RWS-210085

3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 - July 2, 2021
Agenda Item: 4.2

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On RedCap Enhancement in Rel-18 - Supporting Batteryless Devices

Motivation for batteryless industrial monitors

- Industrial facilities have 10,000s of unmonitored assets
  - » A typical food and beverage facility has 300 steam traps and 1000+ machines
  - » A typical chemical refinery has 2000 steam traps and 3000+ motors. A large oil refinery has 20,000+ steam traps
  - » Many US government facilities have over 10,000 steam traps
- Continuous asset monitoring is required for properly maintaining these facilities
- Battery replacement limits large-scale adoption of wireless sensors
  - » Lifetime of battery-operated sensors falls far short of expectation

Plant managers don't want to replace one maintenance problem with another (battery replacement)

Use Case 1: Steam Trap Monitoring

TAM
$15B

Annual steam trap failure rate

20%

Cross-industry pain point†

- » **$50+ billion** in lost energy & downtime
- » **300+ billion** gallons of water waste
- » **300+ million** metric tons of CO_2 emissions

† Annual, global estimates

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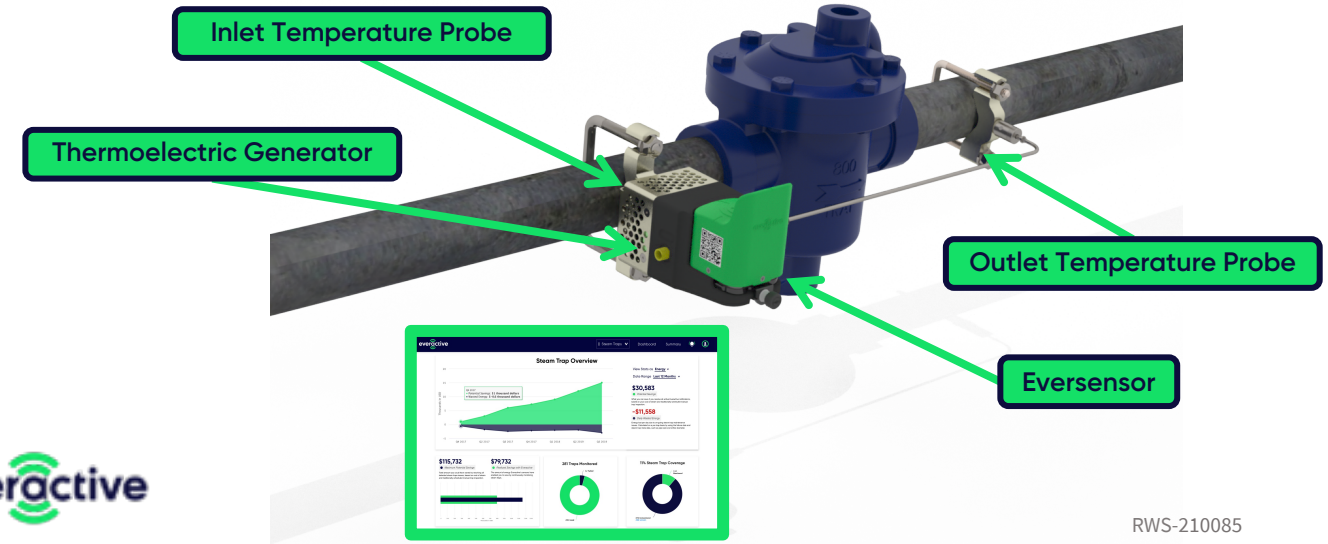

*Compelling returns**

Upfront HW **$0**	Installation per Trap **< 5 min.**
Net Annual Savings **$1,271,522**	Annual CO_2 Savings **28k tons**
Payback Period **3 months**	5-Year ROI **4.2x**

