



Energy Harvesting Committee (EHC) Minutes 13th February 2020

Attendees	Apologies/Non attendees	
John Horzepa, PSMA Thomas Becker, NTA- ISNY Francesco Carobolante, IoTissimo Peter Haigh, Tyndall Maeve Duffy, NUIG Brian Zahnstecher, PowerRox Mike Hayes, Tyndall	Joe Horzepa, PSMA George Slama, Wurth (GUEST) Mohamed Jatlaoui, Murata Lorandt Foelkel, Wurth Robert Andosca, AEI Steve Savulak, UTRC Johan Pederson, Sigma Design Mike Wingard, Amphenol Katherine Kim, UNIST Anthony Laviano, NRAIT Henrik Zessin, Fraunhofer IIS Justin Knott, FCI Jae-Do Park, Univ of Colorado Denver Nathan Jackson, Univ of New Mexico Warren Wambsganss, Astronics Jeffrey Jouper, Astronics Seshank Malap, Tektronix Denis Pasero, Ilika Marcus Taylor, Fleximatix Roberto la Rosa, ST	<i>Doug Osterhout, Google</i> Wensi Wang, BJUT Peter Zou, Huawei Ajinder Singh, TI Aaron Stein, Dartmouth Kevin Parmenter, TSC Guoqing Liu, Huawei (HiSilicon) Jochen Koszescha, Infineon Laili Wang, Xi'an Jiatong University David Newell, NUIG Dan Stieler, PowerFilm Sam Jones, PowerFilm Jamil Khan, Univ of Newcastle (AUS) Dusan Vuckovic, Ikea Gary Johnson, Ilika (for Denis) Baoxing Chen, Analog Devices Scott Thielman, Product Creation Studio Sebastian Bader, MUIN Michalis Kiziroglou, Imperial College London

(Co-chairs in bold font)

(Lisa please remove all Alta team members (regrettably they are closed down & Liubov Ebralidze, Silent Sensors)

Next meeting:- Thurs 17th Mar Face to face (NO VIRTUAL DIAL-IN) at APEC New Orleans, 12-2pm CST, Room 231, Mike to chair, Brian to type.

Also at APEC:- EH Industry Session (IS11) Wed, 3/18/20, 8:30-10:10am CST (PLUS DEMOS DURING BREAK IMMEDIATELY TO FOLLOW), Room R07

Please let Mike & Brian know in advance if you plan to attend either (or both) thanks!

Agenda

0. **EH COMM MISSION STATEMENT REVIEW**
 1. **Welcome any new members/guests.**
 2. **EnerHarv 2020 planning.**
 3. **APEC 2020 last minute updates.**
 4. **White paper.**
 5. **AOB, anything from 'treasure chest' at end of the minutes.**
0. **Committee Mission Statement Overview for 35th Anniv**
 - a. *"The mission of the Energy Harvesting Committee is the development of an ecosystem that provides subject matter expertise and direction on adoption and integration of energy harvesting and related energy storage, conversion and efficiency technologies."*
 - b. BZ & MH ok as-is. "IoT" too broad. **BZ WILL CONFIRM OK WITH GREG**
Assume passive acceptance and close.
 1. **C. NOTE: website PURPOSE statement (REVISIT AROUND AUG TIMEFRAME)**
"The purpose of the energy harvesting forum is to collect and disseminate information related to energy harvesting. The committee's mission is: To support the mission, vision, goals and objectives of PSMA by developing an ecosystem that provides subject matter expertise & direction on the adoption & integration of energy harvesting and related energy storage, conversion and low power technologies; demonstrating that collaboratively we can truly accelerate the adoption of IoT in commercially feasible consumer, industrial applications and beyond."

