



Energy Harvesting Committee (EHC) Minutes 16th Nov 2023

Attendees	Apologies/Non attendees	
John Horzepa, PSMA Prateek Asthana, Tyndall Jean Michel Bidault, ITEN Matthias Kirn, WTO Roberto la Rosa, ST Elias, Norm Elias Model/Sim Hani Kanaan, Dracula Tech Joe Horzepa, PSMA Ningning Wang, Hangzhou DU Toshi Yamamoto, Nichicon Brian Zahnstecher, PowerRox Mike Hayes, Tyndall	Soumyajyoti Maji, Univ of Galway Sebastian Bader, MIUN Thomas Becker, Thobecore Torben Dankwort, Fraunhofer ISIT Pallawi Joshi, Juniper Networks Dan Stieler's, PowerFilm Francesco Carobolante, IoTissimo John Fiske, Armor James Rohan, Tyndall Ed Spence, TMIG (guest) Justin Henspeter, IBM Eric Swenson, IBM Pulugurtha Markondeya Raj, (Dr. Raj), FIU Sergiy Tykhonov, FRABA Baoxing Chen, Analog Devices Dinesh Kithany, Wired & Wireless Cem Som, Würth John Flannery, Tyndall Andreas Beckes, FRABA Dusan Vuckovic, Zvertech Lorandt Foelkel, Würth	Lisa Horzepa, PSMA Peter Spies, Fraunhofer IIS Denis Pasero, Ilika George Slama, Würth Renee Yawger, EPC Technologies David Tang, Netbit Michalis Kiziroglou, Imperial College London Steve Savulak, Collins Aerospace Gary Johnson, Ilika Toby Best, FRABA Johan Pederson, Ignion Nathan Jackson, Univ of New Mexico Mike Donnelly, Mentor/Siemens Christian Pennisi, Jennova TBD, Wisepower Juan Carlos Rodriguez, ADI Cristina Rusu, RISE Maeve Duffy, Univ. of Galway Norm

(Co-chairs in bold font) (New/First-time members indicated in GREEN)

Next meeting:- Thurs 14th Dec 8.30am Central (note early start) Mike to chair, Brian to type.

Agenda

1. Welcome any new members/guests.
2. EnerHarv 2024.
3. APEC 2024 – IS demos & speaker updates
4. Industry Event Watch & List of EH companies
5. Media activities
6. Norm/Gabriel Collaboration Update
7. 'Treasure Chest' at end of the minutes.

1. Welcome new members

2. EnerHarv 2024 planning Ref www.enerharv.com and [Energy Harvesting Forum | Power Sources Manufacturers Association \(psma.com\)](http://Energy Harvesting Forum | Power Sources Manufacturers Association (psma.com))

- **SEPARATE** Workshop committee created & meetings underway
- Will be in Perugia 26-28 June. F Cottone = Tech co-chair, R LaRosa = general chair.
- **BZ/MH submitted SPECIAL PROJECT PROPOSAL TO BoD ON 10/13/23 and was approved.**
- **Please send suggestions for demos, posters, presenters to any committee member... it is by invite only.**
- **Who from EHC wants to be involved?**
 - There will be a sister event - NIPS Summer school 24-26 June. Will encourage young researchers to attend both where possible. <https://www.nipslab.org/>
- John also notes APEC '24 is a little earlier (Feb 25-29, 2024, Long Beach, CA, USA) than normal.

3. APEC 2024 - PSMA Energy Harvesting Industry Session

APEC '24 will be early next year (<https://apec-conf.org/>, Feb 25-29, 2024, Long Beach, CA).

APEC IS: IS14: "Powering the IoT with Energy Harvesting and Wireless Power Transfer, with Functional Demos"

- EHC being designated a 7 slot session (6 presentations + 1 demo session) on Wed Feb 28th 1:30-5 pm PST
- Note we may not get so many EU offers due to proximity to EnerHarv.

