

Bi-Annual ETI Review Report (Oct. 2016-Sept. 2018)
Emerging Technology Initiatives on Smart Grid Communications
Sept. 2018

Officers: (Nov. 2017 – present)

Chair: Angela Yingjun Zhang, The Chinese University of Hong Kong, Hong Kong

Vice Chair: Hamed Mohsenian-Rad, University of California at Riverside, USA

Vice Chair: Hans-Peter Schwefel, University of Aalborg, Denmark

Secretary: Christian Wietfeld, TU Dortmund, Germany

1. Technical Area

1.1 Importance, History and Outlook

The Emerging Technology Initiative Smart Grid Communications (ETI-SGC) originated within ComSoc in 2010, with the belief that Smart Grid will be a new development trend of modern power system, and information and communication technologies (ICT) will play a crucial role not only in reducing losses and increasing efficiency, but also in managing and controlling the ever more distributed power grid to ensure stability and reinforce security. Over the years, ETI-SGC has successfully supported IEEE Smart Grid activities, and promoted ComSoc's position in the development and promotion of Smart Grid related technologies.

As the ETI celebrates its 8th anniversary, it is evident that Smart Grid has become one of the most important technological advancement of the electric power grid, which is arguably the largest and most complex infrastructures ever built by mankind. A dynamic, secure, adaptable, and mission-critical ICT infrastructure has become an important foundation for the success of Smart Grid. It acts as an information bridge among operators and their consumers, assets and work forces, creating a reliable two-way exchange of real-time information. As such, there has been an upsurge of activities in Smart Grid development, in particular the ICT for Smart Grid, over the past decade. This trend is expected to continue for many years to come, considering the substantial capital investment by governments worldwide.

1.2 Differentiation from the Existing Technical Committees

The technical area of ETI-SGC is an obvious departure from the existing TCs of ComSoc. The broad topics of interest include

- Communications and networks to enable the Smart Grid
- Cyber security, privacy, and resilience for the Smart Grid
- Active distribution grids and microgrids
- Smart metering, demand response, and dynamic pricing
- Big data management and analytics for the Smart Grid
- ICT-enabled transactive energy and grid economics
- Energy storage and electric vehicles
- Energy Internet and energy system integration

These topics are not covered in other TCs or ETIs within ComSoc.

1.3 Is the ETI's Scope Complementary or Overlapping with the Existing Technical Committees

The ETI-SGC has minimum overlap with the IEEE ComSoc Power Line Communications (PLC) Technical Committee, since power line communications is one of the communications options in Smart Grid. Note that ETI-SGC covers a broader scope as listed above. Our focus is

not on a particular communication technology, but rather on the ICT impact across the whole energy value chain from generation, transmission and distribution to retailing and customers.

1.4 Does this ETI Intend to Serve the Academic and/or the Industry Community?

The ETI mainly serves the academic community, but we also actively involve members from the industry.

1.5 Do You Propose Any Alternative Structure for this ETI instead of Continuing as an ETI or Being Elevated to a TC?

We apply to be elevated to a TC.

2. Activities

The ETI-SGC has actively contributed to ComSoc and IEEE. The activities since the last report are summarized below.

2.1 Special issues of journals and magazines

ComSoc Journals

- IEEE Wireless Communications, Special Issue on “Smart Grids”
 - ETI involvement: Petar Popovski, Vincent Wong, Christian Wietfeld as guest editors.
 - Publication date: April 2017
- IEEE Communications Magazine, Special Issue on “Internet of Electric Vehicles and Smart Grid”
 - ETI involvement: Vincent Wong as a guest editor.
 - Manuscript due: April 2018; Publication date: December 2018
- IEEE Communications Magazine, Special Issue on “Emerging Technologies for Connected and Smart Vehicles”
 - ETI involvement: Jaime Lloret as a guest editor
 - Manuscript due: Feb. 2018; Publication date: Oct. 2018

ComSoc Co-Sponsored Journals

- IEEE Transactions on Smart Grid, Special Issue on “Theory and Application of PMUs in Power Distribution Systems”
 - ETI involvement: Hamed Mohsenian-Rad as a guest editor
 - Manuscript due: March 2018
- IEEE Transactions on Sustainable Computing, Special Issue on “Intersection of Computing and Communication Technologies with Energy Systems”
 - ETI involvement: Sid Chau, Minghua Chen as guest editors
 - Manuscript due: Dec. 2018
- IEEE Internet of Things Journal, Special Issue on “Internet-of-Things for Smart Energy Systems”
 - ETI involvement: Angela Yingjun Zhang, Vincent Wong, Hans-Peter Schwefel, Sid Chau as guest editors
 - Manuscript due: Sept. 2018

