Energy Harvesting Committee (EHC) Minutes
9th April 2020

Attendees	Apologies/Non attendees	
John Horzepa, PSMA Lorandt Foelkel, Wurth Michalis Kiziroglou, Imperial College London Francesco Carobolante, IoTissimo Gary Johnson, Ilika (for Denis) Joe Horzepa, PSMA **Brian Zahnstecher, PowerRox** **Mike Hayes, Tyndall**	Thomas Becker, NTA- ISNY Peter Haigh, Tyndall Maeve Duffy, NUIG George Slama, Wurth (GUEST) Mohamed Jatlaoui, Murata 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	*Doug Osterhout, Google* 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 Baoxing Chen, Analog Devices Scott Thielman, Product Creation Studio Sebastian Bader, MUIN

(Co-chairs in bold font)

Next meeting:- Thurs 14th May, 10am CST, Brian to chair, Mike to type.

Agenda

0. EH COMM MISSION STATEMENT REVIEW
1. Welcome any new members/guests.
2. EnerHarv 2020 planning.
3. APEC 2020 last minute updates.
4. Industry Event Watch
5. White paper.
6. Webinars
7. 'Treasure Chest' at end of the minutes.
- **7A. Student Competition**
- **7B. Updated Goals**
- **7C. Forward-looking Thoughts**

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**~~ **DEFERRED, NOTICE SENT 3/13/20, NEW DATE TBA**
  - **Closing activities, all financial.**
    - Deferral notice created/distributed.
    - Eventbrite cancelled (paid registrations 100% refunded).
    - Expenditure Freeze (dismiss Admin Temp)
    - Current Accounting / Settle Debts
  - **Forward-looking**
    - Preliminary commitment from NCSU to host new event.
    - Commitment from Exec Chairs to maintain roles for new event. Hoping same for rest. Assuming EWC will maintain roles for new event, but WILL FORMERLY CONFIRM WHEN ENERHARV MAKEUP DATES AND ROUGH LOGISTICS FIGURED OUT.
    - Best guess is print 2011, will need min 5 months leadtime between re-start and new date

3. APEC 2020 Converting to virtual event. APEC Comm focused on working out financials, determine guidance to all stakeholders, then figure out virtual events. Decisions still in-process for what guidance will be for recordings/webinars/etc.

- BZ+MH TO CHASE SPEAKERS FOR EH IS RECORDING LOGISTICS. Even if not end up used for official, eAPEC event, can leverage as a standalone webinar that EH Comm can feed into PTR webinar series.

- **Confirmed presentations**

1. "**3D Silicon Capacitive Interposer for RF Energy Harvesting device: Higher Efficiency, Higher Integration and Simplified Topology**
   Mohamed Mehdi Jatlaoui[1], Frederic Voiron[1], Bruno Allard[2], Nicolas Jeanniot[2]
2. "*Growing the Power IoT Ecosystem*" Mike Hayes, Sr. PM, Tyndall National Institute
3. "*Optimizing Piezoelectric Synchronized-Discharge Harvesters*" Siyu Yang, Georgia Tech/Samsung
4. Demo Session (as standalone, "speaking" slot), TEAM BZ TO OWN **IF DECIDE TO HAVE** A VIRTUAL DEMO SESSION

4. Industry Event Watch - NEW

- Revisit/update the list of good industry events for tracking.
  - Francesco recommends www.iwpc.org as resource.
- Mike has big list from EnABLES to mine. MIKE WILL REACH OUT TO PETER SPIES (EnABLES lead on dissemination) FOR ACCESS.

5. 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

- 4/9/20 UPDATE: Michalis reports Eric Yeatman may also want to participate in whitepaper effort. MK/TB TO PROPOSE SCHEDULE/KEY ACTIONS (5-6 lines), ENABLE DISTRIBUTION AMONGST STAKEHOLDERS. PERHAPS CONSIDER SUBCOMM DEDICATED TO THIS EFFORT (w/ FOCUSED EMAIL CHAIN) – looking for volunteers.

White Paper Energy Harvesting (Title...) (12/11/19 DRAFT VERSION)

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

6. Webinars for PSMA & PELS (FOCUS STARTING APRIL 2020 MTG ONWARDS)

- 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

TREASURE CHEST

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

7A. 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."

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)
- **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**

7C. Forward-looking Thoughts

- Software? Packaging/industrial design? Modelling?

Mike Hayes & Brian Zahnstecher,
9th April 2020.