IEEE Power and Energy Society
Entity Annual Report

2023

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

Chair: François Bouffard
Vice Chair: Ramteen Sioshansi
Secretary: Zhaoyu Wang
TCPC: Zhaoyu Wang
Past Chairs: Jianhui Wang, (2021-2023) 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. It is also one of the broadest in terms of scope.

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 primary accomplishments in 2023 are fivefold: (i) PSOPE's activities in the 2023 PES General Meeting (GM); (ii) materials posted to the PES Resource Center; (iii) actions to promote PSOPE across IEEE PES and beyond with a special focus on industry practitionners; and (iv) continued efforts aimed at increasing the productivity of subcommittees, task forces and working groups. These accomplishments are detailed below.

(i) PSOPE in 2023 PES GM

On the first item, PSOPE had a very successful technical program at 2023 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 2022 PES GM:

	2022	**2023**
Total papers submitted	246 (out of 920 for the full conference, 27%)	295 (out of 1082 for the full conference, 27%)
Committee Conference paper quota	130	148
Transaction papers	40	43
Conference paper accepted	117 (out of 473 for the full conference, 25%)	146 (out of 560 for the full conference, 26%)
Conference paper rejected	129 (48% acceptance ratio)	149 (49% acceptance ratio)
Best paper	13	14
Paper forum session	41	43
Poster session	63	89

PSOPE sponsored 3 tutorials:

1. Voltage Optimization: Methodologies, Implementations, and Industry Practices (4 hours)
2. Probabilistic Energy Forecasting: Methodologies, Implementations, and Applications (8 hours)
3. Application of CIM-based Methodologies to Utility Big Data Management and Real-time Operation Model Update (4 hours)

PSOPE conducted 23 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 2022 figures).

Bulk Power Systems Planning (BPSP) SC (5; 6 during 2022)

1. Lessons learned in Integrated Resource Planning for Rapid Decarbonization of Power Grids
2. Innovative Transmission Planning Approaches for an Uncertain and Volatile Grid
3. Transmission Planning Challenges in High IBR-Penetrated Grids and Modeling Practices
4. Emerging Computational Methods for Planning with Transient Stability Constraints
5. Advanced Energy Management in Renewable-Dominated and Low-Inertia Power Systems

Bulk Power Systems Operations (BPSO) SC (6; 9 during 2022)

1. Hybrid Hydropower Systems for Providing Grid Flexibility Services
2. Pathways towards an equitable and just grid transitions
3. Quantum Computing for Power Systems Operations: A Pragmatic View
4. Next Generation of Dynamic State and Parameter Estimation Tools for IBRs
5. Mitigating Gas Uncertainty in Power Grid Operation
6. Trustworthy Machine Learning for Power System Planning and Operation

Distribution System Operation & Planning (DSOP) SC (3; 5 during 2022)

1. Advanced DMS: Enabling Interoperability for Advanced Distribution system Applications
2. Learning for Power Distribution System Optimization, Control, and Protection
3. Utility Scale Demonstrations: Lessons learned from US-India Joint UIASSIST Project

Power System Economics (PSE) SC (4; 9 during 2022)

1. Is Marginal Cost Pricing still the ideal electricity market design?
2. Energy storage market participation: market design challenges and regulatory barriers
3. DSO market – Demand Response and flexibility based new economic models
4. Hydrogen toward multiple energy delivery pathways and grid services

Technologies & Innovation (T&I) SC (6; 6 during 2022)

1. Emerging Internet of Things (IoT) Applications in Power Systems
2. Online computing technologies for power system control centers
3. Synchrophasors-based Grid Enhancing Technologies
4. Hydrogen power system integration: opportunities and challenges
5. Synchro-Waveforms: Principles, Data-Analytics, and Applications
6. State-of-the-art Review on TSO-DSO Coordination Models and Solution Techniques

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. Presentations from the panel sessions are also made available through some of the subcommittee websites when possible.