Other Journals

- IET Journal on Cyber-Physical Systems, Special Issue on “Cyber-Physical Systems in Smart Grids: Security and Operation”
 - ETI involvement: Qinglai Guo, Kevin Dong Jin as guest editors
 - Publication date: 4th Quarter, 2017

- Hindawi Journal of Optimization, Special Issue on “Optimization for Electric Power System Resilience”
 - ETI involvement: Chen Chen, Chau Yuen as guest editors
 - Manuscript due: May 2018; Publication date: Oct. 2018
- Hindawi Journal on Security and Communication Networks, Special Issue on “Cyber Security in Distributed Smart Systems”
 - ETI involvement: Andrea Tonello as a guest editor
 - Manuscript Due: May 2018, Publication date: Oct. 2018

2.2 Conference organization

ETI-SGC has heavily involved in organizing the IEEE International Conference on Communications, Control, and Computing Technologies for Smart Grids (IEEE SmartGridComm). The ETI also contribute to the organization of IEEE ICC and GLOBECOM every year. Besides, ETI-SGC collaborate with other societies to organize workshops, panels, and tutorials.

IEEE SmartGridComm:

- ETI-SGC involvement in IEEE SmartGridComm Steering Committee
 - Lutz Lampe (Chair), Angela Yingjun Zhang, Petar Popovski, Hamed Mohsenian-Rad, Andrea Tonello, Chris Develder
- ETI-SGC involvement in IEEE SmartGridComm Organizing Committee (Since 2016)
 - IEEE SmartGridComm 2016
 - ⇒ Zhao Xu, Symposia Co-Chair
 - ⇒ Junhua Zhao, Symposia Co-Chair
 - ⇒ Hamed Mohsenian-Rad, Symposia Co-Chair
 - ⇒ Pascal Lorenz, Symposia Co-Chair
 - IEEE SmartGridComm 2017
 - ⇒ Ralf Lehnert, General Chair
 - ⇒ Andrea M. Tonello, TPC Co-Chair
 - ⇒ Anil Mengi, TPC Co-Chair
 - ⇒ Vincent Wong, Symposia Chair
 - ⇒ Angela Yingjun Zhang, Symposia Chair
 - ⇒ Hans-Peter Schwefel, Symposia Chair
 - ⇒ Chris Develder, Symposia Chair
 - ⇒ Marco Levorato, Symposia Chair
 - ⇒ Hamed Mohsenian-Rad, Symposia Chair
 - IEEE SmartGridComm 2018
 - ⇒ Petar Popovski, General Chair
 - ⇒ John Thompson, TPC Co-Chair
 - ⇒ Linus Thrybom, TPC Co-Chair
 - ⇒ Hamed Mohsenian-Rad, TPC Co-Chair
 - ⇒ Melike Erol-Kantarci, Symposia Chair
 - ⇒ Walid Saad, Symposia Chair

IEEE GLOBECOM:

- IEEE GLOBECOM 2016, Dec. 2016, Washington D.C., USA
 - Smart Grid and Power Line Communications Track

- Chair: Dusit Niyato, NTU, Singapore
- Number of papers submitted: 27
- Number of papers accepted: 10
- IEEE GLOBECOM 2017, Dec. 2017, Singapore
 - Smart Grid Communications Track
 - Chair: Walid Saad, Virginia Tech., USA
 - Number of papers submitted: 21
 - Number of papers accepted: 9
- IEEE GLOBECOM 2018, Dec. 2018, Abu Dhabi, UAE
 - Smart Grid and Power Line Communications Track
 - Chair: Giacomo Verticale, Politecnico di Milano, Italy
 - Number of papers submitted: 31 (24 from Smart Grid area)
 - Number of papers accepted: 11 (8 from Smart Grid area)
- IEEE GLOBECOM 2019, Dec. 2019, Hawaii USA
 - Smart Grid Communications Track
 - Chair: Suzhi Bi, Shenzhen University, China

IEEE ICC:

