



IEEE Transportation Electrification Community Strategic Plan 2022 – 2025

Nov 2021
Fei Gao

2021 Strategic Planning Committee Members

Bruno Lequesne, TEC Chair
Yaobin Chen, TEC Past Chair
Philip Krein, TEC Past Chair
Burak Ozpineci, IAS Representative to TEC
Fei Gao, IES Representative to TEC, and TEC SPC Chair
Robert Rassa, AESS Representative
Robert Lyons, SC Representative
Mike Kelly, TEC Executive Director
Alicia Tomaszewski, TEC Project Manager

2021 TEC Steering Committee and Standing Committees

- Chair: Bruno Lequesne
- Secretary: Suresh Gopalakrishnan
- Treasurer: Kiruba Haran
- Standards Committee (and SA representative) – Farid Katiraei
- Education Committee – Eric Cheng
- Membership and Local Group Committee – Zedong Zheng
- Conference Committee (and IES representative) – Fei Gao
- Publicity Committee – Lee Stogner
- Publications Committee – Jason Lai
- ITSS Representative - Hadj Hamma Tadjine
- PELS Representative – Peter Wilson
- PES Representative – David Tuttle
- IAS Representative – Burak Ozpineci
- AESS Representative – Robert Rassa
- SC Representative – Robert Lyons

Administrative support:

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

Strategic Planning Meetings

Committee preparatory meetings:

April, May, June, July and August 2021, 2 hours each.

Official meetings:

- 1) Meeting 1 (Sept. 20, 2021 – 2 hours):
 - Introductions and TEC current status
 - Previous SPC meeting overview and progress
 - “Brainstorming” of new or updated ideas, SWOT analysis
- 2) Meeting 2 (Sept. 27, 2021 – 2 hours):
 - Review of proposed goal and objectives
 - Individual goal formulation and sub-group discussions
- 3) Meeting 3 (Oct. 4, 2021 – 2 hours):
 - Presentation of individual goal and objectives
 - Draft document preparation, next steps and timeline

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Section I: Executive Summary

The IEEE Transportation Electrification Community (TEC) conducted a strategic planning meeting series during the weeks from September 20 to October 4, 2021, via online platform. The purpose was to hold interactive discussions around critical questions identified by TEC leadership and to cast an eye forward to how the Community and its future status can best position TEC to advance its mission on behalf of IEEE.

All discussions were designed to elicit ideas on how TEC can expand their focus to become better integrated and effective over the next four years. In particular, the future status evolution of the TEC has been discussed extensively.

TEC recognizes and encourages individual society 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 enhanced coordination, and pan-IEEE products that could be initiated or further developed within TEC. Over the next 4 years (2022-2025), TEC plans to:

- 1) Move from Community to Council status within IEEE.
- 2) Enhance products and member benefits, by establishing education and webinar materials aimed at a broader public (industry practitioners, academics, and laypeople), in different languages, as well as reinforce its presence on social media and newsletters.
- 3) Grow in membership internationally and promote diversity by establishing technical committees, engaging young professionals and under-represented groups to TEC conferences and activities.
- 4) Increase engagement of people from industry, government, standards bodies, and other professional bodies.

Section II: History of TEC as the first pan-IEEE group in transportation

The IEEE Transportation Electrification Initiative (TEI), organized by the TAB Future Directions Committee, began functioning in 2012. As TEI, the group organized a couple of conferences focused on electric vehicles (IEVC, 2012 and 2013) and laid the groundwork for the transition to TEC. The IEEE Transportation Electrification Community (TEC) became an official entity in 2015, having been recommended for this status by the TAB Future Directions Committee. Since then, TEC has served as a “one voice” for Transportation Electrification external to IEEE. TEC has provided a platform to innovate, create and collaborate on all aspects of transportation electrification within IEEE. TEC members are IEEE OUs as well as individual members.