1. **Welcome New Members**

None so far

2. EnerHarv 2020

- NCSU – North Carolina State **TUE-THU, JUNE 16-18, 2020**
- Mehmet compiling hosting agreement (MOU) with PSMA help. ASSIST needs to hire temp. Almost there, need some budget clarifications. Joe & Brian talking offline. **Final MOU fully executed 1/22/20...no further action required.**
 - Registration is now open– please register early before 1 April for early bird. <https://www.eventbrite.com/e/enerharv-2020-psma-international-energy-harvesting-workshop-tickets-92723148433>
 - Generating flyer for demo and posters – target to release next week

• COMMITTEE

- Latest tentative table of chairs (most people willing to move around)

(# slots targeted)	Chair	Co-chair
Keynotes	<i>Sally Safwat Amin Baoxing Chen Veena Misra</i>	
Energy Transducers	Mehdi Kiana	Baoxing Chen
Power Mgmt	Peter Spies (EnABLES Rep)	Maeve Duffy
Energy Storage	Mohamed Jatlaoui	James Rohan (EnABLES Rep)
System Integration The Italian quarter!	Francesco Carobolante (PELS Rep)	Francesco Cottone (EnABLES)
Low Power Loads	Roberto la Rosa	Yang Yuan
Demos	Lorandt Foelkel	Denis Pasero? Mike to ask him Tues BZ to chase.... Dan Stieler? Geoffroy Gossett?
Panels Sessions	1. Compare with the '5G experience' (panel style prep...smoother experience than '18) Prepare & assign carefully Francesco CA to drive 2. Bring together cluster leaders!! (ASSIST, EnABLES, EHN, Sheshank Pria, PowerMEMS)	
Posters	Jane Cornett	
Media	Julie Holder (supported by Carolin Lehmann of NCSU)	
Admin	Julie Holder (supported by Carolin Lehmann of NCSU)	
Treasurer	Steve Savulak	
Technical Chair	Mike Hayes	
Technical Chair	Shad Roundy	
General Chair	Mehmet Ozturk	
Co-General Chair	Brian Zahnstecher	
Industry liaison	Adam Curry	

Other committee members to date

- Denis Pasero
- Marcus Taylor
- Michalis Kiziroglou
- EPeas – Geoffroy Gosset
- Dusan considering...answer in Sept
- Johan also considering – Brian will stay in touch
- Brendan O' Flynn, Tyndall – subject to availability
- Julie Holder, ASSIST temp.
- Prof. Hengzhao Yang, New Mexico Institute of Mining and Technology- Brian in contact -> ask him to co-chair demos? Update post meeting – not available

Gender balance issue – whilst we have 2 female keynotes we have 0 (out of 15!) female presenters so far in the 5 tech sessions and only 1 targeted. Does anyone have any other suggestions. Thomas suggested Loreto Mateu FhG-IIS – Mike will talk with Peter Spies about this. Asking those approach for abstracts also (e.g. ADI) where possible to consider putting female presenter forward)

Maeve will look at EnerHarv2018 attendees and presenters for inspiration and report back.

There will be an open call for posters and demos. Lorandt and Jane working on a script for this. Last few days of chasing sponsorship options, not expecting any more beyond ADI & Würth.)

- **Sponsors**

- **TECH**

- **EnABLES, PELS, ASSIST, CPSS**

- CPSS will be unable to attend due to corona virus but will continue to promote EnerHarv via their channels.

- **COMMERCIAL** (more open this time, but MUST be related to program, content, etc.)

- How2Power will circulate flyers – **get preliminary one ASAP, also for distribution at APEC**

- Write-up prepared for PSMA Quarterly Newsletter (2019Q4 shipped, **2020Q1 UPDATE DUE TO LISA BY 2/10**).