- IEEE ICC 2017, May 2017, Paris, France
 - Communications for the Smart Grid Track
 - Chair: Deepa Kundur, University of Toronto, Canada
 - Number of papers submitted: 44
 - Number of papers accepted: 16
- IEEE ICC 2018, May 2018, Kansas City, USA
 - Communications for the Smart Grid Track
 - Chair: Vincent Wong, University of British Columbia, Canada
 - Number of papers submitted: 33
 - Number of papers accepted: 12
- IEEE ICC 2019, May 2019, Shanghai, China
 - Communications for the Smart Grid Track
 - Chair: Kemal Akkaya, Florida International University, USA
- IEEE ICC 2020, May 2020, Dublin, Ireland
 - Communications for the Smart Grid Track
 - Chair: Anna Scaglione, Arizona State University, USA

Workshops:

- Workshop on Integrating Communications, Control, and Computing Technologies for Smart Grid (ICT4SG)
 - 2016: ETI Organizers: Wei-Yu Chiu
 - 2017: ETI Organizers: John Thompson, Wei-Yu Chiu
 - 2018: ETI Organizers: Wei-Yu Chiu, John Thompson
- Workshop on Communication in Energy Grids in the Era of Tactile Internet

- Co-located with IEEE SmartGridComm 2018, Oct. 2018
- ETI Organizer(s): Petar Popovski
- Workshop on Data, Analytics, and Synchrophasors for Transparent Distribution Networks
 - Co-located with IEEE SmartGridComm 2018, Oct. 2018
 - ETI Organizer(s): Hamed Mohsenian-Rad,
- Workshop on Future Smart Grid
 - Venue: Klagenfurt, Austria
 - Time: 26-27 Feb., 2018
 - Chair: Andrea Tonello
 - Scope: Integration of renewables; Communication-control-monitoring technologies; Electromobility and its impact to the grid; New paradigms for a fully connected and electrified world; Energy market in new transactive energy
 - 70 participants, good industry participation
- Workshop on Smart Energy Distribution and Utilization
 - Venue: Hong Kong
 - Time: 28-29 May, Hong Kong
 - Organizers: Angela Yingjun Zhang, Zhao Xu, Minghua Chen
 - 80+ participants, heavy involvement of industry and NGOs.

Panels:

- IEEE PES General Meeting 2017
 - Panel on Big Data Access and Big Data Research Integration in Power Systems
 - ⇒ Organizers: Hamed Mohsenian-Rad, Ning Zhou
 - ⇒ Panelists: Emma Stewart, Henry Huang, Behzad Nabavi, Yingchen Zhang, Bill Blevins
- IEEE PES General Meeting 2018
 - Panel on Big Data Analytics for Emerging Power Sensors and Internet-of-Things
 - ⇒ Organizers: Hamed Mohsenian-Rad, Emma Stewart
 - ⇒ Panelists: PingThings, NuGrid Power Corp., CPS Energy, RPU
 - Panel on Best Practices in Sharing of Big Data in Power Systems
 - ⇒ Organizers: Hamed Mohsenian-Rad, Ning Zhou
 - ⇒ Panelists: Better Grids, Oncor, ISO-NY, BPA

2.3 Online content

- Best Readings in Smart Grid Communications:

The Best readings is a concise list of must-read books and articles that reveal the role and the potential of communication networks and systems in the smart grid. The list was created by a Selection Committee, chaired by Petar Popovski. Special measures have been taken to keep very high quality of the list, while avoiding conflicts of interest and self-promotion. The list is available at <https://www.comsoc.org/best-readings/smart-grid-communications>.

We plan to update the list later this year.

2.4 Standards

Some of the approved IEEE Smart Grid Communications standards can be accessed from the ETI website <http://sg.committees.comsoc.org/standards/>. They are

- IEEE 2030-2011 IEEE Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System (EPS) End-User Applications, and Loads.

- IEEE 1815-2012 IEEE Standard for Electric Power Systems Communications – Distributed Network Protocol (DNP3).
- IEEE 1901.2a-2015 IEEE Standard for Low-Frequency (less than 500kHz) Narrowband Power Line Communications for Smart Grid Applications – Amendment 1
- IEEE P1913 Software-Defined Quantum Communication (with power grid as a primary application)

2.5 Any other notable activities

Special Interest Groups

To provide platforms for members to interact and cooperate on focus areas related to smart grid, the ETI has established eight Special Interest Groups (SIGs) in early 2018. They are

- SIG on Communications and Networks to Enable the Smart Grid
- SIG on Cyber Security, Privacy and Resilience for the Smart Grid
- SIG on Active Distribution Grids and Microgrids
- SIG on Smart Metering, Demand Response and Dynamic Pricing
- SIG on Big Data Management and Analytics
- SIG on ICT-Enabled Transactive Energy and Grid Economics
- SIG on Energy Storage and Electric Vehicles
- SIG on Energy Internet and Energy System Integration

The details of the SIGs can be found at <http://sg.committees.comsoc.org/special-interest-groups/>.

