

## ***What is the appropriate application level for wireless instrumentation?***

Tom Garry, Sr. Account Rep., Emerson  
Process Management



## ***First things first... Wireless is an enabling technology***

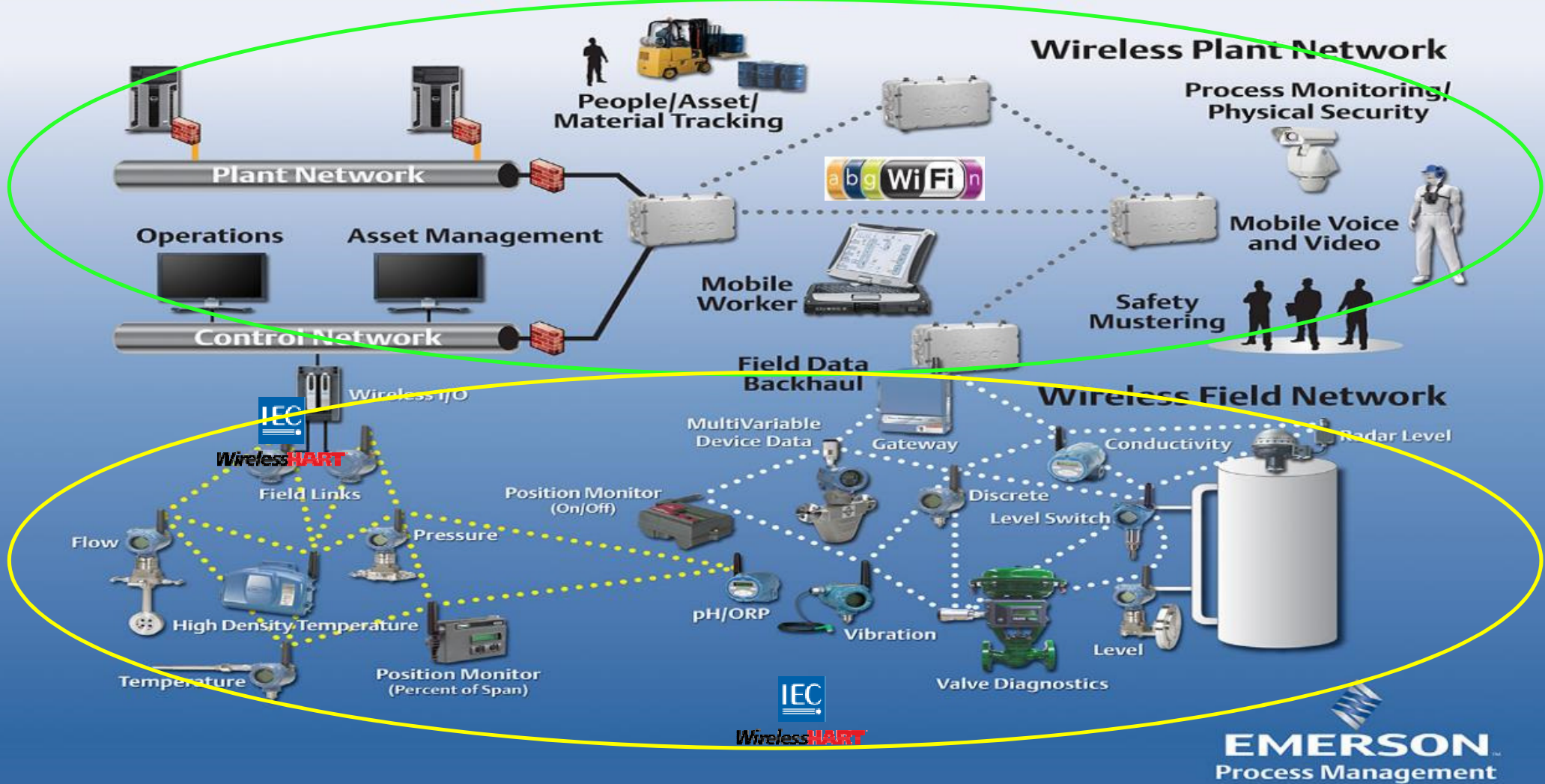
- What is “WIRELESS” ?
  - Is it a product? A bunch of products?
  - A communications protocol?
  - Plant network or field network?
  - Infrastructure vs application discussion?
- 702, 708, 1420, 9420, WIOC, ISA, WiHART...
- Is it the same as WIFI at my house?



**“To transfer information without the use of wires”**

***A different way to solve a problem***

# Emerson Smart Wireless



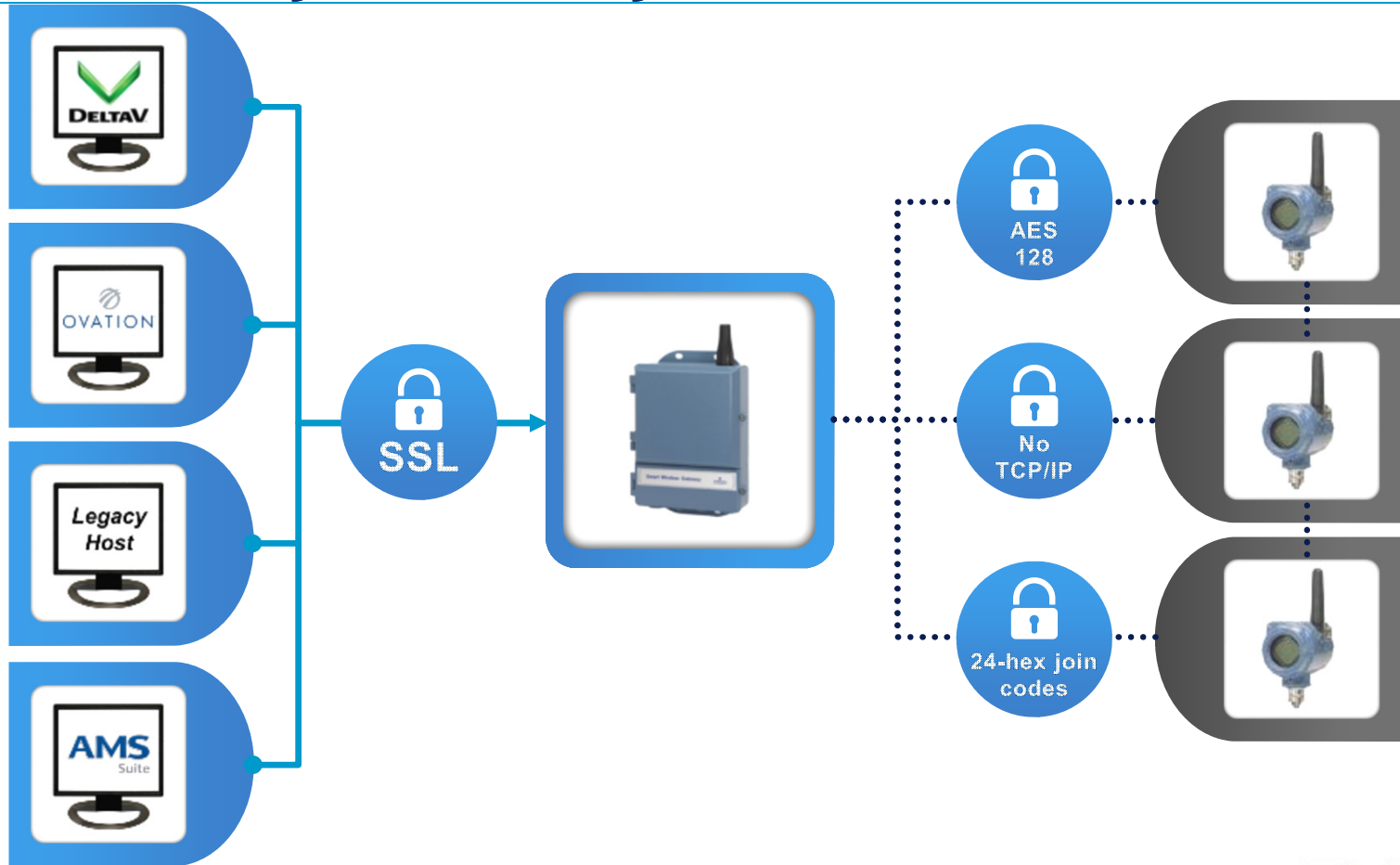
# ***Today's Agenda***

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1. **Security Concerns Put to Rest**
2. Point Selection Flow Chart
3. Incorporating Wireless in Capital Projects
4. Applications
5. Best Practices



