



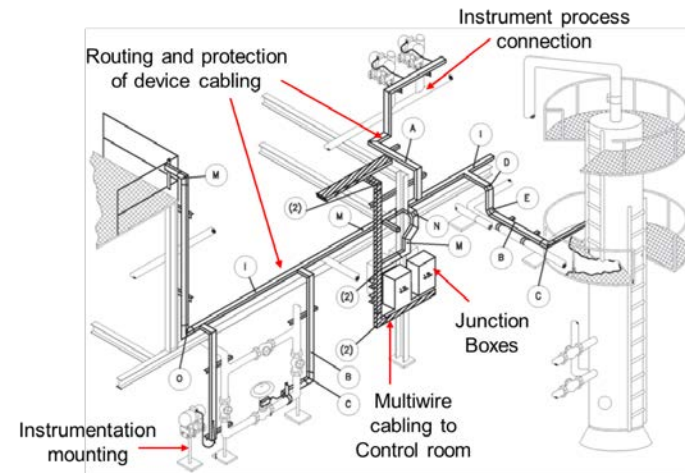
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Giornata di Studio "La tecnologia wireless nel monitoraggio degli impianti Oil & Gas e Energia" ANIPLA/AIS, 6 Maggio 2015

WirelessHART pressure and temperature transmitters with Thermal Harvester

WirelessHART Acknowledgement

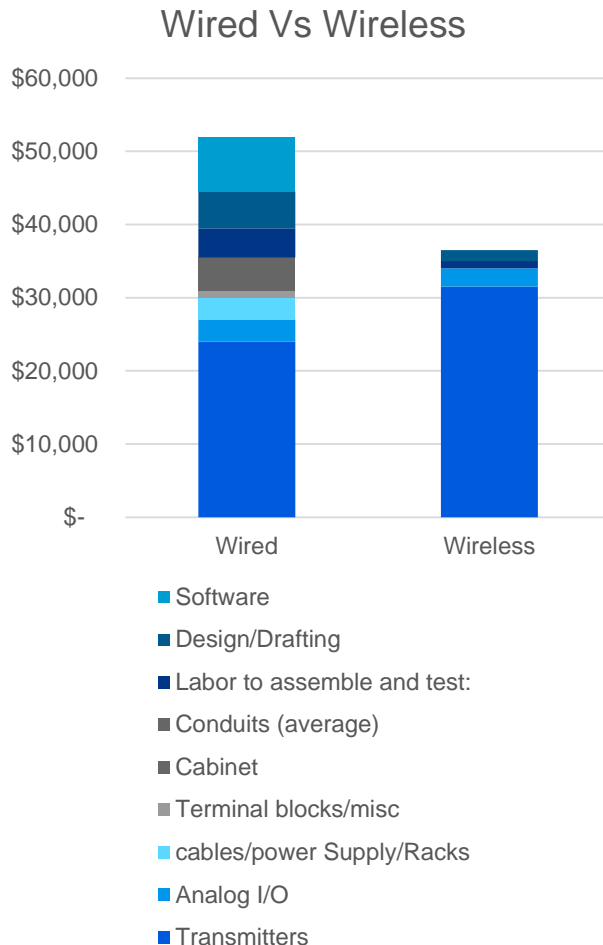
Reduced installation costs and implementation time



- Over 50% of instrumentation installation costs are related to wiring and cabling of devices and communication networks
- Engineering, planning, labour and materials
- Wireless devices and networks can **significantly reduce installation costs and implementation time**

WirelessHART Acknowledgement

Wireless helps you saving at least 30% cost



Hardware costs:	Wired	Wireless
Transmitters	\$ 24.000	\$ 30.000
Analog I/O	\$ 3.000	\$ 2.500
cables/power Supply/Racks	\$ 3.000	
Terminal blocks/misc	\$ 1.000	
Cabinet	\$ 500	
Conduits (average)	\$ 4.000	
Labor to assemble and test:	\$ 4.000	\$ 1.000
Design/Drafting	\$ 5.000	\$ 1.500
Software	\$ 7.500	
TOTAL	\$ 52.000	\$ 36.500

For a 30 A/I installation and data collection in GP area

WirelessHART Acknowledgement

Wireless can reduce your commissioning time



Today getting a plant up and running as fast as possible is a sensible argument.

Wireless does not require:

- Conduit installation
- Wires from device to field cabinet or control room
- Trenching and backfill (with relevant permits)
- IS barriers installation
- Transmitters grounding

What above results in a 75% faster implementation time with wireless.

