

IEEE Power and Energy Society Entity Annual Report

2020

Entity: ELECTRIC MACHINERY COMMITTEE
Website: <https://www.ewh.ieee.org/soc/pes/emc/index.html>
Chair: John YAGIELSKI
Vice-Chair: Jim LAU
Secretary: Gayland BLOETHE
Immediate Past Chair: Kay CHEN

1. Significant Accomplishments:

In 2020, the Electric Machinery Committee activities and accomplishments focused on maintaining its contributions to its legacy of key industrial standards, while supporting new initiatives and standards development in emerging technologies and applications within renewable energy generation and electrification.

Highlights for 2020 include continued co-sponsorship of the IEEE P2800 series of standards (Inverter-Based Resources Interconnecting with Transmission Electric Power Systems), and new co-sponsorship of IEEE2882 (Guide for Performance Evaluation of Software Models of Renewable and Conventional Generators for Power System Studies). The EMC has also supported IEEE P&E and IEEE SA efforts to further internationalize the application of IEEE standards by identifying ones of potential value for national standards adoption.

EMC's position in leading conventional industry technology while embracing the ongoing energy transition topics looks to attract and engage next generation volunteers in PES. Further outreach efforts have included hosting of a "Meet the Committee" webinar, attended by nearly 100 folks, with several subsequently joining the committee.

1.1. Standards

2020 found several working groups completing updates to key standards and guides (IEEE1665, 1553, 1415, 1776, etc). Following comprehensive update to well-established machine testing standards (IEEE112 & 115), the team is now actively revising the associated machine standards C50.12 & C50.13 – reorganizing the scopes to reflect state-of-the art machines applied in new power generation applications.

In addition, EMC has proactively worked through hurdles in development of IEEE2800 and the associated entity standard IEEE2800.1.

Finally, EMC has engaged with NEMA regarding the ANSI/NEMA C50.41 standard (Polyphase Induction Motors for Power Generating Stations), offering to transfer the copyright back to IEEE (from whenst it came), in order to update and reissue. Although EMC expressed willingness to do so, the working group within NEMA has chosen to retain the copyright and intends to try any fold the unique requirements into the larger NEMA MG-1 standard. EMC will monitor the progress and consider if a replacement IEEE standard is warranted.

1.2. Task Forces

Currently, the EMC does not have any active Task Forces, as efforts are focused on standard development.

1.3. Panel Sessions and Tutorials

EMC organized a led a comprehensive suite of panel sessions during the 2020 IEEE P&E General Meeting, successfully adapting to the “virtual” format. These sessions addressed some of the hottest topics in the current power industry – including integration of inverter-based resources, hydroelectric generation and big data / IoT applications to electric machines and drives monitoring.

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

The IEEE PES Electric Machinery Committee constitutes a forum of experienced, well-qualified electrical engineers active in all walks of industry where electrical machines constitute an integral element in their successful operation and development. The committee safeguards and maintains standards that set requirements for consistent design, quality and performance of electrical machines from a power of 10 MVA up to the largest electrical machines in the world at 2000 MVA. These machines are the most critical assets for the modern electricity industry and means significance to the reliability of the modern electricity generation. The committee currently serves a new important role in the ongoing grid transformation introduced by renewable generation. The committee is deeply involved in all the frontiers in the “grid transformation/energy transition”, with a growing emphasis on electric machinery for electrification of areas such as transportation. The members of this committee actively contribute to technology roadmap activities as new electrical machines and drives technologies are adopted in multiple industries – including transportation, renewable energy generation, and the oil & gas sector. Involvement is evidenced by the busy WG activities and panel sessions in 2020.

3. Benefits to Volunteer Participants from the Committee Work:

As noted above, the IEEE PES Electric Machinery Committee is constituted of electrical engineers in all walks of industry where electrical machines are a key technology, such as transportation, renewable energy generation, and the oil & gas sector. The standards developed & maintained by the committee are recognized and applied world-wide. Volunteers benefit from opportunities to contribute in ways that best leverage their capabilities and interests, while helping to shape grid transformation, energy transition, and electrification of areas such as transportation. The relatively small size of the committee and its working groups provide individuals with significant influence.

4. Recognition of Outstanding Performance:

In 2020 the following awards were presented within the Electric Machinery Committee as recognition of the contributions made to both the IEEE PES and the EMC.

At the IEEE Level:

The 2020 IEEE **Nikola Tesla Award**: Akira Chiba, Professor, Tokyo Institute of Technology

“For Contributions to Bearingless and Reluctance Motors.”

An Advance Report is available for the 2021 Tesla Award – Zi-Quang Zhu (University of Sheffield)

At the Power Engineering Society Level:

The 2020 PES **Cyril Veinott Award**: Dan Ionel, Professor, University of Kentucky

“For Contributions to the Design, Development and Manufacturing of High Efficiency Electric Motors and Generators.”

