

**IEEE Power and Energy Society
Entity Annual Report**

2022

Entity: Power System Operation, Planning and Economics Committee (PSOPE)

Chair: Jianhui Wang

Vice Chair: François Bouffard

Secretary: Ramteen Sioshansi

TCPC: Zhaoyu Wang

Past Chairs: Fangxing Fran Li (2020-2021) and Luiz Barroso (2018-2019)

1. Background on PSOPE

PSOPE covers the philosophies, methodologies, practices and tools for operation, planning and economics of interconnected and insular power systems. It sponsors five technical subcommittees (SCs) and the Awards SC. They are listed as follows:

- Bulk Power System Operation (BPSO) SC;
- Bulk Power System Planning (BPSP) SC;
- Distribution System Operation and Planning (DSOP) SC;
- Power System Economics (PSE) SC;
- Technologies and Innovations (T&I) SC; and
- Awards SC

PSOPE is one of the largest committees in the IEEE PES.

As opposed to many of the PES Committees, PSOPE does not focus on *standards*. Each of its subcommittees produces two types of deliverables: (i) organization of panel sessions and tutorials at annual general meetings on relevant topics; (ii) production of reports, papers and webinars to be made available at the [PES Resource Center](#). PSOPE's [webpage](#) is updated and describes in detail the scope of each subcommittee.

PSOPE meets yearly, at the annual PES general meeting. Two meetings are carried out: an administrative meeting, which is restricted to PSOPE's officers, and a "main committee" meeting, which is open to all interested attendees.

2. Significant accomplishments

PSOPE’s accomplishments during 2022 have come on 4 sides: (i) PSOPE’s activities in the 2022 PES General Meeting (GM); (ii) materials posted to the PES Resource Center; (iii) actions to promote PSOPE; (iv) participation of PSOPE in the PES technical retreat; and (v) introduction of a new set of administrative procedures to improve its governance and to stimulate meritocracy and focus on non-PES-GM deliverables. These accomplishments are detailed below.

(i) PSOPE in 2022 PES GM

On the first item, PSOPE had a very successful technical program at 2022 PES GM. The numbers of papers submitted and included in the meeting program are summarized in the table below, which provides a comparison with the 2021 PES GM:

	2021	2022
Total papers submitted	159 (out of 695 for the full conference, 23%)	246 (out of 920 for the full conference, 27%)
Committee Conference paper quota	87	130
Transaction papers	20	40
Conference paper accepted	75 (out of 357 for the full conference, 21%)	117 (out of 473 for the full conference, 25%)
Conference paper rejected	84 (47% acceptance ratio)	129 (48% acceptance ratio)
Best paper	9	13
Paper forum session	26	41
Poster session	40	63

PSOPE sponsored 3 Tutorials:

1. Probabilistic Energy Forecasting: Methodologies, Implementations, and Applications (8 hours, 4 instructors)
2. Modeling and Planning of Distributed Energy Resources in Distribution System with Open-Source Software (4 hours, 4 instructors)
3. PV Hosting Capacity of Distribution Systems: From Accommodation to Integration using Customer and Grid-side Solutions (4 hours, 2 instructors)

PSOPE conducted 35 panel sessions in total, as listed below. All these panels were selected through a voting process and objective criteria.

The complete list of sessions is provided below (with comparisons to 2021 figures).

Bulk Power Systems Planning (BPSP) SC (6; 4 during 2021)

1. Transmission Planning for the Energy Transition
2. Future Reliability and Resilience Study of Electrical and Gas Systems under Extreme Weather Events

3. Current Resource Adequacy Techniques and Shortcomings: Mitigation Strategies and Need to Include Extreme Events in this Analysis
4. Design IBR Models for Fast Simulation and Stability Analysis
5. Incorporating Metrics, Methods, and Counter-Measures for the Resilient Operation of Transmission and Distribution Grids
6. Non-wire Alternatives Coordination toward Efficient Power System Planning

Bulk Power Systems Operations (BPSO) SC (9; 8 during 2021)

