • Asst. Prof. Dr. Yodthong Mensin, Naresuan University • Mr. Parinya Sonsaard, Provincial Electricity Authority (PEA) • Mr. Surat Asvapoositkul, Naresuan University	
12.30-14.00	Lunch in Exhibition Hall				
14.00-15.30	**Super Session 4** Energy Storage: Accelerating the Path to a Carbon-Neutral Future **Session Chair:** Dr. Pimpa Limthongkul, National Energy Technology Center (ENTEC) **Speakers:** • Mr. Kasiean Sukemoke, PEC Technology Thailand Co., Ltd. • Dr. Jiravan Mongkoltanatas, National Energy Technology Center (ENTEC) • Mr. Patipan Kalvibool, Huawei Digital Power Thailand • Mr. Sudhibhumi Pumhiran, Nuovo Plus Co. Ltd. • Ms. Oratai Suwanwilaikul, B.Grimm Power, PLC • Mr. Nawanat Eua-Anant, Electricity Generating Authority of Thailand (EGAT) • Mr. Chaturon Kusonsong, Provincial Electricity Authority (PEA) • Dr. Supawan Saelim, Agora Energiewende	**Panel Session 7** AI-Driven Power System and Equipment Monitoring and Maintenance **Session Chair:** Assoc. Prof. Dr. -Ing.Thanapong Suwanasri, King Mongkut's University of Technology North Bangkok, Thailand **Speakers:** • Ms. Kessuda Poempolpaibool, Siemens Limited Thailand • Dr. Wojciech Koltunowicz, OMICRON Energy Solutions GmbH • Mr, Chaiwat Chaisukesung, Hitachi Energy (Thailand) Limited • Mr. Saar Herman, OFIL System • Mr. Luca Garangnani, INWAVE, Australia	**Panel Session 8** WiP - The Road to Sustainable Success: Women in Power Leading with Purpose and Resilience **Session Chair:** Asst. Prof. Dr. Supattana Nirukkanaporn, Rangsit Univeristy **Speakers:** • Dr. Piyapan Hannarkin, IEEE Power & Energy Society Thailand • Ms. Nammon Lertchitcharat, Electricity Generating Authority of Thailand (EGAT) • Ms. Yada Rungrueang Wisetrat, Schneider Electric (Thailand) • Ms. Keeratisiri Wannaphan, Hitachi Energy (Thailand) Limited	**Panel Session 9** DERs and the Path to Net Zero: Storage, EVs, and Flexible Demand **Session Chair**: Assoc. Prof. Dr. Somporn Sirisumrannukul, King Mongkut's University of Technology North Bangkok **Speakers:** • Dr. Daniel Eghbal, Future Network Strategy, Energy Queenslan • Mr. Worapot Krathong, Metropolitan Electricity Authority (MEA) • Mr. Jiandong Liu, Schneider Electric • Mr. Jaturong Tongkamkaew, Provincial Electricity Authority (PEA) • Asst. Prof. Dr. Komson Daroj, Ubonratchathani University	**Oral Session 9:** Track 8/1 AI and Blockchain for Sustainable and Secure Power Systems **Session Chair:** Asst. Prof. Dr. Teeratum Bunyagul, King Mongkut's University of Technology North Bangkok **Speakers:** • **Feature-Augmented BiLSTM Approach for LSTLF on Power Transmission Systems -** Bhuwadon Saengsukon (15 min) • **A Two-stage Framework for Power System Resilience Assessment: Process Design and a Case Study in Kinmen -** Yuhsuan Wu (15 min) • **La2mnfeo6-double Perovskite Decorated 2d Ti3c2-mxene Hybrid Nanocomposite for Superior Energy Density Supercapacitor for Efficient Led Powering -** Ahmar Ali (15 min) • **Review of Global Inertia Procurement Practices: Lessons for South Africa -** Josh Dippenaar (15 min) • **Interchanging Traditional Power Transformer Medium-Voltage Condenser Type Bushings with Modern Composite Polymeric Bushings -** Sherman NG (15 min) • **Coordinated Electric Ferry Charging Impacts by Balanced Hybrid Metaheuristic Optimization -** Rajib Baran Roy (15 min)

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Room/ Time	Energy Exchange [Exhibition Hall 3]	Spark Room 1 [Exhibition Hall 3]	Spark Room 2 [Exhibition Hall 3]	Spark Room 3 [Exhibition Hall 3]	Spark Room 4 [Exhibition Hall 3]
15.30-16.00	PM Break in Exhibition Hall				
16.00-17.30	**Super Session 4 [continue]** Energy Storage: Accelerating the Path to a Carbon-Neutral Future **Session Chair:** Dr. Pimpa Limthongkul, National Energy Technology Center (ENTEC) **Speakers:** • Mr. Kasiean Sukemoke, PEC Technology Thailand Co., Ltd. • Dr. Jiravan Mongkoltanatas, National Energy Technology Center (ENTEC) • Mr. Patipan Kalvibool, Huawei Digital Power Thailand • Mr. Sudhibhumi Pumhiran, Nuovo Plus Co. Ltd. • Ms. Oratai Suwanwilaikul, B.Grimm Power, PLC • Mr. Nawanat Eua-Anant, Electricity Generating Authority of Thailand (EGAT) • Mr. Chaturon Kusonsong, Provincial Electricity Authority (PEA) • Dr. Supawan Saelim, Agora Energiewende	**Panel Session 10** Net-Zero by 2050: Redesigning Generation, Transmission and Distribution for the Energy Future **Session Chair:** Asst. Prof. Dr. Jirawadee Polprasert, Naresuan University **Speakers**: • Prof. Jai Govind Singh, The Asian Institute of Technology Thailand • Mr. Purna Kharel, K&A Engineering Consulting • Ms. Jennifer-RuiQiong Pan, Hitachi Energy (China) Limited Xiamen Branch • Mr. Arjan Van den Broek, Global Power Synergy PCL	**Workshop 2** The Exclusive Launch of MCSeT with EvoPacT (Invitation Only) **by Schneider Electric**	**Panel Session 11** Stability by Design: Grid-Forming Technologies and Solutions for Renewables of the Future **Session Chair:** Assoc. Prof. Dr. Cattareeya Suwanasri, King Mongkut's University of Technology North Bangkok **Speakers:** • Mr. Witchaya Pimjaipong, Electricity Generating Authority of Thailand (EGAT) • Mr.Thanatpong Pramote, Provincial Electricity Authority (PEA) • Mr. Antti Harjula, Powerlink Queensland • Mr. Yunfeng Liu, Ph.D., Huawei Technologies Co., Ltd.	**Oral Session 10:** Track 8/2 AI and Blockchain for Sustainable and Secure Power Systems **Session Chair:** Prof. Krischonme Bhumkittipich, Rajamangala University of Technology Thanyaburi **Speakers** • **Artificial Neural Network-based Fault Classification and Location Estimation in a 22 Kv Distribution System: a Case Study in Dan Khun Thot, Thailand -** Chompoo Suppatoomsin (15 min) • **Explainable Ai-enhanced Energy Forecasting Using Lightgbm with Shap and Lime Interpretability -** Krishna Prakash N (15 min) • **Quantitative Analysis of Partial Shading Impact on Photovoltaic Module Performance: from Single Cell to Complex Shadow Patterns -** Dr Mohammed Bou Rabee (15 min) • **A Solution to Optimal Power Flow Problems using Improved Dragonfly Algorithm -** Soraphon Kigsirisin (15 min) • **Implementing a Transformer Fleet Management Strategy Combining Reliability and Sustainability Dimensions: A German Utility Case Study -** Supachai Thima (15 min)
18.00-21.00	**Gala Dinner (at Power Hub)**				

SATURDAY 29TH NOVEMBER 2025

Room/ Time	Spark Room 1 [Exhibition Hall 3]	Spark Room 2 [Exhibition Hall 3]	Spark Room 3 [Exhibition Hall 3]	Spark Room 4 [Exhibition Hall 3]
09.00-10.30	**Panel Session 12** DERMS and ADMS: Enabling the Clean Energy Transition at the Distribution Level **Session Chair:** Asst. Prof. Dr. Thongchart Kerdphol, Kasetsart University **Speakers:** • Mr. Thawatchai Tantimaporn, Provincial Electricity Authority (PEA) • Mr. Thanakrit Kittiwararat, Electricity Generating Authority of Thailand (EGAT) • Mr. Worapot Krathong, Metropolitan Electricity Authority (MEA)	**Panel Session 13** Recent Advances and Implementation of Advanced Metering Infrastructure (AMI) in Thailand **Session Chair:** Assoc. Prof. Dr. Keerati Chayakulkheeree, Suranaree University of Technology **Speakers:** • Dr. Somchai Songsiri, Provincial Electricity Authority (PEA) • Mr. Nattanont Chotiheerunyasakaya, Metropolitan Electricity Authority (MEA) • Dr. Chaiyod Pirak, King Mongkut's University of Technology North Bangkok • Dr. Sataporn Limpatthamapanee, Electricity Generating Authority of Thailand (EGAT)		**Oral Session 11:** Track 8/3 AI and Blockchain for Sustainable and Secure Power Systems Track 3 Grid Resilience to Natural Disasters **Session Chair:** Assoc. Prof. Dr. Nattachote Rugthaicharoencheep, Rajamanngala University of Technology, Asst. Prof. Dr. Jirawadee Polprasert, Naresuan University **Speakers:** • **Operational Framework for Fault Detection in Power Systems: a Foundation for Ai-driven Analysis -** Dinesh Babu Krishtappa Nagalingam (15 min) • **The Role of Cyber-physical Security Mechanisms to Secure the Operation of Cyber-physical Systems -** Reynaldo Nuqui (15 min) • **EMD-CNN-LDA-KNN: A Hybrid Framework for Power Quality Disturbance Recognition In Utility Grids -** Supakan Janthong (15 min) • **Traveling Wave Fault Location Error in Branched Distribution Networks -** Rustem Khuziashev (15 min) • **Emergency V2H Operation Considering Detection and Restoration of Multiple Faults in Distribution Systems -** Atsushi Nobori (15 min) • **Optimal Placement of Static VAR Compensators (SVCs) in Transmission Systems Using Deep Reinforcement Learning -** Sirawich Limprapassorn (15 min)

SATURDAY 29TH NOVEMBER 2025

Room/ Time	Spark Room 1 [Exhibition Hall 3]	Spark Room 2 [Exhibition Hall 3]	Spark Room 3 [Exhibition Hall 3]	Spark Room 4 [Exhibition Hall 3]
10.30-11.00	AM Break in Exhibition Hall			
11.00-12.30	**Panel Session 14** Renewable Energy Integration Using Modern HVDC and FACTS Technologies **Session Chairs:** Assoc. Prof. Sanchai Dechanupaprittha, Kasetsart University, Assoc. Prof. Dr. Cattareeya Suwanasri, King Mongkut's University of Technology North Bangkok **Speakers:** • Mr. Ranfeng Situ, Hitachi Energy • Mr. Heinrich von Geymueller, Siemens Energy Limited • Dr. Sankara Subramanian, GE VERNOVA		**Panel Session 15** Digitalization Meets Decarbonization: The Role of AI, IoT, and Blockchain **Session Chair:** Prof. Dr. Weerakorn Ongsakul, Asian Institute of Technology (AIT) **Speakers:** • Dr. Suthat Krongchon, Thai IoT Association • Dr. Chanwit Boonchuay, Synapes (Thailand) Co., Ltd. • Dr. Warodom Khamphanchai, Asian Institute of Technology (AIT)	**Oral Session 12:** Track 8/4 AI and Blockchain for Sustainable and Secure Power Systems **Session Chair:** Assoc. Prof. Dr. Somporn Sirisumrannukul, King Mongkut's University of Technology North Bangkok **Speakers:** • **A Large Language Model-based Framework for Generating Simulation Models of Power System -** Duange Guo (15 min) • **Enhancing Grid Flexibility Through Electrification Under Transmission Constraints in Eastern Japan: Examining Scenarios for Cost-effective Renewable Integration -** Keiki Shimura (15 min) • **Optimal Placement, Sizing, and Scheduling of Battery Energy Storage Systems in Distribution Systems Using Graph Neural Network and Artificial Rabbit Optimization -** Tanachot Wattanakitkarn (15 min)
12.30-14.00	Lunch in Exhibition Hall			
14.00-15.30	**Oral Session 13:** Track 4/4 EV Integration and Distributed Energy Management Systems **Session Chair:** Asst. Prof. Supattana Nirukkanaporn, Rangsit University **Speakers:** • **A Model Predictive Control Scheme for a Csi7-based Transformerless Photovoltaic System -** Natthachai Chaiyakham (15 min) • **Enhancing the Cybersecurity Posture of Microgrids Through Standards-compliant Architecture Patterns -** Raja Sekhar Ravi (15 min) • **Participation of Distributed Renewable Energy Sources to Secondary Dynamic Grid Services -** Bogdan Marinescu (15 min) • **A Fundamental Investigation on Detecting Short-gap DC Series Arcs Generated in Low-voltage DC Equipment -** Mikimasa Iwata (15 min) • **Coordinated Dual-loop Model Predictive Control for Grid-forming Inverters -** Nottakorn Sukmanont (15 min) • **Data-Driven Reliability Evaluation of Distribution Systems with Uncertainty Modeling -** Nottakorn Sukmanont (15 min)	**Oral Session 14:** Track 5 Advanced Smart Grid and Metering Technologies **Session Chair:** Dr. Chaiyod Pirak, King Mongkut's University of Technology North Bangkok **Speakers:** • **Heat Pump Demand Response to Minimize Network Voltage Impacts of Domestic Water Heating -** Sparkle Prentice (15 min) • **Advanced Metering Infrastructure–Enabled Smart Metering for Utility Operations and Distribution Network Planning -** Priyanshu Praliya (15 min) • **Coordinated Electric Vehicle Charging in Low-Voltage Distribution System Using LP-Based Dynamic Optimization Framework -** Papungkorn Sihawong (15 min) • **Optimization of Battery Energy Storage Placement in Low-Voltage Distribution Network by Monte Carlo–Based Quasi-Dynamic Simulation and Genetic Algorithm -** Pongpisit Charoenpanon (15 min)	**Oral Session 15:** Track 6 Bioenergy, Hydrogen, and Decentralized Electrification **Session Chair:** Dr. Kanchit Ngamsanroaj, University of South Carolina, United States **Speakers:** • **Planning System of Power to Methanol Supply Chain -** Yohanes Kristianto NUGROHO (15 min) • **Time-of-day Charging for Electric Vehicles: Impact Analysis of Indian Grid Emission dynamics -** Pradyuman Agarwal (15 min) • **A Study On The Impact Of Superconducting Fault Current Limiter On Arc Flash Hazard In An Industrial System -** Kittipong Anantanasap (15 min) • **A Framework for Generation Expansion Planning Under Transmission Constraints: a Case Study of the Western Cape -** Grace Ruzive (15 min)	**Oral Session 16:** Track 8/5 AI and Blockchain for Sustainable and Secure Power Systems **Session Chair:** Dr. Warodom Khamphanchai, AltoTech Global **Speakers:** • **Multi Objective Dynamic Economic Emission Dispatch Using Water Cycle Algorithm -** Muhammad Faizan Malik (15 min) • **Analysis of Secondary Price Cap in the Philippine Wholesale Electricity Spot Market -** Crizhalyn Weng Miguel (15 min) • **A Two-Stage YOLO-CNN Framework for Automated Lithium-ion Battery Defect Inspection -** Puncharus Phongphitthongchai (15 min) • **Ai-driven Renewable Energy Forecasting: Comparative Analysis of Ml/dl Models with Cloud Computing Integration -** Lakshmanan SA (15 min) • **Arc Flash Analysis in Power Distribution System of the Red Line Mass Transit -** Prayad Boonkham (15 min) • **Optimal Photovoltaic–Battery Storage Sharing for Affordable Net-Zero Urban High-Rises** - Raghuraman Ramakrishnan (15 min)
15.30-16.00	PM Break in Exhibition Hall			

