

IEEE Power and Energy Society
Entity Annual Report

2021

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

Chair: Fangxing Fran Li

Vice Chair: Jianhui Wang

Secretary: François Bouffard

TCPC: Ramteen Sioshansi

Past Chairs: Luiz Barroso (2018-2019) and Hong Chen (2016-2017)

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 subcommittee (SC) 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 the largest committee 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 [PES Resource Center](#). PSOPE's [webpage](#) is updated and describes in details 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.

PSOPE produces two types of technical deliverables: those related to annual PES general meetings (e.g., panel sessions, super sessions, and awards) and those which are non-related to annual PES general meetings (e.g., reports, webinars, and papers).

2. Significant accomplishments

PSOPE’s accomplishments during 2021 have come on 4 sides: (i) PSOPE’s activities in 2021 PES General Meeting (GM); (ii) materials to 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 2021 PES GM

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

	2020	2021
Total papers submitted	295 (out of 1282 for the full conference, 23%)	159 (out of 695 for the full conference, 23%)
Committee Conference paper quota	183	87
Transaction papers	47	20
Conference paper accepted	135 (out of 661 for the full conference, 20%)	75 (out of 357 for the full conference, 21%)
Conference paper rejected	160 (46% acceptance ratio)	84 (47% acceptance ratio)
Best paper	16	9
Paper forum session	44	26
Poster session	75	40

PSOPE sponsored 1 Tutorial:

1. Planning Beyond Reliability - Economics Driven Transmission Planning Under Market Environment: Fundamentals, Applications, Benchmark and Challenges (4 hours, 4 speakers)

PSOPE conducted 33 panel sessions in total, as listed below. All these panels were selected through a voting process and an objective criterion.

The complete list of sessions is provided below (with comparisons to 2020 figures).

Bulk Power Systems Planning (BPSP) SC (4; 4 during 2020)

1. Transmission Planning for Offshore Wind
2. Modeling and Optimization for Integrated Energy System and Multi Energy Networks
3. Integrated Resource Planning in California

4. Advances in Computational Methods and Technologies for Power System Planning

Bulk Power Systems Operations (BPSO) SC (8; 7 during 2020)

1. Advancing Dynamic State Estimation for the Next-Generation EMS: Structure, Algorithms and Experiences
2. Operational Tools for Enabling Grid Resiliency: Needs, Challenges and Solutions
3. FERC 2222: Industry Impact and Technology Solutions to Leverage the Benefits
4. Cyber-Physical Interdependency Modeling, Vulnerability Analysis and Mitigation for Power System Operation and Controls
5. Flexibility Requirements and Procurements: Resource Evolution and Emerging Market Products
6. Hydropower flexibility for large-scale integration of renewable energy sources
7. Advancement in Machine Learning Aided Power System State Estimation
8. Practices of Risk Mitigation in Bulk Power System Operation

Distribution System Operation & Planning (DSOP) SC (5; 5 during 2020)

1. Asset Management Reliability & Resilience Decisions in Practice
2. Planning for Uncertainty on the Distribution System
3. Energy management, control, protection, and operation of Networked Microgrids
4. DER-enabled and Sensor-enabled Active Distribution System Management
5. Novel Information System and Data Communication Developments to Support Enhanced TSO-DSO Interaction

Power System Economics (PSE) SC (9; 8 during 2020)

1. Distributed Energy Resources Integration in the Wholesale Electricity Market
2. Price formation under evolving resource mix
3. Energy Storage Resource Participation in Electricity Markets
4. Towards a Risk-Driven Electricity Market Paradigm
5. FERC Order 745: Ten Years On Revisiting the net benefits test for demand response
6. Risk Management for Clean Power Grids
7. Incentives for Integration of Innovative Technologies
8. Reliability and Economic Efficiency Benefits of Probabilistic Renewable Forecasts
9. Eugene Litvinov Tribute

Technologies & Innovation (T&I) SC (7; 6 during 2020)

1. Advanced Fast Computing Methods for Uncertain Power System Operation
2. Developing Optimization Algorithms and Computational Techniques for Future Resource Integration
3. Deep Learning for Power System Operation and Planning

4. Enabling Technologies for Data Analytics in Wide Area Monitoring Protective and Control Systems
5. AI-enabled data analytics and control for power system IoT framework
6. Managing Delivery Risk in Power Systems
7. Natural Disaster Mitigation: Best Practices

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 2021 PES GM, PSOPE conducted the following 35 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 (14)

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

Task Forces (14)

22. Task Force on Solving Large Scale Optimization Problem in Electricity Market and Power System Applications
23. Task Force on Advanced Future Bulk Power Systems with Massive Distributed Resources
24. Task Force on Advanced Methods for Computational Intensive Power System Planning Applications
25. Task Force on Benchmarks for Validation of Emerging Power System Algorithms
26. Task Force on Cyber-Physical Interdependence for Power System Operation and Control
27. Task Force on Design BPS-Connected Inverter-Based Resource (IBR) Models for Grid Planning (newly established in 2021)
28. Task Force on Dynamic Parameter and State Estimation
29. Task Force on Future TSO-DSO Interaction: Challenges, Business Cases and Solutions
30. Task Force on Internet of Things for Power Systems
31. Task Force on Machine Learning for Power Systems
32. Task Force on Operational Tools for Enabling Resiliency
33. Task Force on Risk Mitigation for Bulk Power System Operation (newly established in 2021)
34. Task Force on Standard Test Cases for Power System State Estimation
35. Task Force on Synchrophasor Applications in Power System Operation and Control
36. Task Force on Water-Power Nexus

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

Thank you to all our session organizers and chairs in 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 values 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, report, papers.

