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InComEss

Innovative polymer-based composite systems for high-efficient energy scavenging and storage

Deliverable

D9.10.b Report on the contribution to standardization

Deliverable Lead: UNE

Deliverable due date: 28/02/2022

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Document History					
Version	**Date**	**Responsible**	**Changes**	**Stage**	**Distribution**
V1.0	24/01/2022	UNE	Document creation	Draft	AR (CIRCE)
V1.0	28/01/2022	AR (CIRCE)	No changes	AR Reviewed	UNE
V1.1	03/02/2022	UNE	Minor updates	Updated draft	All partners
V1.1	21/02/2022	All partners	No changes	Draft reviewed by all partners	Ready for submission

Table of Contents

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EXECUTIVE SUMMARY / ABSTRACT

Deliverable D9.10 “Report on the contribution to standardization” will collect the actions carried out throughout the InComEss project to contribute to standardization based on its results. The contribution to standardization seeks to transfer selected InComEss outputs to European (CEN/CENELEC) or international standards (ISO/IEC) in order to ease the market uptake as well as their impact beyond the duration of the project.

D9.10 shall be delivered in M42, however it was considered that two previous versions were published to first, define a strategy to proceed with this contribution (D9.10.a, M9) and second, to record the actions aimed at interacting with the standardization system (D9.10.b, present document) that will facilitate the subsequent contribution to standardization. It is foreseen that the final version of D9.10 in M42 will include the final standardization route, the technical proposal itself and the advance reached in the consensus building process.

D9.10 is part of Task 9.3 “Standardization activities”, led by the Spanish Association for Standardization (UNE), as National Standardization Body (NSB) member of CEN-CENELEC and ISO-IEC, and included in WP 9 “Exploitation, dissemination and communication”.

SCOPE

This second version of D9.10 collects the actions carried out and the results of the interaction with the standardization system. These interactions are addressed to the standardization technical committees previously identified in D9.10.a where the relevant stakeholders in the different fields are represented.

The objectives of these actions are to:

- Disseminate the goals and available results of InComEss using the standardization community network;
- Gather any feedback that may come from the standardization community regarding the development of the project;
- Facilitate the subsequent contribution to standardization through the prior knowledge of InComEss by the standardization committees.

1 Interaction with the standardization system

The interaction with the standardization system consists of the approach of InComEss to the technical committees (TCs) identified as relevant to the project. The objective of the first contact is to raise awareness about InComEss and to facilitate subsequent contacts in case the standardization process is finally launched within a specific standardization committee. Moreover, feedback is asked to gather any view, opinion or advise about the project and the standardization possibilities or needs.

According to deliverable D9.10.a, the most relevant technical committees to establish a possible first contact were those related to the energy harvesting systems:

Table 1-1: Possible technical committees for dissemination activities

Subject	Technical Committee
Piezoelectric energy harvesting	CLC/SR 49, *Piezoelectric and dielectric devices for frequency control and selection* IEC/TC 49, *Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection*
	ISO/TC 61, *Plastics* CEN/TC 249, *Plastics*
	ISO/TC 206, *Fine ceramics* CEN/TC 184, *Advanced technical ceramics*
	IEC/TC 47, *Semiconductor devices*
Thermoelectric energy harvesting	ISO/TC 229, *Nanotechnologies* IEC/TC 113, *Nanotechnology for electrotechnical products and systems*
	ISO/TC 61, *Plastics* CEN/TC 249, *Plastics*
	IEC/TC 47, *Semiconductor devices*
Power conditioning system	CLC/TC 22X, *Power electronics* IEC/TC 22, *Power electronic systems and equipment*
	CLC/TC 38, *Instrument transformers*
	IEC/TC 96, *Transformers, reactors, power supply units, and combinations thereof*
Supercapacitor	IEC/TC 40, *Capacitors and resistors for electronic equipment*
	IEC/TC 119, *Printed electronics*

1.1 First contact with the standardization technical committees

Considering the progress of the project and the corresponding information available so far, from June 2021 (M16) an initial communication was established with the following TCs:

Table 1-2: Standardization committees contacted

Technical Committees
IEC/TC 49, Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection CLC/SR 49, Piezoelectric and dielectric devices for frequency control and selection (*)

Technical Committees
IEC/TC 40, Capacitors and resistors for electronic equipment CLC/TC 40XA, Capacitors and EMI suppression components
IEC/TC 119, Printed electronics
CEN/TC 249, Plastics (**)
IEC/TC 47, Semiconductor devices CLC/SR 47, Semiconductor devices (*)
CEN/TC 184, Advanced technical ceramics (**)
ISO/TC 229, Nanotechnologies CEN/TC 352, Nanotechnologies

(*) Reporting Secretariats in the absence of a European committee
(**) Since InComEss is a European project, it was initially considered to contact the European TCs instead of their international mirror committees

The communications were addressed to the officers, Chair and Secretary, of each committee (the list of contacts is included in Annex I).