- **"Registration Open" PRESS RELEASE TO BE PREPARED SOON AND TARGETED FOR SHIPMENT ASAP.**

- Adam has circulated targeted sponsorship invites - confirmations from ADI Würth, now moving to 2nd wave, **close out in the next week or so.**

- Bodo's and How2Power agreed as media channels. **Need ½ page by 14th Feb** for Bodo's newsletter!!!! **POST-MTG UPDATE: BODO HAD A TYPO IN EMAIL, HAVE UNTIL 14TH MAR.**

Will be releasing 2nd press release and email, next few days

KEYNOTES

COMMERCIAL SLOT – Baoxing Chen, Analog Devices, *"Powering the IoT: An Energy Harvesting Perspective"*

ACADEMIC-ish SLOT – Sally Safwat Amin, now of Intel (ex UCSD), *"Towards Miniaturized Energy Harvesting Platform for Powering Net-Zero Energy Systems"*

HOST SLOT – Veena Misra, NCSU, *"Self-Powered Wearable Sensors for Health and Environmental Monitoring"*

3. APEC 2020

- Session accepted (IS11), scheduled for Wed, 3/18/19, 8:30-10:15am CST!
- Our working schedule is as follows –
 - **12/20/19:** 1st Draft PPT Deadline for Comm Review (template circulated)
 - **1/8/20:** 2nd Draft PPT Deadline for Comm Review
 - **1/17/20:** Final PPT for USB Proceedings **DONE**
 - **3/2/20:** FINAL PPT Deadline for Comm Review –
 - **3/6/20 APEC Deadline for upload on web to port over**

Assign reviewers to work with presenters on final drafts

- Mohammed's:- Francesco

- Mike's:- Brian

- Siyu's:- **Looking for a volunteer!** We have a decent set of slides, needs help reducing the number

- **Still looking for demos, ref attached single ppt slide, screenshot below**



Industry Session 11: Energy Harvesting (EH)

<i>Wireless IoT Device Battery Life Deployment Simulation Tool</i>	Mike Hayes, Tyndall
<i>Energy Harvesting Development Kits (Multi Source, Multi Sensor)</i>	Lorandt Foelkel, Würth
<i>Off The Shelf (OTS) Indoor Light Powered Sensors From EnOcean</i>	Lorandt Foelkel, Würth
<i>OTS EH Powered Sensors: Window Handle, Aircon</i>	Brian Zahnstecher, PSMA
<i>Flexible Weather Proof Solar Panel Powered Nordic BLE Radio</i>	Dan Stieler, PowerFilm
<i>Self powered temp indicator for shower</i>	BZ
<i>Atmosic possibility, David Su, PV demo?</i>	Francesco
<i>"TBD"</i>	Potentially 1-2+ others to be announced before APEC

- **The bio will be a short script to introduce the speaker – DONE**

- **Confirmed presentations**

1. **"3D Silicon Capacitive Interposer for RF Energy Harvesting device: Higher Efficiency, Higher Integration and Simplified Topology"**
Mohamed Mehdi Jatlaoui¹, Frederic Voiron¹, Bruno Allard², Nicolas Jeannot²
2. *"Growing the Power IoT Ecosystem"* Mike Hayes, Sr. PM, Tyndall National Institute
3. *"Optimizing Piezoelectric Synchronized-Discharge Harvesters"* Siyu Yang, Georgia Tech Recommendation (senior PhD student) from GABRIEL RINCON-MORA given to Michalis
4. Demo Session (as standalone, "speaking" slot), TEAM

4. White paper

Michalis Kiziroglou & Thomas Becker separately expressed interest in participating in a white paper – ref next page for strawman, we shall discuss this on the Jan call. **MK/TB**

TO HAVE ANOTHER OFFLINE DISCUSSION BEFORE NEXT MONTH'S MTG.

EHC attendees 16 Jan were happy with this as a proposal, perhaps can lead to expansion on particular topics (i.e. – Cost Benefit Analysis, Conditional Monitoring, etc.), additional white papers, etc. **Others please provide feedback offline**

Arrange sidebar at EnerHarv based on strawman – agree on priority topics e.g. environmental

Mention in Enerharv committee call next week.

White Paper Energy Harvesting (Title...)

Authors:

PSMA EHC, template...?

Summary

(Purpose...)

Abstract

(Content...)

State of the Art and Users Perspectives

(What)

Methods and Technologies

(Short! summary {copyrights}, tables, technical limitations, classification against renewable energy)

Acceptance Limits

(Users expectations and typical deployment methods, power management and storage issues [batteries])

Opportunities

(How and why)

Implementation Strategies

(Technical excellence, energy balance harvester vs consumer, lifetime)

Exploitation of Results

(Economic excellence, Cost Benefit Analysis, compared to wires, batteries, best sensor is no sensor...)