At the Electric Machinery Committee Level:

The 2020 Distinguished Service Award: Akira Chiba

The 2020 Past President Service Award: John Yagielski

The 2020 Prize Committee Report: Robert Thornton-Jones

PES-TR69, *Report on Coordination of Grid Codes and Generator Standards: Consequences of Diverse Grid Code Requirements on Synchronous Machine Design and Standards.*

The 2020 Prize Standard: Nick Stranges

IEEE Std. 112, *Standard Test Procedure for Polyphase Induction Motors and Generators.*

The 2020 First Prize Paper: J. Carmona-Sanchez, M. Barnes and J. M. Apsley

Virtual Energy Storage: Converting an AC Drive to a Smart Load, Transactions on Energy Conversion, Volume 33, Number 3, pp. 1342-1353.

The 2020 Second Prize Paper: X. Song, C. Buhner, P. Brutsaert, J. Krause, A. Ammar, J. Wiezoreck, J. Hansen, A. V. Rebsdorf, M. Dhalle, A. Bergen, T. Winkler, S. Wessel, M. T. Brake, J. Kellers, H. Putz, M. Bauer, H. Kyling, H. Boy and E. Seitz

Designing and Basic Experimental Validation of the World’s First MW-Class Direct-Drive Superconducting Wind Turbine Generator, Transactions on Energy Conversion, Volume 34, Number 4, pp. 2218-2225.

The 2020 Third Prize Paper: J. Gong, H. Zahr, E. Semail, M. Trabelski, B. Aslan and F. Sculler

Design Considerations of Five-Phase Machine with Double p/3p Polarity, Transactions on Energy Conversion, Volume 34, Number 1, pp. 12-24.

(Alberto Tessarolo is recognized for pre-screening papers for prize paper consideration)

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

In the 2020, The Electric Machinery Committee is maintaining liaises with the following IEEE committees and institutions which share common fields of interest:

- **IAS: Industry Applications Society**

Related topics on the applications of electrical machines. Additionally, the IAS and PES are sponsors of The International Conference on Electrical Machines and Drives (IEMDC) in which the EMC is actively involved.

- **PSRD: The Power System Relay Committee**

The PES has responsibility for relay protection tasks, some of which are of interest to the Electric Machinery Committee in that they provide protection and control functions for electric machines.

- **ISO: International Organization for Standardization**

The ISO issues several technical standards which are of relevance to electric machines, e.g. regarding the measurement of noise and vibration, and recommended vibration limits.

- **IEC: International Electrotechnical Commission**

CIGRE: International Council on Large Electrical Systems

The IEC issues standards on the design and performance of electrical machines which complement those of the IEEE. There is a strong liaison with common participants who work to align the requirements of these standards where conflicts and unnecessary deviations are evident.

CIGRE does not issue standards but has Study Committees and Advisory Groups in the field of rotating machines that survey current industry practices and experience, and issue reports, guidelines, brochures and tutorials. Several EMC members participate in both CIGRE and IEEE working groups and conferences.

- **IEEE Transportation Electrification Community**

The IEEE Transportation Electrification Community coordinates broad activities throughout the IEEE in the growing electrification revolution across transportation domains, including advances in electric and hybrid cars, more-electric ships and aircraft, rail systems, personal transport, and the motive, storage, power grid, electronic intelligence, and control technologies that make them possible. The outgoing EMC Chair, Kiruba Haran, represents PES in the TEC Steering Committee.

6. New Technologies of Interest to the Committee:

Electric Machines are at the heart of power & energy, and on-going transformations in electric power generation and utilization are driving development and implementation of new electric machinery technologies in renewable energy and electrification, just to name a few. Examples include electric machines for electrification of transportation, including flight. For both power generation and transportation, superconducting machines may provide transformational performance benefits. In many applications, the nexus of electric machines with power electronics provide unmatched performance and flexibility, while requiring careful integration within the existing power system. The Electric Machinery Committee strives to remain aware and engaged in these areas, and actively pursues opportunities to help enable these transformations.

7. 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). Please provide the following information.

Total Number of committee members ~120	Officers from regions 8,9 and 10 2	Subcommittee officers from regions 8, 9 and 10 2	Subcommittee members from regions 8,9, and 10 tbc
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8. Problems and Concerns:

The EMC has attempted to proactively contribute in new IEEE initiatives such as entity standards, pilot projects regarding adoption of IEEE standards as national standards, etc. The approach is to be early adopters, hoping to help guide and mature the processes vice attempts to block change. These efforts do draw on the limited resources of our all-volunteer organization, in some deference to the standards technical developments that many see as our primary role. This has also lowered priority on administrative imperatives, such as implementation of 1-2-3-Sign-up.

Further, we are having some trouble mustering volunteers to maintain some of the most mature standards.



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Hopefully we'll expand our EMC community with new members whom are more engaged in standards on renewables integration, to maintain EMC vitality.

9. Significant Plans for the Next Period:

In 2021 the EMC will continue to work on the standards that are the mainstay of its contribution to industry and get involved more deeply with the ongoing “Energy Transition” topics in electric grid transformation, renewable generation and electrification revolutions in transportation. It will strive to bring the work carried out within the EMC and the benefits to a wider audience and broaden its appeal to early-career engineers.

- Sponsor the P2800 & P2882 standards to support IEEE’s activity in improving electricity grid transformation.
- Continue joint conferences with the IEEE Transportation Community and AIAA on electrification of commercial transport aircraft.

Submitted by: John YAGIELSKI

Date: 10-Jan-2020