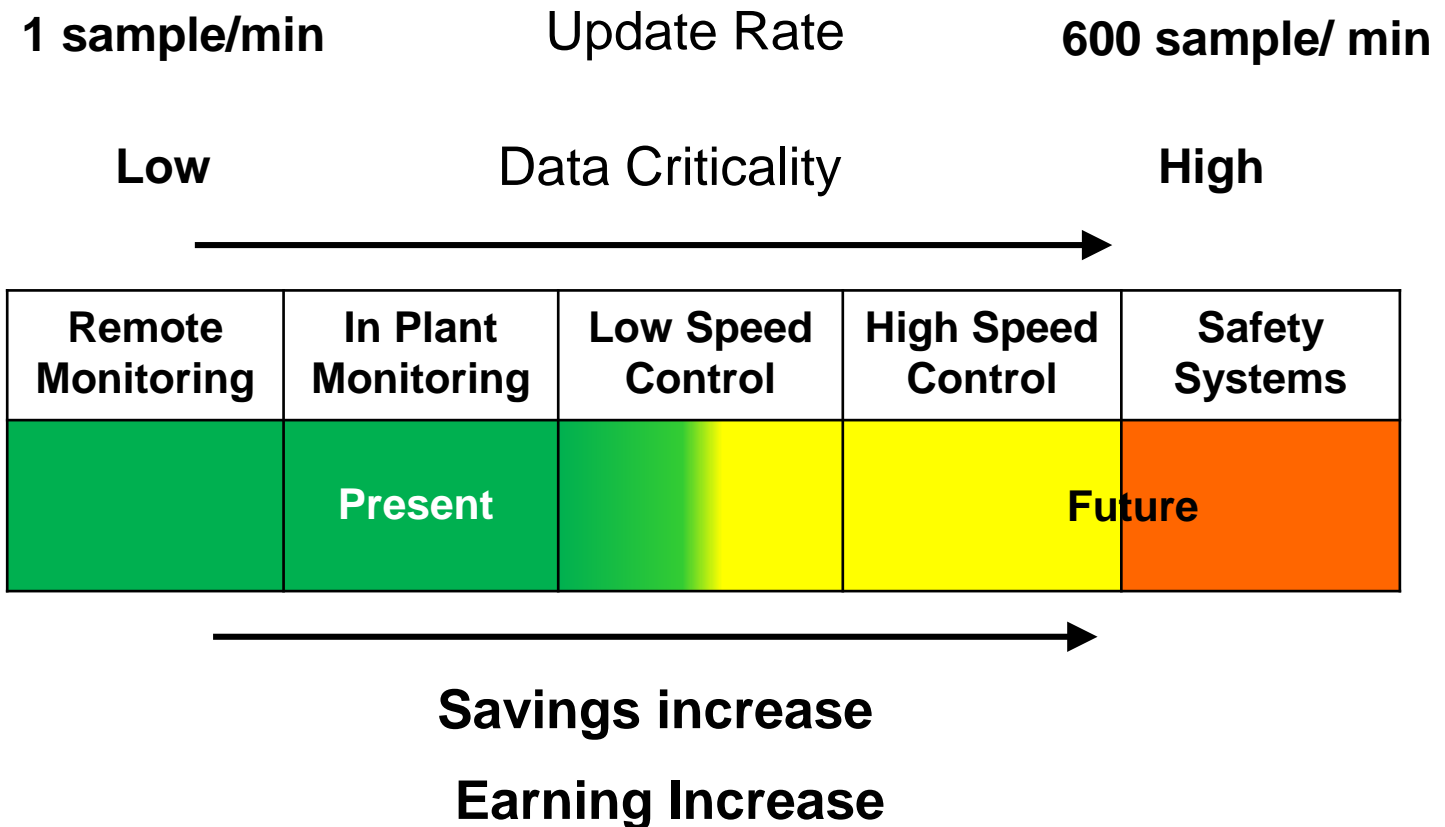
WirelessHART Acknowledgement

Wireless Unlocks Device Diagnostic



- Wireless Hart allows you to access remotely all the parameters of the device.
 - Diagnostic data
 - Increase update rate
 - Residual battery life
 - Walking in front of the device it is not necessary anymore!
- 80% of the 35 million HART instruments do not have remote communications
 - Process and Asset Management information is left stranded in the field
 - Wireless will unlock this information

WirelessHART Performance Trend Process Classification



Wireless

The big concerns



- Expected Battery life in real conditions
 - Battery life is effected by:
 - Ambient Temperature
 - Network Topology
 - Update rate
- The theoretical 10 years life @ 60 sec update rate could easily become few months when working at 50°C ambient with update rate of 1 sec and multiple childrens connected.

Wireless

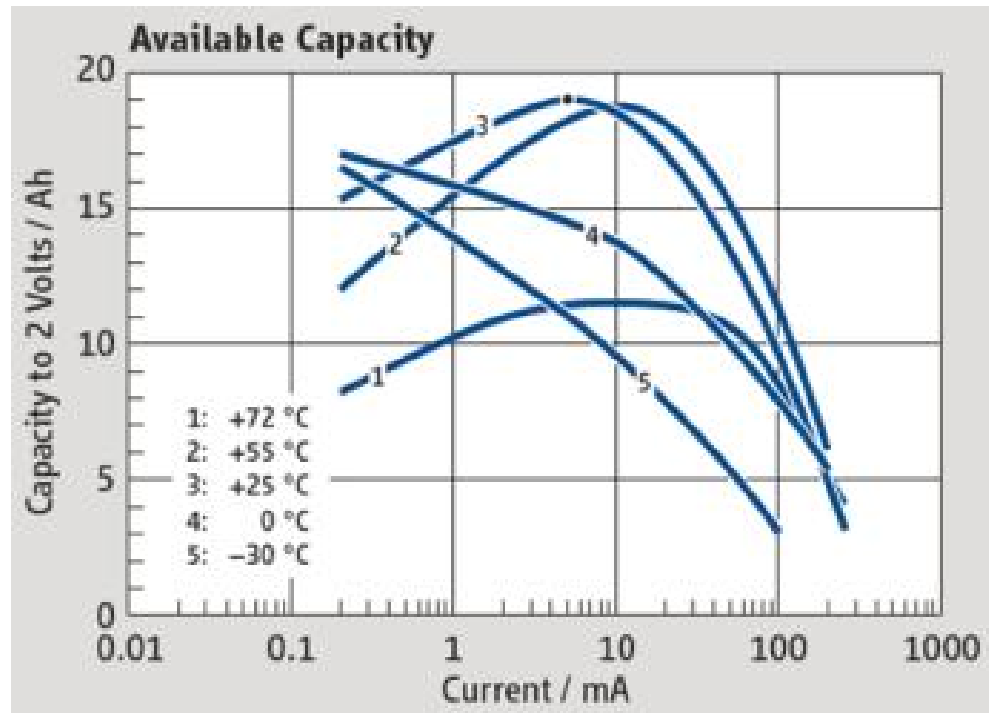
The limits

- Batteries have a limited Energy (3,6 V, nom. Capacity 19 Ah, Nom. Current 4 mA)
- The device is using part of this energy at every signal detection and transmission
 - The lower energy is used, the longer the battery will last.
- According to the Hazardous area standard a Battery can not be charged in a not-safe area.
- Scavenging energy from the environment can be an important solution to increase battery life.