## Robust Security – Gateway & Instruments



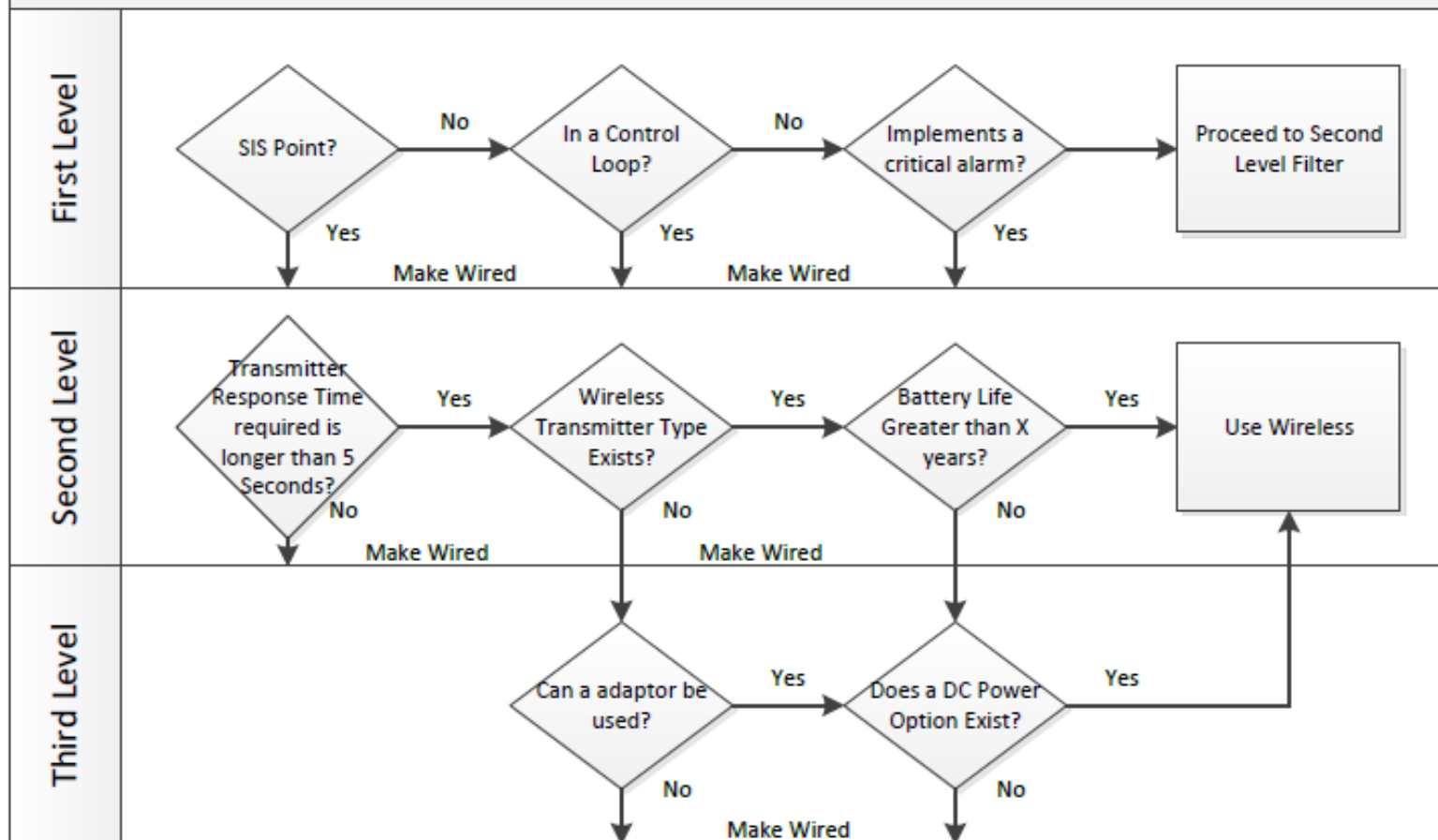
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## Wireless I/O Selection



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# ***Evolution of the Industry Requires Plants that Do More***

## **Old – Conventional Approach**

- Get project delivered, plant running and handed over
- Smart technologies perceived as cost prohibitive
- Efficiency based on “cut and paste” of existing specs which diminishes innovation
- Technology limited as it is centric to the selected automation vendor



## **New – “Smart” Approach**

- Expand focus to include Operational Excellence and environmental compliance
- Smart Technologies are financially justifiable by both EPC and End User
- Technology viewed as an enabler to achieve CAPEX and OPEX goals
- Technologies such as wireless help drive project efficiency
- Mitigation strategy for schedule slippage

# Wireless Enables Operational Excellence for all Project Stakeholders

## Engineering Contractors

### *Increase project flexibility and reduce complexity*

- 6% reduction in CAPEX
- 50% of tasks eliminated in change management process
  - Reduced engineering complexity
  - Reduced interdisciplinary reliance
  - Reduced complexity and hence project risk

## Automation Project Team

### *Deliver value beyond automation scope*

- 11% optimization in solution footprint
- 11% reduction in weight
- 10% reduction in project delivery times

## Asset Operators/Owners

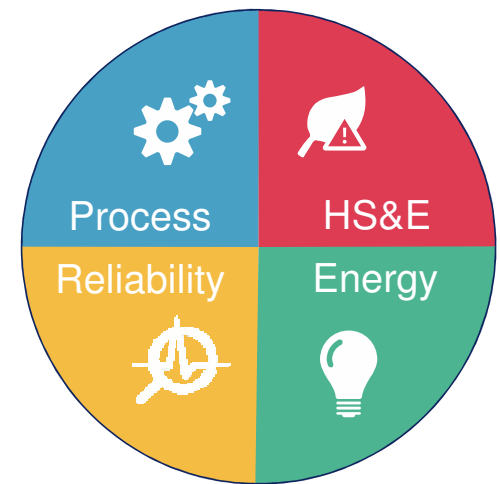
### *OPEX enabled platform for continuous improvement*

- Enables future OPEX and performance initiatives by providing a platform for ad hoc and diagnostic measurements
- 50% savings in additional measurements over traditional methods
- 90% time savings on hazardous area inspections, as per IEC60079 Part 17



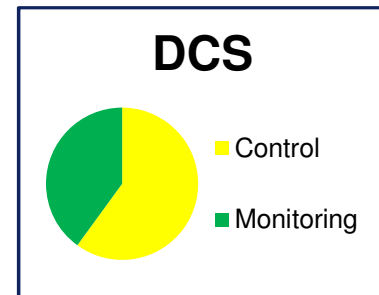
## ***Pervasive Sensing Strategies in Projects***

- Greenfield Projects (new sites)
  - Reduce **engineering cost and time** per point
  - Reduce **installation cost and time** per point
  - Accommodate **management of change** during engineering and construction
  - “**Future proof**” the facility
- Brownfield Projects (modernizations/upgrades)
  - Monitor critical assets for **reliability**
  - Meet new compliance regulations to enhance **safety**
  - Reduce **energy** costs
  - Increase people and process **efficiency**
  - Improved insight on **facility performance**



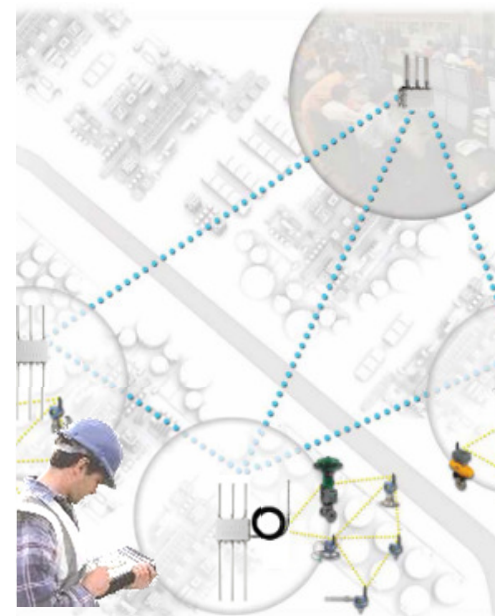
## Wireless I/O Conversion

- Typically ~30% of a project's I/O are good candidates for wireless
  - Process Indication
  - Asset Monitoring
  - Environmental Monitoring
  - Site Safety Monitoring