TECHNICAL SESSION OVERVIEW

Technical Sessions	Date	Time	Room	Topic
Tutorial 1	26 November	09.00-12.00	MR110A	Converter-Driven Stability Issues and Solutions in Power Electronics Defined Power Systems
Tutorial 2	26 November	09.00-12.00	MR110B	Requirements and application of UHF PD Monitoring Systems for gas insulated systems and Increased operation reliability through continuous PD monitoring
Tutorial 3	26 November	09.00-16.30	MR111A	Functional Performance Requirements for Grid Forming STATCOM (including E-STATCOM)- a perspective from the planning stage up to the project execution life cycle
Tutorial 4	26 November	09.00-12.00	MR111B	Decentralised frameworks for Future Distribution Networks with High DER Penetration
Tutorial 5	26 November	13.30-16.30	MR110A	De-risking the Energy Transition with Real-time Simulation and HIL Testing
Tutorial 6	26 November	13.30-16.30	MR110B	IEC61850, Process Bus and Digital Substation: Concepts and Real-Time Simulation Testing
Tutorial 7	26 November	13.30-16.30	MR111B	Real-Time Simulation for Power, Energy & Cybersecurity
Super Session 1	27 November	14.00 - 17.30	Energy Exchange	Ancillary Services and Technologies; Opportunities for Thailand's Power Grid
Super Session 2	28 November	09.00-10.30	Energy Exchange	Grid Modernization – Transitioning Power Systems to Sustainable Power Society with High VRE Penetration (Opportunities & Challenges)
Super Session 3	28 November	11.00-12.30	Energy Exchange	Enabling SMRs in Thailand: Policy, Technology, and Partnerships
Super Session 4	28 November	14.00-17.30	Energy Exchange	Energy Storage: Accelerating the Path to a Carbon-Neutral Future
Panel Session 1	27 November	14.00-15.30	Spark Room 1	Energy Transition is not going as fast as initially intended, what's the impact on global decarbonisation objectives and power systems?
Panel Session 2	27 November	16.00-17.30	Spark Room 1	Innovative Optimization Techniques for Smart Grid Operation and Planning
Panel Session 3	28 November	09.00-10.30	Spark Room 1	Hydrogen in Power Systems: Integration Strategies and Global Perspectives
Panel Session 4	28 November	09.00-10.30	Spark Room 2	Green Hydrogen in Power Generation: Strategic Integration or Market Hype
Panel Session 5	28 November	11.00-12.30	Spark Room 2	[C-Level Roundtable] Powering the Carbon-Neutral Future: From Ambition to Action in a Decentralized, Digital Energy World
Panel Session 6	28 November	11.00-12.30	Spark Room 3	Thailand's Demand Response Journey: Pilot Lessons and Pathways to Automation
Panel Session 7	28 November	14.00-15.30	Spark Room 1	AI-Driven Power System and Equipment Monitoring and Maintenance
Panel Session 8	28 November	14.00-15.30	Spark Room 2	WiP: The Road to Sustainable Success: Women in Power Leading with Purpose and Resilience
Panel Session 9	28 November	14.00-15.30	Spark Room 3	DERs and the Path to Net Zero: Storage, EVs, and Flexible Demand
Panel Session 10	28 November	16.00-17.30	Spark Room 1	Net-Zero by 2050: Redesigning Generation, Transmission and Distribution for the Energy Future
Panel Session 11	28 November	16.00-17.30	Spark Room 3	Stability by Design: Grid-Forming Technologies and Solutions for Renewables of the Future
Panel Session 12	29 November	09.00-10.30	Spark Room 1	DERMS and ADMS: Enabling the Clean Energy Transition at the Distribution Level
Panel Session 13	29 November	09.00-10.30	Spark Room 2	Recent Advances and Implementation of Advanced Metering Infrastructure (AMI) in Thailand
Panel Session 14	29 November	11.00-12.30	Spark Room 1	Renewable Energy Integration Using Modern HVDC and FACTS Technologies
Panel Session 15	29 November	11.00-12.30	Spark Room 3	Digitalization Meets Decarbonization: The Role of AI, IoT, and Blockchain
Workshop 1	28 November	11.00-12.30	Spark Room 1	PCS - Key to Provide Resilience for Future Grid by Hitachi Energy
Workshop 2	28 November	16.00-17.30	Spark Room 2	The Exclusive Launch of MCSeT with EvoPacT By Schneider Electric

TECHNICAL TOURS

TT01 Discover Thailand's Leading Edge in Sustainable Energy and Smart Manufacturing

Schneider Electric Bangpoo Smart Factory, Samut Prakarn
North Bangkok Combined Cycle Power Plant, Nonthaburi
26th November 2024 | 08.00 – 17.30 hrs.

Step inside an award-winning, ISO-certified smart factory that redefines modern manufacturing. Since 1990, this site has produced vital electrical components while pioneering renewable energy integration, digital energy management, and cutting-edge battery storage systems. Witness how Schneider Electric leads the charge toward carbon neutrality with real-time energy optimization and sustainable innovation.

Indulge in a Michelin Guide-recognized seaside lunch featuring the finest fresh seafood while enjoying breathtaking coastal panoramas.

Your tour culminates at EGAT's North Bangkok Combined Cycle Power Plant, a technological marvel delivering nearly 1,500 MW of clean, efficient electricity through advanced generation technology and comprehensive emission control systems.

This immersive experience provides unprecedented insight into the innovations propelling Thailand's sustainable energy and manufacturing future.

TT02 Winds of Innovation: EGAT Hydrogen Hybrid Experience

Fuel Cell : Wind Hydrogen Hybrid System,
Nakhon Ratchasima
26th November 2024 | 08.30 – 18.30 hrs.

Discover Southeast Asia's pioneering renewable hydrogen hybrid power plant in Nakhon Ratchasima, a groundbreaking EGAT development. This revolutionary facility seamlessly integrates 24 MW of wind power with comprehensive hydrogen production, storage, and a 300 kW fuel cell system to deliver stable, environmentally responsible energy solutions.

Tour highlights include twelve advanced wind turbines, a 1 MW electrolyzer for hydrogen production, high-pressure storage infrastructure, and an innovative fuel cell system powering a completely energy-neutral Learning Center. Gain invaluable insights into renewable energy storage technologies and grid stabilization solutions.

Enjoy an authentic countryside lunch featuring traditional Northeastern Thai cuisine, followed by opportunities to discover regional specialties including Sai Krok Isan, signature Korat rice crackers, and exquisite handwoven silk souvenirs.

Oral Session 1
Advanced Generation, Transmission, and Carbon Management Technologies

Session Chair: Komson DAROJ (Ubon Ratchathani university, Thailand)

GTD25-A-0025

GTD25-F-0134

GTD25-F-0061

Paper ID: GTD25-A-0025

Solving Large Scale Multi-carrier Energy Systems

First Author: Buu-Van NGUYEN
(Delft University of Technology,
Netherlands)

Abstract— To integrate renewable energies with our current energy systems, we require interaction between gas and electrical networks. This results into coupled systems also known as multi-carrier energy systems. To design and operate these systems optimally, we have to perform a load flow analysis. Additionally, to obtain accurate results, one has to include the transmission and distribution networks in the analysis. Moreover, all the single-carrier systems have to be computed simultaneously. Hence, the nonlinear system of equations considered are large, which brings us with a challenge to solve the load flow in a fast way. This work focuses on solving the aforementioned system with the Newton-Raphson method. Convergence of the method has been studied for several coupled networks. Conventionally, for the inner solve of the Newton-Raphson method, a direct solver is used, but this solver runs into memory issues for large system of equations. Hence, we consider Krylov solvers such as GMRES and Bi-CGSTAB, because these solvers scale computationally well with the size of the system. For which this work has studied the Krylov solvers convergence behaviour.

Paper ID: GTD25-F-0134

Vlsi Based Multi-zone Smart Home Controller with Fsm-driven Automation Using Round-robin Arbitration and Power Optimization

First Author: DEVANATHAN B
(Amrita Vishwa vidyapeetham,
Chennai campus, India)

Abstract— The evolution of smart home technologies has generated a need for advanced, multi-zone controllers capable of providing automation, optimizing resource allocation, and minimizing power consumption. Conventional systems frequently lack effective arbitration mechanisms and do not optimize energy usage across several active zones. This study introduces a VLSI-based multi-zone smart home controller developed in Verilog, utilizing finite state machines (FSMs) for zone-level automation, a round-robin arbiter for equitable resource distribution, and clock gating methods for power optimization. Each zone is represented as an independent FSM that reacts to motion and temperature changes, while the global arbiter guarantees balanced access to shared devices like HVAC systems. The architecture is modular, scalable, and validated through Verilog simulation using Vivado testbenches. The results indicate successful automation with decreased switching activity, fair arbitration among competing zones, and considerable power savings in comparison to ungated designs. This design underscores the practicality of incorporating FSM-driven control and power-aware strategies into VLSI-based smart home solutions, setting the stage for future FPGA implementations with improved features such as emergency response and real-time logging.

Paper ID: GTD25-F-0061

Thermal Models for Transformer Overload Management: Implementation Challenges and Solutions

First Author: Matthias SCHAD
(Maschinenfabrik Reinhausen GmbH, Malaysia)

Abstract— Thermal models for transformers occupy a curious position in power engineering: extensively standardized yetpersistently underutilized. This paper bridges the gap betweentheoretical elegance and operational pragmatism by documentingthe implementation of the IEEE and IEC loading guides.We describe four functions: maximum load calculation forspecified durations, maximum duration calculation for given loads,temperature forecasting based on ambient and load scenarios,and an Application Programming Interface (API) for control center integration. These functions enable operators to safely utilize transformer thermal capacity. Our implementation confronts several engineering challengeslargely overlooked in academic literature: managing transitionsbetween cooling stages, handling load asymmetry through parallel thermal models, tracking potential hot-spots across multiple windings, adapting to parameter uncertainty through self-learning algorithms, and balancing computational accuracy against real-time constraints. For each challenge, we present practical solutions validated through field implementation.The persistent disconnect between established thermal modelsand operational deployment suggests limitations not in themodels themselves, but in how engineering knowledge transfersfrom theoretical formulation to practical implementation. By documenting these implementation experiences, we contributeto closing this gap and enabling more effective utilization oftransformer assets.

Oral Session 2
EV Integration and Distributed Energy Management Systems

Session Chair: Sanchai DECHANUPAPRITTHA (Kasetsart University, Thailand)

GTD25-F-0049

GTD25-F-0055

GTD25-F-0099

GTD25-F-0023

Paper ID: GTD25-F-0049

Optimal Siting of Pv and Bess Under Varying Ev Penetration Levels in an Ieee 37-bus System Considering System Line Capacity

First Author: Joseph Leo VETERANA (University of the Philippines Los Baños, Philippines)

Abstract— The increasing adoption of electric vehicles (EVs) presents significant challenges to power distribution systems, including higher line loading, voltage fluctuations, and increased power losses. This study evaluates the impact of EV penetration on the IEEE 37-bus distribution network and proposes optimal siting of photovoltaic (PV) and battery energy storage systems (BESS) as a mitigation strategy. Using MATLAB and OpenDSS, system performance is analyzed under three scenarios: no PV–BESS, random siting, and Genetic Algorithm (GA)-based optimal siting. EV behavior is modeled using Monte Carlo Simulation, while PV and BESS models incorporate real-world irradiance and technical specifications. Results show that optimized siting reduces system active and reactive power losses by up to 14.86% and 16.58%, respectively, and alleviates line loading, especially on heavily stressed feeders. These findings highlight the importance of strategic PV–BESS deployment in enhancing distribution network reliability and enabling high levels of EV integration.

Paper ID: GTD25-F-0055

Optimal Online EV Charging with Discrete Rates and Phase Unbalance Constraints

First Author: Can Berk SANER
(National University of Singapore, Singapore)

Abstract— In this work, we focus on the optimal electric vehicle (EV) charging problem for a station equipped with single-phase chargers, considering the aspects of mitigating phase current unbalance and chargers that operate at discrete, non-continuous rates. We frame the problem as maximization of aggregate user utility subject to per-phase current capacity, phase unbalance constraints, and discrete charging rates. We propose an online algorithm by recasting the problem as a separable and increasing concave maximization over an integer polymatroid. The resulting algorithm is proven to find the globally optimal solution in polynomial time. The algorithm is computationally lightweight, does not require specialized optimization solvers, and is scalable for real-time control of large-scale EV charging, offering a practical and effective solution for charging station operators.