Position Paper:

To define the scope of the ETI and its Special Interest Groups, the ETI officers have published a Position Paper (<http://sg.committees.comsoc.org/files/2018/09/IEEE-ETI-SG-Position-Paper-2018.pdf>). The position paper has been reviewed and actively commented by the SIG chairs and other ETI members, and therefore represents a broad consensus view of the ETI.

Nominations:

The ETI regularly nominates members to serve various roles in ComSoc conferences and events. We also nominate IEEE ComSoc Distinguished Lecturers. Here, we list the nominations in the past two years.

- IEEE ICC Selected Areas in Communication, Track on Smart Grid Communications
 - 2016: Lutz Lampe, University of British Columbia, Canada
 - 2017: Deepa Kundur, University of Toronto, Canada
 - 2018: Vincent Wong, University of British Columbia, Canada
 - 2019: Kemal Akkaya, Florida International University, USA
 - 2020: Anna Scaglinoe, Arizona State University, USA
- IEEE GLOBECOM Selected Areas in Communication, Track on Smart Grid Communications
 - 2016: Dusit Niyato, Nanyang Technological University, Singapore (joint with Track on Power Line Communications)
 - 2017: Walid Saad, Virginia Tech, USA
 - 2018: Giacomo Verticale, Politecnico di Milano, Italy (joint with Track on Power Line Communications)
 - 2019: Suzi Bi, Shen University, China
- IEEE SmartGridComm

- The ETI nominated four members to serve as Symposia Chairs for IEEE SmartGridComm 2019. They are
 - ⇒ Communications and Networking Symposium: Anurag Srivastava, Washington State University, USA
 - ⇒ Control and Operation Symposium: Ruilong Deng, Nanyang Technological University, Singapore
 - ⇒ Data Analytics and Computation Symposium: Chau Yuen, Singapore University of Technology and Design
 - ⇒ Cyber Security and Privacy Symposium: Daisuke Mashima, Advanced Digital Science Center, Singapore
- IEEE ComSoc Distinguished Lecturers
 - Three candidates are nominated to ComSoc DL Committee in 2018. The candidates are
 - ⇒ Vincent Wong, University of British Columbia
 - ⇒ Hamed Mohsenian-Rad, University California, Riverside
 - ⇒ Minghua Chen, The Chinese University of Hong Kong
- The 6th IEEE ComSoc Student Competition Program, 2018
 - Fang Yang from Tsinghua University, China is nominated to serve on the Selection Committee.

3. Governance and Participation

3.1 Officer visibility and engagement

The ETI has elected officers, appointed officers, an advisory board, and liaisons. Besides, we have also established eight SIGs, each with one or two chairs. All officers actively contribute to the ETI and are highly visible to the community. Detailed information can be found in 2.1 and 2.2.

Officers (November 2017-present)

- Chair: Angela Yingjun Zhang, The Chinese University of Hong Kong
- Vice Chair: Hamed Mohsenian-Rad, University of California at Riverside, USA
- Vice Chair: Hans-Peter Schewefel, University of Aalborg, Denmark
- Secretary: Christian Wietfeld, TU Dortmund University, Germany

Appointed Officer (November 2017-present)

- Member Relations Chair: Liping Qian, Zhejiang University of Technology

Advisory Board (November 2017-present)

- Vincent Wong, University of British Columbia, Canada (Past Chair)
- Petar Popovski, University of Aalborg, Denmark (Second Past Chair)
- Lutz Lampe, University of British Columbia, Canada
- Steven Low, California Institute of Technology, USA
- Jianhui Wang, Southern Methodist University/Argonne National Lab, USA
- Hartmut Schmeck, KIT, Germany

Liaisons

- Hamed Mohsenian-Rad, Liaison between the ETI and IEEE PES Power System Communications and Cybersecurity Committee
- Angela Yingjun Zhang, ComSoc representative in IEEE Smart Grid Publications Committee (2015-2017)

- Yiyu Shi, ComSoc representative in IEEE Smart Grid R&D Committee
- Stefano Galli, ComSoc representative in IEEE Smart Grid Steering Committee (2015-2017)
- Roberto Martins, ComSoc representative in IEEE Smart Grid Steering Committee (2017-present)