## ***Wireless for Capital Projects: Checklist for your clients***

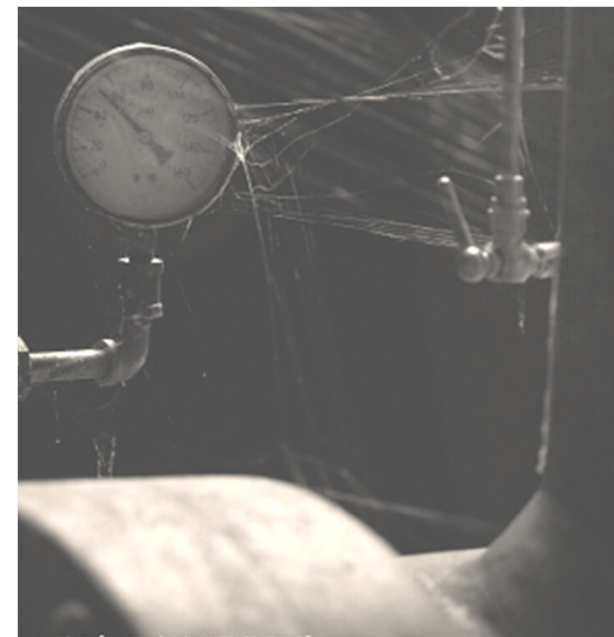
- ☑ Do you expect **design changes** as the project progresses?
- ☑ Are you looking for ways to save **installation cost and/or time**?
- ☑ Do you need help defining which points are potential **candidates for wireless I/O**?
  - Safety, Control, Critical vs Essential Assets
  - Typically 25-35% of I/O good wireless candidates
- ☑ Are you willing to incorporate technologies that can streamline **startup and commissioning**?
- ☑ Will you need to add **additional I/O** to control and monitor everything you want over the life of the facility?



*Reduce Risk, Flawless Startup*

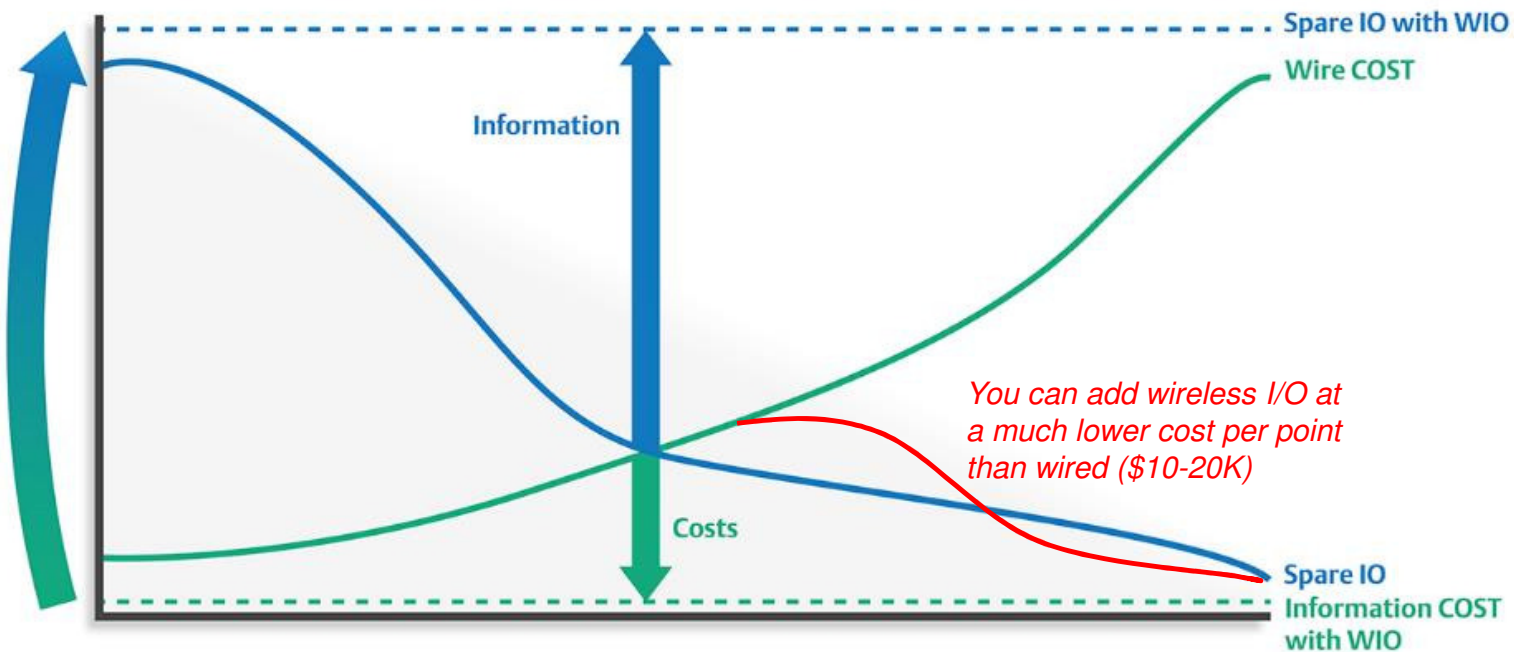
## ***Wireless for Modernization/Upgrades: Checklist for your clients***

- ☑ Do you want to monitor additional assets/equipment but do not have any **spare I/O**?
- ☑ Do you have equipment **NOT being monitored** because it doesn't make technical and/or financial sense?
- ☑ Do you want to **minimize manual inspections** in hazardous or hard-to-reach areas?
- ☑ Do you have **bad actors** in your facility?
- ☑ Do you have any **past failures** that need to be addressed?
- ☑ Do you have any **regulatory compliance** or **SHE reporting** requirements that need to be addressed?



*Improve Plant Performance – Optimization & Efficiency*

# Wireless Impacts Project Cost, Schedule and Risk



**Safety I/O**

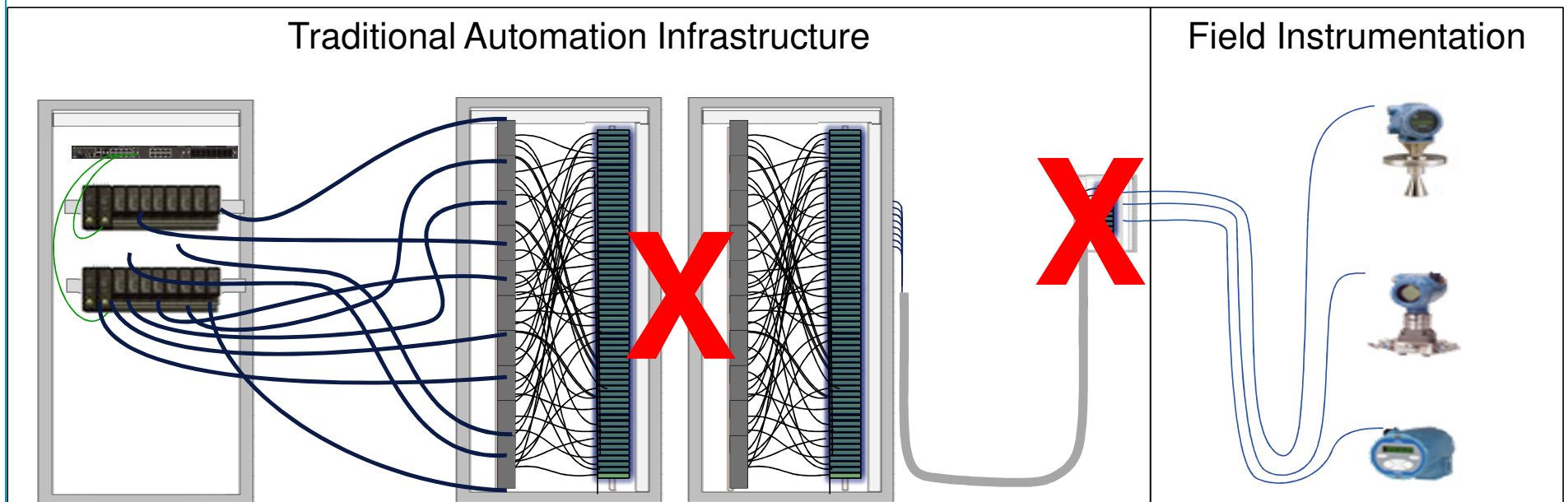
**DCS I/O**

**Business  
Critical I/O**

**Pervasive  
Sensing I/O**

Significant brownfield project cost, schedule, and risk reduction is driving fundamental infrastructure investment into greenfield projects.