Paper ID: GTD25-F-0099

Energy Flow Pathway and Economic Impact of Grid-connected Smart Home Pv–battery Systems Under Tou Tariff

First Author: Thatree MAMEE
(King Mongkut's University of Technology Thonburi, Thailand)

Abstract— This study evaluates the energy flow and cost-impact performance of a smart home PV–battery system under Thailand's time-of-use (TOU) tariff using one year of measured data. Energy flows were classified into PV direct consumption, battery charging/discharging, grid import, and PV export. Key indicators included the self-consumption rate (SCR), self-sufficiency rate (SSR), and cost. Results show a high SCR of 0.94, confirming efficient PV utilization, while SSR averaged 0.24 but rose to 0.40 during on-peak hours, contributing most to savings due to high tariffs. Although PV and battery met only one-quarter of demand, they delivered nearly one-third of cost savings, highlighting the disproportionate benefit of on-peak self-sufficiency. High-resolution analysis proved essential, as lower-resolution datasets underestimated transient interactions and distorted savings estimates. These findings underscore the importance of detailed energy flow analysis for accurate technical evaluation and reliable investment planning.

Paper ID: GTD25-F-0023

Benefits Of Applying Point-On-Wave Closing Fault Interrupters In Distribution Networks

First Author: Roxanna PARTOW
(Engineers Australia, Australia)

Abstract— This paper presents the impact of using a point-on-wave (POW) closing fault interrupter versus a conventional recloser during fault testing on distribution networks. It will demonstrate the effectiveness of using a POW-closing fault interrupter in place of a conventional recloser in reducing downstream transformer magnetizing current using a simple PSCAD model; eliminating repeat through-faults for the upstream substation transformer including a proposed approach to the expected life extension from reducing electrical and mechanical stress. The paper will also explore the added benefits of POW-closing fault interrupters in coordination improvement and minimising the risk of closing onto a fault during loop restoration.

Oral Session 3
Advanced Renewable Energy Integration and Conversion Technologies

Session Chair: Sanchai Noppada TEERA-ACHARIYAKUL (Kasetsart University, Thailand)

GTD25-F-0035

GTD25-F-0132

GTD25-F-0014

GTD25-F-0033

GTD25-F-0091

GTD25-F-0034

Paper ID: GTD25-F-0035

The Role of Battery Storage in Accelerating Large-scale Offshore Wind Deployment

First Author: Nathanael SILAVA
(University of the Philippines
Los Baños, Philippines)

Abstract— This study investigates the integration of offshore wind (OSW) power with Battery Energy Storage Systems (BESS) to improve renewable energy integration in the Philippine grid. Two growth scenarios—low growth and high growth—are evaluated with floating and fixed-bottom OSW platforms. Results show that BESS significantly enhances OSW power output, mitigating the intermittent nature of wind generation. In the low-growth scenario, floating platforms with BESS exhibit a 308.01% increase in average power output, while in the high-growth scenario, the increase is 257.61% for floating platforms and 114.39% for fixed-bottom platforms. BESS improves OSW ramping, supporting greater renewable energy integration into the grid. The BESS state of charge (SOC) remained within 10% to 90%, effectively stabilizing OSW generation by absorbing excess power and discharging during low generation periods. These findings emphasize the critical role of BESS in enhancing OSW integration and reducing stress on conventional generation units.

Paper ID: GTD25-F-0132

Technical Insights Into Net Metering for Distributed Solar Photovoltaics

First Author: Abhay PANDEY
(Tata Power Delhi Distribution Limited, India)

Abstract— As India continues to integrate new solar connections into its electrical infrastructure, particularly at the distribution level, it becomes imperative to evaluate the technical feasibility and grid stability implications of such additions. Uncoordinated integration can lead to voltage fluctuations, reverse power flows, and protection malfunctions, especially in radial distribution networks. This paper presents a structured methodology for assessing the impact of proposed solar connections on the distribution electrical network. The approach includes load flow analysis, voltage profile assessment, fault level evaluation, and hosting capacity estimation to ensure reliable and secure grid operation while facilitating the country's transition to a sustainable energy future. In this paper we would like to share the methodology to analyze the technical feasibility & impact of new solar connection on Distribution electrical network.

Paper ID: GTD25-F-0014

Impact of Bess State of Charge on the Reliability of an Archipelagic Power System with Increasing Pv Penetration

First Author: Alina QUIÑONES
(University of the Philippines
Los Baños, Philippines)

Abstract— The integration of photovoltaic (PV) and battery energy storage systems (BESS) in an archipelagic power grid, specifically the power grid of the Visayas region in the Philippines, was examined through three scenarios: a base case with existing power plants, PV-only integration, and combined PV-BESS integration at varying penetration levels. Monte Carlo simulations were used to evaluate system reliability, showing that while higher PV penetration enhances adequacy, unserved demand remains due to solar intermittency. Incorporating BESS significantly reduces demand not served (DNS) by storing excess PV generation and discharging during peak hours. The greatest reliability improvement was observed in the 40% PV + BESS case, highlighting the crucial role of BESS in enhancing grid reliability, particularly in archipelagic power systems.

Paper ID: GTD25-F-0033

Control of the Negative Sequence Component for Ride-through of Asymmetrical Faults in Grid Forming Inverters

First Author: Ruben INZUNZA
(TMEIC, Japan)

Abstract— Deployment of grid forming inverters in the grid requires them to comply with all grid codesand regulations on every country. Due to the voltage source nature of grid forming converters,current needs to be controlled and limited in different ways during a grid fault.One way to achieve this is by using adaptive virtual impedance, which can control thereactive power in positive sequence according to a k factor.However, in case of unbalanced faults undesired unbalanced components may trip the inverter. This paper presents the control of negative sequence as an addition to the adaptive virtual impedance in positive sequence so that active and reactive current in both positive and negative sequence are controlled during grid fault eventson a grid forming inverter.Test results in C-HIL environment are presented showing that adaptive virtual impedance is an effective method for controlling positive and negative sequence components so as to follow grid interconnection standard requirements during grid faults.

Paper ID: GTD25-F-0091

Evaluation of Peak Shaving Demand Charge and Greenhouse Gas Reduction with Photovoltaic Systems in Medium General Service

First Author: Natchapol RUANGSAP (Metropolitan Electricity Authority, Thailand)

Abstract— This paper presents an evaluation of peak shaving demand charge and greenhouse gas reduction with photovoltaic system in medium general service. The objective is to evaluate peak shaving, demand charge reduction and greenhouse gas reduction with photovoltaic system. The capacity of photovoltaic systems are 20 kW and 30 kW, respectively. The total load is 360kW per day. Calculation electricity cost uses type 3 medium general service by Metropolitan Electricity Authority. The calculation uses Electricity Generation from Renewable Energy (T-VER-S-METH-01-01) from Thailand Voluntary Emission Reduction Program (T-VER). The result found that photovoltaic systems can reduce demand charge, change peak load and greenhouse gas reduction.

Paper ID: GTD25-F-0034

System-Based Protection Testing Considering IBR and Negative Sequence Current Injections

First Author: Veronica A. ROSERO-MORILLO (Institute of Electrical Energy IEE National University of San Juan, Argentina)

Abstract— This study explores the effects of inverter control models on the protection of distribution networks incorporating Inverter-Based Distributed Generation (IIDG). Two main types of fault response models are examined: conventional (positive sequence) and advanced (positive and negative sequences), designed to comply with Fault Ride Through (FRT) constraints and dynamic voltage support during faults. As international standards, such as IEEE 1547-2018 and IEEE 2800-2021, evolve, integrating these models into protection studies becomes necessary. The aim of this work is to validate fault response models developed in MATLAB Simulink and compare them with models available in OMICRON software, assessing their effect on the currents observed by relays in medium voltage networks. This research not only provides model validation for different types of faults but also addresses the direct impact of these models on the behaviour of protection devices in distribution feeders

Oral Session 4
Dynamic Line Rating (DLR) Innovations and HVDC Technologies

Session Chair: Jai Govind SINGH (Energy and Climate Change (ECC), Thailand)

GTD25-F-0101

GTD25-F-0048

GTD25-F-0056

GTD25-F-0141

GTD25-F-0125

GTD25-F-0076

Paper ID: GTD25-F-0101

Var Compensation Sizing and Placement to Enhance Voltage Profile and Reduce Losses in Bhutan Grid

First Author: Samten . (Bhutan Power System Operator, Bhutan)

Abstract— This study assessed the enhancement of voltage profile and the reduction of transmission line losses through optimal reactive power compensation in the Bhutan power grid. With the continuous expansion of the transmission network and rising load demand, maintaining voltages within permissible limit has become essential for grid stability. For the projected 2030 network scenario, the analysis indicated that installing shunt capacitor as VAR compensation is necessary to maintain voltage within the limit and minimize transmission losses. The planned installation of shunt capacitor in the western region ensures acceptable voltage levels while simultaneously reducing transmission losses. The results confirmed that the proper reactive power compensation enhances both system stability and operational efficiency.

Paper ID: GTD25-F-0048

Polarity-Dependent Dielectric Behavior of XLPOInsulated PV Cables under High-Voltage AC and DC Stress: Leakage Current and PRPD Analysis

First Author: Khomsan RUANGWONG (Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang, Thailand)

Abstract— This study investigates the dielectric behavior of cross-linked halogen-free polyolefin (XLPO) insulation in H1Z2Z2-K photovoltaic cables under a direct current (DC) stress of ±999.6 V. The results indicate significant polarity-dependent responses, with insulation resistance (IR) rising from 1.61 TΩ under negative DC to 2.30 TΩ under positive DC. Furthermore, the polarization index (PI) and dielectric absorption ratio (DAR) improve from 6.73 and 2.14 to 12.78 and 2.43, respectively. The Loss Index, obtained from polarization–depolarization current (PDC) analysis, increases from 0.935 to 0.991, suggesting enhanced dielectric stability with positive bias.Additionally, the partial discharge inception and extinction voltages (PDIV and PDEV) are recorded at 8.3 kV for DC and 1.93 kV for AC, exhibiting symmetrical behavior that indicates corona and surface discharge dominance and minimal space charge retention. These findings highlight the importance of considering space charge dynamics and polarity-aware diagnostics in evaluating non-certified XLPO-insulated cables in photovoltaic applications.

Paper ID: GTD25-F-0056

Corona Discharge Pulse Shape Analysis for Sphere Plane Configurations

First Author: Pradeep Kumar GUPTA (Tallinn University of Technology, Estonia)

Abstract— This paper aims to study the experimental corona discharge pulse shape analysis (PSA) for different sizes of sphereplane electrode configurations at different voltage levels for AC and DC sources. To achieve this goal, experimental corona discharge signals measured via oscilloscope in the form of time-resolved partial discharge pattern (TRPD) were used to assess the peak pulse amplitude (ip), rise time (tr), fall time (tf) and pulse width (tpw). The study is carried out on a sphere-plane configuration test object using the proposed pulse detection tool to detect discharge pulses and extract pulse shape characteristics of pulses acquired during a 20-ms time period. PSA patterns are based on the sequence of discharge occurrences. This approach might be very useful when corona discharges are examined and assessed, and can be utilized to comprehend the behavior of corona discharge at various voltage levels for different high-voltage sources.

Paper ID: GTD25-F-0141

MTDC for Connecting Indonesian Islands Enabling Renewable Energy Generation

First Author: Sanjay Kumar CHAUDHARY (Aalborg University, Denmark)

Abstract— Multi-terminal high voltage DC (MTDC) technology feasible solution for archipelago power systems, thereby transmitting the renewable energy from remote islands to the load centers. This paper proposes interconnection of Flores, Sumba and Sumbawa islands with Lombok using MTDC transmission system in Indonesia. The MTDC system has four terminals, one on each island. Each terminal has a modular multilevel converter for the connection of the ac and dc power networks. Thus, the photovoltaic power generated on Sumba and Flores islands can be transmitted to the load centers on Sumbawa and Lombok islands. Droop controllers are implemented in the converter controllers to improve dynamic stability and expand the safe operation range of the system. Simulation studies show that the MTDC system can ride through the short circuit faults on the three islands, and safely recover to normal operation, while the Lombok terminal must remain connected as this terminal is the largest.

Paper ID: GTD25-F-0125

Geospatial Potential Assessment of Dynamic Line Rating: A High-level Methodology for Early-stage Planning.

First Author: Robinson MASWEDZA (Stellenbosch University, South Africa)

Abstract— The rapid integration of renewable energy into the energy mix has resulted in transmission line power flows becoming increasingly constrained. In the past, transmission system operators have relied on Static Line Rating (SLR). Dynamic Line Rating (DLR) provides an innovative approach to increase transmission headroom. However, before DLR systems can be implemented, a high-level potential assessment is crucial because it helps quantify potential DLR benefits. In this study, a geospatial assessment methodology is implemented to assess the potential benefits of DLR using historical weather data. Weather parameters are spatially mapped to individual transmission lines to evaluate the possible benefits of DLR over SLR. This work represents the first regional-scale DLR potential assessment in South Africa. Results demonstrate the ability of DLR to unlock additional headroom on overhead lines. Some of the assessed lines have a rating above the SLR for over 90% of the year. This shows how DLR can unlock additional transfer capability, highlighting its value as a short- to medium-term measure to relieve transmission constraints and enable higher renewable energy integration while long-term grid reinforcements are developed.

Paper ID: GTD25-F-0076

Experimental Study of Partial Discharge in High-voltage CTs and Bushings

First Author: Chernkwan
NAIZAP (Kasersart University, Thailand)

Abstract— This study analyzes partial discharge phenomena (PD) in high-voltage electrical equipment, focusing on current transformers and bushings. PD indicates insulation degradation that can lead to equipment failure if undetected. Using Omicron's MPD800 and TANDO 700 measurement devices, tests were conducted according to IEEE and IEC standards to detect PD activity under varying voltages. The collected data identified PD patterns linked to internal voids, air bubbles, sharp edges, and core defects, with Pattern Type 5 suggesting internal voids and gas bubbles. Results showed many samples exceeded standard PD limits, indicating insulation deterioration. The experimental findings were compared with theoretical models to confirm discharge mechanisms. Routine PD monitoring can help identify early signs of insulation failure, reducing maintenance costs and preventing system outages. This research provides practical guidelines for electrical engineers to diagnose and address PD-related issues, improving the safety and reliability of high-voltage equipment.

