# IEEE PES Task Force on IBR SSO – Events, Studies, Detection, and Solutions: Meeting Minutes

**When: July 24th, 2024, 10 am – 12 pm, US Pacific Time**

**Where: Room 432, Seattle Convention Center – Summit, WA, IEEE PESGM 24**

**1. Introduction of Attendees**

| | Name | Affiliation |
|---|---|---|
| 1 | Zhaongda Chu | Imperial College London |
| 2 | Hossein Mohsenzadeh | UCR |
| 3 | Farrokh Aminifar | Quanta Tech |
| 4 | Adedasola Ademola | Dominion Energy |
| 5 | Jaime De LaRee | Dominion Energy |
| 6 | Ani Gole | Univ. of Minatoba |
| 7 | Xi Lin | Powertech Labs |
| 8 | Ali Yazdanpanah | ERCOT |
| 9 | Xu Bingyin | Shandong University Of Technology |
| 10 | Yanfeng Gong | SEL |
| 11 | Sarika Solanki | Went Varginia University |
| 12 | Mukesh Das | Electranix Corp. |
| 13 | Phani Marthi | Oak Ridge National Lab |
| 14 | Chan Khu Shin | Inha Univ. |
| 15 | Miao Fan | Fire Dimensions Energy |
| 16 | Mj Yang | Hitachi Energy |
| 17 | Ramij Raha Hossain | PNNL |
| 18 | Yan Xn | NTU |
| 19 | David Sanchez | Unicamp |
| 20 | Jimmy Zhang | AESO |
| 21 | Evan Neel | Lancinm |
| 22 | Erangelos Farantatos | EPRI |
| 23 | Kaustav Chartterjee | PNNL |
| 24 | Zhangyu Wang | RWE |
| 25 | Rabi Kar | Univ. of South Florida |
| 26 | Ibrahim Alsaleh | Unicv. Of Hail |
| 27 | Sudip Manandhar | Southern Company |
| 28 | Yasser Mohammed | Univ. Of Alberta |
| 29 | Ben Marshall | National HVDC center |
| 30 | Siqi Bu | Hongkong Polytechnic Univ. |
| 31 | Jihun Kim | Dong-Seoul Univ. |
| 32 | James Marshall | Black and Veatch |
| 33 | Chetan Mishra | Dominion Energy |
| 34 | Anuradha Dissanoyah | Electranix Corp. |
| 35 | Garth Irwin | Electranix Corp. |
| 36 | Mark Mangaliag | Electranix Corp. |
| 37 | Shuan Dong | NREL |
| 38 | Srayashi Konar | GE |
| 39 | Kaustav Deep | Univ. of Minatoba |

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|---|---|---|
| 40 | Sayak Mukharjee | PNNL |
| 41 | Amro Quedan | ERCOT |
| 42 | Yonggang Zhang | Univ Kassel |
| 43 | Jim Follum | PNNL |
| 44 | Ke Chen | Siemens Energy |
| 45 | Dave Beaudoin | Hydro-Quebec |
| 46 | Julia Hariharan | ERCOT |
| 47 | Jihun Kook | Yonsei Univ. |
| 48 | Panagiotis Papadopoulos | Univ . Manchester |
| 49 | Sijia Geng | John Hopkins Univ. |
| 50 | Qiuhua Huang | Colorado school of mines |
| 51 | Nitish Sharma | Baywa R. E. |
| 52 | Ahda Pavani | Fed. Univ. of ABC, Brazil |
| 53 | David Raschka | ABB |
| 54 | Jenny Zhou | PSC consulting |
| 55 | Jiutao Wang | Imperial College London |
| 56 | Luke Doseik | Union College |
| 57 | Arunprasanth Sakthi | RTDS Tech. |
| 58 | Yohan Jang | Hanyang Univ. |
| 59 | Flavio Fernandez | Digsilent GmBH |
| 60 | Joe Chow | RPI |
| 61 | Lin Zhu | EPRI |
| 62 | Tapan Manna | Burns & McDonnell |
| 63 | Kamal Garg | SEL |
| 64 | Hamzeh Devarikia | ERCOT |
| 65 | Sungyun Choi | Korea Univ. |
| 66 | Shruti Rao | GE Vernova Cunsulting |
| 67 | Niraj Dahal | MISO |
| 68 | Zhixin Miao | Univ. of South Florida |
| 69 | Janusz Bialek | Imperial College London |
| 70 | Marco Chiaramello | RTE Franco |
| 71 | Patrick Panciatici | RTE Franco |
| 72 | EMANUEL BERNABEU | PJM Interconnection |
| 73 | Di Wu | North Dakota State Univ. |
| 74 | Yue Zhu | Imperial College London |
| 75 | Anuradha Kariyawasam | Electranix Corp. |
| 76 | Xavier Guillaud | LZEP |
| 77 | Yunzhi Cheng | ERCOT |
| 78 | Xiongfei Wang | KTH Royal Institute of Technology |
| 79 | Sudipta Dutta | EPRI |