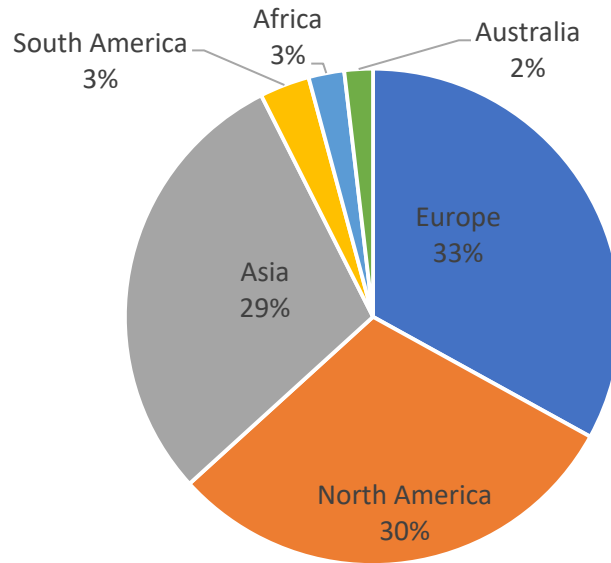
SIG Chairs:

- SIG on Communications and Networks to Enable the Smart Grid
 - Chair: Andrea Tonello, University of Klagenfurt, Austria
- SIG on Cyber Security, Privacy and Resilience for the Smart Grid
 - Chair: Chen Chen, Argonne National Laboratory, USA
 - Co-Chair: Kevin Dong Jin, Indian Institutes of Technology, USA
- SIG on Active Distribution Grids and Microgrids
 - Chair: Zhao Xu, Polytech University, Hong Kong
 - Co-Chair: Junhua Zhao, The Chinese University of Hong Kong (Shenzhen)
- SIG on Smart Metering, Demand Response and Dynamic Pricing
 - Chair: Sid Chau, Australian National University
 - Co-Chair: Kevin Dong Jin, Indian Institutes of Technology, USA
- SIG on Big Data Management and Analytics
 - Chair: Hamed Mohsenian-Rad, University of California at Riverside, USA
 - Co-Chair: Marco Levorato, University of California at Irvine, USA
- SIG on ICT-Enabled Transactive Energy and Grid Economics
 - Chair: Lijun Chen, University of Colorado, USA
 - Co-Chair: Emiliano Dall’Anese, National Renewable Energy Laboratory, USA
- SIG on Energy Storage and Electric Vehicles
 - Chair: Chris Develder, University of Gent, Belgium
 - Co-Chair: Hamidreza Nazaripouya, University California at Riverside, USA
- SIG on Energy Internet and Energy System Integration
 - Chair: Qinglai Guo, Tsinghua University, China
 - Co-Chair: Hao Zhu, University of Texas at Austin, USA

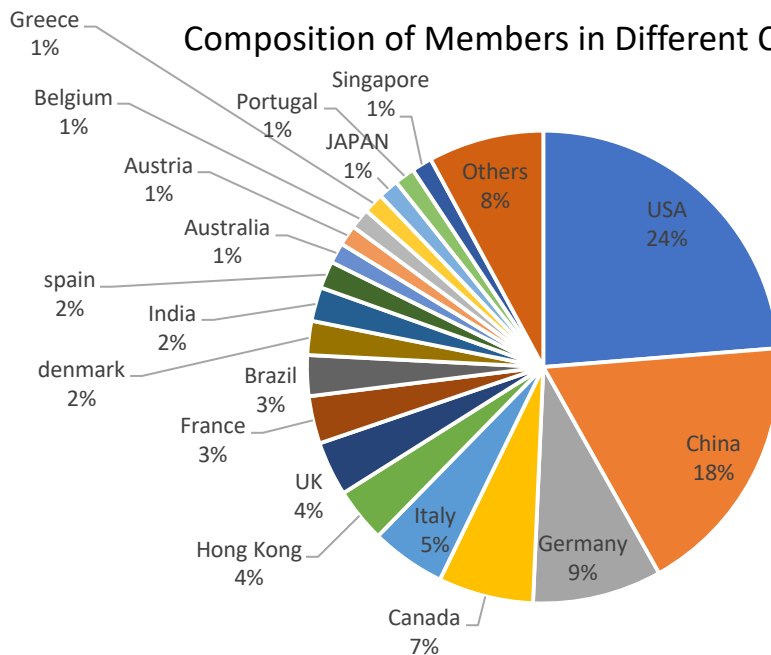
3.2 Members

We actively promote the ETI in the research community. As of Sept. 2018, the ETC has 224 registered members. To become a member, it is necessary to subscribe to the ETI mailing list through <https://comsoc-listserv.ieee.org/cgi-bin/wa?SUBED1=asgcc&A=1>.