The following IEEE Operating Units are sponsors of TEC:

- IEEE Aerospace and Electronic Systems Society
- IEEE Dielectrics and Electrical Insulation Society (starting 1 January 2022)
- IEEE Industrial Electronics Society
- IEEE Industry Applications Society
- IEEE Intelligent Transportation Systems Society
- IEEE Power and Energy Society
- IEEE Power Electronics Society
- IEEE Standards Association
- IEEE Systems Council

Consistent with its initial vision, TEC has acted as a supporter and coordinator of IEEE OUs working in this field. However, the transportation industry is moving at a pace which requires more than just coordination: it requires a leading entity addressing the needs of this industry. This new TEC strategic planning document reflects this fast-moving trend. Individual actions and their reasoning will be detailed here.

Section III: Purpose and Values

The scope of the IEEE Transportation Electrification Community, as approved in 2015, 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 (TEC) coordinates broad and focused 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, off-road vehicles, 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 (TE) external to IEEE
- ✓ Formalize ongoing efforts to 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, smart, 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 2 affiliate members:

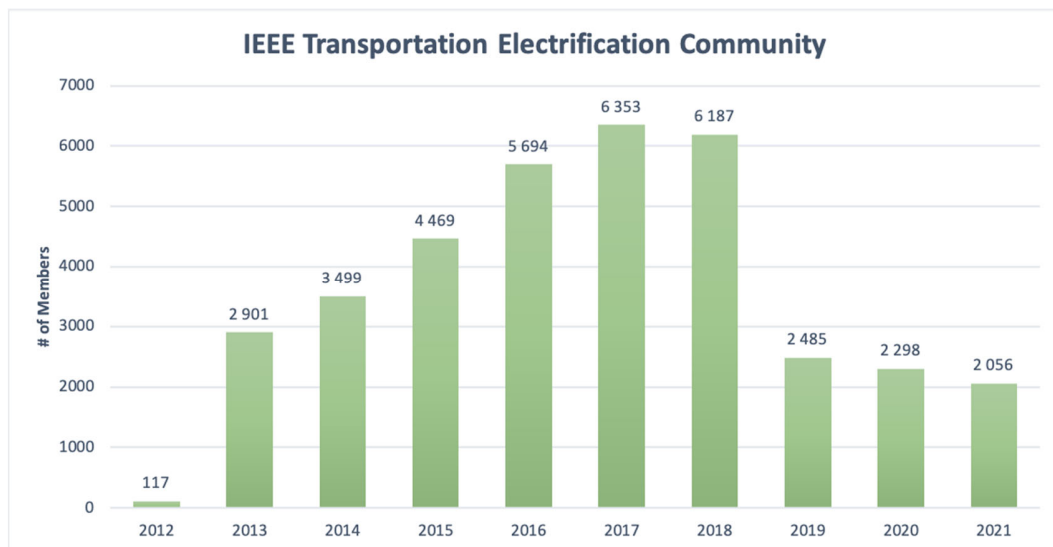
- 7 core societies/OUs:



- 2 affiliated societies/councils:



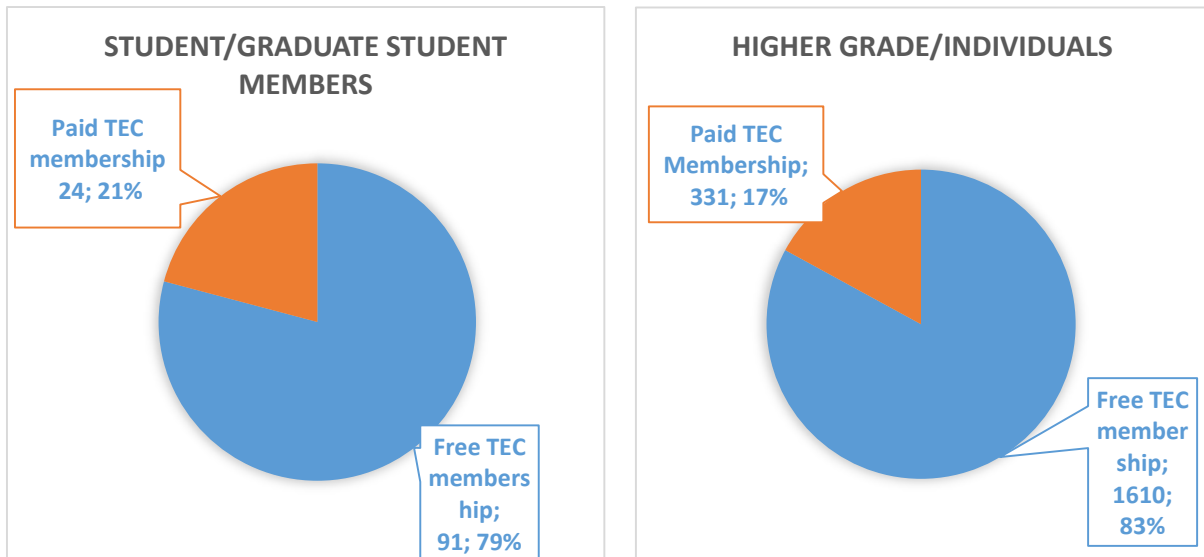
Individual membership has experienced steady growth since inception until 2018. TEC instituted a participation fee for individual members that started in 2019. The historical trends are shown below:



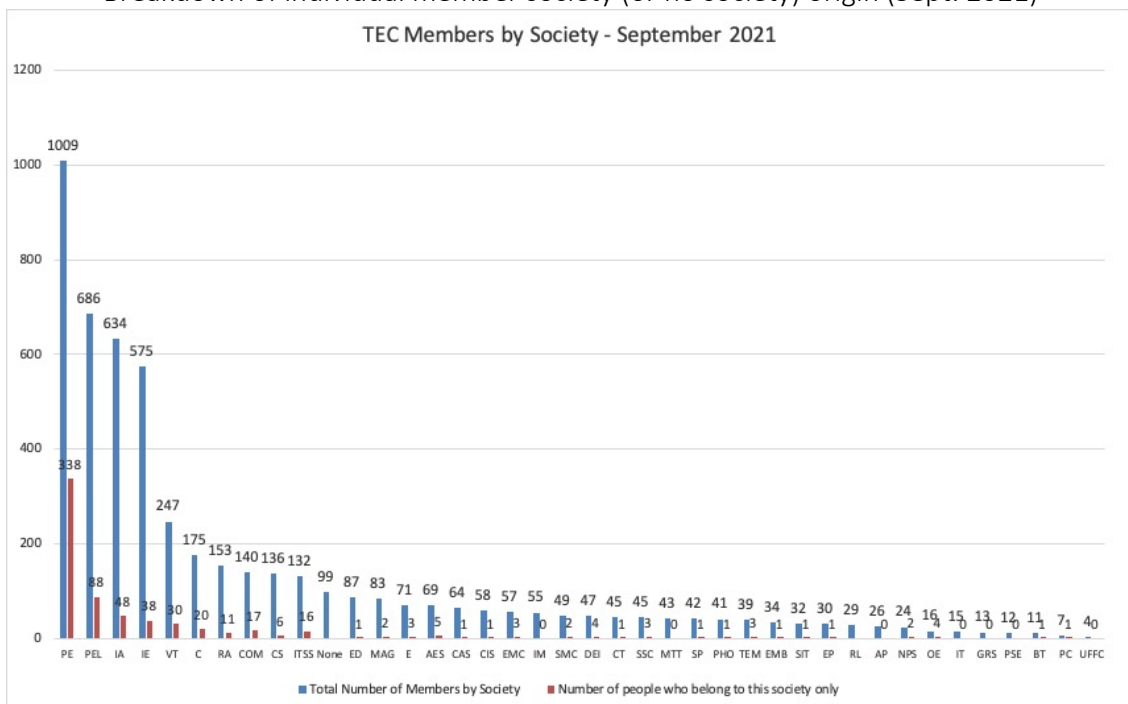
Note: Starting in 2019, TEC instituted a participation fee for individual members. The membership list was also updated by asking members to confirm their participation explicitly.