1. Cyber-Physical Power Electronics-Dominated Systems: Interdependency Modeling and Security
2. Supply of Grid Services from Grid-Edge Assets
3. Addressing Wind and Solar Uncertainty in Grid Operation
4. Reliable and Resilient Estimation Paradigm for Power Systems
5. Impact of IBRs and DERs on Bulk Power System Operation
6. Energy Equity and Justice: How to Distribute Energy System Benefits More Equitably
7. Situational awareness and decision support for power grid operators during extreme events
8. Converter-Interfaced Devices for Power System Restoration with high penetration Renewables
9. Current Security Analysis Techniques and Shortcomings: Mitigation Strategies and Need for Probabilistic Analysis

Distribution System Operation & Planning (DSOP) SC (5; 5 during 2021)

1. AI and Asset Management: dumbing down or smartening up?
2. Enabling distribution DERs to participate in wholesale markets through operational envelope computation and optimal power-flow
3. Electrification in indigenous communities in the Americas
4. Synchrophasor Data Analytics for Power System Monitoring, Operation and Planning
5. Grid Planning and Operation Technologies, Effectiveness and Costs for High DER Integration and Adoption

Power System Economics (PSE) SC (9; 9 during 2021)

1. Distribution System Operator – challenges and opportunities
2. Energy Storage Resource Participation in Electricity Markets
3. Utilisation of probabilistic energy forecasts in power system operation
4. Virtual Battery to Aggregate Diversified Storage-like Flexibility
5. Adapting wholesale electricity market to the decarbonization
6. Stacking revenue streams with energy storage
7. Market Suspension and Emergency Pricing: What happens when the markets stop working?
8. Behind The Meter Distributed Energy Resources Modeling for Market Participation
9. Managing Uncertainty in Grid Operations

Technologies & Innovation (T&I) SC (6; 7 during 2021)

1. New Technologies for Data Analytics in Wide Area Monitoring Protective and Control Systems
2. Designing HVDC Transmission Overlay Networks for a High-Renewables Future
3. Machine Learning Techniques for Power System Decision-making
4. Resilience Metrics under Natural Disaster: Best Practices and Mitigation Methods
5. Frontier of Power System Optimization and Simulation
6. New Approaches to Risk Management for Power Systems

All these panel sessions were very well attended, and received very positive feedback and compliments from attendees.

PSOPE panel chairs provide a short summary of the proceedings of their panel session. The primary reason for this is to create a record of the panel session to (1) offer people who could not attend a digest of the panel deliberations, (2) provide a record and evidence of Subcommittee, Working Group, and Task Force activities and relevance, and (3) provide feedback to the conference organizers. The reports will be curated and made available to the community on the PSOPE website.

During 2022 PES GM, PSOPE conducted the following 45 Committee, Subcommittee, Working Group, and Task Force meetings.

Main committee (2)

1. PSOPE Committee AdCom
2. PSOPE Main Committee Meeting

Subcommittees (5)

3. Bulk Power System Operations Subcommittee
4. Bulk Power System Planning Subcommittee
5. Distribution System Operation & Planning Subcommittee
6. Power System Economics Subcommittee
7. Technologies & Innovation Subcommittee

Working Groups (17)

8. Working Group on Asset Management
9. Working Group on Business Models for Energy Storage
10. Working Group on Demand Response
11. Working Group on Distribution Management System
12. Working Group on Energy Forecasting and Analytics
13. Working Group on Integrated Energy System/Multi-energy Network Modeling Planning
14. Working Group on Integrated Resource Planning
15. Working Group on Modern & Future Distribution System Planning
16. Working Group on Natural Disaster Mitigation Methods and Operation Technology
17. Working Group on Power System Restoration
18. Working Group on Power System Static and Dynamic State Estimation
19. Working Group on Sustainable Energy Systems for Developing Communities

20. Working Group on Test Systems for Economic Analysis
21. Working Group on Transmission System Planning
22. Working Group on Assessment of Power System Flexibility
23. Working Group on Energy Internet
24. Working Group on Machine Learning for Power Systems

Task Forces (14)