Composition of Members from Different Continents



Composition of Members in Different Countries



3.3 Meetings

We have two formal meetings each year at the IEEE International Conference on Communications (ICC) and IEEE International Conference on Communications, Control, and Computing Technologies for Smart Grids (SmartGridComm). The meeting minutes and slide are available at <http://sg.committees.comsoc.org/meeting/>.

- Meeting during IEEE ICC 2016: May 24, 2016, from 8am to 9am in Room Citrine, Mandarin Oriental Hotel, Kuala Lumpur, Malaysia. Number of attendees: 10.
- Meeting during IEEE SmartGridComm 2016: Nov. 8, 2016, from 12pm-1pm in Room Sussex 1, Four Points Sheraton Sydney, Australia. Number of attendees: 10.

- Meeting during IEEE SmartGridComm 2017 (joint meeting with TC-PLC): Oct. 24, 2017, from 6pm-8:30pm in Room Kabinettzimmer, Hotel Taschenbergpalais, Dresden, Germany. Number of attendees: 27.
- Meeting during IEEE ICC 2018: May 21, 2018, from 3pm-5pm, Room Westport, The Westin Kansas City at Crown Center, Kansas City, USA. Number of attendees: 17.

3.4 Policies and Procedures

Policies and Procedures were drafted in the first quarter of 2018, and were discussed and endorsed at the ETI meeting during IEEE ICC 2018. The P&P will be submitted together with this bi-annual report to be reviewed by the ETC. The P&P can be found at <http://sg.committees.comsoc.org/files/2018/06/Meeting-Minutes-Kansas.pdf>.

3.5 Webpage

The ETI website is <http://sg.committees.comsoc.org>. The website provides updated information, including the ETI organization, SIGs, meetings, conferences, journal special issues, and Best Readings. We also update the status of approved IEEE Smart Grid Standards. Links of selected research projects on Smart Grid Communications are solicited from members and posted.

3.6 Quality of the bi-annual report, timeliness, responsiveness

We regularly submit the bi-annual report. The last report was submitted in 2016.

4. Future Plans and Potential Impact

4.1 Future Plans

Following the strategy adopted so far in the ETI, we will strive to promote ComSoc's position in the development and promotion of Smart Grid related technologies. We will provide members with quality networking opportunities as well as a platform to provide volunteer services to the community. If we are elevated to a full TC, we will create the following boards/SIGs within our committee.

- Award Board
 - Annual awards will be established to recognize outstanding contributions, both technical and service contributions, to the technical community and the community the ETI serves.
- Membership Board
 - Currently, we have a Member Relations Chair to promote the ETI membership. If we are elevated to a full TC, we will have a membership board consisting of co-chairs from different geographic regions to attract active researchers in smart grid to join the committee.
- SIG on Standardization
 - To promote ComSoc's presence in standardization activities, we will establish a special interest group dedicated standardization. The SIG will identify what are the existing relevant smart grid communications standards, and which areas within smart grid communications industry are in need for standardization.

Besides, the ETI will continue to be active in all of ComSoc's activities. This will include ComSoc conferences (such as ICC, GLOBECOM, SmartGridComm, etc.) by providing volunteers to their organizing committees, providing representatives to their Technical Program Committees, organizing mini-conferences, symposia, panels, short courses, tutorials, etc., as deemed appropriate by the society and the ETI. The ETI will also support ComSoc

journals, magazines, and standards activities by soliciting volunteers as authors and editors, submitting proposals, and identifying committee members from its membership.

Because of the multi-disciplinary nature of Smart Grid research, the ETI will seek cooperation with other societies, such as IEEE PES, IEEE Control, and ACM. Currently, our members are already actively participating in organizing panels and conferences in IEEE PES and ACM. We will continue to encourage ETI members to take part in the activities of other society.

4.2 Potential Impact

The transformation of the electricity grid into a smart grid is among the most extensive and ambitious undertaking in electrical engineering of today. Information and communication technologies are the essential enablers of such a transformation. In the context of electricity grid, communication systems need to be seen as part of a larger system of systems, including in particular energy, control, and information processing systems. As new technologies and application areas emerge, the ETI will seek to address aspects of these topics relative to its charter. The ETI will strive to ensure that ComSoc members will play a decisive technological role in smart grid communications, control, and computing.