From our target list we have the following confirmations (subject to peer review of presentation materials)

- Tyndall will provide one of each – Eoin Ahern
 - "Tyndall Energy Harvesting Platforms: eSIP, Testbed & Battery Life Simulation Model"

- BZ can confirm Hanh-Phuc Le, UCSD, participation
 - “Energy Harvesting Integrated Circuits for Thermal Electric Generators”
- BZ can confirm FUI participation (Dr. Raj) – multi-modal energy harvesting
 - “Scalable Multimodal Power Harvesting in Laminates and Flex Substrates with Advanced Packaging”
- BZ can confirm Ed Spence – The Machine Instrumentation Group, also covers work in conjunction with Nichicon, PowerFilm, & e-peas.
 - “Application of PV-based Energy Harvesting with Charge Storage Backup to Wireless Vibration Sensor for Condition Monitoring”
- Lorandt assigned as leader for demo session
 - “See the Power IoT in Action! Live, Functional Demos of Solutions”

The following are still being pursued

- MH notes Jennifer Hasler of GATech (via colleague work at UU) interesting work (also pinging for EnerHarv).
- MH can reach out to Nathan Jackson to solicit interest.

The following are diversions

- IEEE HIR??? Diverted to Pkg Comm IS presented by MH & BZ - accepted
- Cristina mentions consideration from Peter Woias of Univ of Freiburg (originally contact of Jane C./Thomas B. from EnerHarv '18) -> target EnerHarv
- Maeve notes this talk on solid state batteries from TDK at PwrSoc that may be worth following up with the speakers on: CeraCharge™ – World’s First Rechargeable Solid-State SMD Battery Hiroshi SatoTDK, Japan -> target EnerHarv

The following are non-runners

- Hani notes many opportunities for topics/demos from Dracula though likely conflicts being close to CES this year.
- BZ notes PowerFilm had good, recent blog on light transmittance research, saving budget for '24.
- Juan-Carlos confirms intent to attend APEC and can facilitate session, but not sure about direct content contribution.
- Jane’s “successor/colleague” for ADI TEG work reverted they do not have enough new material for 2024.
- Maeve suggests a scrub of former speaker lists/archives for inspiration, but unlikely to attend APEC.
- Cristina not planning to attend APEC, but can ask around RISE.
- Roberto says ST not planning to attend APEC, saving for other events.
- Jean-Michel does not have much familiarity with APEC, ITEN unlikely to support '24 (light US support structure), but can look into for future years.

• List of demos:-

- TYN- Battery life simulation model
- Nichicon:- discussing with Ed
- Lorandt:- preparing a list
- Who will be there in person at APEC for committee meeting, Industry session, etc.?
- Schedule/Key Milestones:
 - 10/9/23 = APEC notification of official acceptance/slotting RECEIVED
 - 11/10/23 = target for confirming all six speakers TENTATIVE LIST RELEASED
 - 12/8/23 = PPT DRAFT due to EHC (not APEC)
 - 12/15/23 = PPT draft feedback deadline
 - 1/09/24 = PPT FINAL due to EHC (not APEC)
 - 1/12/24 = PPT FINAL feedback deadline
 - 1/19/24 = APEC hard deadline for camera-ready PPT upload (to get into proceedings)
 - 2/28/24 = Industry Session go live!

4. Industry Event Watch & List of EH companies

- Event tracker
 - Revisit/update the list of good industry events for tracking. EnABLES turned into EU proposals for new research infrastructure (feasibility study) projects RISEnergy (retrofit EH powered WSN), Infrachip (Si on chip) ... will start in 2024. More details to follow late 2023.
 - Next update target Dec '23.

- **Company ecosystem** (review quarterly, next due Dec-ish '23)
 - **BZ CONTINUES TO UPDATE AS INFO TRICKLES IN. BZ WILL ADD SOME COMP CONTRIBUTORS TO HIR CONTENT.**

5. MEDIA ACTIVITIES

(a) Webinars/ PTR? **PERPETUAL OPEN CALL TO EHC FOR WEBINAR SUGGESTIONS.**

- IEEE HIR 2023. HIR = heterogeneous integration roadmap, packaging and system integration focus
 - Effort led by Francesco Carobolante. Possible APEC presentation?
 - Final draft candidate 8/8/23. **BZ/MH WILL SHARE LINK WITH TEAM WHEN PUBLISHED.**
https://eps.ieee.org/images/files/HIR_2021/ch10_power.pdf
- Toshi Yamamoto, Nichicon – LTO Battery Tech. Possibly leverage material related to Sensors Converge (already has ~50% of required content)? Upgrade & share overview with team by next meeting (Oct?). **BZ WILL PING ABOUT STATUS FOR THIS AND APEC.**
- Lorandt Foelkel, Würth – EH Tech Update. **LORANDT SHARED PREVIOUS DIGIKEY WEBINAR FOR REFERENCE.** Mike & Brian feel it is good but needs higher % of new material – under review.
- Prateek Asthana, Tyndall. **Presented PSMA PTR webinar 19th Oct - aro 70 attendees.**
- Leverage Ranajit Sai presentation for 2024 (he has already lined up to give a magnetics PTR)
- Ed (Spence) considering and will revert
- Any other topics?