25. Task Force on Solving Large Scale Optimization Problem in Electricity Market and Power System Applications
26. Task Force on Advanced Methods for Computational Intensive Power System Planning Applications
27. Task Force on Benchmarks for Validation of Emerging Power System Algorithms
28. Task Force on Cyber-Physical Interdependence for Power System Operation and Control
29. Task Force on Design BPS-Connected Inverter-Based Resource (IBR) Models for Grid Planning
30. Task Force on Dynamic Parameter and State Estimation
31. Task Force on Future TSO-DSO Interaction: Challenges, Business Cases and Solutions
32. Task Force on Internet of Things for Power Systems
33. Task Force on Operational Tools for Enabling Resiliency
34. Task Force on Risk Mitigation for Bulk Power System Operation (newly established in 2021)
35. Task Force on Standard Test Cases for Power System State Estimation
36. Task Force on Synchrophasor Applications in Power System Operation and Control
37. Task Force on Water-Power Nexus
38. Task Force on HVDC Overlay Studies
39. Task Force on Faster than Real Time Computing
40. Task Force on Control and Operation of DER
41. Task Force on Energy Use
42. Task Force on Micro-grids Pre-feasibility Toolkit
43. Task Force on Electrification on Native Lands
44. Task Force on Redefining Demand Response in the DER Era
45. Task Force on Hydrogen Integration into Power Systems

These committee meetings were very well attended, and increased significantly international and industry participation.

Thank you to all our session organizers and chairs for putting together a very successful technical program for PSOPE. Special thanks go to the sub-committee vice-chairs for their hard work and enthusiasm with the running of the review process!

(ii) Non-PES GM deliverables

To bring value to the industry, and also advertise committee activities, PSOPE has been encouraging members on developing deliverables that go beyond panel sessions at the PES GM, such as toolkits, webinars, reports, papers.

- **Technical Report by Solving Large Scale Optimization Problems in Electricity Market and Power System Applications:** Yonghong Chen, Feng Pan, Feng Qiu, Alinson S Xavier, Tongxin Zheng, Muhammad Marwali, Bernard Knueven, Yongpei Guan, Peter Luh, Lei Wu, Bing Yan, Mikhail Bragin, Haiwang Zhong, Anthony Giacomoni, Ross Baldick, Boris Gisin, Qun Gu, Russ Philbrick, Fran Li, Security Constrained Unit Commitment for Electricity Market: Modeling, Solution Methodology and Future Challenges, IEEE PES Technical Report, TR96, 2022.
- **Technical Report by Enabling Paradigms for High-performance Computing in Wide Area Monitoring Protective and Control Systems:** Alfredo Vaccaro, Marjan Popov, Vladimir Terzija, Loi Lei Lai, Adam J. Collin, Guido Coletta, Srđan Skok, Aristides Kiprakis, Fabrizio De Caro, Enabling Computing Techniques for Wide-Area Power System Applications PES-TR94, 2022.
- **2022 IEEE PES Grid Resilience Workshop:** The 2022 IEEE PES Grid Resilience Workshop brought together experts from academia, government, industry, and national labs to discuss and present the most recent research and development and real-world implementation activities to enhance the cyber-physical resilience of power grids. The workshop discussed the need for intersectoral collaboration and highlights the need for a diverse workforce to support communities in enhancing their grid resilience. The 2022 IEEE PES Grid Resilience Workshop was organized by the University of Utah, sponsored by the U.S. Department of Energy, and co-sponsored by the IEEE PES Utah Chapter, the IEEE PES Bulk Power Systems Operation Subcommittee, and the IEEE PES Task Force on Operational Tools for Enabling Resiliency. PES Resource center: https://resourcecenter.ieee-pes.org/conferences/grid-resilience/PES_CVS_GRW22_BNDL.html
More information: <https://usmart.ece.utah.edu/2022-grid-resilience-workshop/>
- **IEEE PES Webinar:** Security Constrained Unit Commitment for Electricity Market: Modeling, Solution Methodology and Future Challenges, Nov. 2022.
- **Toolkit – in progress:** A beta version of Excel-based tool for microgrid pre-feasibility toolkit has been discussed by the WG on Sustainable Energy Systems for Developing Communities (SESDC).
- **The WG on Modern & Future Distribution System Planning** is working on a technical report entitled “The Future of Distribution System Planning: Managing Uncertainty and Increasing Flexibility”.
- **The TF on Microgrids Pre-feasibility Toolkit** submitted a white paper to IEEE Access entitled “A new Toolbox for Energy Planning for Isolated Microgrids”
- **The TF on Electrification on Native Lands** delivered a webinar on Electrification issues in Native Lands.