Influence of battery life Ambient temperature



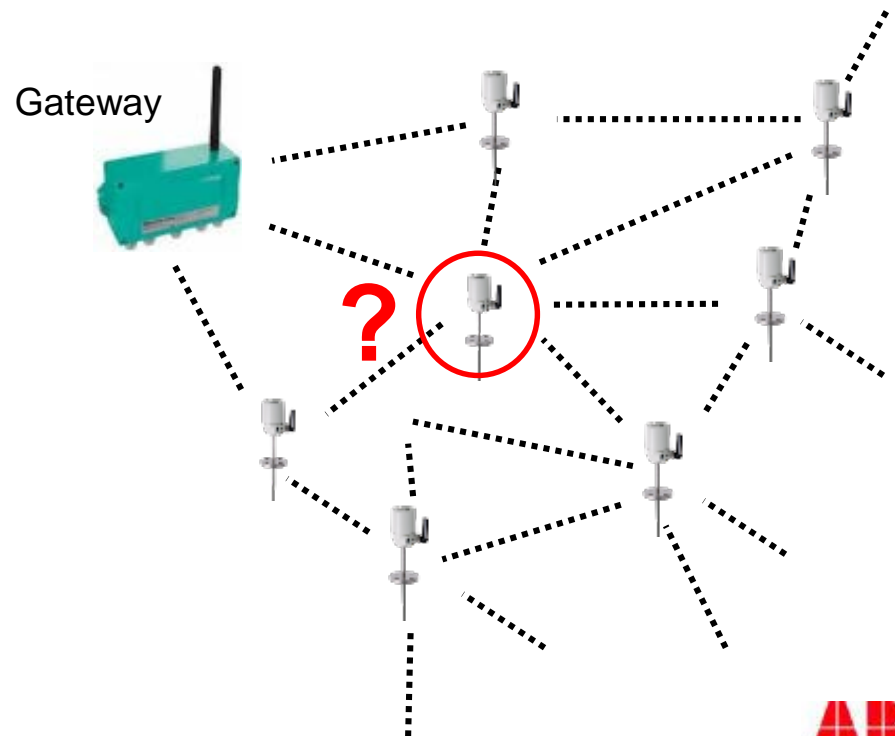
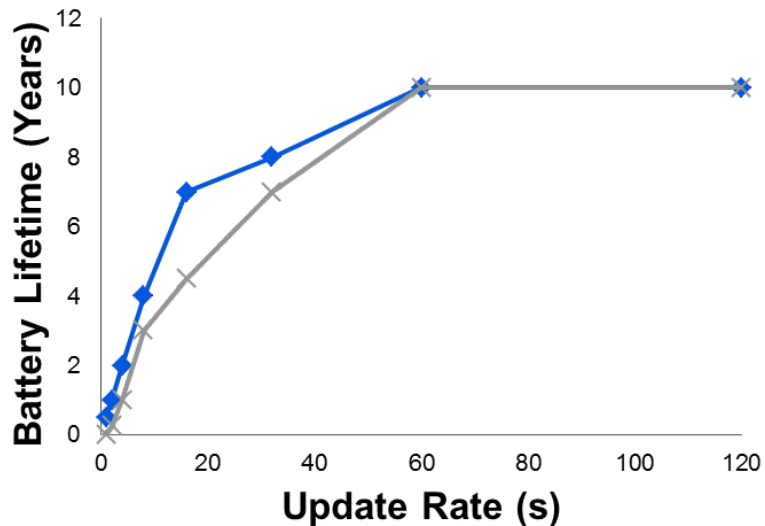
The higher is the temperature the lower is the available capacity



Influence of battery life Topology



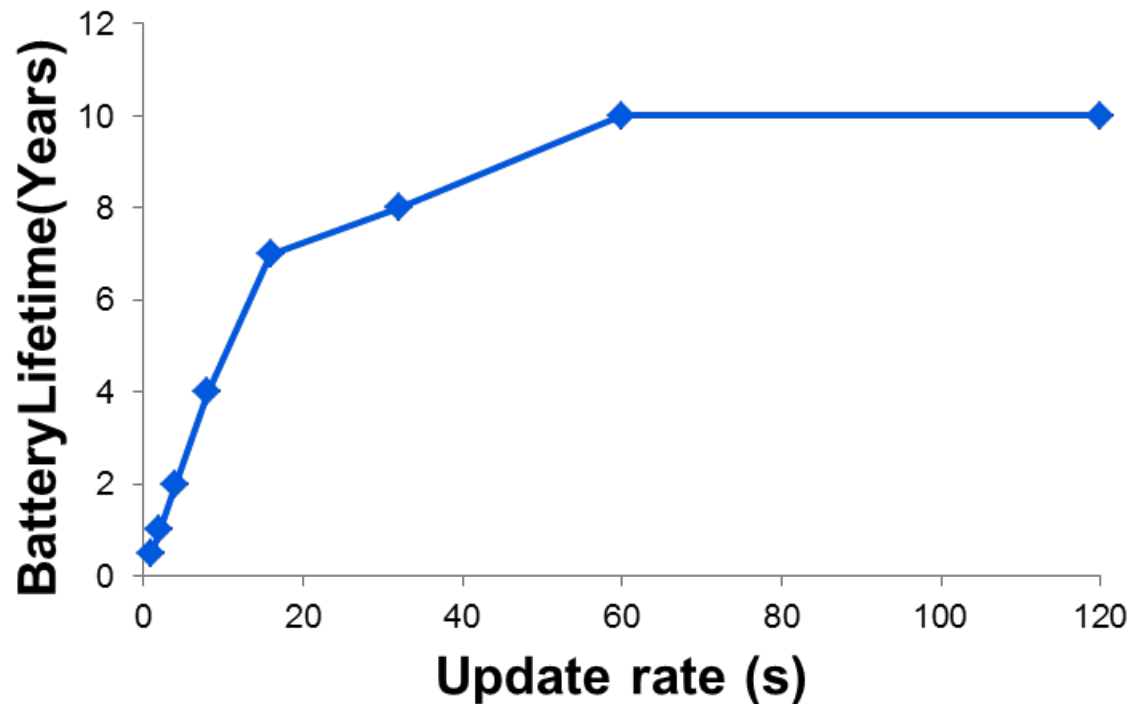
The higher is the number of children the lower is the battery life