Oral Session 5
EV Integration and Distributed Energy Management Systems

Session Chair: Dulpichet RERKPREEDAPONG (Kasetsart University, Thailand)

GTD25-F-0017

GTD25-F-0043

GTD25-F-0053

GTD25-F-0175

GTD25-F-0090

GTD25-A-0042

GTD25-F-0070

Paper ID: GTD25-F-0017

Realistic Assessment of PV and EV Hosting Capacity in Low-voltage Networks: a Comparative Study of Deterministic and Time-series Methods

First Author: Tapparit BANGTIT
(Chiang Mai University,
Thailand)

Abstract— This paper presents a comparative study of Deterministic and Time-Series methods for evaluating the hosting capacity (HC) of distributed energy resources (DERs), including rooftop photovoltaic (PV) systems and residential electric vehicle (EV) chargers. Simulations were conducted on a low-voltage residential feeder with 18 nodes, each representing a household. PV sizes ranged from 3 to 25 kW and EV chargers from 7.4 to 22 kW. The Time-Series method identified constraint violations more accurately across a 24-hour cycle, while the Deterministic method tended to overestimate PV HC and underestimate EV HC. Time-Series results revealed voltage rise at far-end nodes during midday due to PV export and transformer overloading during evening EV charging. These findings demonstrate the importance of temporal analysis in realistic HC assessment. The Time-Series method is recommended for planning due to its ability to reveal when and where violations occur, supporting smarter DER integration strategies.

Paper ID: GTD25-F-0043

Frequency-dependent Behavior and Field-evaluation of Voltage Transformers for Power Quality Applications

First Author: Felix FEUSTEL
(OMICRON, Austria)

Abstract— As renewable energy generation increases, converter-based energy sources are becoming more prevalent in modern power systems. Consequently, the need for accurate power quality (PQ) measurement and monitoring across a wide frequency spectrum is growing significantly. Most voltage transformers (VTs) are optimized for accuracy at the rated frequency and will show complex, non-linear behavior at higher frequencies, limiting their effectiveness for PQ applications.

This paper presents an overview of field-applicable methods for verifying the accuracy of VTs in PQ applications. It illustrates that low voltage Sweep Frequency Response Analysis (SFRA) is a useful and reliable technique for assessing VT performance under on-site conditions and discusses the typical frequency response characteristics of various VT technologies, as measured by this method.

Paper ID: GTD25-F-0053

A Stackelberg Game of Demand Response from the Aggregator's Perspective

First Author: Seangleng KHE
(King Mongkut's University of Technology Thonburi, Thailand)

Abstract— In this paper, we investigate on the modeling of demand response activities between the single aggregator and multiple participating consumers. The model incorporates the Stackelberg game structure that naturally occurs in the information structure and decision sequence, where the aggregator assumes the role of a leader and the participating consumers play the role of followers. The aggregator aims to reduce the most electricity consumption during on-peak hours so that he can obtain most commission and similarly, the consumers aim to save electricity bill and get more rewards. The proposed model is demonstrated to be effective in load control, helping the aggregator to meet the target reduction while the consumers pay cheaper electricity bill. We also discuss a way to incorporate the fairness to all the consumers with a tradeoff for the profit and the performance.

Paper ID: GTD25-F-0175

Feeder Power Disaggregation Using Pmu and Smart Meter Data in Distribution Systems

First Author: Chaowanan JAMROEN (Kasetsart University, Thailand)

Abstract— Accurate profiling of load and generation in distribution networks is critical for state estimation, operational efficiency, and infrastructure planning. This paper proposes a machine-learning-based ensemble framework to disaggregate the aggregated power at a low-voltage radial feeder into residential baseline load, photovoltaic (PV) generation, and electric vehicle (EV) charging components using only limited measurement data. The framework utilizes active power data from a phasor measurement unit (PMU) at the transformer, a smart meter (SM) at a prosumer node, and meteorological data. An ensemble model comprising sub-models for PV, baseline, and EV components is trained using asynchronous and heterogeneous inputs. Simulations on a 5-node test feeder over a 7-day period demonstrate that the proposed approach effectively estimates disaggregated component profiles and accurately tracks the aggregate feeder power. This method offers a scalable and practical solution to enhance observability in partially monitored distribution networks.

Paper ID: GTD25-F-0090

Adapting Power Distribution Infrastructure for the Expansion of Data Centers : Challenges and Solution in the Thailand Metropolitan Area

First Author Pinpong
NUIMANNATE (MEA, Thailand)

Abstract— Data center construction and electricity demand are booming in Thailand, driven by increased investment. The Metropolitan Electricity Authority (MEA) faces the challenge of providing secure, high-capacity power, with a significant portion of requests from these projects (totaling 1,000 MW) opting for 24 kV feeders to save on costs. To address this, the MEA has refined its 24 kV feeder configurations to meet the Tier 3 and 4 reliability standards of these facilities.The MEA's approach involves several key considerations, including feeder load capacity and the optimal number of feeders. It also allows for internal load transfer mechanisms via tie switches, with a maximum capacity of 5 MVA per load set, managed through SCADA to prevent overloads. The design ensures that the total load per feeder does not exceed 12 MVA. This flexible and clear framework helps project designers and consultants comply with MEA specifications, streamlining the power application process and enabling the MEA to effectively meet the rising demands of the data center sector, particularly with the transition to the AI era.

Paper ID: GTD25-A-0042

Large-scale Application of Permanent On-line Partial Discharge Monitoring

First Author Sam ROE (IPEC Ltd, United Kingdom)

Abstract— Partial Discharge is widely recognized as the predominant cause of long-term degradation and catastrophic failure of insulation in medium to high voltage equipment. On-line PD testing is a non-destructive condition assessment tool performed under normal operating conditions to predict asset failures with minimal service disruption.This paper will review the impact of large-scale on-line PD monitoring across large networks highlighting the unique technical challenges this presents. Learnings from deployments across different sectors and geographies will be considered, including 130+ systems at a Middle East utility, 90+ systems in a European Capital and other large installations including clients such as data centers, transport and manufacturing plants. Specific topics are technological considerations including system accuracy and autonomy ensuring PD can be detected within background electrical noise, signal processing methods required to ensure accuracy and minimize false positives. Finally, practical considerations such as system infrastructure and resilience are also discussed.Some individual case studies will show examples of defect detection, asset life extension, and operational optimization and the extent to which PD monitoring has impacted the overall networks both financially and operationally.

Paper ID: GTD25-F-0070

A Multi-parameter and Barrier-based Approach to Gis Modernization Planning in Kuwait's Transmission Network

First Author Majdi ALOMARI
(Australian University, Kuwait, Kuwait)

Abstract— This study introduces a Multi-Parameter Indicator (MPI) model to evaluate GIS substation modernization priorities in Kuwait, combining quantitative infrastructure metrics with qualitative institutional constraints. The MPI assesses five key parameters: age, voltage level, configuration complexity, redundancy, and operational role, while a complementary barrier typology captures procurement, regulatory, and workforce-related challenges. This integrated approach enables classification of substations into four strategic clusters based on both technical urgency and implementation feasibility. Findings show that high MPI scores frequently coincide with elevated institutional barriers, complicating upgrade sequencing. The study proposes a phased roadmap through 2032, targeting substations with high technical risk and low institutional resistance in the early phases, while aligning longer-term interventions with policy reform and capacity development. The results suggest that age-based prioritization alone is insufficient for effective modernization planning in contexts characterized by regulatory fragmentation and limited in-country technical capacity. The proposed dual-factor prioritization framework supports adaptive infrastructure planning, enabling risk-informed resource allocation under operational and institutional constraints. Generalizable to Gulf/MENA systems and aligned with Kuwait's Vision 2035 goals for digitalization and emissions reduction.

Oral Session 6
Advanced Renewable Energy Integration and Conversion Technologies

Session Chair: CHAYAKULKHEEREE (School of Electrical Engineering, Suranaree University of Technology, Nakhonratchasime, Thailand)

GTD25-F-0094

GTD25-F-0022

GTD25-F-0057

GTD25-F-0181

GTD25-F-0006

Paper ID: GTD25-F-0094

Assessing the Wind Energy Potential of the Bay of Bengal Using CMIP6 Climate Models

First Author Ahnaf RAHMAN
(The University of Manchester,
United Kingdom)

Abstract— Bangladesh's Climate Prosperity Plan 2022–2041 and IEPMP 2023 highlight offshore wind energy as a key component of the nation's renewable transition. This study assesses the feasibility of offshore wind development in the Bay of Bengal, analyzing wind speed projections from six CMIP6 climate models (ACCESS-ESM1-5, CMCC-ESM2, CanESM5, MIROC-ES2L, MPI-ESM1-2-HR, UKESM). Historical (1979–2014) and projected (2015–2050) wind speeds under the SSP2-4.5 scenario are compared to evaluate trends in wind power density.Bathymetric data from GEBCO and Marine Conservation Institute informs turbine siting, favoring floating offshore turbines due to depth variability. A sensitivity analysis highlights the cubic impact of wind speed fluctuations (<0.05 m/s) on power output. Turbine efficiency modeling considers commercial designs, including Mingyang MySE 7.25-158 and Siemens Gamesa SG 8.0-167 DD. The southwestern Bay of Bengal shows the highest wind potential, with Payra 230 kV Substation identified for grid integration.This study supports offshore wind deployment in South Asia, offering insights for regional policy and future high-resolution climate modeling.

Paper ID: GTD25-F-0022

Evaluating Break-even Costs of BESS in PV-integrated Systems Across Diverse Load Profiles and TOU Tariff Scenarios in Thailand

First Author Pranuda JIVAGANONT (National Energy Technology Center, Thailand)

Abstract— This study investigates the break-even cost of battery energy storage systems (BESS) integrated with photovoltaic (PV) systems to evaluate their economic feasibility under four electricity time-of-use (TOU) tariff structures in Thailand. The scenarios include: (1) the current tariff framework (base case), (2) a modified on-peak to off-peak price ratio, (3) a proportional adjustment of both on-peak and off-peak prices, and (4) a variation in demand charge levels. Except for the base case, all scenarios represent potential future tariff structures involving shifts in electricity pricing. The analysis considers two system configurations—PV-only and PV+BESS—alongside two peak shaving control strategies: one utilizing excess PV generation exclusively, and another allowing charging from both PV and the grid. Load profiles from three representative user types—laboratory, office, and residential—are employed to reflect diverse consumption patterns and varying levels of compatibility with PV+BESS systems. Preliminary results indicate that changes in tariff structure, particularly those involving increased rates, significantly accelerate the achievement of BESS break-even cost and enhance the system's economic viability across a wider range of load profiles.

Paper ID: GTD25-F-0057

Economic Feasibility of Power Generation by Integrating Floating Photovoltaics on Sea and Small Wind Turbines at Samui Island in Southern Thailand

First Author Kittisak CHAISUWAN
(Energy Technology Program,
Department of Interdisciplinary
Engineering, Faculty of Engineering
Prince of Songkla University, Thailand)

Abstract— This study aims to evaluate the economic feasibility of power generation by integrating floating photovoltaics (FPV) on the sea with small wind turbines in Koh Samui, Surat Thani Province, a well-known tourist destination in southern Thailand. The island typically experiences high electricity demand, with a peak of approximately 104 MW and a monthly energy consumption of about 60.5 GWh. Currently, this energy is supplied from the mainland via an underwater transmission system. Given that Koh Samui is surrounded by the sea, it presents an opportunity to install FPV systems and wind turbines. Based on local weather data, the potential area for FPV installation is approximately 900 square kilometers, with an estimated annual energy output of 142.02 MWh. This system could reduce CO_2 emissions by about 49.7 tons per year. Economic evaluation using internal rate of return (IRR) equal to 6.98% and levelized cost of electricity (LCOE) equal to 2.32 THB/kWh indicates that the investment is financially viable. Future studies should also assess the social and environmental impacts, considering the island's importance as a major tourist destination in Thailand.

Paper ID: GTD25-F-0081

Factors Affecting the Accuracy of Ai-based Forecasting Models for Renewable Energy Generation in Asean

First Author APICHAI SARNTHONG
(Thammasat School of Engineering,
Thailand)

Abstract—— This paper explores how key factors affect the predictive accuracy of artificial intelligence models when applied to renewable energy generation (solar and wind energy generation) specifically from solar and wind sources. We examine the influence of data quality, dataset volume, model architecture, and operational conditions on forecasting outcomes. such as temporal resolution and meteorological variables impact performance. Through a comparative evaluation of multiple models, including LSTM, XGBoost, Random Forest, and CNN-LSTM hybrids, the study finds that CNN-LSTM consistently performs best, particularly in intraday forecasts. This study contributes strategic recommendations for improving forecast reliability in real-world ASEAN applications.

Keywords— Renewable energy forecasting, machine learning, deep learning, artificial intelligence, solar energy

Paper ID: GTD25-F-0006

A Comparison of Impact for Various Biomass Utilization in Indonesian Cofiring Coal-fired Power Plants

First Author Rachmat HERMAWAN (PT PLN (Persero), Indonesia)

Abstract—— Biomass is one of the largest sustainable energy potentials that impacts worldwide GHG emission reduction. Biomass cofiring has a potential energy alternative since it may produce net-balanced CO2 emissions. The Indonesian government has been committed to reducing emissions with several strategic programs and increasing a renewable energy mixed target of 23% by utilizing biomass in the existing CFPP. This paper investigated the impact of various types of biomass in Indonesian CFPP, such as woodchips, sawdust, palm kernel shells, rice husks, and corn cobs. The characteristics of fly ash and exhaust gas emissions as a waste product of the boiler are analyzed to know the impacts on operation and maintenance. The result shows that rice husk has the lowest potential for slagging, indicated by SI of 0.07, FI of 0.3, and BAI of 2.9 in the comparison profile for various 5%-biomass cofiring. In addition, the impacts of CO2 and NOx emissions have also been investigated, with a promising reduction in GHG emissions.

Oral Session 7
EV Integration and Distributed Energy Management Systems

Session Chair: Thongchart KERDPHOL (Kasetsart University, Thailand)

GTD25-F-0087

GTD25-F-0072

GTD25-F-0060

GTD25-F-0008

GTD25-F-0109

Paper ID: GTD25-F-0087

A Reliable Islanding Detection Solution for Grids with Distributed Energy Resources

First Author OD NAIDU (Hitachi Energy, India)

Abstract—— Distributed energy resources based on renewable energy have significantly developed over the past few decades because of the need to include environmentally friendly energy sources due to their advantages of clean and non-exhaustible nature of energy. Due to its unpredictable and uncertain nature, this form of generation poses technological difficulties in terms of operation and control. The integration of these distributed generating systems into the main grid comes with certain challenges, out of which Islanding detection is of prior importance. An islanding detection solution for inverter-based distribution energy resources using the three-phase voltage measured at the Point of Common Coupling (PCC) is proposed in this paper. The islanding condition is detected using two islanding detection indices such as positive sequence voltage phase angle and d-component voltage magnitude. An extensive assessment of the proposed method is conducted by using PSCAD/EMTDC simulations. The proposed method reliably identifies the islanding conditions. The solution is validated with field data and the results are aligned with experimental data.

