

IEEE HVDC AND FACTS SUBCOMMITTEE



<https://site.ieee.org/pes-hvdcfacts/>

MEETING MINUTES: 2023 IEEE PESGM

MEETING LOCATION AND TIME

Meeting date/time: Wednesday, July 19 from 13.30-16.30 Eastern

Location: Bayhill 19 room at the Hyatt Regency in Orlando, Florida

1. WELCOME AND ANNOUNCEMENTS (DIRK VAN HERTEM)

Done.

2. INTRODUCTIONS (ALL)

Done.

3. APPROVAL OF THE 2023 MEETING AGENDA (ALL)

Done.

4. APPROVAL OF 2022 MEETING MINUTES (ALL)

The website has been updated to include the statements of WGs

5. ELECTION SECRETARY (RAJIV)

Rajiv proposed that Sahar Azad be elected as the secretary for two years from January 2023

Nominee: Sahar Azad

Approved.

6. AWARDS AND RECOGNITION (RAJIV VARMA)

i) Uno Lamm Award: To Rambabu Adapa, for advancing DC system representation in transient stability and electromagnetic transient programs, forwarding research in the conversion of AC lines to DC lines, and advancing HVDC-related education globally.

ii) Nari Hingorani Award Committee

a. Custom Power Award: To Deepakraj Divan, for contributions to distributed and decentralized dynamic control of transmission and distribution systems

b. FACTS Award (someone should be nominated for 2024)

iii) IEEE PES T&D Committee Awards: No awards

iv) IEEE PES Technical Committee Prize Paper Award

1) Yue Xia, Ying Chen, Yankan Song, and Kai Strunz

Paper: "Multi-Scale Modeling and Simulation of DFIG-Based Wind Energy Conversion System"

Journal: IEEE Transactions on Energy Conversion Volume & Page Numbers: 560 - 572 Publication

Date (Month & Year): March 2020

v) New IEEE Fellows associated with HVDC and FACTS Subcommittee

Christian Rehtanz– for contributions to wide area monitoring, protection and control systems for electrical power grids,

Xiongfei Wang – for contributions to power-electronic-based power systems

Marta Molinas – for contributions to the modelling and stability of power electronics

vi) Future Nominations from Subcommittee for PES Awards

7. WORKING GROUP REPORTS

I. **WG 15.05.02 DYNAMIC PERFORMANCE AND MODELING OF HVDC SYSTEMS AND POWER ELECTRONICS FOR TRANSMISSION SYSTEMS (KAI STRUNZ)**

The WG met on Monday, July 17, 2023, at 1400 hrs in room Bayhill 31, Hyatt Regency Orlando, Orlando, Florida. It was chaired by Kai Strunz and Ani Gole with Ram Adapa as WG secretary. There were 71 attendees.

- WG Paper under Development
 - The paper on the proposed IEEE 12 bus system for FACTS and HVDC studies is now complete and is undergoing final review.
 - A New user case of a possible scenario with 100% IBR was added to the previous document and presented by K. Strunz.
 - R. Verma proposed the addition of an additional potential item to Table 4- the list of typical studies that could be conducted Stability and Resilience” one more possible study case about sub synchronous resonance (SSR) and sub synchronous control interactions and reactions studies.
- Task Force 1: Task Force on Multiscale Modeling of HVDC and Power Electronics in Grids
 - K. Strunz reported on the TF activities on behalf of Yue Xia and Ying Chen.
 - Multi-scale modelling techniques, are proposed for power system transient simulation to reduce simulation time, but still accurately represent the transients.
 - The test system represents the West-East China regional interconnected system. It has 12609 nodes, including 248 synchronous generators, 1864 transmission lines, 778 transformers, 571 loads and three renewable energy stations. Studies were presented to show the efficacy of multi-scale modelling.
- Task Force 2: Task Force on Stability Analysis of HVDC Systems
 - Heng Wu presented the latest progress and findings of his task force on frequency-domain modelling and dynamic analysis of HVDC & FACTS
 - A thorough literature review of state of art on impedance-based stability analysis has been conducted
 - Several Webinars have been conducted.
- Technical Presentations:

- Jiseong Kang presented a simplified EMT model of the Jeju Island System which is connected through two LCC HVDC lines to the mainland of Korea, with a third MMC-VSC HVDC currently under development. The model is implemented in PSCAD as well as in HyperSim.
- The model can be used to demonstrate many phenomena such as interaction between the DC infeeds, oscillation damping in the Jeju network, addition of renewable generation in Jeju, voltage support, etc.
- The model could be a basis for a future IEEE test system.
- Future Business
 - Ram Adapa proposed to initiate a new task force on the topic of offshore wind combined with HVDC. Kai Strunz agreed to contribute to the task force. The lead of the task force remains open.
 - The progress on the website of the working group needs to be followed up in the future.