Influence of battery life Update rate

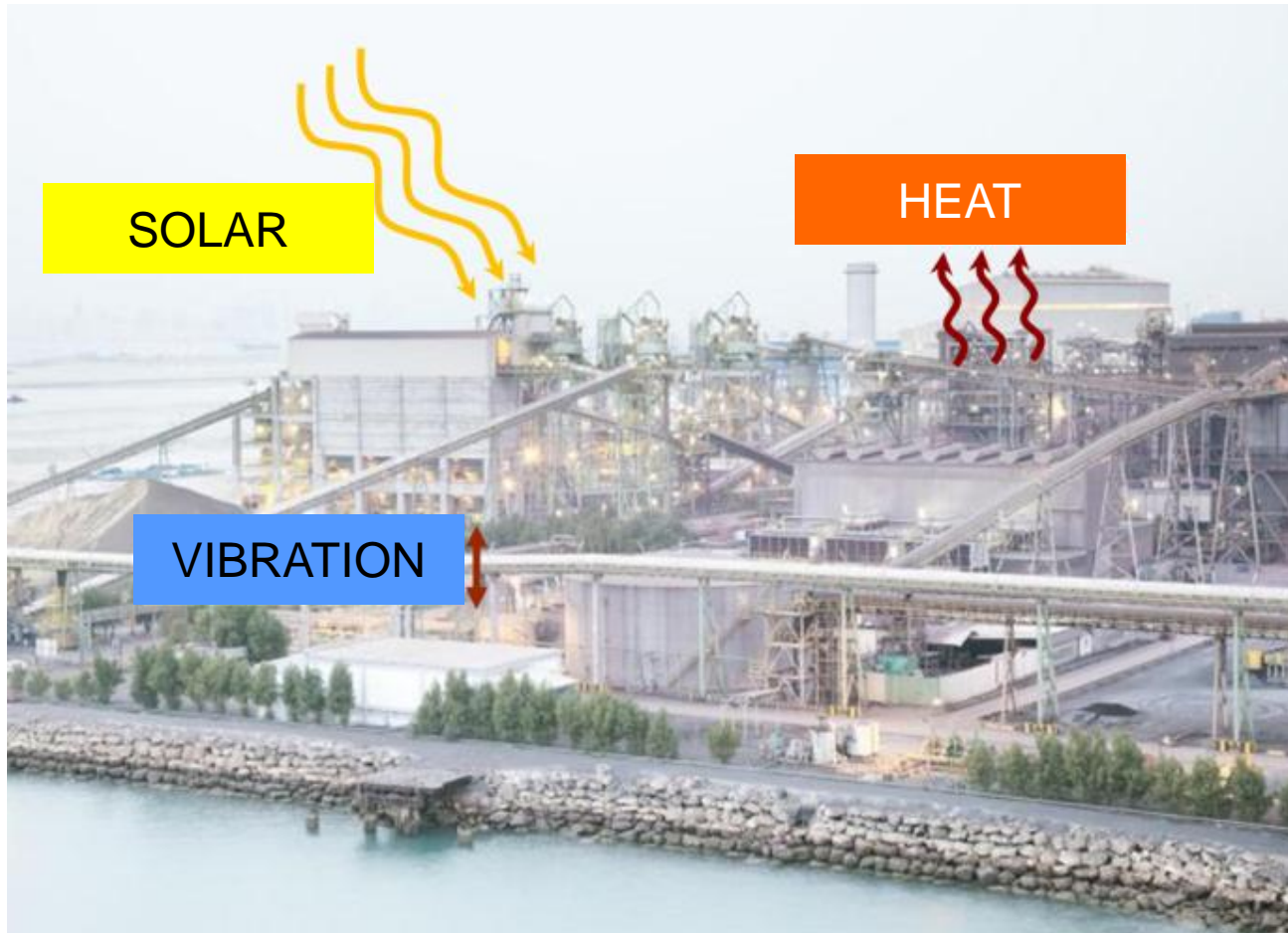
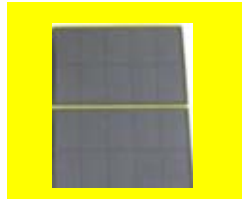