Considering membership details, three important observations can be made:

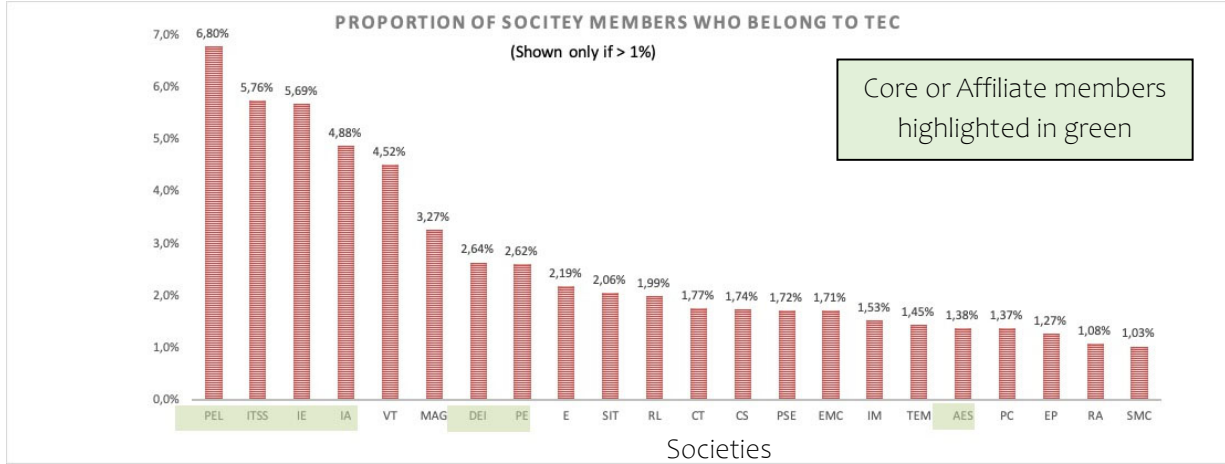
1. First, more than 17% of TEC individual members do not belong to any IEEE societies. This reveals an important opportunity for individuals to belong to an IEEE entity dedicated to transportation in general.



Breakdown of individual member society (or no society) origin (Sept. 2021)

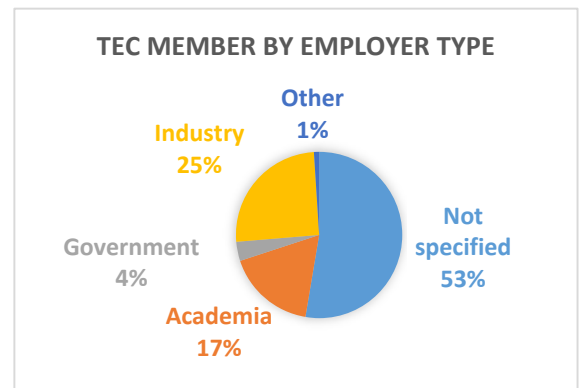


Proportion of society members who belong to TEC (Shown only if > 1%)

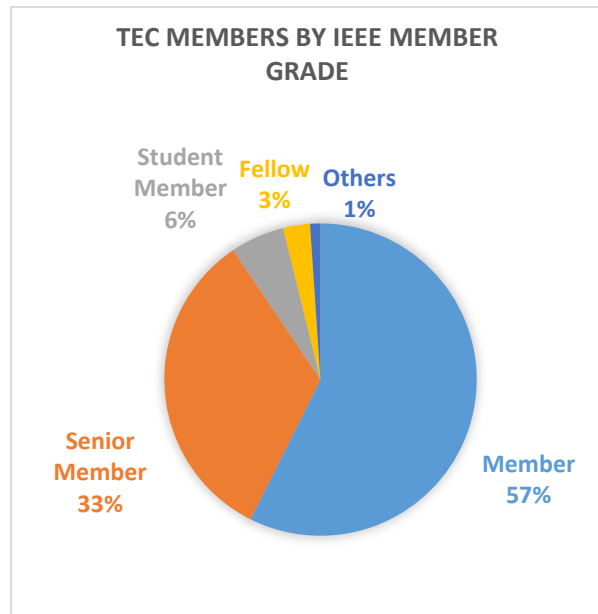
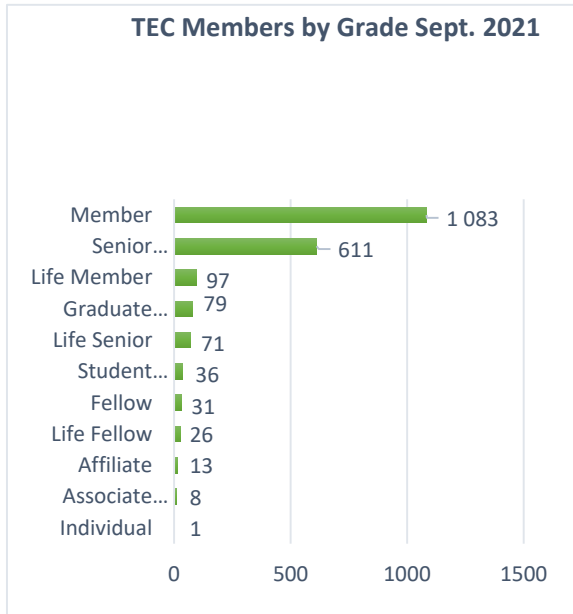