The text for the communication included:

- A brief introduction of the project.
- Definition of the aim of the standardization activities in the project, presenting UNE as part of the standardization community as well as the project partner that leads these activities.
- The possible relationship of the work developed in InComEss with the relevant standardization committee, highlighting some specific aspect of interest of the project and/or the relevant standards.
- Link to the InComEss website.
- The InComEss PowerPoint general presentation.

Annex 2 shows an example of communication.

After the first contact, the following answers were received:

Table 1-3: Response from the technical committees

Technical Committee	Answer
IEC/TC 49, CLC/SR 49	2021/08/11. The IEC/TC 49 Secretary clarifies that they develop and maintain international standards for electronic devices that use piezoelectric materials for frequency control, selection and detection but do not deal with area related to piezoelectric energy harvesting that applies the piezoelectric phenomenon. Moreover, the committee does not have specialists in piezoelectric energy harvesting. Therefore, the Secretary thinks that, in principle, a possible contribution in that area would be difficult.
IEC/TC 40, CLC/TC 40XA	2021/08/18. The IEC/TC 40 and CLC/TC 40XA Chair appreciates so much the contact and information received from InComEss. He confirms the interest of both committees in joining and contributing to the project in the field of standardization. On behalf of these TCs, he invites the consortium to present InComEss at their meetings on September 29th (CLC/TC 40XA) and November 4th /5th (IEC/TC40/WG40) (*)
IEC/TC 119	2021/08/12. The IEC/TC 119 Chair shows interest in the project and also invites InComEss to present it at its meeting on September 7th.
CEN/TC 249	No answer was received after some reminder.

Technical Committee	Answer
IEC/TC 47, CLC/SR 47	2021/08/17. The IEC/TC 47 Secretary welcomes the information on InComEss and forwards it to IEC/TC 47/WG 7 related to semiconductor devices for energy conversion and transfer. The WG 7 Convenor invites InComEss to make a presentation at its meeting on October 5th.
CEN/TC 184	No answer was received after some reminder.
ISO/TC 229, CEN/TC 352	2022/01/25. The ISO/TC 229 Secretary thanks the information provided and forwards it to the leaders of ISO/TC 229/JWG 2 "Measurement and characterization" and ISO/TC 229/WG 4 "Material specifications". The coordinators of both WGs are interested in the project and suggest InComEss to present it at the Strategy Study Group meeting that will possibly take place in May 2022 (to be confirmed). 2022/02/02. Concerning CEN/TC 352, the Chair also welcomes the information on InComEss and undertakes to present it to the members of the WG1 "Metrology and performance evaluation" and at the TC plenary meeting to be held on March 24th.

(*) Finally, it was decided to give priority to the European level and the CLC/TC 40XA meeting was only attended. In the future, it is not discarded to also present the project internationally.

1.2 Subsequent interaction with the standardization technical committees

Although responses were not received from all the TCs, the opportunity to directly present the project to three of them is positively valued by InComEss.

As scheduled, InComEss was formally presented to the TCs during their online meetings (see Annex 3 for the TCs agendas). A specific presentation was prepared to explain the general objectives of the project as well as those WPs most related to the activity of the TC, in particular WP 3 and WP 4. Existing standards and standards in progress, identified in deliverable D9.9 as being of possible interest to the project, were also discussed with the members of the corresponding TC. Additionally, the different options to be considered in case of a future standardization contribution within the TC, were raised.

The general aspects of the project were presented by UNE while the technical part was carried out by Tampere University and IPF.

As an example, the presentation addressed to IEC/TC 47/WG 7 is included in Annex 4.

Although no specific proposals were made due to the limited progress of the project, a positive feedback was received from the three committees. They encouraged the project partners to become active within the TCs and were willing to collaborate on any proposal that the consortium might present within their fields of activity. In particular, CLC/TC 40XA showed special interest in the conclusions that InComEss could achieve in the field of flexible supercapacitors in terms of mechanical dimensions or constructional aspects.

Participants committed to keep the lines of communication open for potential future collaborations.

Concerning the participation of InComEss partners in the TCs (one of the ways of interaction described in D9.10.a), it should be noted that Tampere University is already participating in IEC/TC 119, so that it would facilitate the monitoring of its activity as well as the standardization process in case it is initiated within this TC.

2 Conclusions

The interaction with the standardization system aims at spreading the knowledge of InComEss in the European or international standardization community where different categories of stakeholders are present (industry, academia, test laboratories, etc.) in order to pave the way for a future contribution. Therefore, the standardization system is used as a targeted dissemination channel.

Information on InComEss was delivered to the selected standardization committees in the fields of piezoelectric and thermoelectric energy harvesting, supercapacitors and nanotechnologies. Communications reached 9 TCs and 2 SRs.