Paper ID: GTD25-F-0072

Smart Microgrid Simulation and Techno-economic Optimization for Phuket Island Using Matlab

First Author Sakrapee KHUNPETCH
(Thaksin University, Thailand)

Abstract—— This study investigates the techno-economic viability of a grid-connected microgrid system that integrates solar photovoltaic (PV), wind turbine generators (WTG), and a battery energy storage system (BESS), with a specific focus on the geographical and meteorological characteristics of Phuket Island, Thailand. MATLAB Simscape is utilized for the system modeling. Simulation results indicate that the optimal system configuration comprises 1,178 kW of PV, 635 kW of WTG, and 3,961 kWh of BESS. The energy generation analysis shows that the system produces 6,177 MWh from PV, 4,143 MWh from WTG, and 9,155 MWh from the BESS, while the primary contribution still comes from the power grid, supplying 24,488 MWh. Economically, the system requires an initial capital expenditure of approximately 4.50 million US$. Operating expenses declined from 1.06 million to 0.88 million US$ over time. The net present cost and the levelized cost of energy are estimated at 17.16 million US$ and 0.33 US$/kWh, respectively

Paper ID: GTD25-F-0060

Improving the Integration of Distributed Energy Resources (DERs) in Thailand's Power Grid Using Automatic Voltage Regulator Distribution Transformers (AVRDT)

First Author Matthias SCHAD
(Maschinenfabrik Reinhausen GmbH, Malaysia)

Abstract—— To support Thailand's commitment to achieving carbon neutrality, the increasing penetration of Distributed Energy Resources (DERs), particularly Photovoltaic (PV) systems, presents a significant challenge for the Provincial Electricity Authority (PEA). This paper investigates the application of Automatic Voltage Regulator Distribution Transformers (AVRDTs) for voltage control through simulation analysis on the PEA distribution network. The study's unique contribution is its in-depth simulation of two distinct AVRDT control strategies, Static and Adaptive, to evaluate their effectiveness in accommodating increased solar PV penetration. The results demonstrate that the AVRDT, particularly with the adaptive control strategy, effectively maintains voltage quality within the regulated limits under high PV penetration scenarios, providing valuable insights for future grid modernization efforts and a foundation for subsequent field trials.

Paper ID: GTD25-F-0008

Impact Analysis of Single-phase and Three-phase Electric Vehicle Charging Stations on Power System Operation and Quality

First Author Supakan JANTHONG
(Provincial Electricity Authority,
Thailand)

Abstract—— This study investigates the impact of various EV charging strategies—including single-phase and three-phase, home, workplace, and fast-charging stations—on a typical 22 kV/0.4 kV radial distribution feeder using a detailed MATLAB/Simulink model. The system comprises a 250 kVA Dyn11 transformer, a 1 km RL feeder, and five load buses with diverse load profiles. EV chargers are modeled as controlled current sources with stochastic time-varying profiles. The simulation runs over a 24-hour period with 1-second resolution, incorporating harmonic analysis and voltage monitoring. Key performance metrics such as voltage deviation, total harmonic distortion (THD), voltage unbalance factor (VUF), transformer loading and losses, power factor (PF), and reactive power (Q) flow are evaluated. The results reveal that high EV penetration, especially with fast-charging stations, leads to increased voltage fluctuations, harmonic distortion, and transformer stress. These findings underscore the need for grid modernization, including harmonic mitigation and smart charging strategies, to ensure stable and reliable power system operation under increasing EV demand.

Paper ID: GTD25-F-0109

Practical Testing Approaches for Lpit in Digital Substations

First Author Gilje WOO (OMICRON electronics Korea Inc., Korea, South)

Abstract—— Modern substations are increasingly adopting digital technologies to enhance operational efficiency, reliability, and interoperability. This shift introduces challenges, especially in ensuring the accuracy and reliability of measurement data essential for protection and control. Low Power Instrument Transformers (LPITs) are central to this transition, offering compact and safer alternatives to conventional sensors. Validating the accuracy of LPITs and the integrity of their digital output—Sampled Values (SV)—is critical for integration into IEC 61850-based systems. This paper presents practical testing methodologies that evaluate LPIT performance under realistic conditions. Emphasis is placed on verifying measurement accuracy across load and fault scenarios, and assessing SV stream quality, synchronization, and consistency. Using flexible, high-precision test tools, engineers can simulate scenarios and analyze SV data to confirm compliance with functional and metrological requirements. These strategies support efficient commissioning, maintenance, and lifecycle management in digital substations. By focusing on LPIT accuracy and SV validation, this work contributes to reliable implementation and operation of digital substation measurement systems.

Oral Session 8
Advanced Renewable Energy Integration and Conversion Technologies

Session Chair: Nidchabendha CHANDANACHULAKA ROEKRAI (Kasetsart Univers, Thailand)

GTD25-F-0050

GTD25-F-0118

GTD25-F-0105

GTD25-F-0133

Paper ID: GTD25-F-0050

Performance Evaluation of Biomimetic Turbines Inspired by Ash Tree Seeds and a Conventional Horizontal-axis Wind Turbine

First Author John Russel SAJOL
(University of the Philippines Los Baños, Philippines)

Abstract—— This study investigates the performance of biomimetic wind turbines, fabricated based on the autorotating Ash seed (Fraxinus spp.), in comparison with a similarly fabricated conventional horizontal-axis wind turbine (HAWT) design. Two biomimetic turbine models, a three-blade and an eight-blade configuration, were fabricated using stereolithography (SLA) printing with structurally reinforced profiles for experimental testing. Tests were conducted at wind speeds of 5, 6, and 7 m/s and three resistive load values (6.8 Ω, 56 Ω, and 446 Ω). Results show that both biomimetic turbines significantly outperformed the reference HAWT across all test conditions. The eight-blade model achieved a peak efficiency of 5.38% at 5 m/s and 56 Ω, while the reference turbine remained below 0.35%. The biomimetic designs also exhibited stable output across varying electrical loads, demonstrating strong adaptability and energy conversion in low-wind environments. These findings highlight the aerodynamic advantages of seed-inspired blades and their potential application in small-scale and off-grid wind energy systems.

Paper ID: GTD25-F-0118

Sizing Of A Battery Energy Storage System (BESS) Under A Voltage Regulation Application On A Solar-Penetrated Distribution Network Considering Battery Degradation

First Author Tranz Robin SIA (University of the Philippines Los Baños, Philippines)

Abstract—— Rapid integration of solar energy into traditional distribution networks has introduced significant challenges, particularly voltage variations. As a potential solution to these challenges, Battery Energy Storage Systems (BESS) can be utilized for voltage regulation. By absorbing and injecting power, BESS can help maintain the voltage level within the distribution network. However, proper battery sizing is important, as inappropriate capacity may lead to accelerated degradation or overestimation of benefits. In this study, a voltage regulation operation was simulated using a BESS model under a Takagi-Sugeno Fuzzy Logic control system. The simulation study evaluated 41 battery capacities at four solar penetration levels to explore the relationship between battery capacity, operating life, and solar level integration. The results suggest that operating life improves with increased battery capacity. However, this improvement exhibits diminishing returns. Furthermore, higher levels of solar penetration correlate with reduced battery life as a result of more frequent and intensive cycling.

Paper ID: GTD25-F-0105

Enhancing Transformer Performance for Renewable Energy Applications with Natural Ester Dielectric Fluid

First Author Kin Yu LAM (Cargill Bioindustrial, Singapore)

Abstract—— As the push for energy transition continues to gather pace, the power industry is facing multiple challenges to effectively integrate variable and diffuse output from renewable energy sources to the main grid. While natural ester insulating fluid has long been associated to its benefits in mitigating fire and environmental risks of transformers, this paper discusses how the use of such fluid would also present an effective way to counter some of the notable impact of renewable energy on power systems based on different case studies. With the feasibility of increasing power density and loading capacity, significant technical and cost benefits can be achieved using natural ester transformers in solar photovoltaic and wind turbine applications based on optimization of equipment rating and footprint. Moreover, natural ester dielectric fluid is also effective in enhancing transformer reliability against issues caused by harmonics from renewable energy systems due to its proven capability in suppressing partial discharge. Overall, the adoption of natural ester transformer would enable the energy sector to improve viability of renewable energy projects in the quest for decarbonization.

Paper ID: GTD25-F-0133

Towards Streamlined DG Interconnection Criteria: A Fast Risk-based Hosting Capacity Estimate Method

First Author Munyaradzi Justice CHIHOTA (Centre for Renewable and Sustainable Energy Studies, Stellenbosch University, South Africa, South Africa)

Abstract—— Distribution network operators (DNOs) face growing backlogs of distributed generation (DG) interconnection requests, threatening the energy transition. Effective regulation requires balancing efficiency in application processing with accuracy in assessing hosting capacity (HC). Existing frameworks fall short: fast-track screening is overly conservative, while detailed studies are resource-intensive. Intermediate methods that combine the speed of screening with the accuracy and risk-awareness of detailed analysis are needed. Shorthand HC methods aim to fill this gap but are typically deterministic, neglecting DG spatial diversity and load stochasticity that strongly influence HC. This paper develops a risk-based HC estimation method with two key probabilistic enhancements to short-hand HC calculations: (1) centering the DG's aggregate voltage effect at a risk-based impedance location to PV spatial distribution, and (2) probabilistic computation of available voltage and transformer loading headroom to account for load stochasticity. Tested on practical feeders in South Africa, the method shows reliable estimates with acceptable accuracy relative to detailed stochastic HC results while substantially outperforming deterministic estimates based on standard screening criteria. The method streamlines interconnection processes, facilitating more effective utilization of the grid capacity.

Oral Session 9
AI and Blockchain for Sustainable and Secure Power Systems

Session Chair: Teeratum BUNYAGUL (King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand)

GTD25-F-0071

GTD25-F-0107

GTD25-A-0038

GTD25-F-0137

GTD25-F-0062

GTD25-F-0044

Paper ID: GTD25-F-0071

Feature-Augmented BiLSTM Approach for LSTLF on Power Transmission Systems

First Author Bhuwadon SAENGSUKON
(Energy Engineering Program, Faculty of Engineering, Chiang Mai University, Thailand, Thailand)

Abstract—— The global shift toward renewable energy sources (RES) and electric vehicles (EVs) introduces highly dynamic and unpredictable load patterns, posing significant challenges to conventional forecasting approaches. Because of their complexities in nonlinear behaviors and seasonal fluctuations, it highlights the need for long-short term load forecasting (LSTLF). Even Long-short Term Memory (LSTM) can model temporal trends, it struggles with abrupt changes; conversely, Convolutional Neural Network (CNN) captures localized patterns but lacks temporal memory. To succeed in LSTLF, this study proposes a novel hybrid model, so-called Feature-Augmented Bidirectional LSTM (FA-BiLSTM). FA-BiLSTM mixes CNN-based convolutional layers for local feature enhancement with BiLSTM for bidirectional sequence learning. A five-year consecutive hourly dataset from the four transmission substations in Northern Thailand is employed and partitioned into a ratio of 60%, 20%, and 20% for training, validation, and testing sets, respectively. Experimental results show that FA-BiLSTM achieves LSTLF through R^2 of 95.60%, MAE of 12.64 MW, RMSE of 19.79 MW, and MAPE of 3.01%, clearly more outperforming when compared to its baseline models and the other referred algorithms

Paper ID: GTD25-F-0107

A Two-stage Framework for Power System Resilience Assessment: Process Design and a Case Study in Kinmen

First Author Yuhsuan WU (Taiwan Power Research Institute, Taiwan
Power Company, Taiwan)

Abstract—— This study presents a two-stage framework to assess the resilience of power systems along practical decarbonization pathways against high-impact, low-frequency (HILF) events. The first stage employs integrated resource planning and simulations to design cost-optimal decarbonization pathways. The second stage then conducts a detailed resilience analysis, considering factors like equipment damage probability and system-wide impacts, which are quantified using generalized metrics. A case study on the Kinmen region, targeting a 2030 carbon intensity of 0.4 kg CO2e/kWh, examines system resilience against tsunamis. Results indicate that achieving the target requires substantial solar PV and energy storage deployment to increase renewable energy penetration and reduce reliance on thermal generation. The findings further show that dispersed energy storage systems providing ancillary services significantly enhance power system resilience. The proposed metrics effectively quantify this resilience, offering actionable insights for system planners.

Paper ID: GTD25-A-0038

La2mnfeo6-double Perovskite Decorated 2d Ti3c2-mxene Hybrid Nanocomposite for Superior Energy Density Supercapacitor for Efficient Led Powering

First Author Ahmar ALI (King Fahd University of Petroleum nd Minerals, Saudi Arabia)

Abstract—— The advancement in electrode materials is crucial for the development of high-performance energy storage devices. In this study, we report the synthesis and characterization of a novel nanocomposite consisting of La2MnFeO6 (LMFO) perovskite oxide and 2D Ti3C2 MXene for supercapacitor applications. The LMFO/Ti3C2 nanocomposite leverages the high redox activity of LMFO and the exceptional electrical conductivity and layered structure of Ti3C2, yielding a synergistic effect that enhances electrochemical performance. Comprehensive characterization using X-ray diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), TEM, and X-ray photoelectron spectroscopy (XPS) confirms the successful integration of LMFO and Ti3C2. Electrochemical evaluations in a two-electrode system demonstrate a specific capacitance of 78.0 F.g-1 at 0.2 A.g-1, an energy density of 67.70 Wh.kg-1, and a power density of 250 W.kg-1 over a wide potential window (0-2.5 V). Electrochemical Impedance Spectroscopy (EIS) verifies the low charge transfer resistance of the device. Notably, the incorporation of Ti3C2 enhances the conductivity of the electrode material. This work highlights the potential of LMFO/Ti3C2 nanocomposites offering a promising avenue for sustainable energy storage systems.