- Secondly, TEC has a strong participation from industry: Based on membership data from the IEEE database as of September 17, 2021, the following is the breakdown of TEC members by line of business:

Contact Employer Type (Primary)	Count	% of membership
Not specified	1 144	56%
Industry	550	27%
Academia	376	18%
Government	81	4%
Other	22	1%
Total	2 173	



- Graduate or student members represent now 6.5% (was 14% in 2017, when membership was free for anyone):



Section V: Current TEC-Related Offerings

TEC manages, directly or indirectly, a broad portfolio of offerings. “Direct offerings” refers to products managed or co-managed by TEC itself, while “indirect offerings” are managed by TEC member societies with TEC active in a support role.

Publications

- TEC eNewsletter: 4 online issues per year
- Transactions: Supports core society products. Coordinating special issue of TTE with AIAA/IEEE EATS in 2021

Conferences

- AIAA/IEEE EATS (Electric Aircraft Technologies Symposium) (40% Financial)
- IEEE Symposium on Emerging Technology of Transportation Electrification (Technical)
- Technical co-sponsor with other IEEE OUs for ESTS, ITEC NA, ITEC Asia-Pacific, ITEC India, in discussion with ESARS-ITEC-Europe, plans for VTECH in Latin America

Education

- Online tutorials (IEEE eLearning modules): 19 tutorials online, short course on aerospace electrification (with AIAA)
- Webinars: 5 in 2019, 11 in 2020; 7 in 2021 including new series of virtual panels
- Podcasts: 5 in 2020/2021
- IEEE TEC Prize Ph.D. Thesis Talk - 3 Min Ph.D. Challenge
- Other events: Student competitions; IEEE TryEngineering Tuesday: Electric Vehicles

Membership

- “Chapters” in the form of Local Groups: a TEC Group in Beijing in 2019, more are planned
- Women in Transportation Electrification (WiTEC)

Standards

- Survey of IEEE standards in transportation
- Several high priority fields identified in 2021
- approaching other organizations for possible cooperation: AIAA, ASTM, SAE

Publicity and promotion

- Website, social media, etc.
- TEC Career Center
- TEC Flipboard Magazine

Section VI: SWOT (2021)

The table below shows the overall SWOT analysis as produced by a survey of the TEC Steering Committee in September 2021.

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> • One voice within IEEE and for associations / companies outside IEEE • Clear products offering and dynamic contents update • Strong governing structure and involvement of sponsors OUs • Paying members • Popular webinars • Proven engagement building (e.g. AIAA) • Expanding into some rapid TE growth areas 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • Relatively low visibility across IEEE societies and members • Low interaction with TE related technical committees of our sponsoring IEEE OUs • Modest geographical diversity • Not enough joint activities with own sponsors • Financial position does not have a continuing base, except for sponsor support • Limitations on standards leadership
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Massive TE growth: growing need for IEEE leadership • Help to create synergy in TE areas across IEEE, with the engagement of sponsoring OUs • Act as an “IEEE federation” for TE related conferences, online contents, etc. • Reach out to internal and external organizations on behalf of IEEE in TE • Bridge the world in the field of TE as technology expands globally (especially China) • Standards development • Creation of awards 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • TEC financial status has a limited base • Risk if TE products compete with products from our IEEE OUs, like conferences, magazines, etc. rather than complementing or coordinating with them • Outside organizations jumping into TE leadership gaps where IEEE has relevant activities

Section VII: Goals 2025

The main ideas presented during 2021 TEC Strategic & Planning Committee (SPC) meetings can be grouped under 3 pillars:

2022-2025 Goals summary

1. New status	2. New products	3. New members
New Transportation Electrification Council: Building IEEE's next massive megatrend	TEC's own conferences, publications and online media contents	Broader membership with underrepresented groups, young professionals, strong industry base, early career researchers, etc.

