

# IEEE Transportation Electrification Community Strategic Plan 2018 – 2020

Version 2: February 2018  
Bruno Lequesne

## ***2017 Strategic Planning Committee Members***

Yaobin Chen, TEC Chair  
Pradeep Lall, IEEE Reliability Society Representative to TEC  
Bruno Lequesne, IEEE Industry Applications Society Representative to TEC  
Philip Krein, TEC Past Chair  
Lee Stogner, IEEE Transportation Electrification Initiative Chair  
Mike Kelly, TEC Executive Director  
Alicia Tomaszewski, TEC Project Manager

## ***Inaugural Strategic Planning Meeting***

2017, June 24, ITEC 2017, Chicago, Illinois, USA

### *LRP Attendees:*

Yaobin Chen, TEC Chair  
Ali Emadi, IEEE Transactions on Transportation Electrification Editor-in-Chief  
Fei Gao, TEC Conference Committee Chair  
Mahesh Krishnamurthy, TEC Student Activities Chair  
Jason Lai, TEC Publications Committee Chair  
Bruno Lequesne, IEEE Industry Applications Society Representative to TEC  
Omer Onar, TEC Industry Relations Committee Chair

### *Administrative support:*

Mike Kelly, TEC Executive Director  
Alicia Tomaszewski, TEC Project Manager

## ***Table of Contents***

Section I: Executive Summary  
Section II: History and Background  
Section III: Purpose and Values  
Section IV: Current Status  
Section V: Current TEC-Related Offerings  
Section VI: Process  
Section VII: SWOT 2017  
Section VIII: Goals 2020

## *Section I: Executive Summary*

The IEEE Transportation Electrification Community (TEC) conducted a strategic planning retreat on June 24, 2017 at the Navy Pier in Chicago, Illinois. The purpose of the meeting was to hold interactive discussions around critical questions identified by TEC leadership and to cast an eye forward to how the Community can best position itself in order to advance its mission.

All discussions were designed to elicit ideas on how TEC can expand their focus to become more integrated and effective over the next three years. Not all ideas generated will be implemented, but those ideas that gained traction and energy during the event should be duly considered as a part of TEC strategy over the next few years.

TEC recognizes and encourages individual societies' contributions to offering or developing products within the field of TEC, especially when the scope is limited to a single operating unit or a combination of a few societies. However, there is room for improved coordination, and pan-IEEE products that could be initiated or further developed within TEC. In the next 3 years (2018-2020), TEC plans to:

- 1) Makes its portal a convenient point of access for the non-IEEE world for all offerings in the field within IEEE.
- 2) Offer a symposium, yearly or bi-yearly, on issues of current focused interest in the industry (with a white paper as an outcome).
- 3) Map out Standards activities and needs for transportation electrification, identify gaps and means to fill such needs.
- 4) Ensure IEEE has the best possible Magazine dedicated to all aspects of transportation electrification, from powertrain to connectivity.

## ***Section II: History and Background:***

The IEEE never was a stranger to transportation, going back decades. These efforts, disseminated across many societies, were adequate in the 20<sup>th</sup> century, but recent sea changes in the application of electrical technology to transportation have made it necessary to coordinate and expand such efforts. This technical field was therefore an early choice for the IEEE Future Directions, and the Transportation Electrification Initiative (TEI) was launched in 2011.

Within 3 years, from 2011 to 2014, the IEEE TEI, or Electric Vehicles Community (EVC), has built an impressive participant following of cross-societal members as well as external contributors and strategic partnerships. The Initiative has been praised as a "think-tank of scientists, engineers, academics, practitioners and lay people drawn together with one common passion: to make Transportation Electrification a reality".

Through conferences, publications, one-on-one discussions, external partnering, social media messaging, and the Transportation Electrification web portal, the EVC has sought to accelerate the development and implementation of new technologies while encouraging the dissemination of knowledge. The EVC's primary purpose is to share that knowledge in the spirit of providing a neutral forum of exchange to advance electrification of components, manufacturing methodology, communications, and autonomous operation of all manner of electric vehicles available today and in the future.