## ***Traditional Automation Architecture: Complexity-Driven Risk***



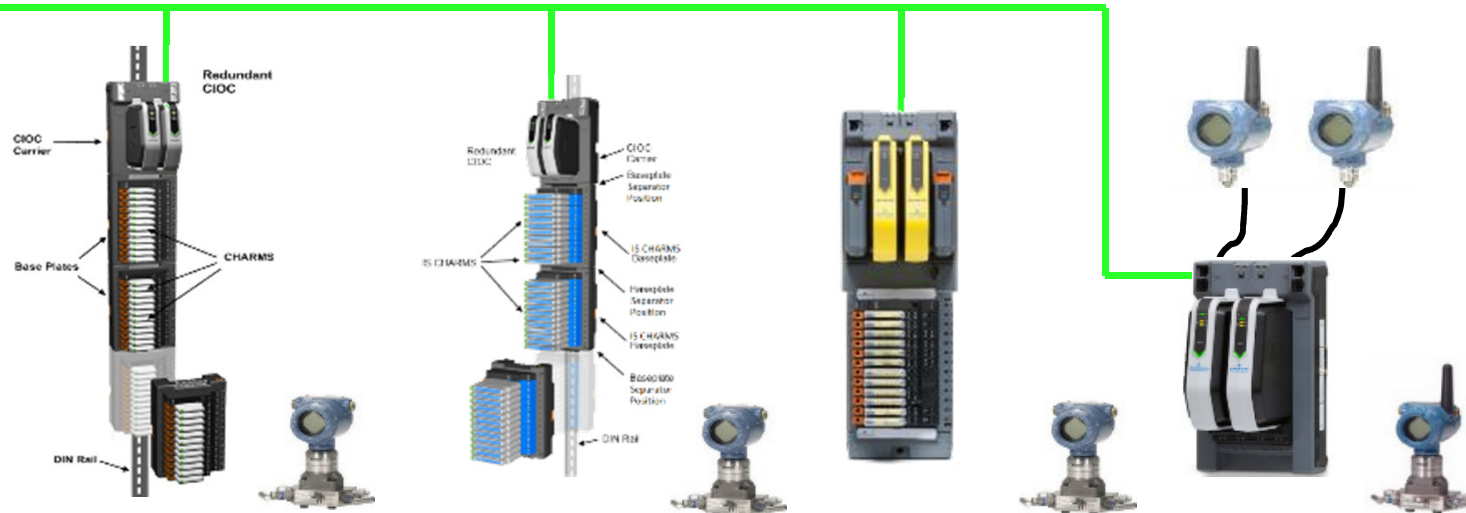
**Concerns with Traditional Architecture: Cost, Time, Space, Weight, Spare I/O, MOC**



## ***Benefits of Pervasive Sensing and I/O On Demand***

- Eliminate marshalling cabinet
- Dramatically reduce cable tray
- Add I/O as needed
- Save time and cost on design and installation
- Common HART-based instrument platform