Responses were not received from all of them, but good comments were received from those dealing with printed electronics, capacitors and semiconductor devices. Although it was not possible to present specific standardization proposals due to the limited progress of the project at that time, these three TCs expressed their interest in the project and offered collaboration and communication disposal. In particular, CLC/TC 40XA was very interested in the possibility of addressing certain aspects related to flexible supercapacitors if the InComEss results in WP 4 allow it.

Regarding the latest answers received from nanotechnologies TCs, it shall be noted the initial suggestion from the CEN/TC 352 Chair to take into consideration the current lack of standards on the characterization, quality control or performance evaluation of carbon nanotubes.

On the other hand, the IEC/TC 49 response expressing its low relationship with InComEss, facilitates the possibility of proposing a possible CWA in the field of piezoelectric energy harvesting, if finally this is an option to be considered in the project. This type of document could be also a good option in case standardization related to hybrid thermo/piezoelectric materials is considered since no specific TC has been identified and there is a lack of specific normative documents on this subject.

The lack of response from some committees is not easy to interpret. In any case, they will continue to be taken into account for future contacts, especially if a proposal that could fall within their field of activity is made.

Next steps in standardization activities shall be aimed at making an effective contribution to standardization. It will require:

- Continue the interactions with contacted TCs, opening new lines of communication if necessary.
- Discuss the potential topics to be standardized based on the outcomes of the WPs.
- Decide on the topic(s) to promote and on the most suitable way(s) to contribute to standardization.
- Develop the final proposal and carry out the standardization process according to the selected roadmap.

These actions and their results will be collected in the final version of D9.10 in M42.

3 Annex 1. List of Officers of the technical committees contacted

Technical Committee	Contact
IEC/TC 49, Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection	Secretary: Mr Masanobu Okazaki (JP) Chair: Mr Donald C Malocha (US)
CLC/SR 49, Piezoelectric and dielectric devices for frequency control and selection	Secretary: Mr Dieter Hinterwäller (DE)
IEC/TC 40, Capacitors and resistors for electronic equipment	Secretary: Mr Ronald Drenthen (NL) Chair: Mr Walter Huck (DE)
CLC/TC 40XA, Capacitors and EMI suppression components	Secretary: Mr Kimmo Saarinen (FI) Chair: Mr Walter Huck (DE)
IEC/TC 119, Printed electronics	Secretary: Mr Kyung-Tae Kang (KR) Chair: Mr Andreas Willert (DE)
CEN/TC 249, Plastics	Secretary: Mr H. Janssens (BE) Chair: Mr H. Omloo (NL)
IEC/TC 47, Semiconductor devices	Secretary: Mr Cheolung Cha (KR) Chair: Mr Bob Mitchell (US)
CLC/SR 47, Semiconductor devices	Secretary: Mrs Laurence Guedon (FR)
CEN/TC 184, Advanced technical ceramics	Secretary: Mr S. Lübbert (DE) Chair: Dr A Rendtel (DE)
ISO/TC 229, Nanotechnologies	Secretary: Mr David Michael (UK) Chair: Dr Denis Koltsov (UK)
CEN/TC 352, Nanotechnologies	Secretary: Mr Patrice Conner (FR) Chair: Mr Emeric Frejafon (FR)

Contact details are omitted due to data protection.

4 Annex 2. Example of communication with a technical committee

InComESS

INnovative polymer-based COmposite systeMs for high-efficient Energy Scavenging and Storage

To the attention of the IEC/TC 40 and CLC/TC 40XA Officers

Dear Sirs

First of all, let me introduce myself. My name is Carmen Martín and I am working in UNE, the Spanish Association for Standardization.

I am addressing you on behalf of the European H2020 project InComEss which aim is to *develop efficient smart materials with energy harvesting and storage capabilities combining advanced polymer based-composite materials into a novel single/multi-source concept to harvest electrical energy from mechanical energy and/or waste heat ambient sources. Three cost-effective and green Energy Harvesting Systems configurations will be realized through the combination of high performance piezoelectric, thermoelectric and Thermo-Piezoelectric generators and monolithic supercapacitors to power selected wireless sensors nodes to be implemented in*

different IoT scenarios for structural health monitoring in buildings and aircrafts and accurate location and monitoring of vehicles through GPS and MEMS sensing.

As part of this project, under the responsibility of UNE, representing CEN/CENELEC in InComEss, specific standardization activities are included to:

- Ensure compatibility with existing technologies by the identification of relevant existing standards.
- Maximize dissemination to proper stakeholders by addressing the relevant standardization technical committees, and
- Contribute with the findings and knowledge generated during the project to the development of standardization in the field.