(b) Conferences/workshops

- Lorandt will be at IEEE EMC conference, let him know if interested..... <https://emc2023.org/> Good event, ~50 attendees, talked to lots of folks, not sure of any new PSMA interest.
- PSMA PwrSoC (<https://www.pdma.com/index.php/conferences/PwrSoC>), September 27 thru 29, 2023, Hannover, Germany **EHC CALL TO ACTION: ANYONE GOING/INVOLVED PLS KEEP EYE OUT FOR SPEAKERS/TOPICS TO LEVERAGE.** Done, will seek overview from team/attendee.
- CAFE (<https://2023.ieee-cafe.org/>), September 25 thru 27, 2023, Torino, Italy (Roberto will have presence)
 - Output of IEEE Transactions on Agrifood electronics (TAFE), (EiC: Danilo De Marchi). **Roberto reports good conference (~80 attendees), particularly good feedback on self-powered apps/WSNs in agro. Some good speaker prospects to leverage for our efforts.**

(c) Publications

- Jean Michel – ITEN working on a white paper for release in Dec. Let us know if we can help with preparation, distribution, promotion, etc.
- Roberto – we should consider putting together an updated white paper, esp. application focused, with lots of new EHC members, leverage EnerHarv?
- Also looking at cross promotions for IPC – industrial automation, Industry 4.0, smart mobility, etc.
- Any material you want to re-cycle.... once not too much of a sales pitch?
- New suggestions
Hoping to mine upcoming events (APEC, EnABLES, APEX, EnerHarv, etc.)

(d) Virtual conferences, articles, etc.

- Suggestions please

6. Norm/Gabriel Collaboration Update

TREASURE CHEST

Approach these items one at a time in future meetings as people raise them.

8A. Sponsorship of a program where students build demonstrators.

- Lorandt has a budget to supply kits
- Help with education links – Qualcomm 'High Tech High'. Francesco will follow up.
- Green story. International dimension. Technology and applications dimensions.
- Würth running design challenge.
- Keep simple, easy to use
- Competition or roadshow?
- PSMA has money to support.

- Action:- write ½ page strawman for student engagement mechanism **NEED A CHAMPION TO LEAD EFFORT FOR COMM**

“Here are Katherine’s thoughts on the competition:

There are two main styles of the competition that could be developed:

1. Engineering-Style Competition

- planning committee chooses specific EH devices that can be used and the target load
- planning committee also specifies energy input conditions (lighting setup, vibrational input, etc) for testing
- specifications are announced and teams would develop the power converter solution based on the specification
- teams can submit videos and/or reports on their team and proposed idea
- final teams are selected and they test their prototypes on site at an event competition (could be a conference)
- judging is based on technical criteria measured during the test (size, weight, efficiency, etc.)
- implementation is the most important aspect for this style of competition
- over different years, the specification and scenarios would focus on different technologies with the same basic format
- more similar to the International Future Energy Challenge run by PELS

2. Design-Style Competition

- planning committee could choose a theme based on a technology or application (e.g. smart homes, wearables, building monitoring, etc.)
- planning committee may want to specify some constraints or scenarios for the competition
- teams come up with complete EH design ideas (transducers, circuitry, load) and develop a prototype
- teams can submit videos and/or reports on their team and proposed idea
- final teams are selected and they present and demonstrate their prototypes on site at an event competition (could be a conference)
- judging is based on mostly qualitative and some quantitative judging criteria (so balanced judge selection will be important)
- this style of competition is more focused on the idea and design, but implementation is also important

There should probably be some discussion on which style the committee would like to see. The engineering-style requires a lot of prep work before even announcing the competition, while the design-style is more work for the judging and evaluation. I could see either being good for students. I hope someone can take these basics ideas and further development them into a competition.”

7B. Updated Goals

- Open to suggestions.
- We should try to forge links with other groups/sessions, e.g. capacitor, magnetics, packaging. – addressing this via “Tiger Team” effort within PSMA (multiple focused initiatives with small teams from various committees).

7C. Forward-looking Thoughts

- Software? Packaging/industrial design? Modelling? Hackathon?
- Incorporate some kind of student competition as part of EnerHarv (Best Student Demo/Poster) or otherwise.

Mike Hayes & Brian Zahnstecher,
16th Nov 2023.