Paper ID: GTD25-F-0137

Review of Global Inertia Procurement Practices: Lessons for South Africa

First Author Josh DIPPENAAR
(Stellenbosch University, South Africa)

Abstract—— As power systems transition toward high shares of inverter-based renewable energy, declining levels of synchronous inertia present growing challenges for managing frequency stability. Globally, system operators are developing mechanisms to value and procure inertia as a dedicated service. This paper evaluates international approaches to defining minimum inertia requirements and procuring inertia services, drawing on experience from Great Britain and Australia. These insights are contextualised within South Africa's regulatory and market framework. Regulatory gaps related to the procurement of inertia in South Africa's Grid and Market Codes are identified, and amendments are proposed to support technology-neutral approaches through a combination of long-term contracts and spot market mechanisms. The analysis highlights the need for regulatory reform, and for further research to ensure secure and cost-effective inertia provision in a future low-inertia power system.

Paper ID: GTD25-F-0062

Interchanging Traditional Power Transformer Medium-Voltage Condenser Type Bushings with Modern Composite Polymeric Bushings

First Author Augusto CARLETTO
(Maschinenfabrik Reinhausen GmbH,
Italy)

Abstract—— As the adoption of composite polymeric bushings grows in medium voltage transformer applications, they offer a modern alternative to aging porcelain barrier and condenser-type bushings. These advanced bushings bring considerable advantages, including reduced maintenance costs, extended transformer life, and better protection for aging infrastructure. A key benefit is the ability to design composite bushings that are fully interchangeable with existing porcelain units, requiring no changes to the transformer setup. An illustrative case involves an Asia-Pacific transmission network operator that undertook a midlife refurbishment of its 20-year-old transformer fleet. Faced with leaking and aging 24 kV and 36 kV condenser-type bushings, they collaborated with Maschinenfabrik Reinhausen (MR) to develop a unique composite solution. The result was a fully interchangeable 2-in-1 bushing design compatible with both voltage levels. The paper shares practical guidance on selecting suitable bushings and navigating the end-to-end implementation—from design to installation. It highlights how damaged bushings can be efficiently upgraded with modern, high-performance alternatives, ensuring transformers remain safe, reliable, and resilient into the future.

Paper ID: GTD25-F-0044

Coordinated Electric Ferry Charging Impacts by Balanced Hybrid Metaheuristic Optimization

First Author Rajib Baran ROY (Central Queensland University, Australia)

Abstract—— As the adoption of composite polymeric bushings grows in medium voltage transformer applications, they offer a modern alternative to aging porcelain barrier and condenser-type bushings. These advanced bushings bring considerable advantages, including reduced maintenance costs, extended transformer life, and better protection for aging infrastructure. A key benefit is the ability to design composite bushings that are fully interchangeable with existing porcelain units, requiring no changes to the transformer setup. An illustrative case involves an Asia-Pacific transmission network operator that undertook a midlife refurbishment of its 20-year-old transformer fleet. Faced with leaking and aging 24 kV and 36 kV condenser-type bushings, they collaborated with Maschinenfabrik Reinhausen (MR) to develop a unique composite solution. The result was a fully interchangeable 2-in-1 bushing design compatible with both voltage levels. The paper shares practical guidance on selecting suitable bushings and navigating the end-to-end implementation—from design to installation. It highlights how damaged bushings can be efficiently upgraded with modern, high-performance alternatives, ensuring transformers remain safe, reliable, and resilient into the future.

Oral Session 10
AI and Blockchain for Sustainable and Secure Power Systems

Session Chair: Krischonme BHUMKITTIPICH (Rajamangala University of Technology Thanyaburi, Thailand)

GTD25-F-0074

GTD25-F-0138

GTD25-A-0048

GTD25-F-0073

GTD25-F-0063

Paper ID: GTD25-F-0074

Artificial Neural Network-based Fault Classification and Location Estimation in a 22 Kv Distribution System: a Case Study in Dan Khun Thot, Thailand

First Author Chompoo
SUPPATOOMSIN (Vongchavalitkul University, Thailand)

Abstract—— In recent years, the integration of artificial intelligence (AI) into power system fault analysis has gained attention for its potential to improve fault classification and localization. This study presents the development of an artificial neural network (ANN) model designed to classify fault types and estimate fault locations in a 22 kV high-voltage distribution line. A simulation model was built using PSCAD to generate fault data for training, while real-world fault current data from reclosers installed by the Provincial Electricity Authority (PEA) in Dan Khun Thot, Thailand, was used for model validation. The case study demonstrates that the ANN model achieves high classification accuracy and location estimation precision, supporting faster fault response and improved grid reliability in practical field applications.

Paper ID: GTD25-F-0138

Explainable Ai-enhanced Energy Forecasting Using Lightgbm with Shap and Lime Interpretability

First Author DEVANATHAN B (Amrita Vishwa vidyapeetham, Chennai campus, India)

Abstract—— Accurate prediction of photovoltaic generation, wind generation, and electric demand is crucial for grid reliability, economic dispatch, and the integration of renewable resources across different operational timeframes. This study proposes a forecasting framework that evaluates multiple machine learning models, including XGBoost, Random Forest, NGBoost, CatBoost, SVR, and KNN, with LightGBM identified as the most effective learner when applied to 5-minute data aggregated into daily intervals. To enhance transparency, Explainable AI techniques are integrated: SHAP quantifies global and local feature contributions, highlighting the influence of lagged signals, while LIME provides case-specific explanations for individual forecasts. The methodology employs chronological data splits with train-only scaling to preserve the integrity of time-series learning and uses R^2 and RMSE metrics for evaluation. Results indicate that forecasting performance varies across datasets, underscoring the need for customized models. Comparative analysis confirms that LightGBM achieves the best trade-off between accuracy, stability, and interpretability. By combining robust forecasting with explainable insights, the proposed framework supports AI-enhanced energy management, enabling situational awareness, informed decision-making, and scalable deployment in renewable-rich power systems.

Paper ID: GTD25-F-0048

Quantitative Analysis of Partial Shading Impact on Photovoltaic Module Performance: from Single Cell to Complex Shadow Patterns

First Author Dr Mohammed BOU
RABEE (PAAET College of Technical Studies, Kuwait)

Abstract—— Partial shading poses a major operational challenge in photovoltaic (PV) systems, causing severe power reduction, hotspot formation, and multiple power peaks. This study presents a detailed experimental investigation on the effects of partial shading—from one to six shaded cells—on the performance of a polycrystalline silicon PV module. I–V and P–V characteristics were measured under uniform and various shaded conditions. Results show that shading a single cell can decrease the maximum power by more than 60% compared to unshaded operation. As the number of shaded cells increases, power loss and fill factor degradation become more pronounced, accompanied by nonlinear distortions in the curves. The analysis highlights the emergence of local maxima in the P–V curve, attributed to bypass diode activation that modifies current paths and introduces step-like features in the I–V response. The comprehensive dataset and findings presented serve as an empirical reference for improving maximum power point tracking (MPPT) and early fault detection algorithms, contributing to the development of more reliable and efficient PV systems under non-uniform irradiance conditions.

Paper ID: GTD25-F-0073

A Solution to Optimal Power Flow Problems using Improved Dragonfly Algorithm

First Author oraphon KIGSIRISIN
(Department of Electrical Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai, Thailand)

Abstract—— Optimal power flow (OPF) problems are a challenging issue for electricity generating suppliers to solve for economic and secure power systems while satisfying constraints. This study proposes Improved Dragonfly Algorithm with Sinusoidal Movement (IDASM) to succeed in these problems. Using IDASM, the weight factor of the food source (optimal solution) and the enemy source (worst solution) are modified. Dragonflies can fly toward or outward from these sources to have a better chance to explore the best food source. The objective is to enhance the exploration performance of dragonflies and to not get trapped in local optima, for obtaining accurate solutions to problems. To investigate its performance, IDASM is simulated for solving OPF problems in the IEEE-30 bus test system using many mathematical objective functions. As a result, IDASM is much more effective in solving all OPF problems when compared to its original and the other referred algorithms.

Paper ID: GTD25-F-0063

Implementing a Transformer Fleet Management Strategy Combining Reliability and Sustainability Dimensions: A German Utility Case Study

First Author Matthias SCHAD
(Maschinenfabrik Reinhausen GmbH, Malaysia)

Abstract—— Power transformers are critical assets for energy utilities and industry, requiring efficient management to maximize availability, lifespan, and cost control. Traditional diagnostics often rely on simplified metrics like a "Health Index," which lack depth for stakeholders managing fleets from CAPEX and OPEX perspectives. These methods also overemphasize transformer age, potentially skewing replacement decisions.This paper introduces a two-dimensional condition assessment methodology that enables holistic asset management decisions by integrating diverse diagnostic data objectively. It also offers a strategy for addressing "data uncertainty," a crucial challenge in decision-making.A case study from a German power utility illustrates the method's real-world application. During an initial evaluation, critical units were identified within a transformer fleet. To reduce uncertainty, targeted measurements followed, leading to internal inspection and successful diagnosis and repair of failure modes.The paper concludes that applying condition-based assessments and addressing uncertainty significantly reduces failure risks, enhances reliability, and enables proactive management of transformers. With this approach, asset managers gain clarity for making informed decisions on repairs, replacements, and lifetime extension—ensuring sustainable, cost-effective operation of transformer fleets.

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Oral Session 11
AI and Blockchain for Sustainable and Secure Power Systems

Session Chairs: Nattachote RUGTHAICHAROENCHEEP (Department of Electrical Engineering Faculty of Engineering Rajamanngala University of Technology Phra Nakhon, Thailand, Thailand), Jirawadee POLPRASERT (Naresuan University, Thailand)

GTD25-F-0088

GTD25-F-0013

GTD25-A-0046

GTD25-F-0030

GTD25-F-0029

GTD25-F-0155

Paper ID: GTD25-F-0088

Operational Framework for Fault Detection in Power Systems: a Foundation for Ai-driven Analysis

First Author Dinesh Babu KRISHTAPPA NAGALINGAM (yes, United Kingdom)

Abstract—— Modern power systems generate vast volumes of protection data through digital relays, SCADA systems, and disturbance recorders. While these datasets are invaluable for system reliability, their scale and complexity often make fault detection challenging. This paper presents a structured framework for fault analysis that integrates relay event records, oscillograph playback, and malfunction diagnosis into a systematic methodology. The framework has been validated using four real-world case studies, including circuit breaker failures, relay mis-operations, and protection logic anomalies, demonstrating its ability to identify root causes and propose corrective measures. Beyond the engineering insights, the methodology establishes a foundation for automation using data-driven approaches. By formalizing data categorization, sequence correlation, and decision pathways, the framework provides a pathway for future AI-based evaluation, enabling predictive diagnostics and real-time fault classification. This work therefore bridges current practical fault analysis with emerging AI applications, offering a replicable and scalable approach for enhancing resilience in modern smart grids.

Paper ID: GTD25-F-0013

The Role of Cyber-physical Security Mechanisms to Secure the Operation of Cyber-physical Systems

First Author Reynaldo NUQUI (Hitachi Energy, United States)

Abstract—— Cyber-physical systems are systems that integrate digital control systems with plants in the real world, such as industrial installations, smart homes/smart cities, transportation systems, or utility grids for power, water, or gas. Such cyber-physical systems have existed for decades, but with the rise of internet-connected control systems and Internet-of Things (IoT) systems in the past decade, they have become prominent and with that the challenge of securing these systems against cyberattacks, that is, remote and computer-based attempts to operate these installations in unauthorized ways, has become more urgent. In recent years a lot of research has been initiated on specific cyber-physical security mechanisms to secure cyber-physical systems. In this paper we compare such cyber-physical security mechanisms with conventional cyber security mechanisms and explain what cyber-physical security mechanisms can and cannot achieve. We propose a template for summarizing the applicability of cyber-physical security schemes. We conclude that cyber-physical security schemes come at a cost of reducing optimality of normal operation and that they can and should only serve as n-th level of defense mechanisms behind a comprehensive conventional security architecture.

Paper ID: GTD25-F-0046

EMD-CNN-LDA-KNN: A Hybrid Framework for Power Quality Disturbance Recognition In Utility Grids

First Author Supakan JANTHONG
(Provincial Electricity Authority,
Thailand)

Abstract—— Disturbances in power quality significantly undermine the stability and operational performance of electrical infrastructures. This paper presents a robust and automated PQDs recognition framework based on synthetically generated signals conforming to the IEEE 1159 standard across ten disturbance classes. Empirical Mode Decomposition (EMD) is first applied to decompose voltage signals into Intrinsic Mode Functions (IMFs), capturing localized temporal characteristics. These are transformed into 2D matrices and fed into a lightweight Convolutional Neural Network (CNN) for automatic feature extraction. Linear Discriminant Analysis (LDA) is then used to enhance class separability and reduce dimensionality, followed by classification using a k-Nearest Neighbor (KNN) model. The proposed EMD-CNN-LDA-KNN framework achieves an average accuracy of 99.8% under noise-free conditions and maintains 97.0% accuracy at 10 dB noise levels. Additionally, it delivers a near-perfect average precision, recall, and F1-score of 99.9%, supported by clear class separation in LDA visualizations and minimal confusion in the classification matrix. These results confirm the framework's strong generalization, noise robustness, and suitability for real-time PQD monitoring in smart grids.

Paper ID: GTD25-F-0030

Emergency V2H Operation Considering Detection and Restoration of Multiple Faults in Distribution Systems

First Author Atsushi NOBORI (Meijo University, Japan)

Abstract—— To improve power system resilience, mobile energy resources as portable storage batteries, have attracted attention. When faults occur in distribution systems and distribution lines become unavailable, restoring power is difficult. However, Vehicle-to-Home (V2H), where Electric Vehicles (EVs) supply electricity to consumers, can mitigate outages. Our research group has developed a V2H operation method enabling sustainable power supply by periodically swapping EVs between healthy and faulty sections in the distribution system where the faulty sections were assumed to be too highly damaged to be restored. In actual operations, the outage section is reduced by a distribution automation system, and the fault locations are detected and removed by field crews. This study presents a simulation model for fault detection and removal under multiple fault scenarios. Furthermore, we propose a method to coordinate V2H operation in parallel with the restoration process. Numerical simulations demonstrate the effectiveness of the proposed method in reducing outages.

Paper ID: GTD25-F-0029

Traveling Wave Fault Location Error in Branched Distribution Networks

First Author Rustem KHUZIASHEV
(kazan state power ingeneering university, Russian Federation)

Abstract—— The sources of error in the algorithms of traveling wave fault location in branched distribution networks of medium voltage class are analyzed. On the example of experimentally registered emergency transient oscillograms, the procedures for determining the beginning of the transient signal and the speed of traveling wave propagation are shown. The redundant information caused by registration of signals in many points of the network is used. The determining influence of the time discretization value of transient signals on the error of the traveling wave fault location is shown. Experimentally obtained results are presented. The directions of error reduction are formulated.