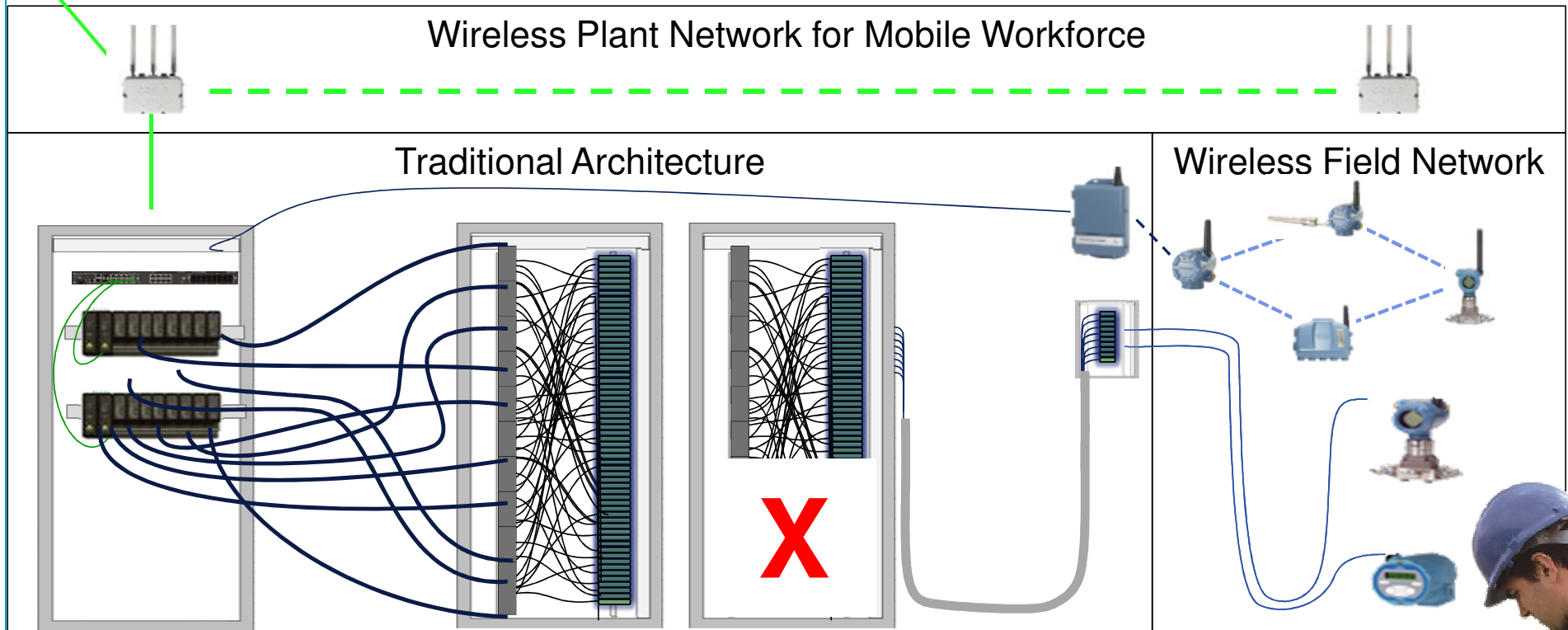
Multi-cores from field



**EMERSON**  
Process Management

Remote  
Information

# ***Pervasive Sensing with Traditional Architecture: Reduces Complexity and Offers Interoperability***

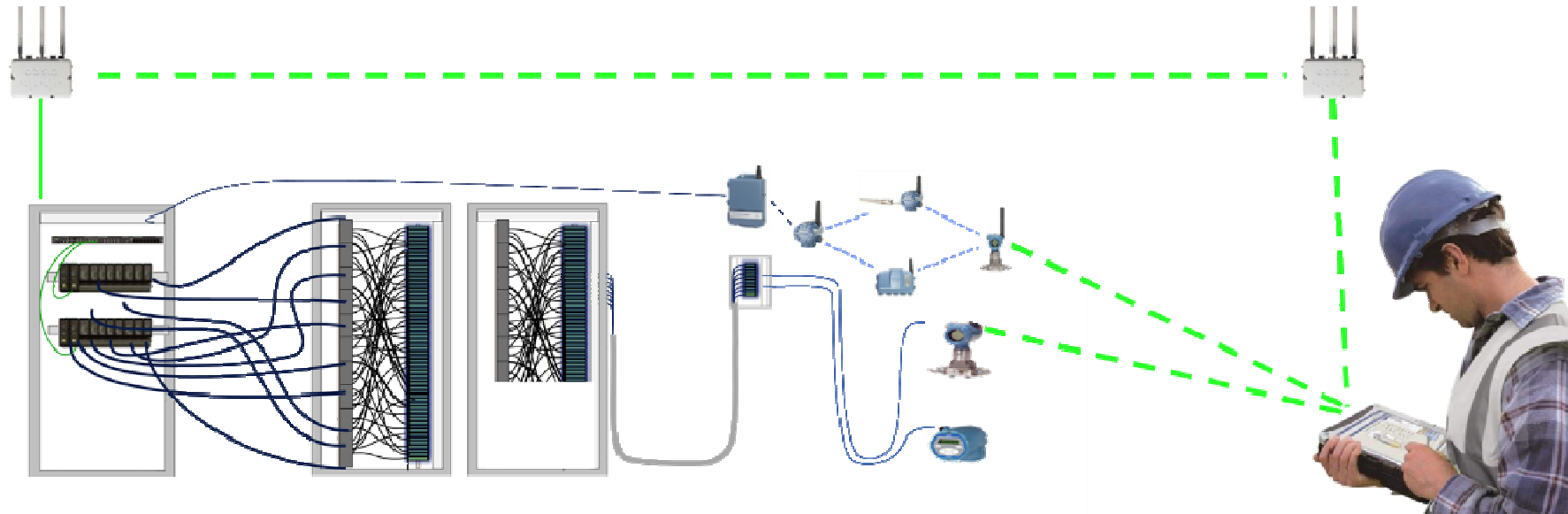


**Advantages: Design flexibility, cost savings, time reduction, expandability, worker productivity**

# Wireless Plant Network – Levels of Adoption

## Levels of Plant Network Adoption:

1. Construction – real time documentation and QA/QC
2. Startup, commissioning, and turnarounds
3. Ongoing plant operations
4. Leverage backhaul connectivity for control room bridging, PLC, RTU, Gateways, Cameras, and Skids



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# Advanced Sensing for Process Optimization



## Process

- ▶ Pump Filter DP's
- ▶ Skin temperatures
- ▶ Steam pressures to CDU
- ▶ DP flow rates in jumper lines
- ▶ Manual gauge replacement
- ▶ Pressure
- ▶ Temperature
- ▶ Level
- ▶ Flow

## Mobility

- ▶ Mobile maintenance
- ▶ Mobile operations

# Wireless Infrastructure Delivers Project Savings



PROCESS

## Major Chemical Manufacturer

### CHALLENGE

- New process unit at existing facility
- Customer under extreme time pressure to bring plant online
- Legacy non-Emerson DCS site
- Approx. 1200 total I/O on project

### SOLUTION

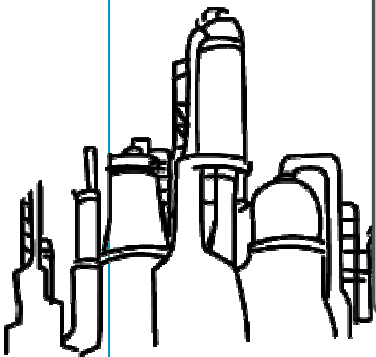
- Wireless Plant Network plus 7 Gateways, 300+ wireless transmitters
- Emerson content includes: DeltaV, AMS, Rosemount, MagTech, Flow, Analytical, Mobile Worker, WIOC
- Strong partnership with EPC

### RESULTS

- Plant Design included 25% Wireless I/O
- Estimated \$2M in project savings
  - 1000's Man-hours saved

Mobile Workforce tablets used as remote workstations throughout start-up and commissioning

Utilized AMS on tablet to perform onsite troubleshooting



# Wireless Mobile Worker Improves Efficiency



PROCESS

## Ergon Refining

### CHALLENGE

- Ergon executed a turnaround and DeltaV migration that required loop checking 300 loops and indicators *and* verification of approximately 100 DVC valve actuators.
- Ergon targeted 10, 24 HR shifts.

### SOLUTION

Two Mobile Worker equipped checkout crews were deployed. Cabinets were staged in advanced and hardware checked with Mobile Worker.

### RESULTS

- Checkout time was reduced by half – from 4 to 2 weeks.
- Required manpower was reduced by half. Virtually no loop troubleshooting during startup.

*"Mobile Worker with Emerson's Wireless Plant Network gave Ergon flexibility and increased efficiency on our turnaround. It allowed us significant cost savings, and may be used as a tool by Engineering and Operations in the future. We cut way back on the communication from the field to the control room. We used to have to ask the console operator to run the valves up and down to prove the connection, now we do it all outside from the Toughbook." ~Steve Elwert, Ergon Refining*

# Tank Level Monitoring



PROCESS



OMV Petrom Petrobrazi



## CHALLENGE

- Not having reliable information needed to effectively mass balance tanks.
- Personnel in hazardous locations doing manual rounds for 159 tanks of various sizes and heights.

## SOLUTION

- Wireless remote monitoring of tanks to get reliable and increased accuracy of product stocks measurement and mass balance



## RESULTS

- Increase the operational performances
- Increase the health, safety and environmental protection
- Inventory with accounting system
- Reduced costs with installation and maintenance, network extension capability

*"Considerable cost savings for installation and maintenance, the system delivers robust, reliable and secure transmission of tank data" - Paul Dima, Wireless SEE*

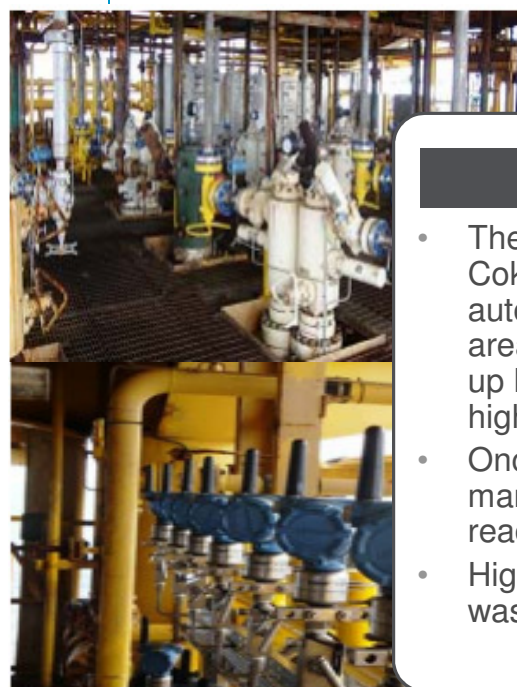


# Calcining Unit for Coker



PROCESS

## American Oil and Gas Company



### CHALLENGE

- The Calcining Unit for a Coking operation wanted to automate non-production areas of the plant to free up labor resources for higher-value activities.
- Once per month visit to manually record instrument reading.
- High cost of wired system was \$8k--\$15k/point.

### SOLUTION

- Wireless HART infrastructure to monitor:
- Motor bearing temps.
- Pump casing temps.
- DP across water filters
- Inline pressures on chemical injection lines to detect plugging.
- Average: \$1k/point
- Resolution improvement from 1/month to 1/hour



### RESULTS

- Unit went from a PM based to proactive TAR.
- Bearing Temps used to monitor capacity at which calciner is operating.
- Back flushing performed as needed.
- Operators now solve problems not record data.

# *Advanced Sensing for Reliability*



## Reliability and Essential Asset Monitoring

- ▶ Heat exchanger monitoring
- ▶ Pump monitoring
- ▶ Blower monitoring
- ▶ Cooling tower monitoring
- ▶ Compressor monitoring
- ▶ Air cooled heat exchanger monitoring
- ▶ Valve monitoring
- ▶ Filter monitoring

# Cooling Tower Monitoring



RELIABILITY



## PEMEX® PEMEX Refinery



### CHALLENGE

- Hazardous location
- Operators performed 3 rounds/day or 8760 hours/year
- Costly slowdowns or shutdowns – e.g. 20% throughput reduction costs \$1.6M per year

### SOLUTION

- Wireless infrastructure added and cooling tower monitoring solution added to 2-3 cells of four separate cooling towers.
- Total 122 wireless field devices and five gateways.

### RESULTS

- 87% reduction in manual operator rounds
- Improved operator safety
- \$1.8M/yr savings in chemical costs (20%)
- \$4.8M/yr savings in fan maintenance costs
- \$1.6M/ yr savings in reduced production slowdowns

*They received a payback in about two weeks, along with all the results achieved they are adding additional wireless instrumentation for remaining cooling tower cells, and implementing Essential Asset Monitoring to remaining cooling towers. The plan is to implement the solution in three other sites across Mexico. - N. Bishop*

# Heat Exchanger Monitoring



RELIABILITY

## ConocoPhillips

### CHALLENGE

- Crude unit was subject to preheat train fouling.
- No data to quantify how much energy was being lost, or when (and which) exchangers to clean.