2. **Task Force Meeting**

   a. **Agenda**

   The face-to-face Task Force meeting was moderated by Dr. Yunzhi Cheng, the chair. Starting with reviewing the major activities accomplished in the past year since IEEE PESGM 2023, including the 2024 Spring Technical Workshop at ESIG and published paper entitled "Real-World Sub-synchronous Oscillation Events in Power Grids With High Penetrations of Inverter-Based Resources" authored by several of Task Force members won the Technical Committee Prize Paper Award 2024 from IEEE PES Analytic Methods for Power Systems (AMPS) and Outstanding Paper Award from IEEE Transactions on Power Systems (TPWRS). Followed by introduction of the invited speakers to the Task Force meeting. There are 5 presentations planned in this year's meeting to focus on the IBR SSO events, studies, detection and solutions from different aspects. At the end, Dr. Cheng concluded the meeting with future plans of activities and upcoming meetings.

   b. **Presentation**

      i. Dr. Yunzhi Cheng, ERCOT, "Recent SSO events in ERCOT"
      SSO events observed by ERCOT recently are presented by Dr. Cheng with details. The presentation includes several types of IBR related sub-synchronous oscillations, including a newly investigated transformer saturation related oscillation. During Q&A, it was mentioned that ERCOT is evaluating if transformer saturation should be included in the planning stage to prevent such oscillation issue.

      ii. Prof. Xiongfei Wang, KTH Royal Institute of Technology, "Low-frequency resonances with GFM converters"
      Prof. Wang gave a presentation on their recent research on low-frequency resonances with grid-forming converters from power electronics perspectives, including demonstrating the implemented testbed structures, observed IBR SSO events, and proposed. Different oscillation phenomena and root causes were compared and discussed. A question received from PJM professional is about the adoption of adaptive control, which may bypass the tuning of converter control parameter. However, it was discussed and agreed that the best approach is to tune IBR based on the real-world operating conditions with regular technical updates.

      iii. Dr. Sudipta Dutta, EPRI, "Sub-synchronous interactions - tools and new considerations"
      A presentation on the detections and solutions of sub-synchronous interactions among inverter-based FACT devices, resources and loads is made by Dr. Dutta from EPRI. The toolset presented was an impedance-scan-based tool in positive sequence and EMT environment with a short circuit analysis tool.

      iv. Prof. Yue Zhu, Imperial College London, "Impedance-based method for SSO root cause tracing and early warning"

An open-source SSO analysis tool implemented in MATLAB environment was developed and introduced by Prof. Zhu in the Task Force meeting. It was developed in frequency-domain and validated with EMT simulation test benches to assist system operators with SSO analysis, where IBRs are usually black-box.

v. Prof. Di Wu, NDSU, "Oscillation analysis for power systems dominated by grid-forming converters"
In the last presentation, Prof. Wu demonstrated the research work accomplished based on Kauai Island SSO event reported in 2023. The event is different and new because of the stiff grid condition with GFM converters. It was introduced in three major parts: (1) system implementation and EMT simulation results that show oscillations against each other; (2) mode shape analysis that identified the root cause; (3) participation factor analysis.

c. **Future Plan**
At the end of Task Force meeting, Dr. Cheng concluded the meeting and indicated further collaborations for more IBR SSO related investigation and discussions, especially related to GFM IBRs. The Task Force meeting will continue in the coming year PESGM with additional activities to be scheduled.

3. **Adjourn – The meeting adjourned at 5 pm.**
4. **Meeting pictures**
   a. **During Prof. Wang's presentation.**



**b. During Dr. Dutta's presentation.**