TEI transitioned in 2014 as a technical consortium of eleven IEEE Societies, councils, and IEEE Operating Units as a new Technical Community, IEEE-TEC. Of those engaged entities, a "core" of seven (Core-7) have come forward to form a leadership body to meet the challenge of providing technical expertise, oversight of the finances, programming, services, and governance of the TEC. The Core-7 is comprised of the following societies: Consumer Electronics (CES), Industry Applications (IAS), Industrial Electronics (IES), Intelligent Transportation Systems (ITSS), Power Electronics (PELS), Power and Energy (PES), and Standards Association (SA). The remaining Operating Units and societies form an affiliate level, serving as technical sponsors, for the purpose of input and collaboration across multiple overlaps within any and all related Societies' fields of interest.

The establishment of the IEEE Transportation Electrification Community has provided a mechanism to manage and steward opportunities in TEC field of interest, while helping to define "one IEEE" and give one voice for Transportation Electrification external to IEEE.

In 2017, the TEC steering committee tasked its Strategic Planning Committee to develop a strategic plan for the next 3 years and beyond. This document summarizes this plan, as approved by TEC's steering committee on (Date TBD).

### *Section III: Purpose and Values*

The scope of the Transportation Electrification Community is:

The IEEE Transportation Electrification Community discusses the technologies, organizations and projects that will enable the clean, connected and efficient transportation and vehicular systems of the future. Discussions include electric and hybrid cars and trucks, more-electric aircraft, electric rail and light rail systems, electric ships, off-road vehicle systems, and other forms of personal and mass more-electric transportation. The community also discusses key enabling technologies, including batteries, battery charging and management, power electronics, electric motors and drives, networked vehicles, fuel cells, high-power wireless power transfer, and other forms of energy storage. The community takes a leadership role in vehicle to grid (V2G) and grid interaction issues, IEEE Standards in transportation and vehicles, high-performance electric traction, student electric vehicle competitions, and vehicle intelligence.

The IEEE Transportation Electrification Community coordinates broad and deep activities throughout the IEEE in the growing electrification revolution across transportation domains, including advances in electric and hybrid cars, autonomous vehicles, more-electric ships and aircraft, rail systems, personal transport, and the motive, storage, power grid, electronic intelligence, and control technologies that make them possible. TEC creates leadership, professional development, standards development, and other opportunities for practitioners, researchers, students, and all IEEE members interested in electric transportation.

Strategic Points and Affirmation of Purpose:

- ✓ TEC will be the “one voice” for Transportation Electrification external to IEEE
- ✓ Formalize ongoing efforts to assure and support the TE community that the IEEE is committed to being a major influencer, technical knowledge repository, and standards leader for the electric vehicle and transportation industry globally.
- ✓ Provide a platform to innovate, create and collaborate on all aspects of transportation electrification.
- ✓ Solidify IEEE as a force for driving the transformation for clean, efficient, connected and safe transportation.

## Section IV: Current Status

### Membership

TEC membership consists of IEEE units (societies, councils, other operating units) as well as individuals. Unit membership consists of 7 core members and 4 affiliate members, see Fig. 1.

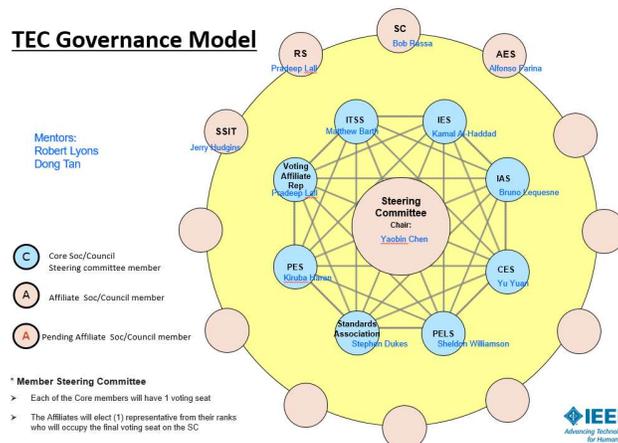


Fig. 1 – TEC Governance Model

Individual membership has experience steady growth since inception, as shown in the table below:

Year	Number of members	Increase
2014	0	
2015 (Dec)	4,476	
2016 (Dec)	5,765	+29%
2017 (Sep 22)	6,322	+10%

Considering membership detail, three important observations can be made:

1. First, 40% of TEC individual members do not belong to any IEEE societies, see Fig. 2. This reveals an important need for individuals to belong to an IEEE entity dedicated to transportation in general.