Paper ID: GTD25-F-0155

Optimal Placement of Static VAR Compensators (SVCs) in Transmission Systems Using Deep Reinforcement Learning

First Author Sirawich
LIMPRAPASSORN (King Mongkut's University of Technology North Bangkok, Thailand, Thailand)

Abstract—— The increasing penetration of renewable energy makes reactive power management important, making optimal Static VAR Compensator (SVC) placement crucial yet computationally difficult for modern power systems. Traditional optimization approaches struggle to scale with modern grid complexity and discrete investment decisions. This paper proposes a Deep Reinforcement Learning (DRL) framework enhanced with Graph Neural Networks (GNNs) to learn power system topology directly from network data. A key novelty lies in training the agent through direct interaction with a high-fidelity AC Optimal Power Flow (OPF) solver, exposing it to not only normal operation but also critical contingency scenarios. Although the simulation-based training is time-intensive, the resulting AI planner rapidly identifies near-optimal SVC placement strategies, demonstrating the ability to restore OPF feasibility in scenarios with non-convergent baseline states. The proposed framework demonstrates the potential of DRL-based optimization for complex, high-fidelity power system planning problems.

Oral Session 12
AI and Blockchain for Sustainable and Secure Power Systems

Session Chairs: Somporn SIRISUMRANNUKUL (King Mongkut's University of Technology North Bangkok, Thailand)

GTD25-F-0110

GTD25-A-0024

GTD25-F-0156

Paper ID: GTD25-A-0110

A Large Language Model-based Framework for Generating Simulation Models of Power System

First Author Duange GUO (UNSW Sydney, Australia)

Abstract—— This paper proposes a dual-agent framework based on the large language model (LLM) to automatically generate the power system's dynamic simulation. The progress is divided into two parts: agent I is responsible for making a plan, transferring the reasoning output into a specific recognized procedure with functions; agent II is responsible for generating code, using the database if functions exist, or generating new functions and then storing them in the database. Meanwhile, two feedback loops are set for the code generation and planner to guarantee the automation of the whole process. Electromagnetic transient models of the IEEE 9-buses are generated in MATLAB/Simulink platform in the case studies, which illustrate that the general commercial LLM has the potential to be directly used in the power system domain to perform insightful tasks based on the simulation feedback, and generate the data source during training progress to achieve a self-evolving LLM.

Paper ID: GTD25-A-0024

Enhancing Grid Flexibility Through Electrification Under Transmission Constraints in Eastern Japan: Examining Scenarios for Cost-effective Renewable Integration

First Author Keiki SHIMURA (Tohoku University, Japan)

Abstract—— This study investigates a cost-optimal strategy for integrating renewable energy by enhancing grid flexibility through regional electrification in Eastern Japan, which faces significant curtailment risks due to limited transmission line capacity. To address this challenge, we propose region-specific electrification utilizing end-use technologies that enable demand response and enhance hourly supply-demand balancing.A multi-regional energy chains model was developed to simulate the entire energy system by integrating both power and non-power sectors under a carbon neutrality scenario for 2050. The model optimizes regional electrification rates, ensures hourly power balancing, and incorporates inter-regional transmission constraints, flexible thermal generation, and demand response enabled by end-use technologies such as heat pump water heaters and electric vehicles.Simulation results demonstrate that optimal electrification enhances grid flexibility and enables greater renewable integration. On the demand side, technologies with demand response contribute to load leveling. On the supply side, coordinated operations with demand response improve grid flexibility through dispatchable operation of LNGCC plants, effective utilization of transmission lines, and efficient operation of storage facilities. These coordinated operations enable deeper renewable energy penetration and reduce total system costs.

Paper ID: GTD25-F-0156

Optimal Placement, Sizing, and Scheduling of Battery Energy Storage Systems in Distribution Systems Using Graph Neural Network and Artificial Rabbit Optimization

First Author Tanachot
WATTANAKITKARN (King Mongkut's University of Technology North Bangkok, Thailand)

Abstract—— The increasing integration of distributed energy resources has intensified the need for efficient deployment of Battery Energy Storage Systems (BESS) in modern distribution systems. However, determining the optimal planning of BESS while considering complex technical and temporal constraints remains challenging. This paper presents an optimization approach to determine the placement, sizing, and operational scheduling of BESS in a distribution system that is represented by the IEEE 33-bus test system. The method begins with the development of the Graph Neural Network (GNN), which is trained on credible datasets generated from multiple operating scenarios simulated in OpenDSS. The trained GNN serves as a fast and accurate power flow solver, achieving a prediction error of less than 5% while efficiently estimating bus voltages and power losses. The Artificial Rabbit Optimization (ARO) is an algorithm that acts as the metaheuristic optimizer. In each iteration, ARO uses the output from GNN to evaluate candidate solutions. Results from the IEEE 33-bus test system indicate that the proposed method can reduce both BESS operating costs and total active power losses while maintaining better voltage profiles.

Oral Session 13
EV Integration and Distributed Energy Management Systems

Session Chairs: Somporn SIRISUMRANNUKUL (King Mongkut's University of Technology North Bangkok, Thailand)

GTD25-F-0054

GTD25-F-0112

GTD25-A-0008

GTD25-A-0045

GTD25-F-0016

GTD25-F-0032

Paper ID: GTD25-F-0054

A Model Predictive Control Scheme for a Csi7-based Transformerless Photovoltaic System

First Author Jonggrist
JONGUDOMKARN (Khon Kaen University, Thailand)

Abstract—— While current source inverters (CSIs) offer improved system reliability, compared to voltage source inverters (VSIs), through their inherent current limiting capabilities, conventional CSI topologies still suffer from significant leakage current. The novel CSI7 topology, which enhances the traditional CSI by incorporating a seventh switch, shows promise for transformerless PV systems by reducing switching losses and leakage current; however, it faces issues such as current distortion. A finite-control-set model predictive control (FCS-MPC) has shown advantages in various power electronic applications, but has not been tailored for CSI7. To address this gap, this paper proposes an MPC strategy designed explicitly for CSI7, which utilizes the system's predictive model to estimate both the DC and inverter output currents. Simulation results demonstrate that the proposed method can reduce the current distortion compared to the conventional space vector modulation designed for the CSI7.

Paper ID: GTD25-F-0112

Enhancing the Cybersecurity Posture of Microgrids Through Standards-compliant Architecture Patterns

First Author Raja Sekhar RAVI
(Flinders University . Swan Foresight Pty Ltd., Australia)

Abstract—— The rapid global adoption of microgrids has significantly expanded the cyber-attack surface of critical infrastructure, posing serious challenges to safety and reliability. Threats such as unauthorised access, malware infections, grid manipulation, and data breaches can lead to operational disruptions, financial losses, and risks to human safety. These challenges are amplified by the inherent complexity of renewable energy ecosystems (RESs), which integrate diverse Distributed Energy Resources (DERs), edge devices, and multi-vendor supply chains. Designing, deploying, and maintaining resilient operations in such environments is technically demanding, while uncertainty about where to begin and how to allocate budgets for cybersecurity further complicates the decision-making. This paper addresses these issues by analysing the key standards and frameworks currently shaping cybersecurity in RESs, proposing a three-layer architecture pattern to support standards compliance and strengthen security posture, and applying this approach to a local microgrid to highlight practical challenges, observations, and opportunities for further research and industry development.

Paper ID: GTD25-A-0008

Participation of Distributed Renewable Energy Sources to Secondary Dynamic Grid Services

First Author Bogdan MARINESCU
(Ecole Centrale Nantes, France)

Abstract—— One of the main bottleneck in increasing the share of Renewable Energy Sources (RES) is dynamic stability. In particular, RES participation to grid services should be ensured. Secondary (voltage/frequency) grid services are targeted here. It is shown how several geographically distributed RES can directly and fully (together with classic thermal plants and with the same rights and obligations) participate to such services. The RES are considered together into a new concept called Dynamic Virtual Power Plant (DVPP). It proposes an original multi-time scale control to gather the primary controls of each RES. Important questions as decentralization of the controls, plug and play capability (no reconfiguration of the control or any other action in case of stop or restart of RES of the DVPP), interactions with primary controls, N-1 security assessment level and energy markets are discussed. This paves the way to practical implementation compared to existing VPP concepts which focus only the market level (and so, no dynamic matter).Study cases, including hardware implementation (on 20kW lab generators) and real-time and hardware in the loop experimentations, are shown.

Paper ID: GTD25-A-0045

A Fundamental Investigation on Detecting Short-gap DC Series Arcs Generated in Low-voltage DC Equipment

First Author Mikimasa IWATA (Nagoya University, Japan)

Abstract—— With the large-scale introduction of renewable energy sources such as PV to the power system, DC transmission and distribution equipment will be widely utilized in the future. In the DC equipment, DC series arcs may occur due to loose terminals or poor contact. Therefore, if it is left unattended, this can lead to equipment damage and/or fire. To prevent accidents like those, the technology for detecting DC series arcs is necessary. This paper describes the results of an experimental investigation into this matter. To simulate actual equipment failure, in this paper, an arc is generated in air with an extremely short electrode gap (0.4 mm) by setting the DC power supply voltage 100 V and the current 40 A. By focusing on the minute vibrations in the current waveform during arc generation, we confirmed that arc generation can be detected by applying Wavelet transformation to the current waveform and comparing the signals before and after arc generation. Furthermore, we conducted fundamental investigations into the relationship between the minute vibrations of the current waveform and the behaviors of the arc.

Paper ID: GTD25-F-0016

Coordinated Dual-loop Model Predictive Control for Grid-forming Inverters

First Author Nottakorn SUKMANONT
(Kasetsart University, Thailand)

Abstract—— The most prominent technology is the Grid-Forming Inverter. This technology enables the full potential of renewable energy to be harnessed, forming an electrical grid without relying on traditional generators. However, the current issue lies in the control systems of this technology, which are not yet efficient enough. The use of outdated PI control results in suboptimal power efficiency when utilizing clean energy. This problem becomes even more critical when energy fluctuations occur, making PI control ineffective for managing grids powered solely by renewable sources. This paper proposes a solution to this issue by introducing Dual-loop Model Predictive Control (MPC), which divides the control into voltage and current loops, each handling its specific task. This approach improves power efficiency, bringing it closer to 100%, and enhances the system's performance in islanding mode. Test results demonstrate that Dual-loop MPC outperforms PI control in both transient and steady-state performance, improving the electrical system's voltage, frequency, and current. Additionally, the system was tested under fault conditions, islanding mode, and load shedding to clearly illustrate that Dual-loop MPC provides superior performance in these scenarios.

Paper ID: GTD25-F-0032

Data-Driven Reliability Evaluation of Distribution Systems with Uncertainty Modeling

First Author Nottakorn SUKMANONT
(Kasetsart University, Thailand)

Abstract—— In developing countries, one of the critical factors influencing national development is the power system, particularly the distribution of electricity from producers to end consumers. The performance of the distribution system directly impacts overall power system quality, typically assessed through reliability calculations. Reliability indicates the frequency and duration of power interruptions experienced by consumers. Traditional methods, such as the Markov model rely on mathematical frameworks that often overlook critical real-world factors. These methods typically struggle to capture the impact of environmental variability, including seasonal changes, which can significantly influence system performance. For example, environmental conditions that vary by season such as summer, winter, and the rainy season have different impacts on the system. Traditional calculation methods do not effectively address these seasonal uncertainties. Therefore, this paper proposes a Fuzzy Logic-based approach to handle real-world data uncertainties, utilizing Gaussian Distribution to improve accuracy and realism. Additionally, the Monte Carlo method is used to estimate key reliability indices, including SAIFI, SAIDI, and ENS values in the distribution system. The results demonstrate that this method is effective for system analysis and adaptation.

Oral Session 14
Advanced Smart Grid and Metering Technologies

Session Chairs: Chaiyod PIRAK (King Mongkut's University of Technology North Bangkok, Thailand)

GTD25-F-0077

GTD25-F-0131

GTD25-F-0154

GTD25-F-0157

Paper ID: GTD25-F-0077

Heat Pump Demand Response to Minimize Network Voltage Impacts of Domestic Water Heating

First Author Sparkle PRENTICE (RMIT University, Australia)

Abstract—— This study proposes and demonstrates a methodology for demand response technology in residential heat pumps that intends to minimize voltage violations on a low-voltage distribution network while electrifying domestic water heating. The network voltage performance is first analyzed using a baseline scenario of gas water heating, followed by a simple timer control of heat pumps, restricted to operate during lower grid demand periods. The simple timer control is then replaced with intelligent rule-based controls that consider both network voltage in real time and heating urgency rules, prioritizing heat pump operation and urgency to heat water when voltages are high. The analysis is undertaken utilizing a thermal-electric co-simulation platform that links thermodynamic heat pump models using TRNSYS software, and distribution network modelling using DIgSILENT PowerFactory. Results show that simple timer-based heat pump operation doubled the voltage violations from 3.8% to 8.3%, while the intelligent controls minimized voltage violations to under 2% increase, while guaranteeing thermal amenity.

Paper ID: GTD25-F-0131

ADVANCED METERING INFRASTRUCTURE–ENABLED SMART METERING FOR UTILITY OPERATIONS AND DISTRIBUTION NETWORK PLANNING

First Author Priyanshu PRALIYA (Tata Power Delhi Distribution Limited, India)

Abstract—— This paper demonstrates how AMI-based smart meter data can be leveraged to improve distribution planning and operations in Delhi. We integrate smart meter, MDM, GIS and SAP datasets to monitor transformer loading, implement HVDS virtual metering for unmetered DTs, and analyze distributed PV generation. Using 30-minute interval data and predictive analytics, a DT Monitoring System (DTMS) identifies transient and sustained overloads, forecasts near-term peak loading using pocket-wise growth, and supports operational measures such as DT swapping and feeder reconfiguration. A solar application correlates PV generation with DT loads to assess hosting capacity and reverse-power risks. Case analyses show reduced manual measurement effort, improved asset utilization, and better planning decisions demonstrating AMI-driven analytics, potential to lower CAPEX and increase grid reliability.