II. WG 15.05.08 HVDC ECONOMICS AND OPERATING STRATEGIES (EUGEN STARSCHICH)

The presentation slides are attached to the report.

III. WG 15.05.14 EDUCATION ON HVDC AND FACTS (BRIAN JOHNSON)

The Working Group on HVDC and FACTS education met and had 15 people in attendance. We discussed two panels from the T&D Conference and Exposition. One with a subject along the lines of HVDC & FACTS Fundamentals, and the other along the lines of Enhancing Power System Resilience Using HVDC and FACTS. Committee members talked about establishing a liaison with Substations WG I11 – Education and coordinating with them for panels or other activities.

IV. WG 15.05.18 STUDIES FOR PLANNING OF HVDC AND WG 15.05.19 PRACTICAL TECHNOLOGIES FOR VSC HVDC SYSTEMS (ROBERT RENNER) AND WG 15.05.19 PRACTICAL TECHNOLOGIES FOR VSC HVDC SYSTEMS (DIRK VAN HERTEM)

The Working Group offered a tutorial on “Studies for planning and execution of HVDC projects” with 25 participants. The Working Group hosted a panel on “Network code requirements for HVDC systems in high RES environments”. The Working Group discussed the standards approval process and teaching HVDC & FACTS related topics.

V. P2745– UNIFIED POWER FLOW CONTROLLER WORKING GROUP (YI YANG)

The presentation slides are attached to the report.

8. REPORT ON HVDC AND FACTS WITHIN THE SUBSTATIONS COMMITTEE SC10 (DAVID LANGNER)

- Working Groups:
 - WG11 – Power Electronic Equipment (Chair: Jeff McElray)

IEEE 1585-2002 – IEEE Guide for the Functional Specification of Medium Voltage (1-35kV) Electronic Series Devices for Compensation of Voltage Fluctuations (Inactive – Reserved)

IEEE 1623-2020 – IEEE Guide for the Functional Specification of Medium Voltage (1kV-35kV) Electronic Shunt Devices for Dynamic Voltage Compensation (Will be allowed to go inactive)

IEEE PC37.431.40 – Standard for Functional Specification of Medium (1kV to 69kV) Voltage Series and Shunt Electronic Devices for Dynamic Voltage Compensation (PAR approved 2021, PAR will expire 12/2025, monthly meetings)

- WGI2 – Thyristor Controlled Series Capacitors (TCSC) (Chair: Humayun Tariq)

IEEE P1534-2009 – Recommended Practice for Specifying Thyristor Controlled Series Capacitors (Published 2009, Revision underway, actual PAR will expire 12/2024, 1st week of May voted to go for ballot)

- WGI3 – Dynamic Reactive Power Compensators (DRPC) (Chair: Julie Lacroix)

IEEE PC37.431.10 – Functional Specification of Dynamic Reactive Power Compensators

- A working group tasked with an effort to combine both IEEE 1052 and IEEE 1031, and get it published until 2028 when IEEE 1052 will expire
- PAR submittal until the end of 2023

- WGI4 – Static Var Compensators (SVC) (Chair: Mikael Halonen)

IEEE 1031-2011 – IEEE Guide for the Functional Specification of Transmission Static Var Compensators (Inactive – Reserved)

IEEE 1303-2011 – IEEE Guide for Static Var Compensator Field Tests (Inactive-Reserved)

Task Force 4 – Dynamic Step Response Guidelines for Static Shunt Compensators

- WGI5 – Voltage Sourced Converters (VSC) (Chair: Ben Mehraban)

IEEE 1052-2018 – IEEE Guide for the Functional Specification of Transmission Static Synchronous Compensator (STATCOM) Systems (Active Standard)

- WGI7 – Reliability of HVDC Converters (Chair: Andrew Bailey)

IEEE 1240-2011 – IEEE Guide for the Evaluation of the Reliability of HVDC Converter Stations (Published 2001, Reaffirmed 2012, actual PAR will expire 12/2023, monthly meetings, PAR extension until 12/2024 requested)

- WGI8 – Power Electronic Building Block (Chair: Herbert Ginn)

IEEE 1676-2010 – IEEE Guide for Control Architecture for High Power Electronics (1 MW and Greater) Used in Electric Power Transmission and Distribution Systems (Inactive – Reserved)

- WGI9 – Modern Protection System for Static Shunt Compensation (Joint with PSRC K12) (Chair: Mikael Halonen)

IEEE PC37.431.20 – IEEE Guide for Protecting Transmission Static Shunt Compensators (PAR approved 2019, PAR will expire 12/2023, 1st week of May voted to go for ballot)

- WGI10 – High Voltage Direct Current (HVDC) (Chair: John Chahwan)