The objective of this contact is, on one hand, to raise awareness on the project to this TC and gather feedback on any suggestion, question or comment. On the other hand, it is intended that in the second half of the project, there is a contribution to standardization from selected project results. Depending on several factors such as the nature of these results and the standardization landscape at the moment, this contribution to standardization may be aimed at generating new pre-standards (Workshop Agreements) or participating at TC level by making some contribution to a standard under development, for example.

One of the work packages of InComEss is focused on developing low-cost environmentally sustainable storage supercapacitors (SCs) with high energy density and power density together with extended operation window (temperature and voltage) to store the energy harvested by the piezoelectric, thermoelectric and thermo-piezoelectric generators devices. Printability of electrodes and electrolyte-based materials combinations will be further assessed and demonstrated for the monolithically preparation of SCs with increased capacitance and enhanced thermal and mechanical stability.

That is the reason why we think the project could be of interest to TC 40. Furthermore, the EN/IEC 62391 standards were identified as of possible interest for the project.

Please, find attached a brief summary containing the most relevant information about InComEss (further detailed in the webpage). Feel free to circulate this information to your TC members or to anyone you consider potentially interested in the objectives and results of the project. Now the project is 1/3 progressed and we would be very grateful if you could give us feedback regarding the interest in this project for the TC activity. Additionally, any suggestion, question or comment related to the project would be very useful.

If you think that additional information would be welcome, as well as other kind of contact (a dedicated telco, attending to a TC, SC or WG meeting to explain the project, etc.) we would be pleased to address it.

I would greatly appreciate if you could provide at least an initial feedback no later than mid-September.

Thank you in advance for your attention and kind collaboration.

Looking forward for your reply, yours sincerely,

Carmen MARTÍN MARINO
Business Manager
Electrotechnology and ICT
camartin@une.org

5 Annex 3. IEC/TC 119, CLC/TC 40XA (abstract) and IEC/TC 47/WG 7 Agendas

IEC

119/AG1 Agenda
For IEC use only
2021-09-07

INTERNATIONAL ELECTROTECHNICAL COMMISSION
TECHNICAL COMMITTEE No. TC119: PRINTED ELECTRONICS
AG1 Agenda

Proposed agenda for the 2021 meeting of IEC/TC 119/AG1
Meeting Date/Time: Tuesday 2021-Sep-07 from 8:00 am to 12:00 am (CEST)
Meeting Venue: via ZOOM web-meeting

Item	Description	Documents
1	Roll call of the participants	
2	Review of liaison strategy, liaison officers	
2.1	ISO TC 130 interaction	
3	Strategic Business Plan	
4	UNE presentation of projects MADRAS and InComEss	
5	Future meeting schedules	
5.1	2022 Plenary meeting – proposal from ES	
5.2	Invitation to meet at LOPEC 2022	
6	Any other business	

ZOOM log-in data

Topic: IEC TC 119 - AG1 - Advisory Group
Time: Sep 7, 2021 08:00 AM Amsterdam, Berlin, Rome, Stockholm, Vienna

Join from PC, Mac, Linux, iOS or Android:
https://iec.zoom.us/j/91745569535?pwd=L3R0WEE4NFI1SVNQNUJTbjJYWnp5Zz09

Meeting ID: 917 4556 9535
Password: 381839

International numbers available:
https://iec.zoom.us/u/auDyJbzUV

Or Skype for Business (Lync):
https://iec.zoom.us/skype/91745569535

FORM Agenda (IEC)
2011-02-11

Not for reproduction
Original: English

TC40XA/Sec/0900/DA
September 2021

CENELEC

EUROPEAN COMMITTEE FOR ELECTROTECHNICAL STANDARDISATION

TECHNICAL COMMISSION 40XA: CAPACITORS AND EMI SUPPRESSION COMPONENTS

Draft Agenda for the 45th meeting of TC 40XA, to be held on September 29th, 2021, starting 9:00 (CEST).

Meeting place: Meeting will be organized as a teleconference.

1 Opening

2 Agenda

2.1 Draft Agenda **TC40XA/Sec/0xxx/DA** will be discussed and approved 3.

3 Committee Administration

3.1 Delegates

Changes in delegates after 44th meeting:

3.2 Attendance

3.3 Next Meetings

3.4 Working groups

No active working groups.

3.5 Business Plan

BP will be discussed

3.6. Collaboration tool

Collaboration Platform is in active use.

4 Last Meeting

4.1 Unconfirmed minutes of the 44th TC40XA meeting held May 6th 2021 as teleconference, TC 40XA/Sec/0887/RM will be approved

4.2 Actions marked with **bold** in the minutes of the last meeting.

5 General topics

5.1 Reports from other Committees

5.1.1 IEC TC 40,

See subjects below in paragraph 6.

5.1.2 IEC TC 91, Electronics assembly technology,

Mr. Huck will report.