During the 2023 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 (15)

8. BPSO - Working Group on Power System Static and Dynamic State Estimation
9. BPSO - Working Group on Power System Restoration
10. BPSP - Working Group on Integrated Resource Planning
11. BPSP - Working Group on Transmission System Planning
12. BPSP - Working Group on Assessment of Power System Flexibility
13. BPSP - Working Group on Energy Internet
14. DSOP - Working Group on Sustainable Energy Systems for Developing Communities
15. DSOP - Working Group on Modern & Future Distribution System Planning
16. DSOP - Working Group on Asset Management
17. PSE - Working Group on Business Models for Energy Storage
18. PSE - Working Group on Demand Response
19. PSE - Working Group on Test Systems for Economic Analysis
20. PSE - Working Group on Energy Forecasting and Analytics
21. TI - Working Group on Machine Learning for Power Systems
22. TI - Working Group on Natural Disaster Mitigation Methods and Operation Technology

Task Forces (23)

23. BPSO - Task Force on Dynamic Parameter Visibility: Identifiability, Algorithms and Uncertainty Quantification
24. BPSO - Task Force on Advanced Intelligence Techniques for Resilient Power System Restoration
25. BPSO - Task Force on Impacts of IBR and DER Integration on Operations
26. BPSO - Task Force on BPS-Connected Inverter-Based Resource (IBR) Operation Challenges
27. BPSO - Task Force on Standard Test Cases for Power System State Estimation

28. BPSO - Task Force on Operational Tools for Enabling Resiliency
29. BPSO - Task Force on Cyber-Physical Interdependence for Power System Operation and Control
30. BPSO - Task Force on Risk Mitigation for Bulk Power System Operation
31. BPSO - Task Force on Equity and Energy Justice in Power Systems
32. BPSO - Task Force on Water-Power Nexus
33. BPSP - Task Force on Advanced Methods for Computational Intensive Power System Planning Applications
34. BPSP - Task Force on Design BPS-Connected Inverter-Based Resource (IBR) Models for Grid Planning
35. DSOP - Task Force on Micro-grids Pre-feasibility Toolkit
36. DSOP - Task Force on Electrification Issues on Native Lands
37. DSOP - Task Force on Control and Operation of Distributed Energy Resources
38. DSOP - Task Force on Future TSO-DSO Interaction: Challenges, Business Cases and Solutions
39. PSE - Task Force on Redefining Demand Response in the DER Era
40. TI - Task Force on Hydrogen Integration into Power Systems
41. TI - Task Force on Reinforcement Learning for Power System Dynamic Controls
42. TI - Task Force on Machine-learning based Power System Synthetic Data Generation, Validation, and Sharing
43. TI - Task Force on Benchmarks for Validation of Emerging Power System Algorithms
44. TI - Task Force on Solving Large Scale Optimization Problem in Electricity Market and Power System Applications
45. TI - Task Force on Digital Twin of Large-Scale Power Systems for Adoption of Emerging Technologies

We note that in 2023 the following working groups and task forces were established under the Technologies and Innovation (IT) SC:

1. Working Group on Machine Learning for Power Systems
2. Working Group on Cloud Computing
3. Task Force on Enabling technologies for Dynamic Thermal Rating of Power Components
4. Task Force on Digital Twin of Large-Scale Power Systems
5. Task Force on Hydrogen Integration into Power Systems

These new WGs/TFs will be having their first official meetings at the 2024 GM.

These committee, working group, and task force meetings were often well attended, and increased significantly international and industry participation. Each of the subcommittees and the working groups and task forces within them have promoted diversity and inclusion in participation, and have also promoted a healthy mix of industry and academic participation.

The committee officers thank all 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.

