

IEEE Power and Energy Society Entity Annual Report

2021

Entity: Transmission and Distribution Committee

Website: <https://cmte.ieee.org/pes-td/>

Chair: Surya Santoso

Vice-Chair: Eriks Surmanis

Secretary: Julio Romero Agüero

Immediate Past Chair: Gary Chang

1. Significant Accomplishments:

The Transmission and Distribution Committee (T&D) is comprised of 7 subcommittees and 80 WGs/TFs. During the period of 2021, the T&D Committee approved 15 conference papers for publication and 13 panel sessions in IEEE PES GM 2021. The T&D Committee supports SCC21 on the revision and amendment of IEEE 1547-2018. Additionally, the T&D Committee is now a new home for SCC22 on Power Quality. The former SCC22 is now called PQ Standards Coordinating Subcommittee 22 under the T&D Committee. The T&D Committee also contributes to revising the Technical Council O&P Manual Template and recommending a new platform and requirements superseding the defunct registration/membership database tools.

In September 2020, the T&D Committee worked with IEEE SA Open Source Committee (OSCom) to have the first project from the IEEE Power & Energy Society approved as an Official IEEE Open Source Project. The software project includes C++ and C# source code for reading and writing PQDIF files as specified in IEEE Std 1159.3-2019 Recommended Practice for Power Quality Data Interchange Format (PQDIF). In December 2021, the IEEE SA Open Community Manager approved the first release of the PQDIF libraries, allowing public download from the IEEE SA OPEN platform at <https://opensource.ieee.org/pqdif/pqdifnet/>.

As part of the Entity Proposal Management (EPM), the T&D Committee reviewed 21 proposals. Of these 21 proposals, the T&D Committee stated that 10 of them were within its scope. The T&D Committee was granted oversight for five (5) of these proposals and four of the proposals are still awaiting final decision from the EPM Committee.

The T&D Committee assigned a Standards Committee Representative (SCR) to eight of its entity standards development projects and developed guidelines on steps to take during the review of proposals from the Entity Proposal Management Committee. Also, the T&D Committee became a Co Standards Committee for the entity project IEEE P2963, which is a first-ever collaboration with the IEEE SA Corporate Advisory Group (CAG).

Despite its modest size, the T&D Committee manages and oversees a large swath of PES projects, specifically, 13% and 18% of all active PES standards and PARs, respectively. Below is a summary of standards that were and are under revision, waiting for approval, or approved overseen by each Subcommittee under the T&D Committee:

CAPACITOR SUBCOMMITTEE

- IEEE 824 - IEEE Standard for Series Capacitor Banks in Power Systems. The Ballot group was reformed, and PAR was reinitialized in 2021. A new Ballot group is being formed with the ballot to go out in February 2022. The PAR is to expire in December 2024.
- IEEE 1726 - IEEE Guide for the Functional Specification of Fixed-Series Capacitor Banks for Transmission System Applications. A new PAR is expected to begin the standard update and revision.
- IEEE 18 - Standard for Shunt Power Capacitors. The ballot invitation was sent and closed. It is the initial ballot stage. The PAR is to expire in December 2022.
- IEEE 1036 - IEEE Guide for the Application of Shunt Power Capacitors. The PAR has been approved. The expected date of submission of the draft to the IEEE SA for the initial ballot is Dec. 2023.
- IEEE Std 1531-2020, IEEE Guide for the Application and Specification of Harmonic Filters. The Guide was officially published on January 26, 2021

DISTRIBUTION SUBCOMMITTEE

The Distribution SC had one standard (1806) approved by IEEE-SA in 2021. It also had 3 additional ones approved by the subcommittee to go to ballot. There was also one Technical Report that was approved to go to the PES Resource Center. With the meetings being virtual in 2021, there was greater participation in the working group meetings, especially from utilities. Below is an update on each of our PARs:

- IEEE 1782 - Guide for Collecting, Categorizing and Utilization of Information Related to Electric Power Distribution Interruption Events. PAR Active and Ballot Pool is being formed.
- IEEE 1366 - Guide for Electric Power Distribution Reliability Indices. PAR Active. Ballot pool is formed and submitted draft for balloting.
- IEEE 1695 – Guide to Understanding, Diagnosing and Mitigating Stray Contact Voltage. PAR active. Working on draft.
- IEEE 1656 - Guide for Testing the Electrical, Mechanical, and Durability Performance of Wildlife Protective Devices on Overhead Power Distribution Systems Rated up to 38 kV. PAR active and has gone thru MEC review. Currently addressing MEC comments
- IEEE 1854 - Guide for Smart Distribution Applications PAR active. Working on draft with co-sponsoring committees
- IEEE 3102 - Standard for Conservation Voltage Reduction (CVR) Data Collection and Management Procedures PAR recently approved. Forming groups to start drafting the Standard.
- IEEE 1885 - Guide for Assessing, Measuring and Verifying Volt-Var Control Optimization on Distribution Systems. Initial ballot completed. Re-circulation is currently underway.
- IEEE 2748 - Recommended Practice for Fault Diagnosis and Protection in Smart Distribution System. Entity PAR Active
- IEEE 1806 - IEEE Guide for Reliability-Based Placement of Overhead and Underground Switching and Overcurrent Protection Equipment up to and Including 38 kV. Guide approved and published in 2021.
- IEEE 2845 - Draft Trial-Use Standard for Testing and Evaluating the Dielectric Performance of Celebratory Balloons in Contact with Overhead Power Distribution Lines Rated up to 38kV System Voltage. PAR is active and Task Force is currently drafting the standard.

ENGINEERING IN THE SAFETY, MAINTENANCE AND OPERATION OF LINES (ESMOL) SUBCOMMITTEE

ESMOL has had a productive 2021. Our flagship publication, IEEE 516 – Guide for Maintenance Methods on Energized Power Lines, has been updated and will be published this year. ESMOL will be presenting a panel session on wildfire mitigation at the 2022 PES General Meeting and will lead additional panel sessions at future meetings. Below is an update on each of our PARs:

- IEEE 516 - Guide for Maintenance Methods on Energized Power Lines. The updated Guide will be published by mid 2022.
- IEEE 957 - IEEE Guide for Cleaning Insulators. The PAR has been issued and work will be completed in 2022.
- IEEE 1048b - Guide for Protective Grounding of Power Lines, Amendment: Differentiating the Fabric Carrier Mat and the Rigid Carrier Mat. The revision to the guide is in progress and will be finished in 2022.
- IEEE 1067 - Guide for In-Service Use, Care, Maintenance, and Testing of Conductive Clothing for Use on Voltages Up to 765 kV ac and +/- 750 kV dc. The PAR has been issued and work continues on the revision with the expected date of submission of draft for initial ballot in January 2023.
- IEEE 1070 -Guide for the Design and Testing of Transmission Modular Restoration Structure Components. A PAR will be requested in 2022 in order to update the Guide.
- IEEE 1307 - Standard for Fall Protection for Utility Work. ESMOL is currently considering forming a group to start revisions for the next update cycle.
- IEEE 1882 - Guide for Establishing, Benchmarking and Maintaining a Work Program for Energized Transmission Lines. Ballot group was formed and will be ready for balloting early in 2022.
- ESMOL is currently drafting several papers including the following: Helicopter Work and Qualifications, Live Working Insulator Testing, and Transmission and Distribution Minimum Approach Distance.

HVDC & FACTS SUBCOMMITTEE

The Subcommittee is committed to promoting diversity, recognition of outstanding contributors, disseminating state of the art knowledge through panel sessions, Tutorials, webinars in PESGM and T&D Conferences; publishing PES Reports; in addition to developing new Standards. The Subcommittee comprises five Working Groups. The IEEE P2745 Unified Power Flow Controller (UPFC) Working Group also reports to this Subcommittee. Our significant accomplishments in 2021 are as follows:

- **Introducing Diversity**
The Subcommittee made special efforts to introduce diversity in its officers by electing a female Secretary. Robyn Koropatnick, Principal Stantec, Winnipeg, Canada, was elected in this position.
- **Award Nominations**
The Subcommittee strongly believes that several individuals, Working Groups are making outstanding contributions, which need to be recognized. The Subcommittee made special efforts to nominate worthy individuals for all the three T&D Committee awards - Best Paper, Outstanding Guide, Outstanding Report; and one PES level award.
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- Five active members of the HVDC and FACTS Subcommittee were elected as IEEE Fellows Class of 2022.
- State of the art Knowledge exchange/dissemination through Panel Sessions. The subcommittee proposed 7 panel sessions for IEEE PESGM 2021, all of which were approved. These panels sessions were:
 - Modelling and stability analysis of HVDC Transmission converters using analytical methods
 - Application of multi-scale modeling and simulation techniques to AC-DC power systems
 - Using replica converter models for HVDC system simulations
 - Impact of COVID 19 on HVDC operations
 - Grid forming capability for HVDC: definitions and applications
 - Recent HVDC and FACTS installations, refurbishments, and special techno-economic choices
 - Emerging Trends in Modelling and Control of HVDC and FACTS
- Furthermore, eight panel sessions have been proposed for the IEEE PESGM 2022, and additional panels for the IEEE PES T&D Conference. Interest in participation in Supersessions has also been expressed.
- The Subcommittee WG “Studies for Planning of HVDC” published a Technical Report “PES TR-86 Studies for Planning HVDC” in February 2021
- Two new Task Forces (TF) were started in 2021, one of which conducted a widely attended international webinar.
 - TF on Multi-scale Modeling and Simulations of HVDC and FACTS
 - TF on Frequency-domain modeling and dynamic analysis of HVDC and FACTS
- A proposal for Tutorial on VSC – HVDC has been submitted for the 2022 IEEE PES GM.
- The status of different Standards Development activities is as below:
 - IEEE 2745.2 - Guide for Technology of Unified Power Flow Controllers (UPFC)-Multilevel Converter Part 2: Terminology. The project was completed and published on September 1, 2021.
 - IEEE 2831 - Recommended Practice for Distributed Traveling Wave Fault Location Device for High Voltage Direct Current (HVDC) Transmission Lines: In progress
 - IEEE 2832 - Guide for Control and Protection System test of Hybrid Multi-terminal High Voltage Direct Current (HVDC) Systems: In progress
 - IEEE 2837 - Guide for Technical Requirements for Hybrid High-Voltage Direct-Current Transmission Protection and Control Equipment: In progress
 - IEEE 2892 - Recommended Practice for Medium Voltage (1.5 kV to 35 kV) Direct Current (DC) Transformers: In progress
- Plans for next year
 - The Subcommittee plans to initiate collaboration with “HVDC Subcommittee of IEEE Transformers Subcommittee”
 - Need guidance on selection of voting members in the Subcommittee for future elections of Subcommittee Officers.

OVERHEAD LINES SUBCOMMITTEE

In 2021, the OHL SC added a new standing working group, absorbing the Lightning Performance of Overhead Lines Working Group and their two standards from the T&D committee. We established two new entity working groups for new standards and opened PARs for one new individual standard and three standards revisions. All 10 of our standing working groups and their approximately 20 task forces met twice virtually to maintain standards progress and education. We gathered a team and prepared a proposal for a panel session that was accepted for the 2022 IEEE T&D Conference & Expo on the recent FERC Order 881 regarding transmission line ratings. Below is an update on each of our PARs:

- IEEE P2772 - Test Method for Energy Loss of Overhead Conductors
 - Published April 29, 2021
- IEEE P2828 - Guide for Measuring Method of Overhead Power Transmission Line Galloping Based on Monocular Video
 - Published June 29, 2021
- Projects in ballot resolution, plan to publish in 2022:
 - IEEE P1308 - Recommended Practice for Instrumentation: Specifications for Magnetic Flux Density and Electric Field Strength Meters - 10 Hz to 3 kHz
 - IEEE P2683 - Guide to Strength Loss in Tubular Steel Poles
 - IEEE P2781 - Standard for Wedge-shaped Groove Clamps
 - IEEE P2819 - Recommended Practice for Measuring Method of Electromagnetic Environment for the Corridor of High-voltage Overhead Power Transmission Lines in Parallel Mixed with Alternating Current and Direct Current
- Projects nearing completion that plan to go to ballot in 2022:
 - IEEE P563 - Guide on Conductor Self-Damping Measurements
 - IEEE P664 - Guide for Laboratory Measurement of the Power Dissipation Characteristics of Aeolian Vibration Dampers for Single Conductors
 - IEEE P751 - Guide for Wood Structures Used for Overhead Electric Transmission Lines
 - IEEE P987 - Guide for Application of Composite Insulators for Overhead Electric Power Lines
 - IEEE P1227 - Guide for the Measurement of DC Electric-Field Strength and Ion Related Quantities
 - IEEE P2797 - Guide for Forecast and Early Warning of Icing on Overhead Transmission Lines in Micro-topographic Areas
 - IEEE P2954 - Recommended Practice for Overhead Transmission Line Design
- Projects in progress with plans to complete in 2023:
 - IEEE P691 - Guide for Transmission Structure Foundation Design and Testing
 - IEEE P1218 - Trial-Use Guide for Maintenance of Wood Transmission and Distribution Line Structures
 - IEEE P1410 - Guide for Improving the Lightning Performance of Electric Power Overhead Distribution Lines
 - IEEE P2833 - Guide for Overhead Transmission Lines with Composite-Insulated-Crossarm Supports
 - IEEE PC135.100 - Standard for Line Hardware on Overhead Line Construction
 - IEEE PC135.90 - Standard for Pole Line Hardware for Overhead Line Construction