- **Workshop by T&I Task Force on Machine Learning for Power Systems.** An IEEE Workshop on Machine Learning for Power Systems was held virtually on November 17th, 2021, organized by the TF on Machine Learning for Power Systems. Presenters include Fran Li (organizer), Jin Zhao, Junbo Zhao, Pengwei Du, Spyros Chatzivasileiadis, C.Y. Chung, Anurag K. Srivastava. The video and slides are available in the PES Resource center and can be accessed at:
https://resourcecenter.ieee-pes.org/technical-committees/videos/PES_PSOPE_WEB_111721.html
https://resourcecenter.ieee-pes.org/technical-committees/slides/PES_PSOPE_SLD_111721_SLD.html

- **Data Library by Task Force Benchmarks for Validation of Emerging Power System Algorithms.** The Power Grid Library for Benchmarking AC Optimal Power Flow Algorithms, January 2021, is available at: <https://arxiv.org/abs/1908.02788>
- **Technical Report by BPSO TF on Power System Dynamic State and Parameter Estimation:** J. Zhao, A. K. Singh, A. Mir, A. Taha, A. Abur, A. Gomez-Exposito, A. P. S. Meliopoulos, B. Pal, I. Kamwa, J. Qi, L. Mili, M. A. M. Ariff, M. Netto, M. Glavic, S. Yu, S. Wang, T. Bi, T. V. Cutsem, V. Terzija, Y. Liu, Z. Huang, Power System Dynamic State and Parameter Estimation-Transition to Power Electronics-Dominated Clean Energy Systems, IEEE PES Technical Report, TR88, 2021.
- **WG/TF Technical Paper by BPSO TF on Power System Dynamic State and Parameter Estimation:** Y. Liu, A. K. Singh, J. B. Zhao (TF Chair), A. P. Meliopoulos, B. Pal, M. A. M. Ariff, T. Van Cutsem, M. Glavic, Z. Huang, I. Kamwa, L. Mili, A. Saleem Mir, A. Taha, V. Terzija, S. Yu, "Dynamic State Estimation for Power System Control and Protection," IEEE Trans. Power Systems, vol. 36, no. 6, pp. 5909-5921, 2021. (IEEE TF on Power System Dynamic State and Parameter Estimation).
- **WG/TF Technical Paper by PSE WG on Business Models for Energy Storage:** R. Sioshansi et al., "Energy-Storage Modeling: State-of-the-Art and Future Research Directions," *IEEE Transactions on Power Systems*, In-Press, doi: 10.1109/TPWRS.2021.3104768.
- **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).
- **Nine new websites for Task Forces and Working Groups** have been developed and maintained over the 2020-2021 timeframe:
 - WG on Power System Static and Dynamic State Estimation developed their website at: <https://cmte.ieee.org/pes-pssdse/>
 - TF on Advanced Methods for Computationally Intensive Power System Planning Applications (CIPSPA): <https://site.ieee.org/pes-cipspa/>
 - TF on Sustainable Energy Systems for Developing Communities: <https://site.ieee.org/pes-sesdc/>
 - WG on Business Models for Energy Storage: <https://site.ieee.org/pes-psope/subcommittees/power-system-economics-subcommittee/working-group-on-business-models-for-energy-storage/>
 - WG on Demand Response: <https://site.ieee.org/pes-psope/subcommittees/power-system-economics-subcommittee/working-group-on-demand-response/>
 - WG on Test Systems for Economic Analysis: <https://site.ieee.org/pes-psope/subcommittees/power-system-economics-subcommittee/working-group-on-test-systems-for-economic-analysis/>
 - WG on Energy Forecasting and Analytics: <https://site.ieee.org/pes-psope/subcommittees/power-system-economics-subcommittee/working-group-on-energy-forecasting-and-analytics/>

- TF on Machine Learning for Power Systems: <https://cmte.ieee.org/pes-mlps/>
- TF on Internet of Things for Power Systems: <https://cmte.ieee.org/pes-iotps/>

(iii) Actions to promote PSOPE

PSOPE has also continued the actions to promote the committee:

- Preparation of a flyer, following a similar look and feel to all of the committee flyers, with consistent messaging and branding. The flyer was 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 (also see Section 2.(ii)).

(iv) Technical retreat

PSOPE participated in the IEEE-PES Technical Council January 2021 Strategic Planning Retreat and the November 2021 Strategic Planning retreat, both held virtually.