IEEE 1378-2022 – IEEE Guide for Commissioning Line-Commutated Converter (LCC) High-Voltage Direct-Current (HVDC) Converter Stations and Associated Transmission Systems (Published 1996, Reaffirmed 2008, Ballot approved since 05/2022, published since 04/2023)

IEEE P2656 – Guide for Functional Specification of Voltage-Sourced Converter for HVDC Stations (PAR approved 2017, PAR will expire 12/2024)

- WGI11 – Education (Chair: Andrew Steffen)

Managing and promoting educational material developed within SCIO Working Groups **AND IEEE PC37.430.10** – Standard Definitions for Flexible Alternating Current Transmission Systems (FACTS) and High Voltage Direct Current (HVDC) Stations (PAR approved 03/2021, PAR will expire 12/2025)

- P2825 – Guide for Static Synchronous Compensator (SSSC) General Requirements and Test Methods (Chair: Zhao Guoliang (Entity PAR))

➤ PAR approved 09/2019, PAR will expire 12/2023, **No draft document shared yet**)

- NEWS & UPDATES

➤ 2020: T&D Show in Chicago (only virtual) – One (1) Paper and one (1) Presentation

➤ 2021: Resource Center – One (1) Paper

➤ 2022: T&D Show in New Orleans – One (1) Tutorial (8h) and One (1) Panel Session (4h)

➤ 2023: GM in Orlando, 16th July 2023 – one (1) joint Tutorial (8h) with HVDC and FACTS Subcommittee

➤ Title: Dynamic Grid Stabilization with for Grid-Forming + Energy Storage Technology & GM in Orlando, 18th July 2023 – one (1) Panel Session (4h), Title: Enhanced STATCOM Applications.

- Future Activities (2024)

➤ T&D show in Anaheim, CA, 6th - 9th May 2021

– one (1) Tutorial (8h)

– one (1) Panel Session (4h)

- HVDC & FACTS Subcommittee’s first collaborative Tutorial (on Sunday) with the “SCIO - FACTS AND HVDC STATIONS” SUBCOMMITTEE of the Substations Committee was very successful. All the 40 seats allotted by PES for this Tutorial were filled up. Then PES released more number of seats. The room was full with 65 participants. From our Subcommittee, Brian Johnson, Sergey Kynev, Ozgur Can Sakinci, and Rajiv Varma were presenters in the Tutorial. However, Rajiv Varma participated virtually.

9. REPORT ON 2023 PANEL SESSIONS AND TUTORIALS (SESSION MODERATORS)

Tutorial: Studies for planning and execution of HVDC transmission projects (Sunday, 8-17h)

Panel: Development and Implementation of Low Frequency High Voltage AC (LF-HVAC) Transmission, Its Advantages and Disadvantages over High Voltage DC (HVDC) (Monday, 13-15h)

Panel: Gap Analysis of any Inverter Based Resource (IBR) Related Issues Facing Electric Power Industry (Tuesday, 13-15h)

Session Chair: Rajiv Varma; Total 5 speakers (3 in-person and 2 virtual)

The session went well with more than 50 attendees.

This panel session was conducted in collaboration with NERC. The panel addressed gaps related to issues related to Inverter Based Resources (IBRs) issues which have not been addressed in IEEE Standard 2800-2022 and NERC Standards and made suggestions for upcoming revisions of these Standards. The panel topics included:

Grid Integration of offshore wind plants, Challenges with short-circuit modeling and analysis for IBR-dominated systems, Lessons Learned on IBR Hybrid Plant Dispatch, Summary of NERC IRPS Electromagnetic Transients Guideline; and Damping of Power Oscillations and Subsynchronous Oscillations by Solar PV Systems as STATCOMs.

Panel: Protection of VSC-based HVDC Transmission Systems, Requirements, Challenges and Recent Advancements (Tuesday, 15-17h)

It received great attention from the audience (50 attendees).

Panel: Network code requirements for HVDC systems in High-RES environments, (Wednesday, 10-12h)

10. STANDARDS AND STANDARDS APPROVAL (DIRK VAN HERTEM)

- IEEE HVDC & FACTS subcommittee discussed in detail the concerns on quality and abundance of IEEE standards in the HVDC & FACTS domain which the HVDC & FACTS subcommittee seemed to be not (fully) involved. These decisions were taken:
 - The HVDC and FACTS subcommittee sets up standards mirror committee.
 - Min 5 members, no two of the same company
 - That mirror committee elects/appoints a chair, who will act as standards responsible of the subcommittee and is added to the board of the subcommittee (next to a chair, vice chair and secretary)
 - Elections as with chair, vice chair and secretary, but continuation is possible.
 - The subcommittee interacts with the T&D committee (and if needed with IEEE SA) to investigate how we can ensure that IEEE standards retain the necessary quality and have the involvement of all relevant stakeholders (Veto right + no bypassing)
 - Clear process (largely in place, but to be followed up by new standards responsible)
 - Stronger vetting of proposals pre-submission and in review (Veto + no bypassing)
 - All standards supported by the HVDC and FACTS subcommittee shall have the involvement of the subcommittee.
 - Min = liaison of the standards mirror committee participating in the development + reporting at the subcommittee meeting
- The HVDC and FACTS subcommittee approved the above conditions and decided to be a responsible subcommittee.