IEEE Current Grade Description	Count of Members
Affiliate	19
Associate Member	75
Graduate Student Member	160
Individual	78
Life Fellow	2
Life Member	25
Life Senior	10
Member	1976
Senior Member	116
Student Member	126
<b>Total Count of TEC Members who do not belong to an IEEE Society</b>	<b>2587</b>

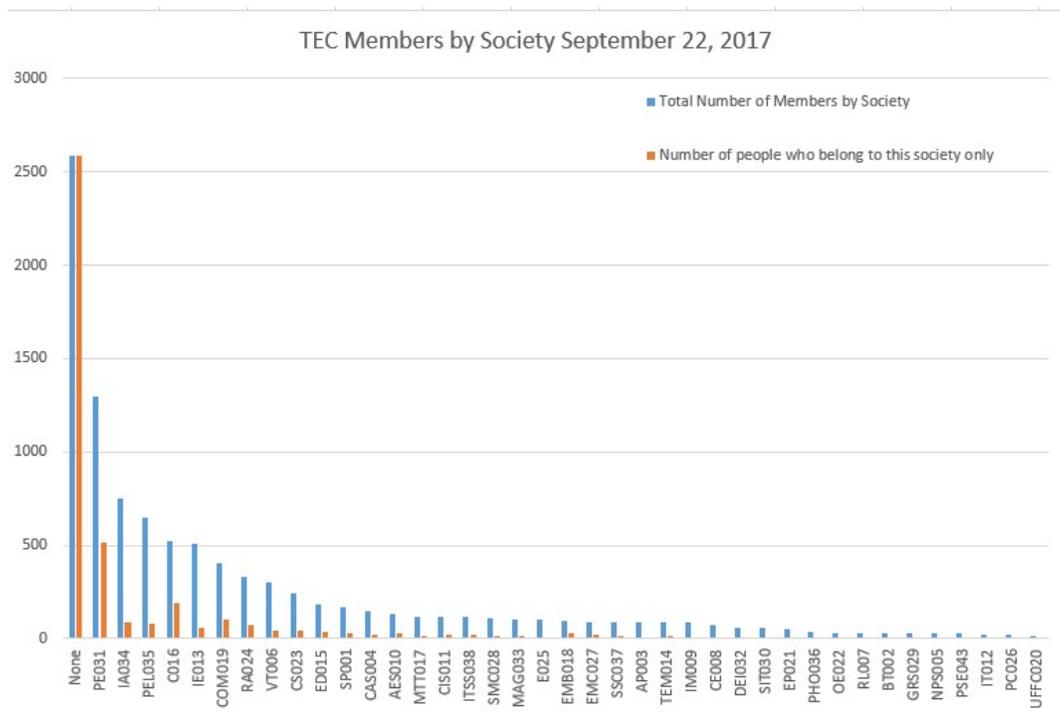
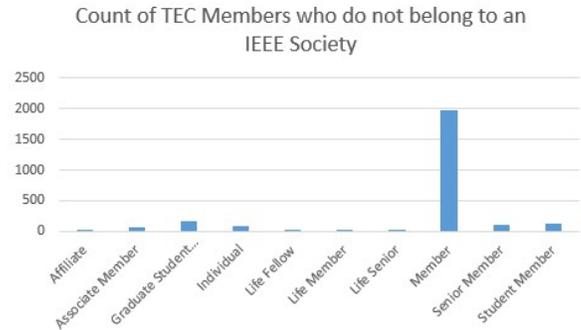
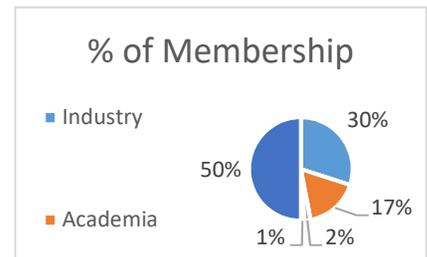


Fig. 2: Breakdown of individual member society (or no society) origin (Sept. 2017)

2. Strong participation from industry: Based on membership data from the IEEE database as of September 22, 2017, the following is the breakdown of TEC members by line of business:

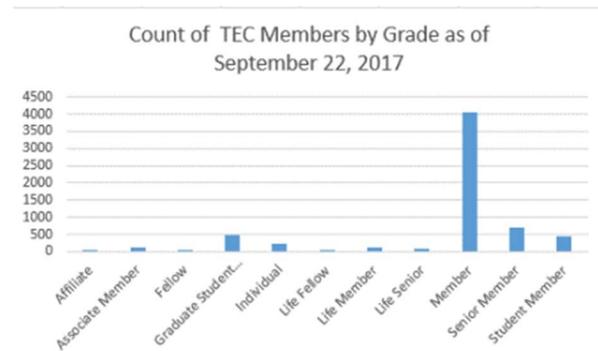
Category	Count	% of Membership
Industry	1,928	30%
Academia	1,060	17%
Government/Armed Forces	124	2%
Retired	62	1%
Unknown	3,148	50%
	<b>6,322</b>	<b>100%</b>



### Numbers as of September 22, 2017

3. Members seem to be relatively young, with 14% of them being graduate or student members:

IEEE Current Grade Description	Count of Members
Affiliate	60
Associate Member	105
Fellow	29
Graduate Student Member	467
Individual	240
Life Fellow	25
Life Member	107
Life Senior	80
Member	4072
Senior Member	708
Student Member	429
<b>Total TEC Membership as of September 22, 2017</b>	<b>6322</b>



## *Section V: Current TEC-Related Offerings*

TEC manages, directly or indirectly, a broad portfolio of offerings. “Direct offerings” refers to products managed by TEC itself, while “indirect offering” are managed by TEC member societies.

Conferences:

To date no conference is managed directly by TEC (see future plans below):

Conferences exclusively focused on transportation:

- IEEE Transportation Electrification Conference and Expo (ITEC) – With events in North America, Europe, Asia-Pacific, and India.
- IEEE Electric Ship Technologies Symposium
- IFEEC - ECCE Asia

Conferences with significant transportation element:

- IEEE Energy Conversion Congress & Exposition
- IEEE International Symposium on Systems Engineering
- Asian Conference on Energy, Power and Transportation Electrification (ACEPT)

#### Education:

Launched by TEI and managed by TEC:

- TEC e-Learning Courses (<http://ieeexplore.ieee.org/courses/category/16>):
  - Batteries (5 offerings) presented by Robert Spotnitz
  - Electric Machines (5 offerings) presented by Mahesh Krishnamurthy
  - Electric Vehicles (4 offerings) presented by James Gover
  - Fuel Cells (5 offerings) presented by Fei Gao
  - Wireless Power Transfer (5 offerings) presented by Chris Mi

Launched and managed by TEC:

- IEEE TV and Resource Center - <http://resourcecenter.tec.ieee.org/>
  - 27 DL and tutorial videos in place
  - Live webinars
- Distinguished Lecturer program - <https://tec.ieee.org/distinguished-lecturers-program>

#### Publications:

- No specifically TEC publication to date
- Electrification Magazine (PES, IAS, PELS); launched 2013.
- Transactions on Transportation Electrification (PELS, IAS, PES, VTS); launched 2015.
- Transactions on Intelligent Vehicles (ITSS, VTS, RAS, CES); launched 2016.
- The transactions from the member societies include many papers and issues dedicated to transportation.

#### Standards:

- Standard Initiative SCC 42: Leads the coordination of IEEE standardization activities for technologies related to transportation, especially in the areas of connected vehicles, autonomous/automated vehicles, inter- and intra-vehicle communications, and other types of transportation electrification. These technologies include but are not limited to Mobile Apps, Sensor Networks, and Communications that allow human to vehicle, vehicle to vehicle, vehicle to infrastructure, vehicle to platform, and vehicle to everything exchange of information and data. Where standardization needs exist, the SCC will develop guides, recommended practices, standards, and common definitions of terms.
- IEEE Standards Association and SAE International collaboration agreement for smart grid and vehicle-electrification standards

#### Student Activities:

- Formula Hybrid
- NASA Robotic Mining Competition

## *Section VI: Strategy Development Process*

The timeline for the creation of the Strategic Plan is as follows:

- Spring 2017: TEC Strategic Planning Committee tasked by TEC Steering Committee to develop a strategic plan for the next 3 years and beyond.
- June 24th – Strategy meeting (full day meeting).
- July 18th – Summary for TEC Steering Committee. Comments and general approval.
- August – Budgetary implications developed.
- September – Plan of action approved.
- November – Presentation to TAB
- 2018: Implementation