The higher is the update rate the lower is the battery life



Energy harvesting for wireless devices

Environmental Sources



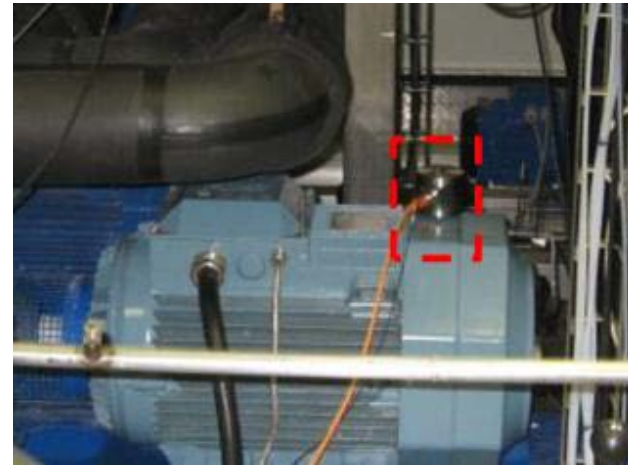
Energy harvesting

Photovoltaic



- Suitable for sunny and out-door installations
- Limited applicability for indoor or outdoor dirty effected locations (sand, oil, grease powders etc)
- Need to accumulate energy during the day for poor light timeframe usage
- Widely used in upstream oil & gas on-shore (RTUs and well automation)

Energy harvesting Vibration



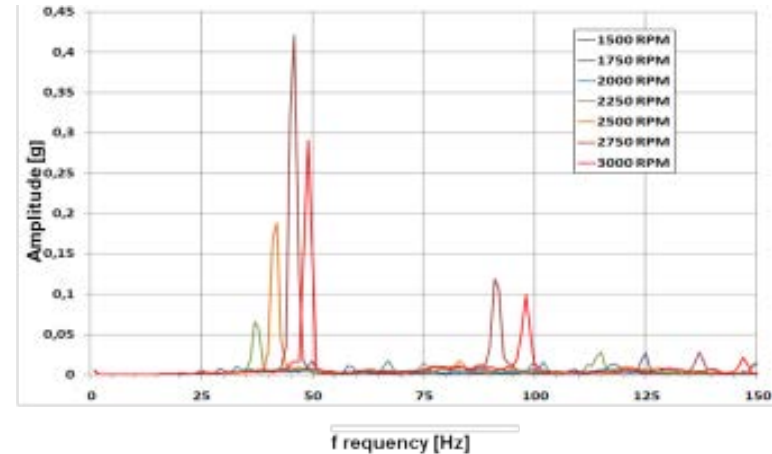
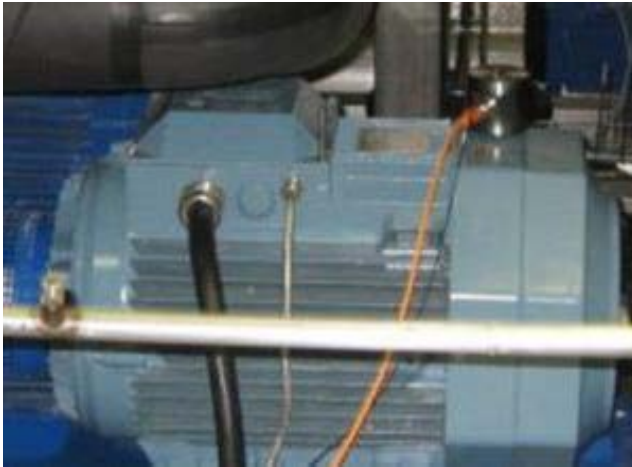
Resonator based technology:

- Applicable when fixed frequency is available
- Limited applicability with variable frequencies

Rugged industrialized solutions not really available

Strongly application related applicability

Energy harvesting Vibration

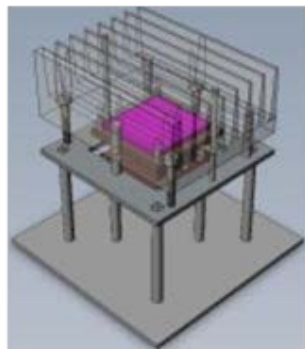
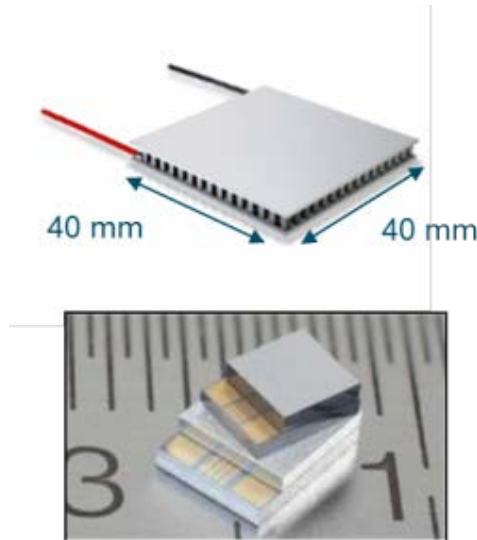


State of the art.