### SOLUTION

- Analyze the efficiency of heat exchangers using heat duty calculations through wireless temperature and flow measurements. Installed without any interruption to process.

### RESULTS

- Efficiency gained in energy savings was estimated at **\$55K per heat exchanger, per year.**
- Investment **payed back under 90 days** for each exchanger.

*"Due to monitoring, customer can now able to maximize heat exchanger operation and maintain the tubes more effectively to prevent costly heat losses and avoid disruptive tube ruptures. In addition, they created a safer work environment for all." - Randy Stout, Emerson*

# Pump Monitoring



RELIABILITY



## Flint Hills Pine Bend

### CHALLENGE

- Need to prevent a vapor cloud release when pumps fail to protect staff and environment.
- Only able to monitor a few essential pumps, but not sure which pumps need service.

### SOLUTION

- Utilize Essential Asset Monitoring to measure the seal for gas leaks of essential pumps throughout their operation.
- Use monitoring to know which pumps need service.

### RESULTS

- **No fires in 5 years** due to early detection on three pump failures 1st year. Avoided shut downs!
- **Monitor 158 pumps at 1/10th the cost** of the manual process of just a few pumps and more effectively.

*"Today, I'm happy to report that FHR Pine Bend has not had a single pump fire in more than 5 years! Now that we can monitor all our pumps we can plan preventive maintenance instead of being reactive."*

*- Flint Hills Pine Bend, Emerson Exchange 2013*



# Advanced Sensing for Safety & Environmental



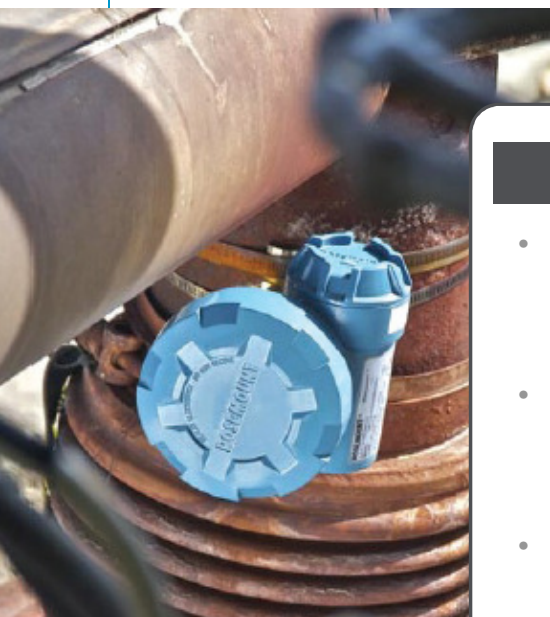
## Health, Safety, Security & Environment

- ▶ Eye wash / safety shower monitoring
- ▶ Gas detection
- ▶ Leak detection
- ▶ PRV release
- ▶ Hydrocarbon detection
- ▶ Emissions / discharge monitoring
- ▶ Tank overfill/spill detection
- ▶ Corrosion
- ▶ Effluent discharge
- ▶ Interlocks on gates/doors
- ▶ Access awareness
- ▶ Personnel location tracking
- ▶ Safety mustering
- ▶ Disaster recovery

# Pressure Safety Valve Monitoring – Downstream



HSSE



## Refinery in AP

### CHALLENGE

- Hydrogen leaks on generation and reforming units were safety concerns.
- About 10 random PSVs were leaking every month, flaring feedstock at \$1,600/Ton.
- Data capture was not possible for the customer.

### SOLUTION

- Non-intrusive Wireless Acoustic transmitters connected to SCADA system for online PSV monitoring.

### RESULTS

- **Less than 1 year payback!**
- Fast to pinpoint and mitigate Hydrogen leaks.
- Eliminated frequent rounds in hazardous locations as well as provided information to interpret PSV condition.

*“Real-time recording and capturing of data is now possible through Emerson Wireless Solution. Also, trends for specific time intervals which could be used for further analysis.”*

# Detecting Hydrocarbon Leaks



HSSE



## BP Geel

### CHALLENGE

- Detecting and monitoring hydrocarbon leaks around tanks, valves and pipe flanges because level continuously fluctuates due to changing process demands.

### SOLUTION

- Non-intrusive solution to detect liquids leak around the tanks, sump wells, and curbs of pump skids.



### RESULTS

- Tanks spills monitored to improve employee safety and avoid environmental incident
- Able to demonstrate regulation compliance

*"Wireless breaks the cost paradigm by reducing maintenance visits, time-consuming physical monitoring, and injury-related occurrences. Furthermore Wireless was easy to install. Minimizing the engineering department efforts by allowing members of maintenance to install and maintain the equipment."* Tom Kenis, E&I, BP Geel (Belgium)



# Safety Shower Monitoring



HSSE



## Texas City Refinery

### CHALLENGE

- Safety Showers onsite were not monitored
- Customer was concerned about response times in case of accidental exposure
- Water temperature in outdoor showers can be excessively hot in summer months

### SOLUTION

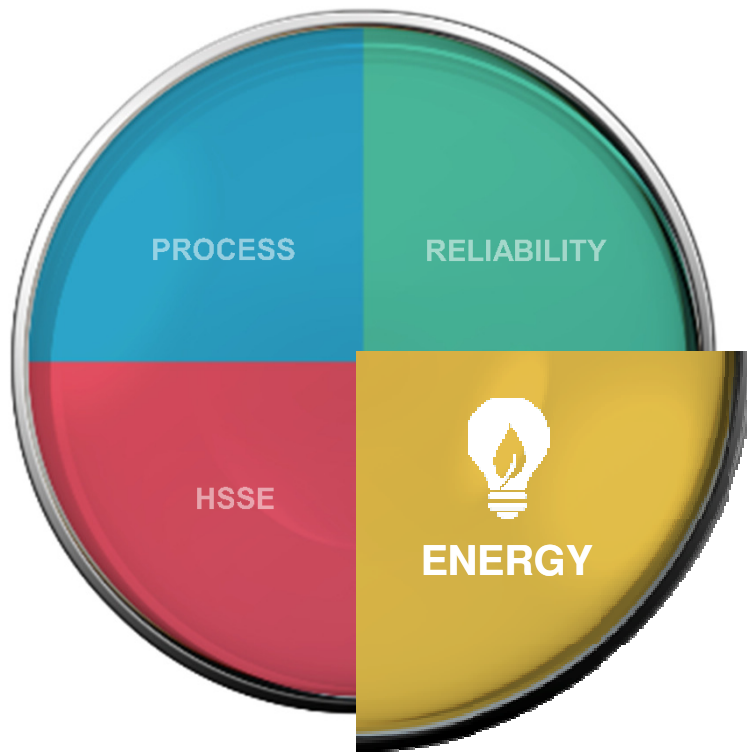
- Installed wireless discrete transmitter kits on dozens of safety showers
- Installed wireless temperature transmitters on specific showers to circulate water in pipes as needed



### RESULTS

- Able to detect personnel in distress more quickly
- Faster response from first aid personnel
- Prevent hot water from being dispensed
- Resulted in complete WiHart coverage of Refinery

# *Advanced Sensing for Energy Efficiency*



## Energy and Utilities

- ▶ Water/Wastewater consumption and discharge
- ▶ Instrument air monitoring
- ▶ Steam trap monitoring
- ▶ Natural gas monitoring
- ▶ Energy Advisor
- ▶ Remote monitoring

# Pressure Relief Valve and Steam Trap Monitoring



ENERGY

## Refinery in India

### CHALLENGE

- Not knowing which of many possible hydrogen process lines is flaring.
- Plants had no visibility of which steam traps have failed. Thus losing energy and money unconsciously.

### SOLUTION

- Deploying pervasive sensing strategy by using non-intrusive Acoustic 708 transmitter solutions that works on WirelessHART protocol to detect leaks.
- Commission easily.