- **Cyber-Physical Interdependence for Power System Operation and Control:** Amir Abiri Jahromi, Ankur Srivastava, Astha Chawla, Bang Nguyen, Bendong Tan, Bu Siqi, Chendan Li, Charalambos Konstantinou, Fei Teng, Goli Preetham, Ioannis Zografopoulos, Juan Ospina, Junbo Zhao, Linh Vu, Luo Xu, Mohammad Asim Aftab, Mohammadreza Arani, Ömer Sen, Panayiotis Moutis, Pudong Ge, Qinglai Guo, Subham Sahoo, Subhash Lakshminarayana, Suman Rath, Tuyen Vu, Wentao Zhu, Zhaoyuan Wang. **PES-TR119, 2023**

- **State Estimation for Integrated Energy Systems: Motivations, Advances, and Challenges:** Ankur Srivastava, Antonio Gomez Exposito, Anamitra Pal, Ankush Sharma, Arturo Bretas, Dragan Ćetenović, Huaizhi Wang,Innocent Kamwa, Liang Chen, Lamine Mili, Manyun Huang, Qi Zhao, Saikat Chakrabarti, Sheng Chen, Tingting Zhang, Vladimir Terzija,Victor Levi, Wen Zhang, Weiye Zheng, Yanbo Chen, Yang Li, Yuzhang Lin, **PES-TR118, 2023**

- **Integrated Water and Power Systems: Current State and Research Roadmap:** Rebecca O'Neil, Konstantinos Oikonomou, Masood Parvania, Vincent Tidwell, Ali T. Al-Awami, Mathaios Panteli, Steven Conrad, Ted Brekken, Erfan Goharian, Nathalie Voisin, **PES-TR114, 2023**

- The Working Group on Business Models for Energy storage delivered a technical paper published through the IEEE Transactions on Power Systems titled "Energy Storage Modeling: State-of-the-Art and Future Research". The paper won the 2023 PES best paper award.

- The Energy Forecasting Analytics Working Group conducted a tutorial at the 2023 General Meeting.

(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 officers manned the poster during the poster session to promote its activities and answer questions from attendees.
- 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.
- Upon recommendation from the Technical Council, PSOPE has adopted a policy to attract industry-driven panel sessions for the 2024 General Meeting. To that effect, the committee has instigated a industry track that requires industry-only panelists and organizers. The objective is to increase the value of committee participation by industry members.

(iv) 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.

All subcommittees have been asked to carry out a strategic review of their structure and terms of reference with the aim of streamlining their activities and avoid redundancies. This is currently underway in the Power System Economics Subcommittee. This subcommittee will serve as a template for the other SCs.

IEEE Memberplanet was supposed to replace 123Signup and go live in 2023 as the default tool for IEEE membership management. This is a pending item at the time of writing this report.

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 2023 PES GM:

- *IEEE PES and PSOPE Technical Committee Prize Paper Award*
  Ramteen Sioshansi, Paul Denholm, Juan Arteaga, Sarah Awara, Shubhrajit Bhattacharjee, Audun Botterud, Wesley Cole, Andres Cortés, Anderson de Queiroz, Joseph DeCarolis, Zhenhuan Ding, Nicholas DiOrio, Yury Dvorkin, Udi Helman, Jeremiah X. Johnson, Ioannis Konstantelos, Trieu Mai, Hrvoje Pandzic, Daniel Sodano, Gord Stephen, Alva Svoboda, Hamidreza Zareipour, and Ziang Zhang

  Energy-Storage Modeling: State-of-the-Art and Future Research Directions, *IEEE Trans. Power Syst.*, vol. 37, no. 2, pp. 860-875, Mar. 2022.

- *IEEE PES Technical Committee Distinguished Individual Service Award*
  Masood Parvania

- *Outgoing Subcommittee Chair Recognition*
  - Masood Parvania - Outstanding service to Bulk Power System Operations Subcommittee
  - Murali Baggu Outstanding service to Distribution System Planning and Operations Subcommittee
  - Masood Parvania Outstanding service to Bulk Power System Operations Subcommittee
  - Ramteen Sioshansi - Outstanding service to Power Systems Economics Subcommittee
  - Xiaochuan Luo, Outstanding service to Technologies and Innovations Subcommittee

- *Technical Committee Outstanding Technical Report*
  Security Constrained Unit Commitment for Electricity Market: Modeling, Solution Methodology and Future Challenges