5.1.3 IEC TC 119, Printed Electronics

5.1.4 IEC TC 111, Environmental standardization for electrical and electronic products and systems, CLC TC 111X, Environment

Mr. Huck will report.

5.1.5 IEC TC 104 – Environmental Conditions, Classification and Methods of Test

Mr. Saarinen will report.

5.1.6 TC 113, Nanotechnology standardization for electric and electronic products and systems.

Nothing to report.

5.1.7 Technical problems coming from the Hazard Based Standards.

5.1.8 TC 101, Electrostatics

5.1.9 TC 56, Dependability

5.2 Question on liaisons from BT

TC40XA/Sec0520/DS requesting clarification on liaisons and encouraging to co-operate with stakeholders. This will be kept on the agenda although there is nothing to be reported.

5.3 BT Reporting

5.3.1 TC40XA's report to BT

Report to BT after the 44th meeting, and BT's reports back will be noted: **TC40XA/Sec/0888/REP.**

5.4 Others

5.4.1 AEC Q200 Revision E – Stress test qualification for passive components

AEC Q200 Draft Revision E, TC40XA/Sec/636/INF.

Discuss the situation.

5.4.2 INnovative polymer-based COmposite systeMs for high-efficient Energy Scavenging and Storage

Presentation of European Horizon2020 project InComEss.

6.0 IEC TC40

TC 40 2021 plenary meeting's preliminary agenda, 40/2842/DA, TC40XA/Sec/0901/INF

IEC

For IEC use only	TC47/WG7 2021-10

INTERNATIONAL ELECTROTECHNICAL COMMISSION
TECHNICAL COMMITTEE No. 47: SEMICONDUCTOR DEVICES
WORKING GROUP No. WG7: ENERGY CONVERSION AND TRANSFER Working Group

Draft agenda of the TC47/WG7 meeting via ZOOM web-meeting on 2021-10-05 from 14:30 pm to 16:00 pm (CEST)

1. **Opening of the meeting**
2. **Approval of the agenda**
3. **Confirmation of the last minutes held via ZOOM web-meeting on May 20, 2021**
4. **Report of convenor**
5. **Discussion of working projects**

Project Reference	Title	Document Reference	Current Stage Date	Current Stage	Next Stage Date	Next Stage	Project Leader
IEC 62830-8 ED1	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 8: Test and evaluation methods of flexible and stretchable supercapacitors for use in low power electronics	47/2529/NP (Init. Date: 2019-04)	2021-09	PRVD	2021-10		Jae Yeong Park
IEC 63150-2 ED1	Semiconductor devices - Measurement and evaluation methods of kinetic energy harvesting devices under practical vibration environment - Part 2: Human arm swing motion	47/2683/NP (Init. Date: 2021-05)	2021-09	PCC	2021-10		Yuji Suzuki
PNW 47-2707 ED1	Semiconductor devices - Measurement and evaluation methods of kinetic energy harvesting devices under practical vibration environment - Part 3: Human foot impact motion	47/2707/NP (Init. Date: 2019-04)	2021-09	PRVN	2021-10		Isaku KANNO

6. **Maintenance**

Reference	Title	Stability Date	Action [withdraw/ reconfirm(year)/revise]
IEC 62830-1:2017	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 1: Vibration based piezoelectric energy harvesting	2023	Reconfirm (2023)
IEC 62830-2:2017	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 2: Thermo power based thermoelectric energy harvesting	2023	Reconfirm (2023)
IEC 62830-3:2017	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 3: Vibration based electromagnetic energy harvesting	2023	Reconfirm (2023)
IEC 62830-4:2019	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 4: Test and evaluation methods for flexible piezoelectric energy harvesting devices	2027	Reconfirm (2027)
IEC 62830-5:2021	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 5: Test method for measuring generated power from flexible thermoelectric devices	2024	Reconfirm (2024)
IEC 62830-6:2019	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 6: Test and evaluation methods for vertical contact mode triboelectric energy harvesting devices	2024	Reconfirm (2024)
IEC 62830-7:2021	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 7: Linear sliding mode triboelectric energy harvesting	2024	Reconfirm (2024)
IEC 62969-2:2018	Semiconductor devices - Semiconductor interface for automotive vehicles - Part 2: Efficiency evaluation methods of wireless power transmission using resonance for automotive vehicles sensors	2023	Reconfirm (2023)
IEC 62969-3:2018	Semiconductor devices - Semiconductor interface for automotive vehicles - Part 3: Shock driven piezoelectric energy harvesting for automotive vehicle sensors	2023	Reconfirm (2023)
IEC 62047-28:2017	Semiconductor devices - Micro-electromechanical devices - Part 28: Performance testing method of vibration-driven MEMS electret energy harvesting devices	2021	Reconfirm (2025)
IEC 63150-1:2019	Semiconductor devices - Measurement and evaluation methods of kinetic energy harvesting devices under practical vibration environment - Part 1: Arbitrary and random mechanical vibrations devices	2024	Reconfirm (2024)
IEC 63244-1:2021	Semiconductor devices - Semiconductor devices for wireless power transfer and charging - Part 1: General requirements and specifications	2027	Reconfirm (2027)