- The maximum power is generated when the transducer is calibrated at the vibration frequency.
- What's happening if the frequency changes?
Example: Motor connected to a variable frequency Speed Drive

Energy harvesting

Thermoelectric generators (TEG)



Conventional TEG

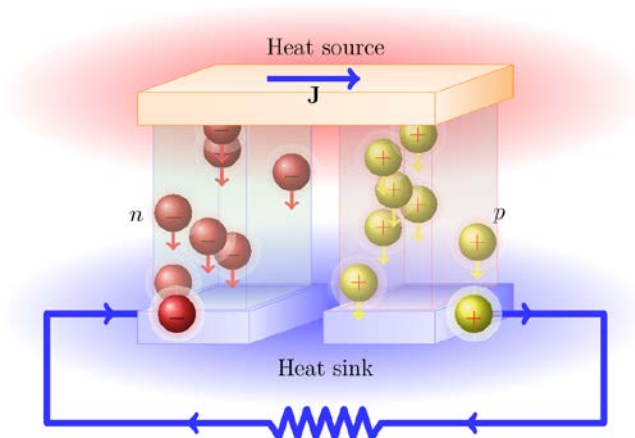
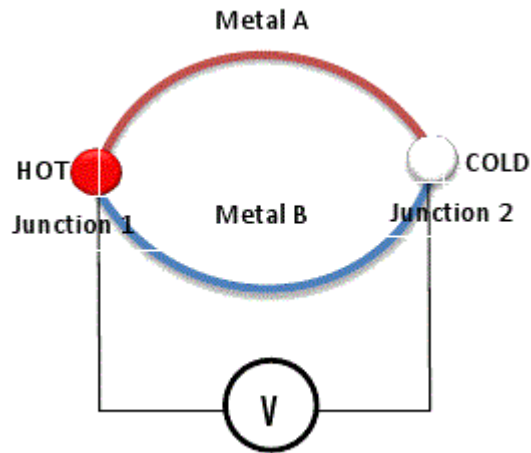
- Recommended where the saving is more important than the module dimensions.
- The generated Voltage is low and specific sophisticated modules are needed for the energy management.

Micro-TEGs

- Compact, better performances
- Recommended for integrated solutions where space is an important factor.

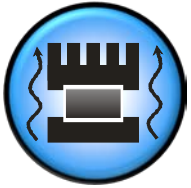
Energy harvesting

Principle of operation Seebeck effect



- The thermoelectric effect is the direct conversion of temperature differences to electric voltage.
- A thermoelectric device creates voltage when there is a different temperature on each side.
- At the atomic scale, an applied temperature gradient causes charge carriers in the material to diffuse from the hot side to the cold side.
- This effect can be used to generate electricity, measure temperature or change the temperature of objects.

Energy harvesting Comparison



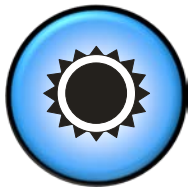
- **Thermal Gradient– Thermal Harvester**

- Reliable, robust, proves and simple
- A thermal gradient is needed



- **Vibration – resonant harvesters**

- Few available on the market «applicationspecific»
- Very complex, vibration are often not available



- **Light – Photovoltaic**

- Reliable, Available on the market and simple
- Availablility of light, applicable in clean environments