** Estimate for outfitting 1,000-trap process manufacturing facility*

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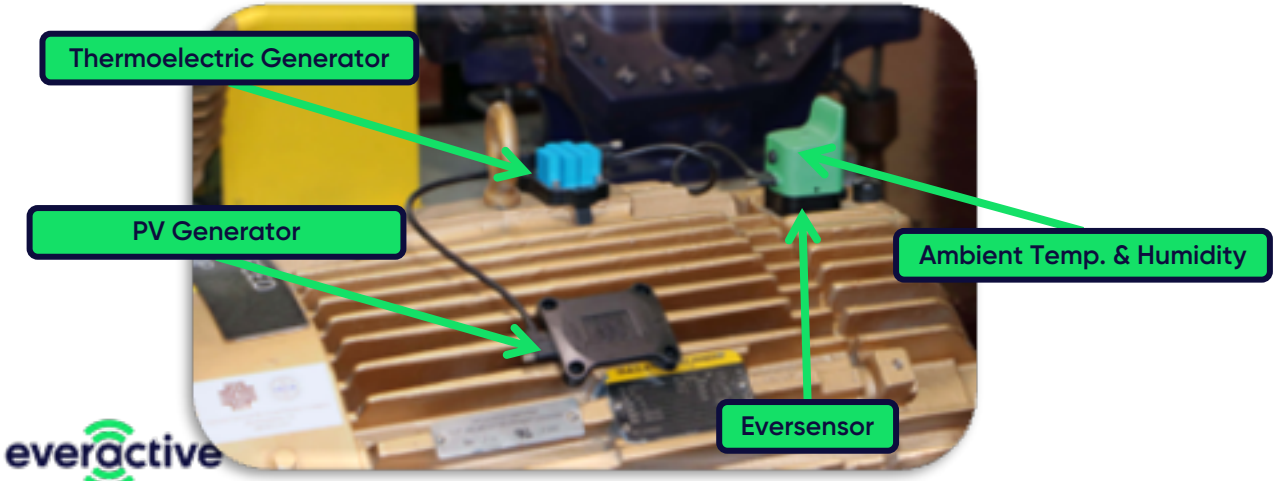
Use Case 2: Machine Health Monitoring

TAM
$63B

Maximize Facility-Wide Returns

- ✓ Prevent unplanned downtime
- ✓ Increase uptime & availability
- ✓ Improve overall equipment effectiveness
- ✓ Reduce electricity consumption
- ✓ Extend machine life



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Impact of just 2% improvement in motor efficiency

Annual electricity savings		*Motor Horsepower*		
		75	*120*	*200*
Electricity Savings ROI		3.1x	4.9x	8.1x
Number of Motors	2,000	$1.5M	$2.4M	$4.0M
	5,000	$3.8M	$6.0M	$10.1M
	10,000	$7.6M	$12.1M	$20.3M

53%
Industrial motors' share of global electricity consumption

16,689
homes' electricity usage for 1 year

Industry Adoption Of Everactive's Batteryless Monitoring

Investors

AsahiKASEI
FLUKE
Thaioil Group
ABB
FORTIVE
Armstrong

Customers

> **If the IoT system required battery replacement, it is a failed system.**
>
> *– Maintenance & Reliability Leader*

WestRock
JLL
HERSHEY'S
LYCRA
aramark
COLGATE-PALMOLIVE
MARS
Morgan Stanley
Sapuito
3M
MERCK
mizkan
TRINITY
Hill's
UNIVERSITY VIRGINIA
NIH
UNIVERSITY OF MICHIGAN
DANONE

Awards

IoT BREAKTHROUGH AWARD 2021
NetEvents innovation 2019 awards WINNER Hot Start-Up
FROST & SULLIVAN 2019 BEST PRACTICES AWARD NORTH AMERICAN INDUSTRIAL INTERNET OF THINGS NEW PRODUCT INNOVATION AWARD
Gartner COOL VENDOR 2019