### RESULTS

- Immediate detection of failed PRV and steam trap upon installation.
- Greater visibility to reduce loss due to malfunction of assets 24x7 remotely without the need to deploy personnel to the field

*"Wireless solution help us to deploy the monitoring project saving a lot of cost and time. The Wireless solution integration into DCS is straight forward and easy too. Now, we can monitor our asset 24 x 7 and reduce flaring loss." - Ketan Patel, Emerson Exchange 2014*

# Steam Trap Monitoring in Refinery



ENERGY



## CHALLENGE

Continually reduce environmental impact by reducing energy usage, but unable to determine how much energy they were wasting.

## SOLUTION

Monitoring of 187 steam traps and 63 pressure relief valves to ensure proper operation, avoiding equipment damage and wasted energy via lost steam.

## RESULTS

The first audit showed **25% of steam traps were failing, that were unknown.**  
**Payback in one year** in energy savings by correcting issue.

## ***End of Part 1***

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- Best Practices to follow

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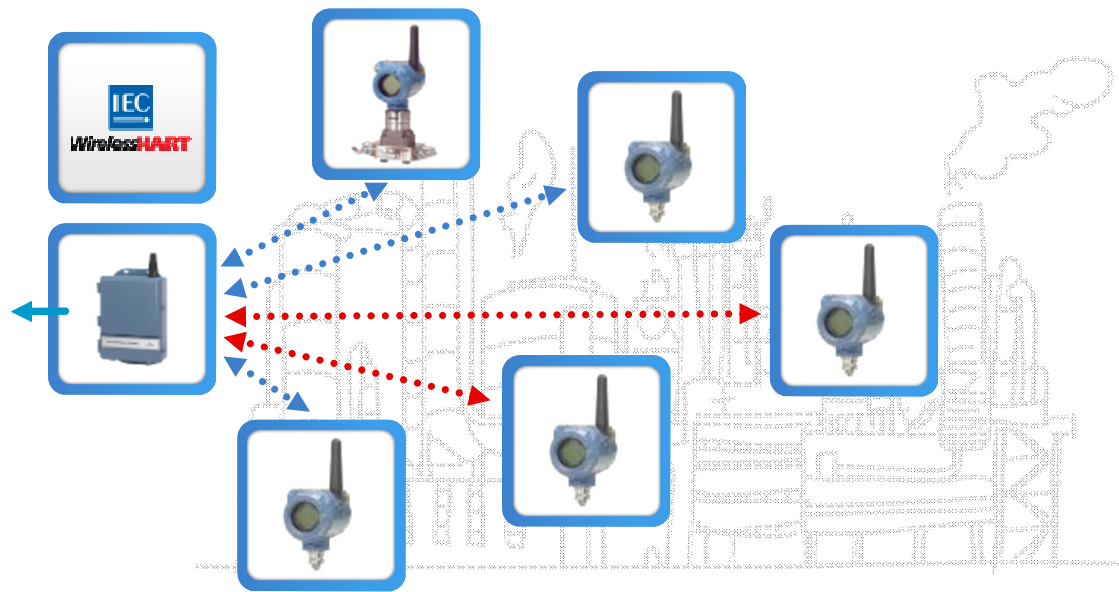
## ***Best Practices and FAQs***

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- Communications Protocol
- Battery Life and Gateway Capacity
- Distance and Antenna Ranges
- Interoperability



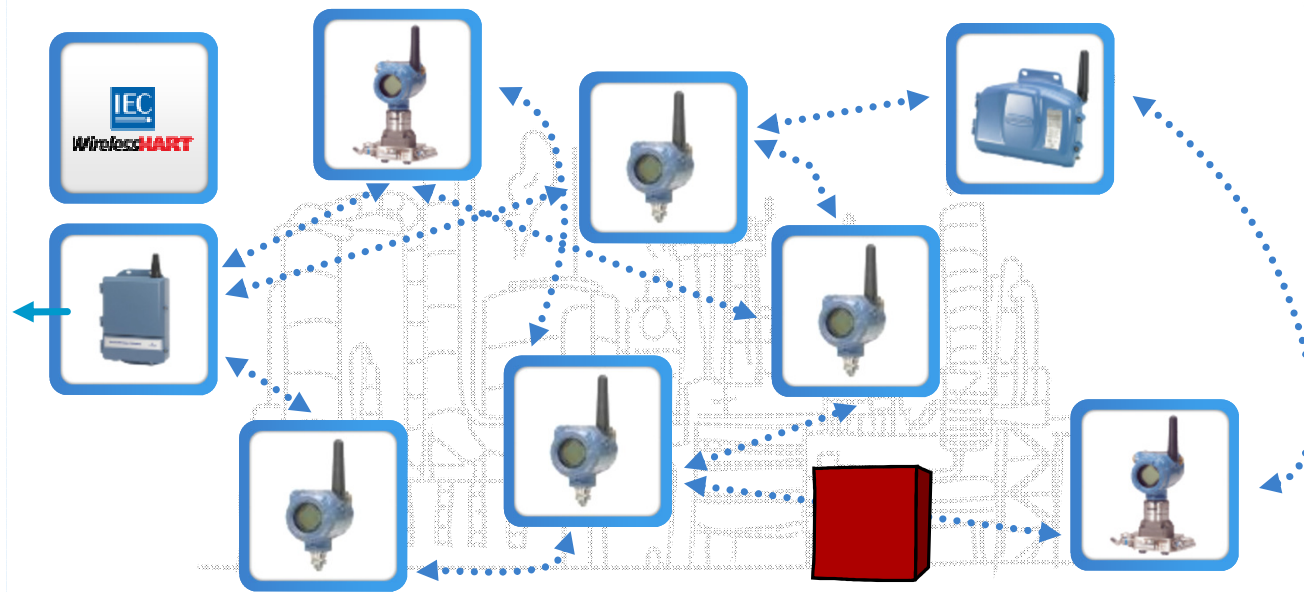
## IEC 62591 (WirelessHART) – HART Without the Wires



***Did you know...***

*Wireless sensors generally meet the same specifications as their wired counterparts (operating temperatures, hazard ratings, etc.).*

# ***Self-Meshing Network: Reliability and Flexibility***



## ***Battery Life***

Battery Life = Sensor Type x Update Rate

**Pressure Sensor (3051S)**

@ 1sec = 6 months  
@ 1 min = 8-10 Years

**Discrete Sensor (702)**

@ 1 sec = 1.5 years  
@ 1 min = 8-10 years



## ***Gateway Capacity***

Gateway Type  $\times$  Number of Devices  $\times$  Update Rate



**1410 Gateway**  
**@ 1sec = 12 devices**  
**@ 1 min = 25 devices**

**1420 Gateway**  
**@ 1 sec = 12 devices**  
**@ 1 min = 100 devices**



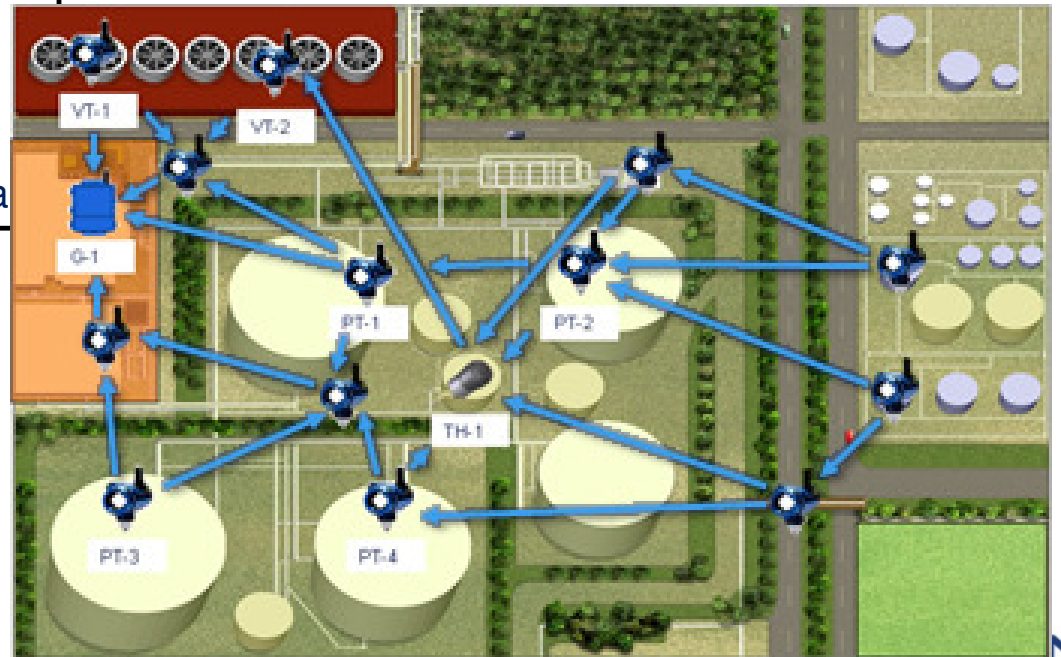
# Field Network Distance and Antenna Ranges