(iii) Actions to promote PSOPE

PSOPE has also continued the actions to promote the committee:

- A committee flyer, following a similar look and feel to all of the committee flyers, with consistent messaging and branding. The flyer is printed and distributed during the Monday evening Poster Session at the PES General Meeting.
- Committee Palm Card: printed as a 2-sided piece and distributed at the PES General Meeting at registration, at the PES booth, during the poster session and other places where appropriate. The idea is that potential new members can see at a glance what our committee is about and know who to contact for more information if they are interested.
- Development of a number of IEEE websites of WGs and TFs to allow easier search for current and past focused activities.
- PSOPE (Fran Li) contributed to one of the PES monthly trending technologies collections on machine learning.

(iv) Technical retreat

PSOPE participated in the IEEE-PES Technical Council November 2022 Strategic Planning Retreat in Orlando, Florida.

(v) Improving Governance Procedures

PSOPE's officers have been working jointly to stimulate all of its working groups (WG) and task forces (TF) to produce deliverables that go beyond panel sessions in PES GM. WG and TF should not be simple placeholders for panel sessions (slots) for the GM. Those not producing a concrete deliverable plan will be disbanded. In addition, in an attempt to have better outreach and information sharing, WG and TF officers were encouraged to create their own IEEE-style websites.

PES and Technical Council initiated China Satellite in early 2020 with its China Chapter. There has been confusion about how the China Chapters Council Satellite Committees work with the PES main technical committees. It has been decided after the Technical Council Retreat in November 2022 that China Chapters Council Satellite Committees will now all report to the Localized Technical Activities Committees (ITAC). The details remain to be seen in 2023.

IEEE Memberplanet will replace 123Signup and go live in 2023 as the default tool for IEEE membership management.

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

By presenting and discussing the operational, planning and economics aspects of power system technologies and operations, PSOPE activities serve as a bridge between academic research and practical applications, help guide research and development activities. In addition, PSOPE shares information about

industry experiences and key challenges to provide feedback to the industry regarding the effectiveness of new techniques and methodologies.

The panel sessions, TF/WG/SC/Committee meetings also serve as live forums for academic researchers and industrial practitioners to listen to each other, provide networking opportunities among international participants to establish communication and collaboration.

4. Benefits to Volunteer Participants from the Committee Work:

With more committee activities, such as delivering webinars, preparing reports and papers, organizing and chairing panel sessions, paper forum, transaction paper sessions, as well as creating and organizing Task Forces, Working Groups, PSOPE has attracted more volunteers. Through their contacts with other participants, volunteer participants in PSOPE work gain knowledge and experiences they can apply in their jobs, which can benefit their careers and organizations.

5. Recognition of Outstanding Performance:

PSOPE has an Award Subcommittee in full function. The following awards and IEEE PES Technical Committee Certificates of Appreciation were presented to the following committee members during the 2022 PES GM:

- *PSOPE Prize Paper Award*

Wei Wang, Nanpeng Yu, Yuanqi Gao and Jie Shi

Department of Electrical and Computer Engineering, University of California, Riverside, CA, USA

W. Wang, N. Yu, Y. Gao, and J. Shi, " Safe Off-Policy Deep Reinforcement Learning Algorithm for Volt-VAR Control in Power Distribution Systems," *IEEE Transactions on Smart Grid*, vol. 11, no. 4, pp. 3008-3018, July 2020, doi: 10.1109/TSG.2019.2962625 .