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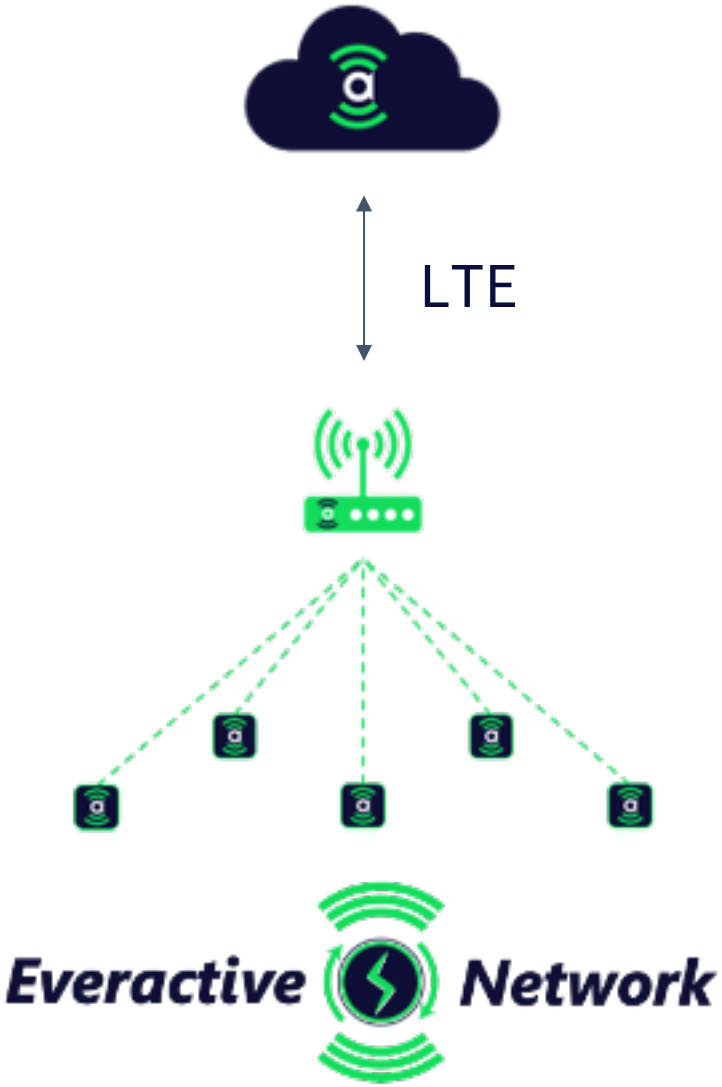
Advantage of Wakeup Receivers

- Everactive currently deploys a proprietary network designed around ultra-low power wakeup receivers
  - » Communication radio + companion wakeup receiver
- Everactive's wakeup receiver active power: 200nW
  - » Operates continuously from a harvested power budget
- Always-on wakeup receiver provides many benefits
  - » Reduces the (overhead) power of network synchronization
  - » Provides low-latency uni-cast or broadcast messaging to devices
  - » Scales to 1000+ devices with <1% dropped packets
  - » Simplifies device provisioning - ease of installation



Value of Directly Connecting to 3GPP Network

- Ease of deployment
  - » Leverage existing infrastructure with worldwide connectivity
  - » Bypass customer's IT infrastructure (e.g. enterprise WiFi network)
- Scalability
  - » Supporting dense networks of monitors - 1 device / square meter
- Mobility
  - » Will enable new applications for monitoring mobile assets and asset tracking

Need for low power support in RedCap beyond eDRX

- eDRX provides some end-user tradeoffs between latency and average power, but not sufficient flexibility for energy-harvested devices.
  - » Receiver needs to be ultra-low power, often uses event triggered always on communication.
- eDRX uses the main receiver always, increasing UE power.
  - » No support for ultra-low power wake-up receivers (WUR)
- Limited low power protocol support:
  - » RedCap not flexible to consider fluctuation in sensor traffic due to variations in available harvested power
  - » No UE power class low enough for harvested energy UE.
  - » No wake-up receiver support in any operation mode. (The Rel-16 DCI based WUS solution not suitable for ultra-low power WUR.
- Low power protocol support would drive next-wave batteryless IoT traffic to 3GPP networks

Considerations

- Industrial monitor data rates are low, but the **value** of the data is high
- Battery lifetime limits the adoption of industrial monitors
- Adding ultra-low power wakeup receiver functionality to RedCap will enable batteryless sensors