



# EnerHarv 2022

PSMA International Energy Harvesting Workshop • April 5-7, 2022 • Raleigh, NC, USA

# EnerHarv 2022 Day 2 Opening Remarks

Wed, April 6, 2022

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# Some sound bites from day 1

## **Keynote – Patrick Mercier**

- **Size & usability**                      **Battery life**                      **Utility**
- **Advantages of integration**
- **Various methods for integration/partitioning of components, circuits and systems**
- **On and off chip MHz PMICs**
- **Lot of innovative architecture moving/stacking L & C**
- **Event driven controller, multi source, time shared L, etc.**
- **Bio fuel cells (glucose, lactate) – can double up as sensors**
- **Novel power amplifier architectures**
- **World record for WPT (>40%)**
- **Also open to migrating better passives, e.g. batteries**

# Some sound bites from day 1

## **Transducer session – Saibal, Cristina, Luc**

- Wideband challenge
- Innovative MEMS & mezo devices e.g. Bi-stable quadratic non-linear VEH
- Various options for integration of magnetics
- Advantage of wireless – Accessibility , weight (cables)
- Condition monitoring of pumps and industrial machinery => good applications – deterministic
- Watch out for repeatability, consider how and where to place parts
- Good for non critical low data rate senses for automotive
- Other good apps - pumps, wind turbine, tyre pressure, pacemakers
- System level packaging is important and not considered adequately
- Sleep power often dominates
- AlN offers high quality, durability and ease of integration
- Tungsten based parts with high Q, innovative wafer level fabrication, bonding and adding cantilever/mass
- Best reported normalized power density at  $<100\text{Hz}$

# Some sound bites from day 1

## **System integration 1 - Sami, Valeria, Omer**

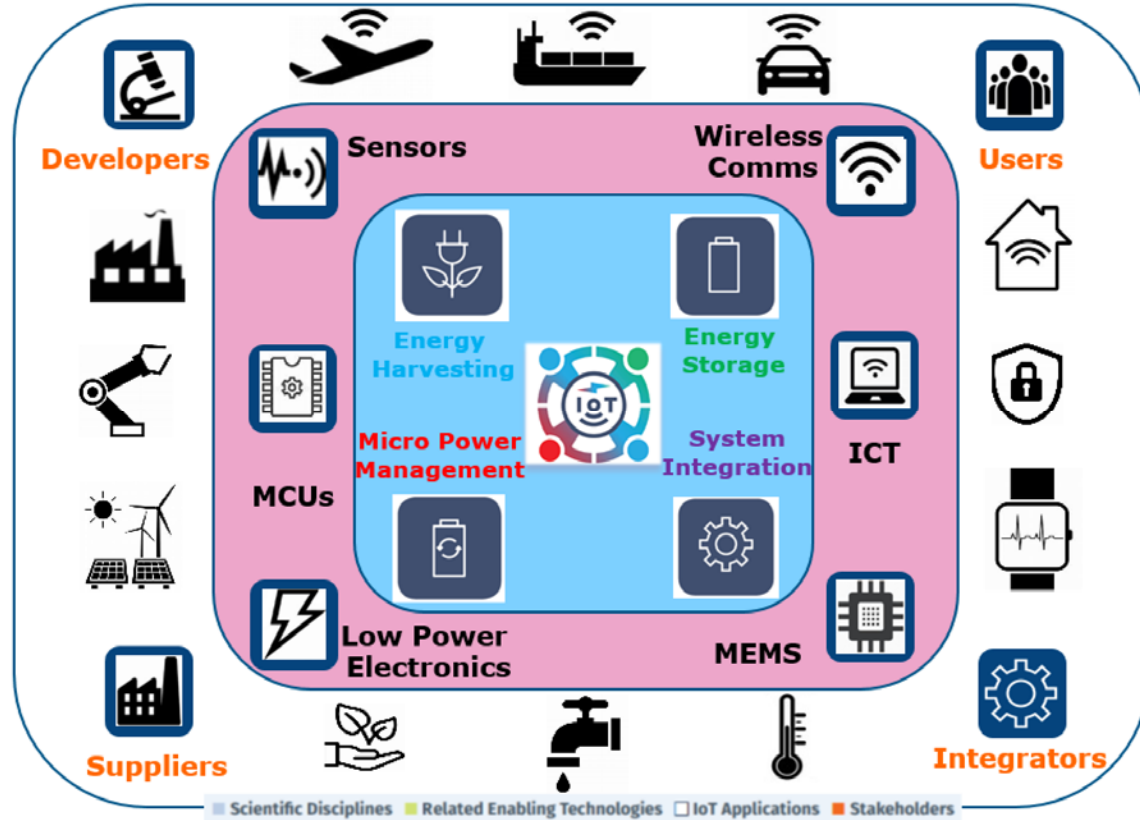
- Advanced patterning challenges
- Need long life with low losses
- Nice spider chart to assess technologies
  - Energy Density      Thermal stability      Cycle life      Self discharge      Power Density
- Ideally looking for DC to GHZ performance – ion capacitors with standard fab processes
- Need easy tuning and multimodal capability
- Samples tested with LoRaWAN & BLE platforms
- Capacitive micro-machined ultrasonic transducers (CMUT) – parallel plate cap with movable plate can also generate ultrasound
- Glass substrate technology
- Can be used for neurostimulation applications – but watch FDA limits
- EVAR device for treating (measuring) aneurisms
- Can create low power VOC environmental sensors
- Pros and cons of ultrasonic over RF (size, delivery range, power density)
- Opportunities to improve wireless power output – not looked at closely till now

# Some sound bites from day 1

 **Power Net Generation WSN Experience – Lorandt, Roberto, Brendan, Luc, Brian**

- Customer driver – what is killer application?
- Batteries too cheap – life cycle costs not fully taken into account – someone else’s problem. Also we need to educate the entire ecosystem on this – cost, environmental impact, sustainability, etc.
- Regulations can help change attitude of adopter
- We should be optimistic – it takes time and good traction to date
- Will adding complexity to the edge hurt us?
- People will always greedy and use all the power we give them.. and more
- Need more than just software – we need LOGIC (architecture and intelligence to dynamically collect data in the leanest possible way to meet application need)
- Need to have tools and databases to help better predict batter life – many applications are less deterministic and have higher probability distribution (ambient energies, data collected, etc.) -> incident based
- Lack of standard parts due to multitude of applications , with major variations in needs
- Simplicity and customization needed.
- Consider going sub contract manufacturer rote – big names will not engage

# How does our ecosystem look now?



# Enjoy days 2 and 3!



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