- *PSOPE COMMITTEE DISTINGUISHED SERVICE AWARD (2022)*

- Fran Li

for outstanding contributions and service as chair of PSOPE

- *Outgoing Subcommittee Chair Recognition (2021)*

- Pengwei Du - Outstanding service to Bulk Power System Planning Subcommittee

- Andre Luiz Diniz - Outstanding service to Power Systems Economics Subcommittee

- Kwok W. Cheung – Outstanding service to Technology & Innovations Subcommittee

- Anil Pahwa – Outstanding service to Awards Subcommittee

- *Technical Committee Outstanding Technical Report*

Power System Dynamic State and Parameter Estimation-Transition to Power Electronics-Dominated Clean Energy Systems, Technical Report, PES-TR88, July, 2021.

Junbo Zhao, Antonio Gomez-Exposito, Lamine Mili, Marcos Netto, Samson Shenglong, Shaobu Wang, Ali Abur, Shahrokh Akhlaghi, Vladimir Terzija, Innocent Kamwa, Bikash Pal, Tianshu Bi, Zhenyu Huang, Abhinav Kumar Singh, Abdul Saleem Mir, Yu Liu, M. A. M. Ariff, M. Glavic, T. Van Cutsem, A. P. Sakis Meliopoulos, Junjian Qi, Alireza Rouhani

- *IEEE Fellows (Class of 2022)*
 - Dr. Anurag Srivastava (Vice Chair of the BPSO Subcommittee)

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

PSOPE coordinates with several other PES committees, notably AMPS, PDSP and T&D, SBLC, and RSICC. At the committee level, we have appointed three new representatives or coordinators: Representative to Standard Coordinating: Dr. Hamid Zareipour, University of Calgary; Liaison to Energy Internet Coordinating Committee (EICC), Dr. Pengwei Du, ERCOT; and Liaison to Renewable Systems Integration Coordinating Committee (RSICC): Dr. Xin Fang, Mississippi State University.

7. New Technologies of Interest to the Committee:

The major new technologies of interest to PSOPE include the impact on power system operation, planning and economics of significant penetration of stochastic generation resources, the operational issues and opportunities related to smart-grid technologies, DER-enabled Advanced Distribution Management System (ADMS) and Distributed Energy Resources.

8. Significant Plans for the Next Period:

In 2022 PSOPE had the following rotation of committee and subcommittee levels:

Committee level: The main committee completed the officer rotation.

- Outgoing Chair: Dr. Fangxing (Fran) Li, University of Tennessee, fli6@utk.edu
New Chair: Dr. Jianhui Wang, Southern Methodist University, jianhui@smu.edu
New Vice Chair: Dr. François Bouffard, McGill University, francois.bouffard@mcgill.ca
New Secretary/TCPC: Dr. Ramtean Sioshansi, Carnegie Mellon University, rsioshan@andrew.cmu.edu

Subcommittee level:

- BPSP:
Chair: Dr. Amy Li, Southern California Edison, amy.li@sce.com
Vice Chair: Rui Bo, Missouri University of Science and Technology, rbo@mst.edu
Secretary: Xin Fang, Mississippi State University, xfang@ece.msstate.edu