The ABB choice

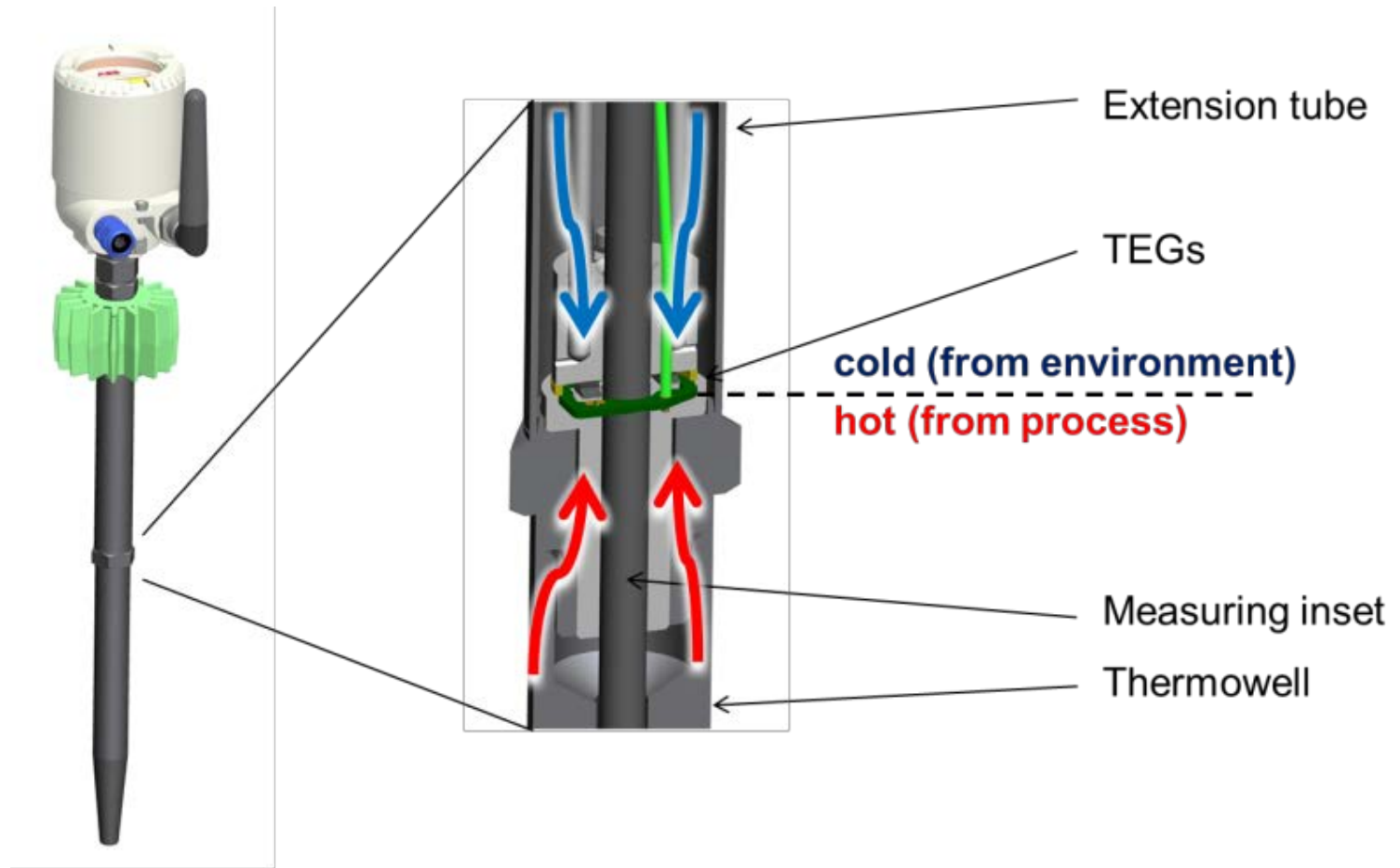
Thermal Harvesting for autonomous power

- In almost every plant we dissipate heat which is lost in atmosphere.
- Recovering the heat and using it to feed power to field devices is a smart, cheap and sustainable concept



The ABB choice

Thermal Harvesting for autonomous power



Wireless

How to approach the «big concerns»?



- Using state of the art Wireless specifically developed device
 - Avoid add-on adapter to Std devices as it will drain battery soon.
- The ABB 266 Wireless Hart gets a 10 years life at 32 sec update rate with 3 children at 21°C
- Consider battery life extender solutions.
 - Thermal
 - Vibration
 - Solar



Energy harvesting Wireless Hart ABB field devices

Wireless Hart ABB field devices



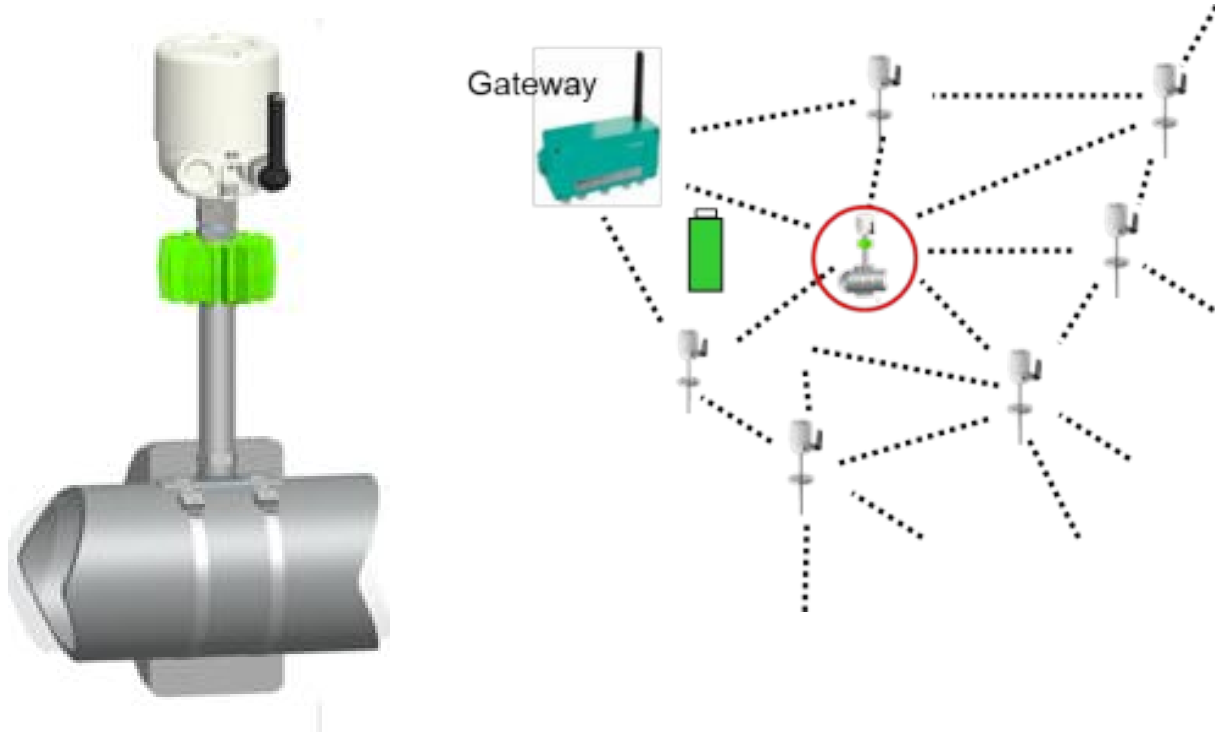
Wireless Hart TSP300-W & TTF
300 Temperature Transmitters