7. **Future works**

   Discussion on two new working items proposal

   - **Thermoelectric-related energy harvester (Atsushi Yamamoto, JPNC)**
   - **Hybrid energy harvesting (KRNC)**

8. **Any other business**

   - **The future plan and strategy of WG7 will be discussed to develop new standards and to advance the WG7.**
   - **The participation status of current WG7 members will be reviewed and discussed to invite more technical experts.**
   - **InComESS (INnovative polymer-based COmposite systeMs for high-efficient Energy Scavenging and Storage), presented by Carmen Mart in, UNE, Spanish Association for Standardization**

9. **Date of the next meeting**

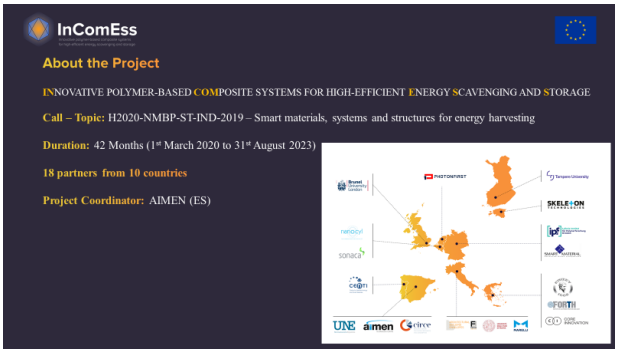
   - **18th - 20th May 2022, WG6 and WG7 Spring meeting, Kumamoto, Japan (18th: Meeting)**
   - **30th Oct. to 4th Nov. 2022, 2022 Plenary meeting, San Francisco, USA (WG7 meeting: Oct. 30th)**

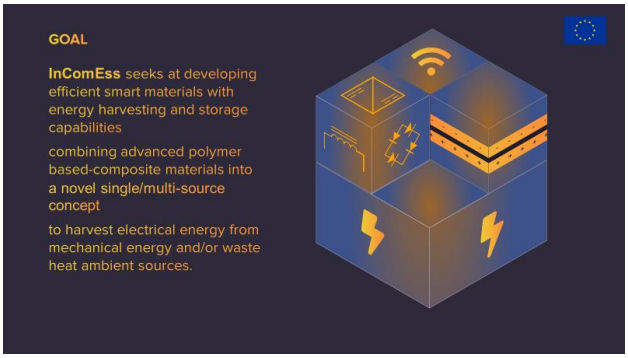
10. **Close of the meeting**

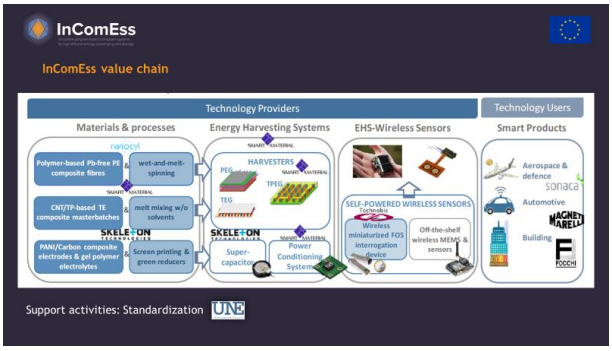
Please note that an electronic version of this Draft Agenda in which hyperlinks have been established will be available on the IEC website four weeks prior to the meeting.

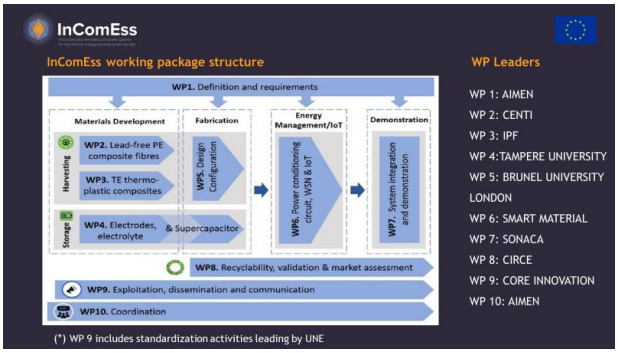
Instructions on how to download the files can be found in 2001/136/AC.