(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 session (slots) for the GM. Those not producing a concrete deliverable plan will be disbanded. WG and TF chairs were requested to prepare a balance of its recent deliverables and of its planned ones, so that the committee can have a deliverable plan. With the implementation of the platform 123Signup by the Technical Council, it is expected the committee will have a common platform to share information and track its deliverables.

PSOPE has developed the 123Signup system for the committee rosters and meeting attendance per instruction from the PES Tech Council.

In addition, in an attempt to have a better outreach and information sharing, WG and TF officers were encouraged to create their own IEEE-style websites. During 2020-2021, nine websites for WGs and TFs were created and linked to the respective SC webpages.

PES and Technical Council initiated China Satellite in early 2020 with China Chapter. This was discussed at the IEEE PES GM2020 and the November 2020 retreat (virtual). Because there were many questions and confusions raised by a number of technical committees, the PES Technical Council provided five

guidelines for integrating China Satellite. Within PSOPE, there was no activity of integrating China Satellite into PSOPE during 2020 and 2021, most likely due to the unprecedented and unexpected pandemic.

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 of 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 2021 PES GM (Online):

- *PSOPE Prize Paper Award*

Bowen Hua¹, Ross Baldick¹ and Jianhui Wang²

¹ University of Texas at Austin, Austin, TX, USA

² Department of Electrical Engineering, Southern Methodist University, Dallas, TX, USA

B. Hua, R. Baldick and J. Wang, "Representing Operational Flexibility in Generation Expansion Planning Through Convex Relaxation of Unit Commitment," *IEEE Transactions on Power Systems*, vol. 33, no. 2, pp. 2272-2281, March 2018, doi: 10.1109/TPWRS.2017.2735026. .

- *PSOPE COMMITTEE DISTINGUISHED SERVICE AWARD (in 2021)*
 - Mike Henderson
for outstanding contributions and service as chair of Transmission Planning Working Group

- *Outgoing Subcommittee Chair Recognition*
 - 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
- *IEEE Fellows (Class of 2022)*
 - Dr. Anurag Srivastava (Vice Chair of 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 WSPCC. At the committee level, we have appointed three new representative 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 (REICC): Dr. Xin Fang, NREL.

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 ADMS and Distributed Energy

8. Significant Plans for the Next Period:

In 2021 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. Ramteem Sioshansi, Ohio State University, sioshansi.1@osu.edu

Subcommittee level:

- **BPSP:**
Outgoing Chair: Pengwei Du, ERCOT, pengwei.du@ercot.com
New Chair: Dr. Amy Li, Southern California Edison, amy.li@sce.com
New Vice Chair: Rui Bo, Missouri University of Science and Technology, rbo@mst.edu
New Secretary: Xin Fang, NREL, xin.fang@NREL.gov

- PSE:
 Outgoing Chair: Dr. Andre Luiz Diniz, CEPEL, diniz@cepel.br
 New Chair: Dr. Ramteen Sioshansi, The Ohio State University, sioshansi.1@osu.edu
 New Vice Chair: Dr. Erik Ela, Electric Power Research Institute, eela@epri.com
 New Secretary: Dr. Tongxin Zheng, ISO-NE, tzheng@iso-ne.com
- T & I:
 Outgoing Chair: Dr. Kwok W. Cheung, GE Digital, kcheung@ieee.org
 New Chair: Dr. Xiaochuan Luo, ISO-NE, xluo@iso-ne.com
 New Vice-Chair: Dr. Yonghong Chen, MISO, ychen@misoenergy.org
 New Secretary: Dr. Alfredo Vaccaro, University of Sannio, vaccaro@unisannio.it
- 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, EnerNeX, sadhikari@enernex.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 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	2	3	250

The BPSO has been involved in 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. Message from the Chair:

My term of service as the PSOPE chair from January 2020 to December 2021 was (unfortunately) well aligned with the COVID-19 pandemic. During this difficult time, everything was transferred to online events, and nearly all active PSOPE participants and volunteers did not have the chance to meet and greet each other in person at PES General Meetings or other events. Everyone missed the in-person face-to-face communications. Although we had many difficulties, I was so fortunate to have many volunteers from PSOPE and PES who made significant service contributions to our committee and PES in general. In particular, I would like to thank all PSOPE officers, especially Vice Chair Jianhui Wang, Secretary François Bouffard and TCPC Ramteen Sioshansi for excellent team work during pandemic. Also, PSOPE's past chairs, Luiz Barroso (2018-2019) and Hong Chen (2016-2017), have also provided a superb guidance for our work. I would also like to thank all PSOPE subcommittees, WG, and TF officers and volunteers for your wonderful and unselfish contributions.

Despite the pandemic, PSOPE still had many new exciting achievements in 2020 and 2021 such as 30+ panel sessions at each of the two virtual annual meetings GM20 and GM21, many successful virtual committee/SC/WG/TF administrative meetings, several WG/TF reports/papers, and a virtual workshop.

Starting 1/1/2022, Professor Jianhui Wang from Southern Methodist University will be the new PSOPE Chair. I am highly confident that under his leadership, PSOPE will perform exceedingly well and provide outstanding service to our PES community.

Submitted by: Fran Li, The University of Tennessee - Knoxville

Date: 12/31/2021