- DSOP:
Outgoing Chair: Dr. Murali Baggu, NREL, Murali.M.Baggu@ieee.org
New Chair: Dr. Nanpeng Yu, University of California, Riverside, nyu@ece.ucr.edu
Vice Chair: Dr. Zhaoyu Wang, ISU, wzy@iastate.edu
Co-Vice Chair/TCPC: Dr. Lina He, UIC, lhe@uic.edu
Secretary: Dr. Yuzhang Lin, UMass Lowell, yuzhang_lin@uml.edu
Co-Secretary: Dr. Xiangqi Zhu, NREL, Xiangqi.Zhu@nrel.gov
- PSE:
Outgoing Chair : Dr. Ramteen Sioshansi, Carnegie Mellon University, rsioshan@andrew.cmu.edu
New Chair: Dr. Erik Ela, Electric Power Research Institute, eela@epri.com
New Vice Chair: Dr. Tongxin Zheng, ISO-NE, tzheng@iso-ne.com
New Secretary: Dr. Rui Bo, Missouri University of Science and Technology, trbo@mst.edu
- T & I:
Outgoing Chair: Dr. Xiaochuan Luo, ISO-NE, xluo@iso-ne.com
New Chair: Dr. Yonghong Chen, MISO, ychen@misoenergy.org
New Vice-Chair: Dr. Alfredo Vaccaro, University of Sannio, vaccaro@unisannio.it
New Secretary: Song Zhang, Amazon, songaws@amazon.com
- BPSO:
Outgoing Chair: Dr. Masood Parvania, University of Utah, masood.parvania@utah.edu
New Chair: Dr. Anurag Srivastava, Washington State University, anurag.k.srivastava@wsu.edu
New Vice Chair: Dr. Clayton Barrows, National Renewable Energy Laboratory, clayton.barrows@nrel.gov
New Secretary: Dr. Mohammad Khodayar, Southern Methodist University, mkhodayar@mail.smu.edu
- Awards:
Outgoing Chair: Dr. Anil Pahwa, pahwa@ksu.edu
New Chair: Dr. Zhaoyu Wang, Iowa State University, wzy@iastate.edu
New Vice Chair: Dr. Fei Ding, National Renewable Energy Laboratory, Fei.Ding@nrel.gov
New Secretary: Dr. Sarina Adhikari, Mitsubishi Electric Power Products, Inc, Sarina.Adhikari@meppi.com

PSOPE will sponsor and organize technical activities related to 2022 GM, and other IEEE PES conferences, such as T&D, further attract more international and industry participation, as well as participation from young engineers and women engineers. The focus will be to strengthen PES awareness, including developing webinars to introduce and promote the committee, and presenting related technical subjects. The governance actions aiming at more concrete deliverables, recognition of meritocracy of the SC/WG/TF will continue and it is hoped that PSOPE will be able to deliver high-quality research and industrial contributions for its members.

9. 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). PSOPE has been continuously expanding its membership basis.

Our state of the art of membership is below (order of magnitude).

Total Number of committee members	Officers from regions 8, 9 and 10	Subcommittee officers from regions 8, 9 and 10	Subcommittee members from regions 8, 9, and 10
1000	1	3	250

The BPSO has been involved in the creation of the Global Power Systems Transformation Consortium (G-PST). The G-PST presents a promising initiative that could generate increased engagement from power system operators in under-represented regions. PSOPE and BPSO have ongoing and active engagement with the G-PST and will continue to pursue opportunities to expand membership and provide networking opportunities to under-represented regions.

10. Problems and Concerns:

One of the concerns for PSOPE is to focus the outreach and activities of its SC on deliverables that go beyond just the organization of panel sessions. We continue to request all SC, WG and TF chairs to produce more reports, webinars and papers that complement the organization of sessions for the PES GM, in an effort to add more value to the PSOPE members.

PSOPE has also been increasing industry participation through practical and trending topics in its activities, but reaching a fair balance between industry and academic participation in the committee has been a continuous challenge. The effort will continue in 2023, to bring more value to the industry, and is part of a major action by the Technical Council to strengthen PES awareness.

As we move back to in-person meetings, we hope to recruit more industry members through conferences, etc.

11. Message from the Chair:

I started my term at the beginning of 2022. After three years of an unprecedented pandemic, it is great to see our IEEE colleagues at in-person meetings and conferences. Under the outstanding leadership of the past chair (Prof. Fran Li), PSOPE continued its broad range of activities without any major interruptions and grew even further during the pandemic. In 2022, we have kept adding new members, task forces and working groups. Our panel sessions at conferences were consistently well attended and received. We have also been active in contributing to PES-level initiatives such as roadmap development, diversity & inclusion, collaboration with other IEEE sister societies, etc. Looking forward, my top priority in 2023 is to increase industry engagement through reforms in panel session organization procedures and paper review processes.

Submitted by: Jianhui Wang, Southern Methodist University

Date: 1/31/2023