11. SUBCOMMITTEE MEMBERSHIP / BYLAWS (DIRK VAN HERTEM)

- At the 2022 Subcommittee meeting, it was suggested that the website should include a list of members and a way to request membership. Suggested that ListServ (<https://listserv.ieee.org>) be utilized to maintain the member database/e-mail addresses.
- In 2023, the HVDC & FACTS subcommittee discussed how membership to the subcommittee should be requested and what the appropriate procedure is. The subcommittee also discussed how and when new

officers should be elected. The voting process in the subcommittee was discussed as well. Finally, how activities of WGs, ad hoc committees,... should be started or stopped was discussed.

12. PROPOSALS FOR NEW ACTIVITIES WITHIN THE HVDC AND FACTS SUBCOMMITTEE (DIRK VAN HERTEM)

Two proposals were received for new activities within the HVDC and FACTS subcommittee:

- Low-frequency AC systems (LFAC): A new WG will be formed. The scope and objectives of the WG are determined. The WG is expected to report to the subcommittee regularly and to meet annually. Chair is Bhaskar Mitra.
- End-to-end DC: There was significant discussion on whether the topic is in line with HVDC & FACTS Subcommittee objectives. Rajendra Singh had a short presentation about this topic. It was decided that a new Ad hoc committee will be formed, and the committee is required to report on its progress in the PES GM subcommittee meeting in 2024. The committee will host a panel session at PESGM 2024. The chair (Rajendra Singh), Vice-chair (Ram Adapa), and secretary (Satish Naik Banavath) have been selected and the scope, short-term and long-term objectives, and deliverables of the committee have been determined.

13. PLANS FOR PANEL SESSIONS AND TUTORIALS FOR 2024 PES CONFERENCES (ALL)

- i) Panel Sessions (We will have max 6 panel sessions; A reminder email will be sent to everyone. Title, description, name of tentative presenters (min 4)).
- ii) Tutorials
- iii) Supersessions

T&D deadlines:

- Deadlines for 2024 IEEE PES GM: tutorials, panels, papers, etc. – Opens 10/4, Due mid-November
 - First announcement to subcommittee: today (ideally)
 - Other topics can be raised before August 20, and refinement and prioritization till October 15
- Deadlines for 2024 IEEE T&D Conference/Expo: Papers and Panel Requests – Due August 20, 2023

14. LIAISON REPORTS

- i) CIGRE B4 (Neil Kirby)
 - Recent/New Cigre Working Groups:
 - B4.91 Power-electronics-based transformer technology, design, grid integration and services provision to the distribution grid
 - B4.92 STATCOMs at Distribution Voltages
 - B4.93 Development of Grid Forming Converters for Secure and Reliable Operation of Future Electricity Systems
 - C2/B4.43 The impact of Offshore Wind power hybrid AC/DC connections on System Operations and System design
 - B4.94 Application of VSC-HVDC in a System Black Start Restoration
 - TF B1/B3/B4C4/D1.95 Harmonization of voltage designations and definitions across different HVDC component technologies

- C4/B4.72 Lightning and Switching Induced Electromagnetic Compatibility (EMC) issues in DC power systems and new emerging power electronic-based DC equipment
 - B4.95 Developments in Power Semiconductor Technologies and Applications in HVDC/FACTS
 - B4.96 HVDC connection of power system with a high proportion of photovoltaic (PV) generation
 - C4/A3/B2/B4.75 Guide to procedures for the creation of contamination maps required for outdoor insulation coordination
- Upcoming Events :
 - B4 Colloquium – Vienna, Austria – September 9-15 2023
 - Cigre Canada Conference – Vancouver, BC, Canada - September 25-28, 2023

ii) CIGRE US National Committee

No updates at this time.

15. OLD BUSINESS

16. NEW BUSINESS

i) Arising from the floor

17. PRESENTATIONS

There were three technical presentations by

- i) Ram Adapa, EPRI, Uno Lamn award recipient
- ii) Ifte Huq, Siemens Energy, Germany
- iii) Frederick Page, Mitsubishi Electric, Japan

The presentation slides are attached to the report.

18. GENERAL REPORTS ON HVDC AND FACTS PROJECTS/DEVELOPMENTS

19. NEXT HVDC AND FACTS SUBCOMMITTEE MEETING

The next full meeting is to be held at GM 2024 Seattle, most likely on Wednesday, 13h30-16h30

20. Adjournment

The meeting adjourned at 16:30.