**750 feet** = Regular Antenna, clear line of sight (no obstructions), min. install height @ 6 feet

**100-250 feet** = Regular Antenna, surrounded by industrial equipment

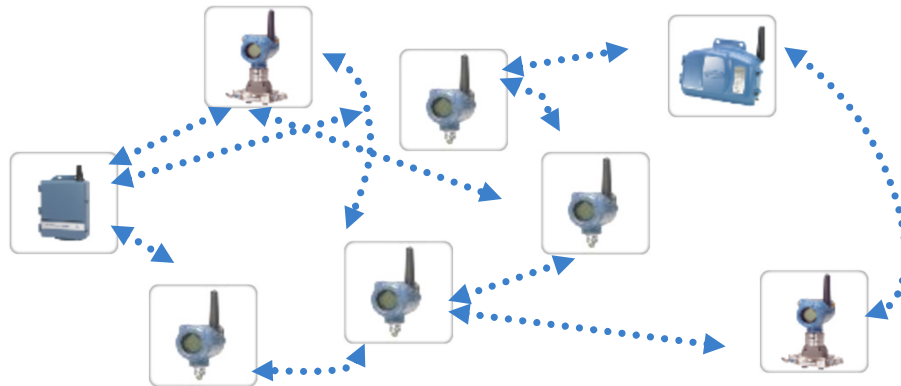
**½ mile** = Extended Range

**1 kilometer** = High Gain, Remote Antenna

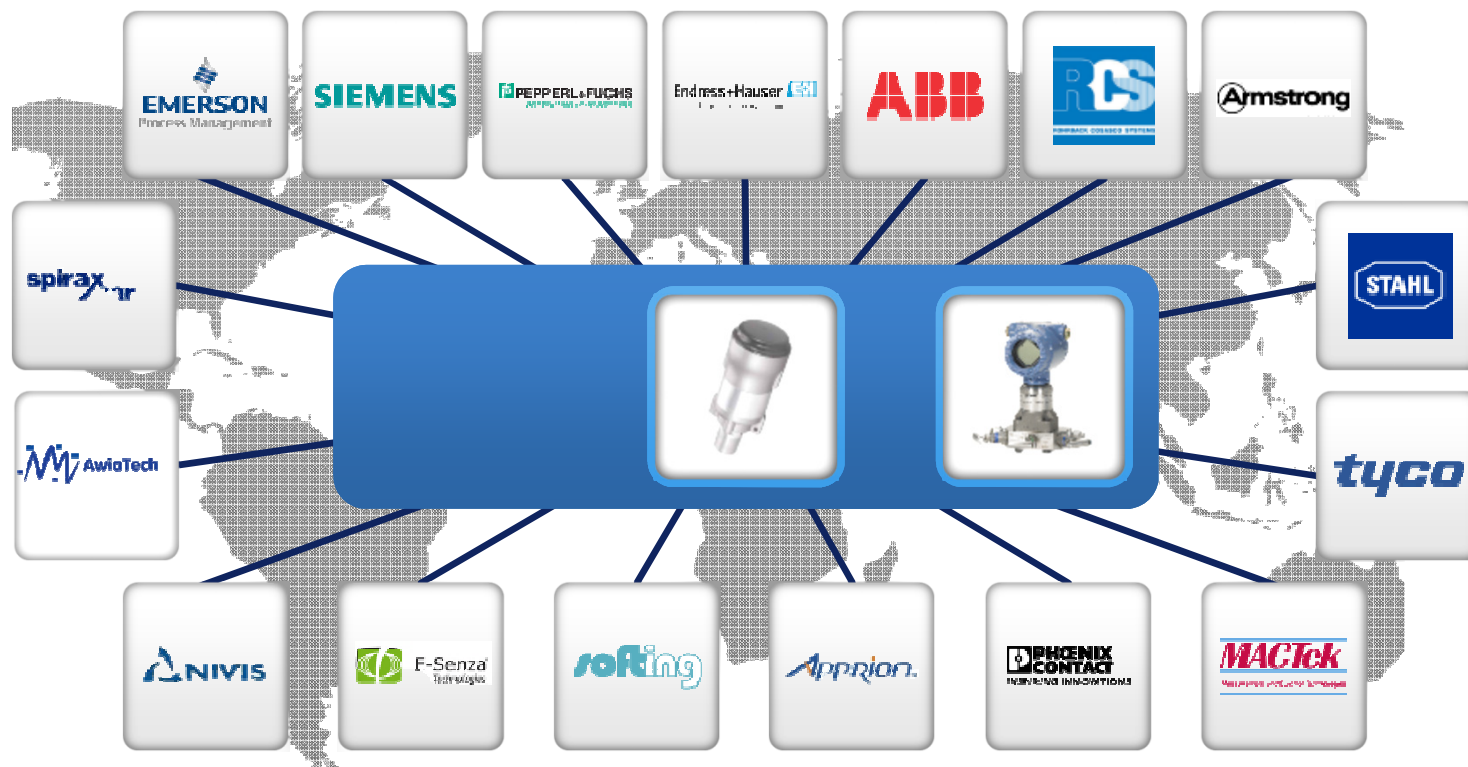


## ***Installation Best Practices – 99.99% Reliability***

- Network scoped to a single process unit
- 5 devices within range of gateway
- 3 good neighbors per device
- At normal update rates: 25% of devices within range of gateway
- Effective range is determined by the density of infrastructure that causes obstruction of wireless signals

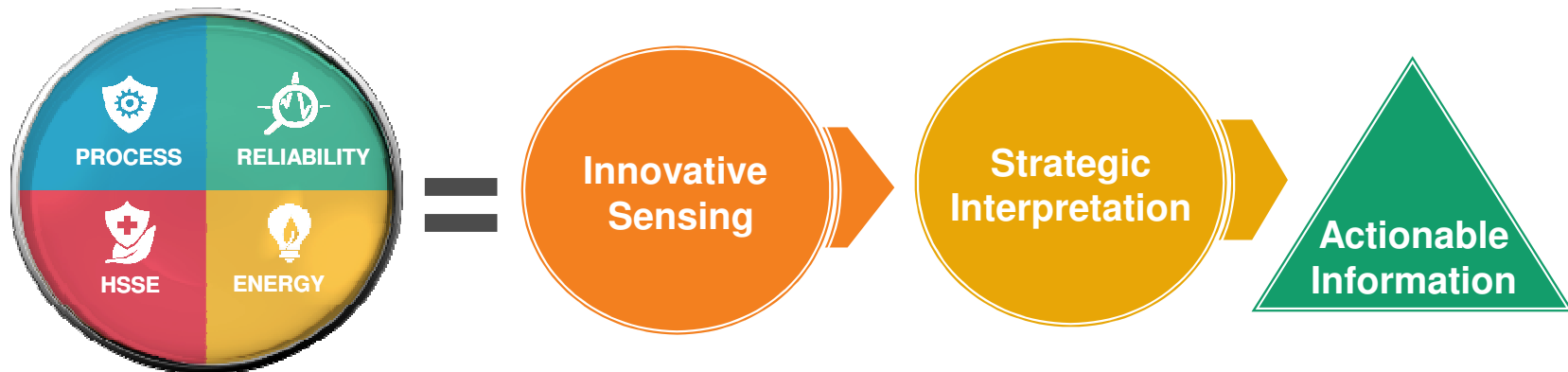


## Interoperability via WiHart



## Summary

- We are living in a connected world
- Pervasive Sensing is powered by our wireless technologies
- Wireless reduces complexity, cost and risk
- How are you planning to integrate these technologies into **YOUR** projects?





***Thank you for attending!***

Any questions?