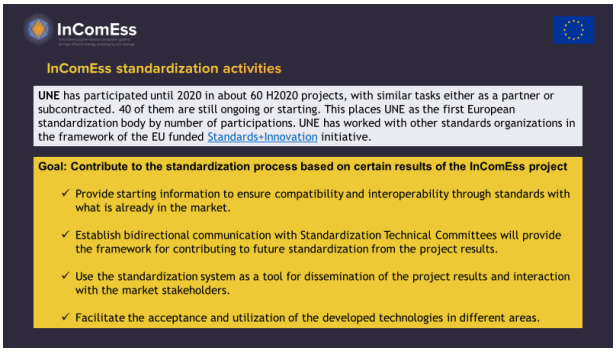
6 Annex 4. InComEss presentation for IEC/TC 47/WG 7











InComEss standardization activities

Option 1

Standardization within a Standardization Committee

Development of a new standard. When there is a result of H2020 Project to be promoted to a standard in a field covered by a Technical Committee, and such committee decides to include this development in its work programme.

Contribution to an on-going standard. As a consequence of the monitoring of the standardisation landscape, it may be found that the results of the project are covered by an on-going standard but that these results do not fit in the current draft standard. Gaps in standards may be found both in standards that are being developed from a new initiative, and standards already published that are undergoing a review process.

Request the modification of a standard that is not under development or revision. The gap may be also found in published standards that are not under the standardization committee's annual work programme. In that case, a fully justified modification request can be made to the Technical Committee.

Outline of a future standard. Only when there is not a clear view on a full roadmap for the contribution to standardisation (like lack of agreement within the Consortium or lack of the expected results).

InComEss standardization activities

Option 2

Fast track to new standardization

Development of a new CEN/CENELEC Workshop Agreement (CWA), a specific document whose nature and timeline for its development is very suitable for the framework of the R&I projects. A CWA could serve as the basis for new standards in the future or its content could be integrated into an existing one.

Some relevant IEC/TC 47 standards for InComEss

a) Concerning piezoelectric energy harvesting

Reference	Title
IEC 62830-1:2017	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 1: Vibration based piezoelectric energy harvesting
IEC 62830-4:2019	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 4: Test and evaluation methods for flexible piezoelectric energy harvesting devices
IEC 62969-3:2018	Semiconductor devices - Semiconductor interface for automotive vehicles - Part 3: Shock driven piezoelectric energy harvesting for automotive vehicle sensors (Adopted at European level as EN IEC 62969-3:2018)
IEC 63150-1:2019	Semiconductor devices - Measurement and evaluation methods of kinetic energy harvesting devices under practical vibration environment - Part 1: Arbitrary and random mechanical vibrations
IEC 62047-28:2017	Semiconductor devices - Micro-electromechanical devices - Part 28: Performance testing method of vibration-driven MEMS electret energy harvesting devices
IEC 62047-30:2017	Semiconductor devices - Micro-electromechanical devices - Part 30: Measurement methods of electro-mechanical conversion characteristics of MEMS piezoelectric thin film (SC 47F, Micro-electromechanical systems)
IEC 62047-37:ED1	Semiconductor devices - Micro-electromechanical devices - Part 37: Environmental test methods of MEMS piezoelectric thin films for sensor application (SC 47F, Micro-electromechanical systems)

b) Concerning thermoelectric energy harvesting

Reference	Title
IEC 62830-2:2017	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 2: Thermo power based thermoelectric energy harvesting
IEC 62830-5:ED1	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 5: Test method for measuring generated power from flexible thermoelectric devices

c) Concerning supercapacitors

Reference	Title
IEC 62830-8:ED1	Semiconductor devices - Semiconductor devices for energy harvesting and generation - Part 8- Test and evaluation methods of flexible and stretchable supercapacitors for use in low power electronics

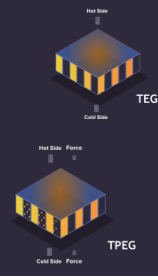
Possible interaction with IEC/TC 47 - Advanced melt-mixed polymer composites for harvesting of heat wasted (WP 3)

Main objective:

Development of high-performance flexible p- and n-type polymer-based TE composite materials with improved thermoelectric characteristics to be used alone in the TEG and together with PE composite fibres in the hybrid TPEG.

Specific objectives:

- Develop high-efficient and high-performance p- and n-type thermoplastic-based TE composites with enhanced thermoelectric characteristics (Seebeck coefficients of about 70 μV/K and power factor of 8 μW/(m·K2)) for applications from -25°C up to 250°C operating temperatures.
- Select optimal material combinations and processing conditions for the fabrication of high-quality melt-mixed thermoplastic composites with enhanced dispersion of CNTs and electrical conductivity above 1 S/cm.
- Enable the development of efficient and stable CNTs/polymer combinations with enhanced electron transport abilities for achieving higher power factors and maximum energy output of TE composites.



WP3: Advanced melt-mixed polymer composites for harvesting of heat wasted

Main objective:

Development of high-performance flexible p- and n-type polymer-based thermoelectric (TE) composite materials to use for energy generation in the TEG and hybrid TPEG devices.