Wireless Hart 266 Pressure
Transmitters

Energy harvesting

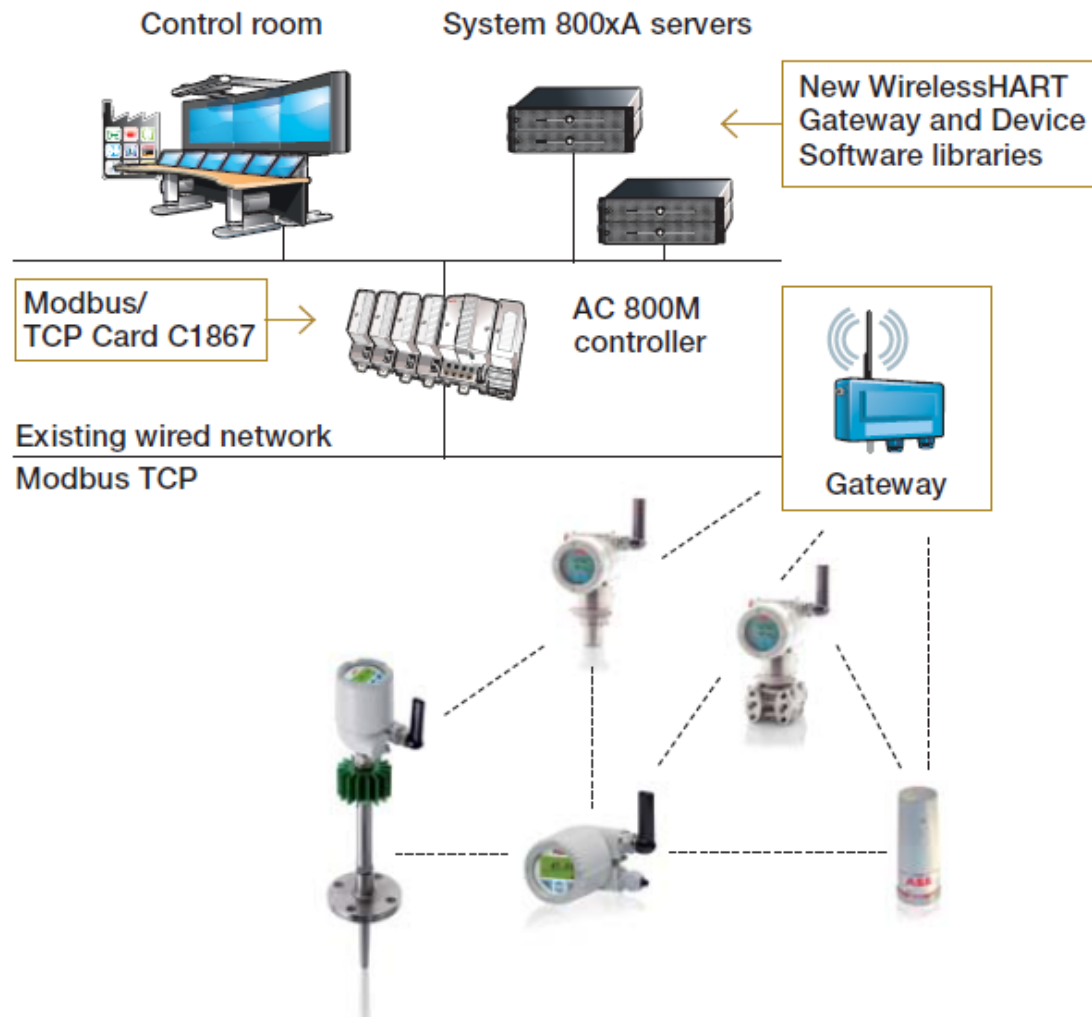
Thermal harvester solution result



No battery usage with 30K of temperature gradient and 16 s of update rate

Wireless Hart

The complete ABB integrated offering



Energy Harvesting for Wireless Instruments

Robinson Brothers – Temperature Monitoring

- **Challenge**
 - **Monitor process temperature** when there is no control system connectivity nearby
- **Solution**
 - **Install Wireless Energy Harvester** temperature devices from ABB
- **Results**
 - With a 30degC temperature change from process to ambient the energy harvester powers the whole instrument – **no need for a battery.**
 - The instruments were installed and **visible on the plant control network within 1 hour**

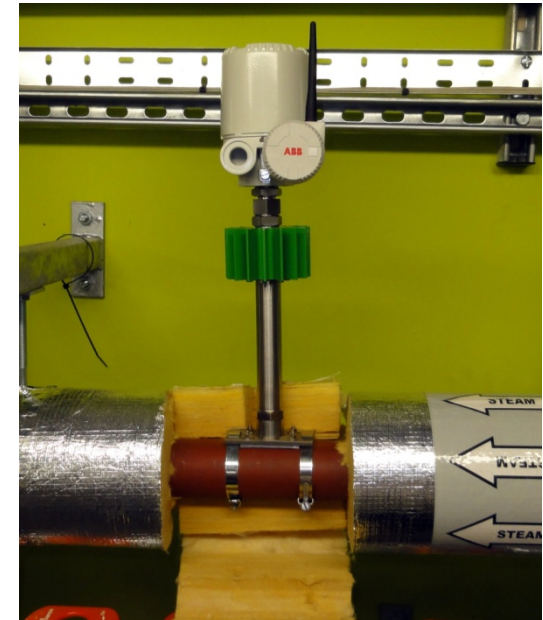


Energy Harvesting for Wireless Instruments

Imperial College – Carbon Capture

- **Challenge**
 - To quickly install a temperature and pressure monitor on a steam pipe
- **Solution**
 - Surface mount TEG energy harvester
- **Results**
 - Surface clamp temperature and pressure instrument was quickly installed
 - The TEG harvester removes the need to replace batteries in the future
 - Using the existing WirelessHART network resulted in rapid host integration

Imperial College
London



Energy Harvesting for Wireless Instruments

Südzucker – Sugar Beets Pellets Drying

- **Challenge**
 - Get temperature information out of a rotary furnace without a contact ring.
- **Solution**
 - Installation of a temperature sensor with Energy Harvesting direct into a pre mounted thermowell.
- **Results**
 - Temperature was measured and sent via wireless communication to a Screen Master to visualise and to storage the temperature information.
 - The TEG harvester enable the temperature measurement on a rotary furnace without contact rings.



Energy Harvesting for Wireless Instruments

ThyssenKrupp – Coking Plant

- **Challenge**

- Temperature Monitoring for waste water of cooling system for coking plant



- **Solution**

- Installation of 3 temperature sensors with Energy Harvesting (surface mount).

- **Results**

- Transmit values from factory into central office of maintenance engineering team.
- Display and log values with ABB Screenmaster SM500F



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