Key Strategies

<p>1.1 Identify potential member societies, propose to TAB to become a council, review TEC field of interest</p> <p>1.2 Help IEEE to achieve leadership in TE. Coordination of IEEE activities</p> <p>1.3 Participation in relevant standards. Address compliance and verification, work with government bodies</p> <p>1.4 Enhance existing relevant products and establish new ones that open new market opportunities</p> <p>1.5 Formulate business model for financial stability</p> <p>1.6 Establish a clear ongoing strategic planning process</p>	<p>2.1 Establish education and webinar materials for general/technical public with different languages</p> <p>2.2 TEC Newsletter with invited overview article type, be indexed in IEEE Xplore</p> <p>2.3 More social media contents and advertisement</p> <p>2.4 Development of publication and opportunities (new products, etc.)</p> <p>2.5 More activities like e-learning, Master/PhD talk, student competition</p> <p>2.6 Increase engagement of industry people to the conferences</p> <p>2.7 Start focused workshops or (executive) roundtable events</p> <p>2.8 Identify standard and certification opportunities</p>	<p>3.1 Establish technical committees, working groups, chapters to engage individuals and members</p> <p>3.2 Increase membership numbers</p> <p>3.3 Encourage young professionals to attend the TEC conferences</p> <p>3.4 Attract more WIE (WiTEC) members by offering more service and professional activities</p> <p>3.5 Attract more industry people from other professional bodies and all transportation modalities</p> <p>3.6 Consider geographical diversity and other under-represented groups</p> <p>3.7 DL series program development</p>
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Strategic Goals	Targeted Timeline
1. New Transportation Electrification Council: Spearheading IEEE's next megatrend	
1.1 Identify potential member societies, propose to TAB to become a council, review TEC field of interest <ul style="list-style-type: none"> – Potential advocate OUs meetings at end 2021 and early 2022 	Short term
1.2 Help IEEE to achieve leadership in TE. Coordination of diverse but so far separate IEEE activities to establish central IEEE role in transportation electrification and PoC for external organizations <ul style="list-style-type: none"> – Leadership in systems aspects of massive energy transition from fuel to electric transport – TEC has a well-established track record, operating in a coordination and collaboration role in the field – Provide more coordination among the multiple Societies that engage in TE 	Long term
1.3 Participation in relevant standards. Address compliance and verification, work with government bodies <ul style="list-style-type: none"> – As a Council, TEC can participate in standards development with supports from IEEE SA 	Medium to long term
1.4 Enhance one or more existing relevant products and establish new ones that open new market opportunities	Short to Medium term
1.5 Formulate business model that leads to financial stability within three years after Council approval	Short term
1.6 Establish a clear ongoing strategic planning process <ul style="list-style-type: none"> – Target 2022 TAB meetings, and status transition in 2023 	Short term
2. Enhance products and member benefits	
2.1 Establish education and webinar materials aimed at the general public. Explore offerings in various languages. Expand current technical webinars, tutorials, and short courses <ul style="list-style-type: none"> – Show people the electric transportation experience – Courses on various topics (WPT, drive, security, charging, energy storage, retrofit, EV design, space vehicles, autonomous vehicles, etc.) 	Short to Medium term