  Yonghong Chen (Chair), Feng Pan (Vice-Chair), Feng Qiu (Secretary), Tongxin Zheng, Muhammad Marwali, Haiwang Zhong, Bernard Knueven, Yongpei Guan, Peter Luh, Bing Yan, Mikhail Bragin, Lei Wu, Ross Baldick, Anthony Giacomoni, Boris Gisin, Qun Gu, Alinson S Xavier, Russ Philbrick, Jie Wan, Fran Li, Qiaozhu Zhai

- *IEEE Fellows (Class of 2023)*
  - Dr. Yonghong Chen
  - Dr. Paul Denholm

- Dr. Alejandro Dominguez-Garcia
- Dr. Pierluigi Mancarella
- Dr. Javad Lavaei

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 2023, PSOPE had the following committee roster and rotations at the subcommittee levels:

Committee level:

Chair: Dr. Jianhui Wang, Southern Methodist University, jianhui@smu.edu
Vice Chair: Dr. François Bouffard, McGill University, francois.bouffard@mcgill.ca
Secretary/TCPC: Dr. Ramteen Sioshansi, Carnegie Mellon University, rsioshan@andrew.cmu.edu
New TCPC: Dr. Zhaoyu Wang, Iowa State University, wzy@iastate.edu

Subcommittee level:

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

- DSOP:
  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:
  Chair: Dr. Erik Ela, Electric Power Research Institute, eela@epri.com
  Vice Chair: Dr. Tongxin Zheng, ISO-NE, tzheng@iso-ne.com
  Secretary: Dr. Rui Bo, Missouri University of Science and Technology, trbo@mst.edu

  The scope of the subcommittee, and to move toward working groups that are long-lasting and support organization of themes, whereas task forces are short-term and focused on a deliverable for a particular issue that it has deemed the IEEE PES to be best to help solve. The working group and task reorganization will commence at the 2024 General Meeting.

- T & I:
  Chair: Dr. Yonghong Chen, National Renewable Energy Laboratory, yonghong.chen@nrel.gov
  Vice-Chair: Dr. Alfredo Vaccaro, University of Sannio, vaccaro@unisannio.it
  Secretary: Song Zhang, Amazon, songaws@amazon.com

- BPSO:
  Chair: Dr. Anurag Srivastava, West Virginia University, anurag.srivastava@mail.wvu.edu
  Vice Chair: Dr. Clayton Barrows, National Renewable Energy Laboratory, clayton.barrows@nrel.gov
  Secretary: Dr. Mohammad Khodayar, Southern Methodist University, mkhodayar@mail.smu.edu

- Awards:
  Chair: Dr. Zhaoyu Wang, Iowa State University, wzy@iastate.edu
  Vice Chair: Dr. Fei Ding, National Renewable Energy Laboratory, Fei.Ding@nrel.gov
  Secretary: Dr. Sarina Adhikari, Mitsubishi Electric Power Products, Inc, Sarina.Adhikari@meppi.com

PSOPE will sponsor and organize technical activities related to 2024 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	0	1	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 2024, 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.

Lastly, as we prepare for the 2024 GM, we are witnessing increasing strain among members to be able to review GM papers in a timely and adequate manner. We have heard criticism from reviewers and authors alike. As a result, PSOPE will be working with relevant stakeholders to identify and possibly pilot novel approaches to paper revision in high-submission volume technical committees like ours (e.g., AMPS).

11. Message from the Chair:

I am starting my term at the beginning of 2024. Under the skillful leadership of Prof. Jianhui Wang, PSOPE has emerged stronger than before the global pandemic. Our membership is strong and growing as evidenced by the large participation in the General Meeting and the growing number of highly-relevant working groups and task forces. 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 three priorities in 2024 are:

1. To continue with increasing industry engagement through reforms in panel session organization procedures and paper review processes;
2. Foster strategic reviews of terms of reference and subcommittee structures aiming at increasing technical activities' impact and reach;

3. Explore innovative approaches to improve the quality of paper reviews for the PES GM and to better engage authors in helping with the review of GM papers.

Submitted by: François Bouffard, McGill University **Date: 2/26/2024**