- Projects in progress with plans to complete in 2024 (or earlier):
 - IEEE P738 - Standard for Calculating the Current-Temperature Relationship of Bare Overhead Conductors
 - IEEE P1243 - Guide for Improving the Lightning Performance of Transmission Lines
 - IEEE P2942 - Guide for In-Service Application, Care, Maintenance, and Testing of Insulating Flexible Sling for Live Working
 - IEEE PC135.62 - Standard for Zinc-Coated Forged Anchor Shackles
 - IEEE PC135.80 - Standard for Fasteners for Overhead Line Construction

POWER QUALITY SUBCOMMITTEE

Officers of the PQ Subcommittee and the T&D Committee presented a conference paper describing a roadmap for power quality standards within IEEE PES, IEEE IAS, and IEEE SCC-21 at the International Conference on Electric Distribution (CIRED) in September 2021.

Many PQ Subcommittee members are members of the Steering Committee and/or Technical Committee of the IEEE International Conference on Harmonics and Quality of Power (ICHQP), which will be held as in-person conference in Naples, Italy in June 2022 with hybrid attendance/presentation options. Final drafts of conference papers were due on January 15. Below is an update on each of our PARs:

- IEEE 2938 - Guide for Economic Loss Evaluation of Sensitive Industrial Customers Caused by Voltage Sags. Expected date of draft submission for initial ballot is October 2022.
- IEEE P1159.3 - Recommended Practice for Power Quality Data Interchange Format (PQDIF). Expected date of draft submission for initial ballot is March 2024. In December 2021, the IEEE SA Open Community Manager approved the first release of the PQDIF libraries, allowing public download from the IEEE SA OPEN platform at <https://opensource.ieee.org/pqdif/pqdifnet/>.
- IEEE 1409 - Guide Technology Methods for Power Quality Improvement in Electric Power Systems. Expected date of draft submission for initial ballot is March 2024.
- IEEE 1453 - Standard for Measurement and Limits of Voltage Fluctuations and Associated Light Flicker on AC Power Systems. In balloting; resolving comments from first recirculation.
- IEEE 1564 - Guide for Voltage Sag Indices. Expected date of draft submission for initial ballot is February 2025.
- IEEE 519 - Standard for Harmonic Control in Electric Power Systems. In balloting; resolving comments from first recirculation.
- IEEE 519.1 - Guide for Applying Harmonic Limits on Power Systems
- IEEE 3139 - Guide for Power Quality Data Analytics. Expected date of draft submission for initial ballot is November 2024.
- IEEE 2844 - Recommended Practice for Limiting Voltage Imbalance in Electric Power Systems

TRANSMISSION SUBCOMMITTEE

Officers of the Transmission Subcommittee and the T&D Committee presented a conference paper introducing the new subcommittee and its working groups at the 2021 CIGRE Grid of the Future Conference in October 2021 in Providence, Rhode Island, USA. The Transmission Subcommittee organized and formed three new working groups:

- Reliability Impact of Inverter-based Resources
- Generation and Energy Storage Integration
- Voltage Optimization

2. Benefits to Industry and PES Members from the Committee Work:

The scope of the Transmission and Distribution Committee is the treatment of all matters related to the design, theoretical and experimental performance, installation, and service operation of parts of electric power systems which serve to transmit electric energy between the generating sources and substations or customer points of common coupling through AC or DC lines. In 2021, the Committee has provided benefit to industry by:

- Maintaining, updating, developing, and managing standards and guides pertaining to capacitors, distribution systems, lightning, HVDC/FACTS, power quality, and overhead lines, including their safety, operation, and maintenance.
- Disseminating technical know-how and recommended practices through panel sessions, paper publications, standards, and tutorials.
- Providing industry with a venue for participating in cutting-edge research and best practices dialogs, and participating in the standards-making process.