Paper ID: GTD25-F-0154

Coordinated Electric Vehicle Charging in Low-Voltage Distribution System Using LP-Based Dynamic Optimization Framework

First Author Papungkorn SIHAWONG
(King Mongkut's University of Technology North Bangkok, Thailand)

Abstract—— This paper presents a linear-programming (LP)-based dynamic optimization framework for coordinated electric vehicle (EV) charging in a 16-bus low-voltage distribution network. The framework integrates Python and DIgSILENT PowerFactory through iterative 5-minute unbalanced load-flow simulations executed over a 24-hour horizon to emulate realistic, time-varying grid conditions. Both residential demand and stochastic EV behavior—including variations in charging start time, departure time, and state of charge (SOC)—are modeled to capture practical load fluctuations that may result in transformer or feeder overloading. At each simulation step, PowerFactory evaluates network loading and transfers key parameters to Python, where the LP optimizer determines the optimal charging power for each EV subject to voltage and capacity constraints. The optimized setpoints are then sent back to PowerFactory for the next iteration. Simulation results show that the proposed LP-based control effectively alleviates transformer and feeder overloading, reduces voltage deviations, and improves overall network performance. The findings confirm the practicality and scalability of integrating Python-based optimization with PowerFactory for near-real-time EV charging coordination.

Paper ID: GTD25-F-0157

Optimization of Battery Energy Storage Placement in Low-Voltage Distribution Network by Monte Carlo–Based Quasi-Dynamic Simulation and Genetic Algorithm

First Author Pongpisit
CHAROENPANON (King Mongkut's University of Technology North Bangkok, Thailand)

Abstract—— This study presents an integrated optimization framework for coordinating electric vehicles (EVs), photovoltaic (PV) systems, and battery energy storage systems (BESS) in low-voltage distribution networks. Monte Carlo Simulation is used to model the stochastic behavior of EV charging, while a Quasi-Dynamic Simulation evaluates network performance under variable operating conditions. A Genetic Algorithm (GA) determines the optimal BESS size and placement within defined technical constraints. The study considers network operation limits, including maximum feeder loading of 100 %, transformer loading not exceeding 90 %, and voltage levels maintained within 0.909–1.043 p.u. Simulation results in DIgSILENT PowerFactory, conducted on a 30-bus 24/0.4 kV system with 28 EV charging points, reveal that the optimal configuration corresponds to a BESS of 200–250 kWh capacity, with the most probable installation location at Bus 28 (91.03 % probability). The proposed method effectively mitigates overloading and voltage deviations, enhances hosting capacity for EVs and rooftop PV systems, and improves the overall reliability and sustainability of low-voltage power networks.

Oral Session 15
Bioenergy, Hydrogen, and Decentralized Electrification

Session Chairs: Kanchit NGAMSANROAJ (Hydrogen and Fuel Cell Center, University of South Carolina, United States)

GTD25-F-0007

GTD25-F-0128

GTD25-F-0142

GTD25-F-0179

Paper ID: GTD25-F-0007

Planning System of Power to Methanol Supply Chain

First Author Yohanes Kristianto NUGROHO (University of Southern Denmark, Denmark)

Abstract— This work advocates for the incorporation of an agent-based simulation framework to strategically optimize Power-To-Methanol (PtM) plants and associated supply chain operations, thereby encapsulating CO_2 suppliers, methanol distribution channels, and transportation entities for both CO_2 and methanol within its ambit. Key decision-making facets explored in this context encompass PtM plant process control, as well as supply and production planning, coupled with a comprehensive economic scrutiny of the PtM supply chain. The evaluation includes CO_2 and methanol ordering policy, capital budgeting during the lifetime of the methanol supply chain, materials requirement planning for CO_2 and methanol. The primary outcomes enhancing the field of renewable energy include the utilization of a digital model for Power-to-Methanol (PtM) processes, which incorporates production planning and control procedures into both PtM plant and supply chain design. This digital model facilitates the evaluation of the economic feasibility of the PtM supply chain. The measurable results derived from the digital model, lead to reduced carbon emissions, increased internal rate of return, shorter payback periods, and decreased price sensitivity within the methanol supply chain.

Paper ID: GTD25-F-0128

Time-of-day Charging for Electric Vehicles: Impact Analysis of Indian Grid Emission dynamics

First Author Keshav MAHESHWARI
(Electrical Engineering, IIT Bombay, India)

Abstract— India's power sector must balance rapidly growing electricity demand with ambitious decarbonization goals. Two major strategies have been adopted: deployment of 500 GW of non-fossil capacity and achieving 30\% electric vehicle (EV) sales by 2030. However, uncoordinated charging could increase reliance on coal-based generation (such as night-time charging), while smart charging offers significant emission reduction potential. This study develops a high-resolution integrated supply–demand model to capture temporal and seasonal variations in grid carbon intensity, focusing on marginal emission factors (MEFs) as they best represent incremental EV load and charging impacts. The analysis addresses three key gaps: limited integration of renewable variability with EV adoption, inadequate representation of charging technologies, and absence of policies linking intraday emission dynamics with charging times. Results show emission factors are 20–25\% lower in afternoons and 10–15\% lower in summer/monsoon months, yet coal still accounts for 95\% of emissions. Coordinated daytime Level-2 AC and optimized evening DC fast charging, supported by time-of-day incentives, can reduce MEFs by 1–2\%, yielding substantial environmental benefits when scaled to 20–25 million EVs.

Paper ID: GTD25-F-0142

A Study On The Impact Of Superconducting Fault Current Limiter On Arc Flash Hazard In An Industrial System

First Author Kittipong ANANTANASAP
(Chulalongkorn University, Thailand)

Abstract— The growing integration of distributed generation in power systems has resulted in higher short- circuit current levels, raising concerns about equipment overheating, insulation degradation, and system stability. Among conventional mitigation methods, the Resistive Superconducting Fault Current Limiter (R-SCFCL) offers a promising solution by dynamically increasing impedance during faults without affecting normal operation. It, however, may affect the fault clearing time of protection system, resulting in ARC flash safety. This study assesses the impact of R-SCFCL integration on arc flash hazards in an industrial system, utilizing DIgSILENT PowerFactory and calculations based on the IEEE 1584 standard. It is found that while R- SCFCL effectively reduces arcing current, the incident energy, which determines Personal Protective Equipment (PPE) requirements, does not always decrease. In some scenarios, lower arcing current and shorter working distances result in higher incident energy. The settings of overcurrent protection are revised to ensure not only effective coordination among protection devices but also mitigation of arc flash hazard.

Paper ID: GTD25-F-0079

A Framework for Generation Expansion Planning Under Transmission Constraints: a Case Study of the Western Cape.

First Author Grace RUZIVE
(Stellenbosch University, South Africa)

Abstract— South Africa's energy crisis persists despite significant renewable energy integration, with grid constraints emerging as a critical bottleneck. This study addresses the challenge by proposing a deterministic framework for generation capacity expansion planning under transmission constraints for networks with limited grid upgrades. This is achieved through the application of deterministic hosting capacity analysis to generation expansion planning. The transmission constraints considered for the study are transmission line thermal limits and transformer thermal limits. The framework calculates the generation capacity margin at each bus and iteratively adds a fixed percentage of generation capacity until the transmission constraints are exceeded or violated. This framework is applied to a case study of the Western Cape transmission network and implemented using a linear load flow analysis in PyPSA. Results indicate that a 15% increase in maximum generation capacity at each bus in the network results in line overloading. The proposed framework offers a computationally efficient and scalable approach to generation expansion planning enabling planners to assess congestion and overloading thresholds without relying on computationally intensive generation expansion planning methods.

Oral Session 16
AI and Blockchain for Sustainable and Secure Power Systems

Session Chairs Warodom KHAMPHANCHAI (AltoTech Global, Thailand)

GTD25-F-0121

GTD25-F-0025

GTD25-F-0113

GTD25-F-0136

GTD25-F-0098

GTD25-F-0515

Paper ID: GTD25-F-0121

Multi Objective Dynamic Economic Emission Dispatch Using Water Cycle Algorithm

First Author Muhammad Faizan
MALIK (Bahria University Islamabad, Pakistan)

Abstract— Multi-Objective Optimization problem has acknowledged a substantial consideration recently due to the increase in environmental pollution. It has drawn the attention of researchers to incorporate emission constraints while doing economic dispatch. Economic Emission Dispatch (EED) plays a vital role in energy conservation by reducing cost and emissions simultaneously. However, it introduces an additional level of complexity in addressing multi-objective optimization problems. When the valve-point effect is considered, EED becomes a multi-objective, non-convex optimization problem for generating unit systems, characterized by significant non-linearity. In this research, this complex problem is solved for the load demand of 24 hours, making it Dynamic Economic Emission Dispatch, using a metaheuristic technique, Water Cycle Algorithm(WCA). To test the operational performance and compatibility of WCA among other evolutionary algorithms; a standard IEEE test system of 5, and 10-unit is used. The results demonstrate that Water Cycle Algorithm is more efficient and effective in solving the DEED problem in comparison with the others.

Paper ID: GTD25-F-0025

Analysis of Secondary Price Cap in the Philippine Wholesale Electricity Spot Market

First Author Crizhalyn Weng MIGUEL
(University of the Philippines Diliman, Philippines)

Abstract— In the Philippine Wholesale Electricity Spot Market, the Secondary Price Cap (SPC) mitigates sustained high electricity market prices while allowing expensive plants to recover their operating marginal cost. A dynamic SPC mechanism is recommended based on similar mechanisms from Singapore's WEM, Australia's NEM, and the Philippine Independent Power Producers Association's recent proposal. SPC is proposed to be updated based on the short-run marginal cost (SRMC) of a peaking plant including fuel prices, foreign exchange rates, and consumer price indices. Meanwhile, the Cumulative Price Threshold follows a multiplier mechanism based on fixed and variable costs of generating plants. Using iPool software for backcasting simulations, price duration curves were produced for December 2022 when without SPC, electricity prices exceed fossil fuel plants' long-run marginal cost (LRMC) about 80 percent of the time. Results show that the proposed SPC mechanism strikes a better balance between electricity prices and generation fuel prices.

Paper ID: GTD25-F-0113

A Two-Stage YOLO-CNN Framework for Automated Lithium-ion Battery Defect Inspection

First Author Puncharus PHONGPHITTHONGCHAI (Kasetsart University, Thailand)

Abstract— Lithium-ion batteries (LIBs) are widely used in electric vehicles and energy storage systems, but their inspection remains a challenge. Manual visual inspection is labor-intensive, inconsistent, and unsuitable for high-throughput production lines. This study presents an automated inspection framework based on a two-stage computer vision pipeline. In the first stage, YOLO-based detectors (YOLOv8n, YOLOv8s, and YOLOv11n) were used to localize battery cells from raw images. In the second stage, cropped regions of interest were classified into four categories: normal prismatic cell, damaged prismatic cell, normal pouch cell, damaged pouch cell using lightweight CNN architectures (ResNet18 and EfficientNet-B0). A custom dataset of 1,120 images, expanded to 5,000 through augmentation, was collected using a dual-camera setup with top and side views. Experimental evaluation on a held-out test set demonstrated that the best configuration, YOLOv11n combined with EfficientNet-B0, achieved 95.83% accuracy with precision, recall, and F1-scores above 0.96. These results confirm the effectiveness of the proposed hybrid pipeline and its strong potential for real-time industrial applications in battery production and recycling.

Paper ID: GTD25-F-0136

Ai-driven Renewable Energy Forecasting: Comparative Analysis of Ml/dl Models with Cloud Computing Integration

First Author DEVANATHAN B (Amrita Vishwa vidyapeetham, Chennai campus, India)

Abstract— Accurate forecasting of renewable energy is essential for efficient grid management and sustainability. This study compares machine learning models—Lasso Regression, Ridge Regression, Decision Tree, Random Forest, Artificial Neural Networks (ANN), and Long Short-Term Memory (LSTM)—using time-series data from the Open Power Systems database in Germany. Results show that ANN and LSTM achieved the best performance, with R^2 values of 0.9967 and 0.9966 and the lowest error metrics, outperforming traditional models. The project also delivers a cloud-based web interface where users input parameters such as humidity, air pressure, and cloud cover to instantly predict renewable energy output. The platform enhances usability and accessibility, contributing to reliable and sustainable energy forecasting.

Paper ID: GTD25-F-0098

Arc Flash Analysis in Power Distribution System of the Red Line Mass Transit

First Author Promsak APIRATIKUL
(Rajamangala University of Technology Thanyaburi, Thailand)

Abstract— Arc Flash Analysis in Power Distribution System of the Red Line Mass TransitPrayad BOONKHAM#+, Chaimongkol PENGTEM, Promsak APIRATIKUL, Terdkiat LIMPITEEPRAKARN, Arnon NIYOMPHOL Rajamangala University of Technology Thanyaburi, ThailandIn this research, the researcher has tried to test Arc Flash Analysis in Energy Management software platform or ETAP of the electrical system installed at the Red Line electric train station to check whether it complies with the electrical installation standards for Thailand and the safety distance and wearing of safety equipment while working. The results show that when comparing the actual results with the IEEE and NFPA standards, the values are close to each other. However, the designed system has a different voltage supply from the Metropolitan Electricity Authority or MEA and Provincial Electricity Authority or PEA, which is 25 kV. There should be a professional agency responsible for setting standards for both stability and quality of high voltage level continue.

Paper ID: GTD25-F-0151

Optimal Photovoltaic–Battery Storage Sharing for Affordable Net-Zero Urban High-Rises

First Author Raghuraman RAMAKRISHNAN (Indian Institute of Information, Technology, Design and Manufacturing, Kancheepuram, India)

Abstract— Designing net-zero energy buildings in the context of urban high-rises with solar photovoltaic source alone is challenging due to affordability concerns and limited rooftop space availability. This work deals with an optimal photovoltaic–battery energy storage system (PV–BESS) sizing framework for two urban high-rises. The proposed architecture utilizes a shared BESS that buffers the complementary load profiles of the buildings considered in this study. Inter-building energy exchange is facilitated through a common DC bus. Three objectives to capture the energy reliability, affordability, and grid stress have been formulated. A multi-objective grey wolf optimization algorithm is applied to these conflicting objectives in order to achieve a balanced, cost-effective, and grid-supportive net-zero energy operation. A comparative study between individual and shared BESS configurations has been performed. The shared BESS with the proposed energy transfer significantly enhances overall grid friendliness by 42%, and lowers deficit energy by 68% with a moderate, justifiable increase in initial investment in the considered buildings. The results confirm that shared BESS-based optimal sizing improves operational efficiency and affordability, thereby promoting net-zero energy attainment in urban settings.

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