Environmental Impacts

(Ecological excellence, Life Cycle Assessment, GWP, CO₂eq, SO₂eq)

Beyond State of the Art

(Next Steps)

Reconsideration of the Application Scenario

(Know what to know, not to what to measure, Virtual Sensing...)

Future Harvesting Research Needs

(Expectations to funding bodies, EU, US, China...)

Standardisation

(Current situation, suitable organisation)

Everything else why we want to write the White Paper

About

TREASURE CHEST

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

5. Updated goals

- Open to suggestions.
- Consider a white paper? (Who will co-write and when?) – **REMINDER can members please give Mike & Brian inputs offline**
- Mike & Brian to revert with proposal for doing a white paper if so approved
 - OR other dedicated champion from EH Comm, **will put call out**
- 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)**
- **BZ INITIATIVE:** working on feasibility for an official, IEEE Future Directions initiative on Energy Harvesting (a 1-6yr process)
 - JOE notes PSMA would be happy to support such an initiative, **BZ to figure out if/how**
 - BZ has obtained process detail (<https://cmte.ieee.org/futuredirections/fd-opportunities/>), **BZ to pitch initial proposal to PELS TC6 at ECCE on 10/1/19...WILL SHARE FINAL PPT WITH TEAM**

6. Organise webinars for PSMA & PELS (FOCUS STARTING APRIL 2020 MTG ONWARDS, after APEC, discuss also briefly at the face to face at APEC for the March monthly meeting face to face)

- We are ok for PSMA webinars (did 1 in Nov) for now but need to discuss PELS et al.
 - Dan Stieler, PowerFilm was considering one (will be chased by way of Sam)
 - Sample abstract suggested per existing blog (<https://www.powerfilmsolar.com/about-us/the-horizon-blog/2018/08/10/outdoor-vs-indoor-solar-the-key-differences>), BZ reviewed/supports, **need Committee input. Worth reviewing seeing as Powerfilm’s abstract did well in voting but was not in top 2.**
 - Lorandt willing to do 1 – getting back up to speed (in your own time Lorandt) – Q1/2 2019? Also depends on whether Lorandt/delegate does APEC paper. **BZ TO FOLLOW-UP WITH LORANDT**
- Dan & Dusan willing to revert with suggestions – no commitment yet – Dusan thinking about an applications orientated presentation but no commitment yet.
- Brian and Raj (GeorgiaTech) gave IEEE EPS webinar on IoT with Dushan, Marc & Denis – Went very well. Can do a variant for PSMA later in the year.
- Would be good to do 1-2 on ‘practical real life performance’ of parts and systems – comparison of technologies. Saw some good examples at EnerHarv e.g. Ilika & ARM presentations

7. 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.
- Wurth running design challenge.
- Keep simple, easy to use
- Competition or roadshow?
- PSMA has money to support.
- Action:- Catherine and Mike met at EnerHarv & discussed, She will write ½ page strawman for student engagement mechanism. Mike will ping again. **NEED A CHAMPION TO LEAD EFFORT FOR COMM Maeve willing to help but does not have bandwidth to lead.**

“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.”

7. Technical forum (links, list of forthcoming events, etc.)

- Johan will review and update the list of events when he gets a chance but EnABLES project is creating a calendar of events, Mike should be able to share this (edited version) in July/Aug
 - Johan delivered updated list on 7/23/18, which MH & BZ will digest and share with group.
- Any volunteer(s) for white papers, weblinks, use cases, etc.
- Reach out to other societies/groups and cross link? – Mike & Brian to discuss.
- Note activities underway separately to re-vamp PSMA website.
- Does this add any value, should we remove??

8. AOB, actions, next meeting, etc.

- Software? Packaging/industrial design? Modelling?

**Mike Hayes & Brian Zahnstecher,
13th February 2020.**