2.2 TEC Newsletter with invited overview article types. Target indexing in IEEE Xplore	Short to Medium term
<ul style="list-style-type: none"> – Special attention to be paid on not too technical articles, to be distinguished from transactions type papers 	
2.3 More social media contents and advertisement	Medium term
2.4 Development of publication and opportunities (new products, etc.)	Medium to long term
<ul style="list-style-type: none"> – Need to be coordinated with potential new TEC status – Council status opens new possibilities on magazine and journal type publication 	
2.5 More activities like e-learning, Master/PhD talk, student competition	Short to Medium term
2.6 Increase engagement of industry people to the conferences	Medium term
2.7 Start focused workshops or (executive) roundtable events	Short to Medium term
<ul style="list-style-type: none"> – start with a plan for 1 to 2 events per year 	
2.8 Identify standard and certification opportunities: Charging, autonomous vehicles, mobility as a service, etc.	Short to Medium term
<ul style="list-style-type: none"> – start with ICAIDs on specific topics, and lend support for existing initiatives from IEEE SA and other OUs 	
3. Membership growth and diversity	
3.1. Establish technical committees, working groups, chapters, and other direct ways to engage individuals and individual members	Short to Medium term
<ul style="list-style-type: none"> – Create new chapters / joint chapters with TEC sponsors – Create technical committees with focus and interests of a specific technical field 	
3.2. Increase membership numbers, Keep paid TEC members when transition to a council	Medium term
3.3. Encourage young professionals to attend the TEC conferences	Short to Medium term
<ul style="list-style-type: none"> – Provide opportunities of travel grants or other financial supports 	
3.4. Attract more WIE (WiTEC) members by offering more service and professional activities (e.g. dedicated WiTEC panels in conferences)	Short term
<ul style="list-style-type: none"> – Focus on personal development of women members – Encourage chairs of young professionals or women 	

engineers from other core societies to join TEC and work in synergy	
3.5. Attract more industry people from other professional bodies (SAE, ACM, etc.) and from all transportation modalities (rail, marine, aerospace, etc.)	Long term
3.6. Consider geographical diversity and other under-represented groups – Add new dedicated section in TEC operation manual and bylaws	Short to Medium term
3.7. Distinguished Lecturer series program development – Re-activate TEC DL program (stopped in the past due to financial issue)	Medium term

Rationale for progression to Council:

The Transportation Electrification Community can do much more as a Council. Transportation electrification is one of the most rapidly expanding IEEE fields in many years:

- Automotive – Battery Electric Vehicle sales increased 40% in US in 2020, EV/PHEV sales are at 85% in Norway, 12% in China, and there are literally dozens of startup companies involved today
- Aircraft: dozens of new startup companies and some regulars are developing battery-powered aircraft, many with hydrogen fuel
- Fleets: Amazon has ordered 100,000 electric delivery vans; many companies are developing the capability, many of which are autonomous
- Ships: There are transformative changes in such applications as ferries (in Norway for instance), around ports, and also for smaller, pleasure crafts for instance.
- We see the need for a Journal focused on electrification in the transportation industry
 - Technical Communities cannot have a publication; Councils can.

As a Council, TEC can:

- Have Chapters across the world for IEEE members interested in electrification
- Provide more coordination among the multiple Societies that engage in technology relevant to the field
- Initiate focused Conferences with member Societies in the field
- Initiate a new Journal – perhaps Open Access – on electrification in the transportation industry
- Participate in standards development
- Initiate awards in the field

Purpose of a Technical Council:

- Per IEEE Bylaw I-401.6, Technical Councils may be established by the Technical Activities Board for *the purpose of providing a continuing mechanism for two or more IEEE Societies, called Member Societies, to work together in a multi-disciplinary technical area of mutual interest, primarily through conferences and publications.*
- TEC has actually been doing that – essentially operating as a Council - since its formation 6 years ago.

Implementation plan

The implementation plan for the goals above (numbered 1.1 to 3.7) should be driven by TEC steering and standing committees:

- Steering committee: G1.1, G1.2, G1.5, G1.6, G3.1 (*joint*)
- Publication committee: G1.4 (*joint*), G2.2, G2.4
- Conference committee: G1.4 (*joint*), G2.6 (*joint*), G2.7, G3.3 (*joint*)
- Membership committee: G2.6 (*joint*), G3.1 (*joint*), G3.2, G3.4, G3.5 (*joint*), G3.6
- Education committee: G2.1, G2.5, G3.7
- Standard committee: G1.3, G2.8, G3.5 (*joint*)
- Publicity committee: G2.3, G3.3 (*joint*), G3.5 (*joint*)