Task 3.1 Melt mixed conductive polymer composites development
- We will develop recipes for composites based on thermoplastic polymers and electrical conductive fillers (e.g. carbon nanotube, carbon black) prepared by melt compounding
- The goal are high thermoelectrical parameters of the composites like Seebeck coefficient, conductivity, and power factor

Task 3.2 Additivation of p-type and n-type polymer-based TE composites
- We are investigating different kind of additives (e.g. polymers, ionic liquid, metal oxides) which can help to switch the mainly p-type TE behavior of the composites to n-type behavior
- Finally, we will characterize the performance of TE modules in dependence on temperature difference (link to WP5, WP7).

Task 3.3 Electron transport mechanism of melt mixed TE composites

Task 3.4 Scale-up of materials for fabrication of energy harvesting components

WP3: List of deliverables

D3.1 : Report on melt-mixed CNT-based thermoplastic composites [M 18]
This report discusses the influencing factors of the processing parameters, filler type, filler and additive contents that enhance CNT dispersion within melt mixed composites for increased electrical conductivity.

D3.2 : Melt-mixed p- and n-type TE composites [M 26]
This document analyses the TE characteristics of melt-mixed CNT/thermoplastic composites with respect to materials composition and processing parameters. A ranking list of best TE performing materials combinations will be provided.

D3.3 : Dynamics of charged exciton and charge transfer in TE polymer composites [M 26]
This report describes the electron transport mechanisms of TE polymer composites under different ambient conditions and define best CNT/polymer materials combination for optimum TE performance and stability.

NOTE: These deliverables are confidential documents

Possible interaction with IEC/TC 47 - Monolithic SuperCapacitors for energy storage (WP4)

Main objective:

Development of low-cost environmentally sustainable storage supercapacitors (SCs) with high energy density and power density together with extended operation window (temperature and voltage) to store the energy harvested by the PEG, TEG and hybrid TPEG devices.

Specific objectives:

- Develop printable high energy density and power density polymer/carbon-based composite electrode materials with increased capacitances (above 400 F/g) and high-energy densities (around 5 Wh/kg).
- Improved synthesis of PANI/carbon-based composites by using green-based methods for achieving higher cycling performance above 90 % cycle stability at 5.000 cycles.
- Develop monolithically fabricated supercapacitors by using printing technology to store the energy harvested by the energy harvester components of the PE-EHS, TE-EHS and TPE-EHS.

WP4: Monolithic SuperCapacitor for energy storage

Main objective:

Development of low-cost environmentally sustainable storage supercapacitors (SCs) with high energy density and power density together with extended operation window (temperature and voltage) to store the energy harvested by the PEG, TEG and hybrid TPEG devices.

Task 4.1 Development of ICP/carbon material composites as electrode material
- We will develop printable ICP/carbon composites materials based on high surface carbon architectures modified with intrinsic conductive polymer (ICP) for their application as electrode materials in the energy storage application.
- The goal is to combine EDL capacitance of the carbon-based materials with pseudocapacitance of the ICP to achieve and enhanced capacitance.

Task 4.2 Fabrication of monolithic storage SCs
- We will develop the fabrication of printed monolithic Supercapacitors (SCs) to be combined with energy harvester. We will use sheet-to-sheet screen printing and aim on large scale roll-to-toll fabrication.
- We are investigating different gel polymer electrolytes to increase operation window, new barrier materials to improve the life-time, and architecture for large-scale manufacturing.
- Finally, we will characterize the performance of SC after mechanical stress (under bending deformation).

WP4: List of deliverables

D4.1 : Report on ICP/carbon-based composites as electrode material [M 22]
This document describes the electrochemical characteristics of materials combinations and process conditions used for the synthesis of PANI/carbon-based composites.

D4.2 : Report on inks based on PANI/carbon composite materials [M 27]
This report discusses the processing conditions to prepare and print the emulsions of the PANI/carbon-based composite inks.

D4.3 : Electrical performance of monolithic SC [M 30]
This report describes the different materials combinations of the electrodes, electrolyte, barrier coatings and current collectors used to fabricate monolithic SCs by screen printing techniques with their corresponding electrical behaviour.

D4.4 : Overall performance of monolithic SCs [M 33]
This report describes the electrical energy performance of monolithic SCs devices manufactured by using R2R printing. Best performing materials combinations and processing conditions will be also provided.

NOTE: These deliverables are confidential documents

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7 Annex 5. Abbreviations and acronyms

Abbreviations and acronyms	
CEN	European Committee for Standardization
CLC	CENELEC, European Committee for Electrotechnical Standardization
ISO	International Organization for Standardization
IEC	International Electrotechnical Commission
TC	Standardization Technical Committee
SR	Reporting Secretariat
WG	Working Group
CWA	CEN-CENELEC Workshop Agreement (type of standardization document)