3. Benefits to Volunteer Participants from the Committee Work:

The IEEE PES Transmission & Distribution Committee provides benefits to its volunteer participants in the following ways:

- Offering participants an opportunity to work with acknowledged leaders in shaping the T&D industry and informing on T&D issues
- Affording industry leadership roles and mentoring for volunteer participants
- Providing a forum for networking with peers from the T&D industry

4. Recognition of Outstanding Performance:

The following members of the T&D Committee were elevated to IEEE Fellow and won the PES Society Level awards this past year:

IEEE Fellows for Class of 2022

- Satish Ranade - for contributions to integration of renewable and distributed energy resources into power systems (Department of Electrical and Computer Engineering, New Mexico State University)
- Maryam Saedifard - for contributions to modulation, control and protection of multilevel converters for high-voltage DC transmission (School of Electrical and Computer Engineering, Georgia Tech)
- Subhashish Bhattacharya - for contributions to power conversion systems and active power filters (North Carolina State University)
- Liangzhong Yao - for leadership in HVDC grid supporting integration of large wind farms
- Lingling Fan - for contributions to stability analysis and control of inverter-based resources (University of South Florida)
- Trevor Maguire - for leadership in the development of large scale real-time power systems simulators (RTDS Technologies)

PES Society Level Award

- Thomas McDermott- 2021 IEEE PES Award for Excellence in Power Distribution Engineering, (Department of Electrical and Computer Engineering, University of Pittsburgh)

- Rajiv K. Varma- 2021 IEEE PES Nari Hingorani FACTS Award (Department of Electrical and Computer Engineering, University of Western Ontario)
- Hans Bjorklund – 2021 IEEE PES Uno Lamm High Voltage Direct Current Award

5. Coordination with Other Entities (PES Committees, CIGRE, standards, etc.):

- PES Energy Internet Coordinating Committee
- PES Intelligent Grid and Emerging Technologies Coordinating Committee
- PES Marine Systems Coordinating Committee
- PES Renewable Systems Integration Coordinating Committee
- Liaisons with numerous IEC, CIRED and CIGRE committees
- Liaisons with numerous NESC and ANSI committees.
- Liaisons with US National Committee for CIRED via IEEE PES Distribution Subcommittee and IEEE PES Power Quality Subcommittee
- Liaison with NEMA via Capacitor Subcommittee
- Liaison with Power and Energy Magazine
- Liaison with Industry Technical Leadership Committee
- Category A Liaison between the PQ Standards Coordinating Subcommittee and IEC Subcommittee 77A

6. New Technologies of Interest to the Committee:

Technologies of interest include emerging and mature technologies enhancing the performance of transmission systems, overhead line maintenance, inspection, and safety, smart distribution devices, and power quality instrumentations, algorithms, and analytics.

7. Global Involvement

PES is looking to increase involvement with members from Regions 8, 9 and 10 (Africa, Europe, Middle East, Latin America, Asia and Pacific). Please provide the following information.

Total Number of committee members 1300-1400	Officers from regions 8,9 and 10 1	Subcommittee officers from regions 8, 9 and 10 0	Subcommittee members from regions 8,9, and 10 30
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8. Significant Plans for the Next Period:

The T&D Committee continues its work in overseeing, maintaining, and developing standards within its scope. The Committee is committed to supporting the Technical Council’s Entity Proposal Management process, serving as co-standard committee for IEEE 1547 revision and P2800.2, and China’s T&D Satellite Committee.

The T&D Committee has instructed its Subcommittee Chairs to proactively identify candidates for leadership positions, as well as speakers for activities organized by their respective organizations (e.g., panel sessions, etc.), in alignment with overall PES diversity objectives, and to help communicate these goals to our members. Goals include increasing participation of female engineers and members from Regions 8 to 10 in leadership positions and events sponsored by the T&D Committee. The T&D Committee will define and monitor metrics to evaluate progress in this area.

PES membership increased significantly in 2021 by about 8% YoY, despite the challenges and limitations imposed by the COVID-19 pandemic. Most of this increase happened in Region 10, the creation of the China Satellite T&D Committee has contributed to this growth. This model could be explored in other geographic regions (e.g., Region 9). The T&D Committee will explore this topic in more detail during this year.

PES is currently working on a mentorship program for Young Professionals, since this is the fastest growing membership segment. Members of the T&D Committee are already participating in this initiative. The T&D Committee will help identify potential additional mentors for this program.

Submitted by: Surya Santoso

Date: January 29, 2022