## Section VII: SWOT (2017)

The overall SWOT analysis as produced by the survey of the TEC Steering Committee in May 2017.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>● Regularly updated website information and committee meeting</li> <li>● The ability to bring together a variety of FOI experts to generate new IP</li> <li>● TEC is able to sit on the cutting edge of a lot of different areas. For example, energy storage and power electronics. We can use this to grow high quality conferences and journals that members of industry and academia will want to participate in.</li> </ul>	<ul style="list-style-type: none"> <li>● Not very visible at most levels.</li> <li>● Standards leadership, both as collaborator with SAE and a partner with SAE and others</li> <li>● A possible tendency to compete with existing products and efforts when a focus on new and complimenting would be more effective</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>● Ability to do student outreach at different levels</li> <li>● Have sponsored sessions with the branding clearly visible. Conference organizers should see the value TEC brings so that they can talk about it and also join it.</li> <li>● Expand the number and types on committees as well as add contributors to each. Promote all TEC related activities in IEEE to elevate the brand.</li> <li>● Global student competitions</li> </ul>	<ul style="list-style-type: none"> <li>● Technical communities have not established any leadership identity within IEEE as alternatives to Technical Societies for nurturing vital emerging issues. Too much “buzzword” feel without a structure and mission that is clear to those outside the community.</li> <li>● Losing mind share and industry recognition growth.</li> <li>● Do more and more people identify IEEE with TEC each year?</li> <li>● SAE has committees for aerospace and automotive electrification that produce standards. These would be considered direct competitors to standards we might produce</li> <li>● Insufficient interest from the member societies in working with TEC. I feel they leave TEC in its own world, not really caring.</li> </ul>

## ***Section VIII: Goals 2020***

TEC has identified 4 major initiatives aimed at 1) filling gaps in current IEEE offerings in transportation, and 2) cementing IEEE and, within IEEE, TEC, as the technical leaders in this field.

### **Goal 1: Portal**

Comprehensive, easy-to-navigate one-stop shop for any and all events in electrification within IEEE. This portal already exists, in fact it was developed at the beginning of the TEI initiative. However, it is felt that further developments could make it a more convenient point of entry for individuals, within and outside of IEEE, with technical interest in the field. This can be particularly true for the many professionals not versed in IEEE structure, who could come to better appreciate IEEE leadership in this area.

Specifically:

- Includes TEC offerings, as well as products from individual member societies
- Tutorial/Webinars/Conferences

***Assigned to: Alicia Tomaszewski, TEC Project Manager and Steering Committee Representatives***

### **Goal 2: Symposium Series**

TEC member societies offer a great array of technical conferences focused on one aspect or another of transportation electrification. What is missing however is an event focusing on recent technical challenges facing the industry, because such challenges often overlap with several IEEE societies' fields, leaving the matter either partially addressed by individual societies, not covered at all, or addressed in a way that lacks visibility outside of the organizing operating unit.

Objective: Bring together technical leaders to learn about and discuss a specific topic. A critical outcome would be a white paper.

- Focus on one timely subject (always different)
- Meant to bring together leaders needing technical understanding and in-depth discussions
- Keynotes, panels, roundtables, etc.
- Organized by a TEC Steering Committee
- Frequency could be every year or every other year.

There is nothing of the kind within IEEE, would complement current conference portfolio.

***Assigned to: Fei Gao, TEC Conference Committee Chair***

### Goal 3: Standard Coordination Group

Active Standard Committee to manage IEEE’s portfolio of transportation standards. Standard Initiative SCC 42 is a step in this direction, but its focus on connected vehicles and autonomous/automated vehicles covers only part of transportation electrification. It therefore needs to be expanded and reinvigorated to address this rapidly evolving field.

- Map out standard activities in the field, assess future needs.
- Coordinate with other engineering organizations:
  - SAE (and ASME, AIAA, etc) mostly for North America
  - Local organizations across the globe.

*Assigned to: Stephen Dukes, TEC Standards Committee Chair*

### Goal 4: TEC Magazine

Bring together all aspects of transportation electrification in one magazine:

- Focus on “one IEEE” in Transportation
- For industry, electrification is not compartmentalized

The Electrification Magazine already addresses some of this needs, but it is focused on powertrain electrification, therefore missing such important elements as connectivity, etc. It also covers microgrid power systems which although somewhat related to transportation (via vehicle charging) tend to dilute the focus. TEC has started a dialog with the Electrification Magazine, primarily PES and also IAS and PELS.

*Assigned to: Bruno Lequesne, TEC Strategic Planning Committee Chair and Jason Lai, TEC Publications Committee Chair.*