Digitization of Nuclear Plants

Wireless Gauge Reader Applications and ROI

3/7/2024

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WGR Deployments – Nuclear Generation

- Duke Energy (Fleetwide: Oconee, Robinson, Brunswick, Harris, Catawba, McGuire)
- Southern (Fleetwide: Farley, Hatch, Vogtle)
- Xcel Energy (Fleetwide: Prairie Island, Monticello)
- PSEG (Fleetwide: Salem, Hope Creek)*
- Bruce Power (Canada)
- Constellation Energy (Calvert, Braidwood, Clinton, JAF, Nine Mile Point, Limerick, Ginna, Peach Bottom)
- NextEra (Fleetwide: Turkey Point, St. Lucie, Point Beach, Seabrook)
- Vistra Luminant (Comanche Peak, Davis Besse)
- STP Nuclear (South Texas)
- Nebraska Public Power District (Cooper)
- Arizona Public Service (Palo Verde*)
- Entergy Vermont Yankee (1 unit – decommissioned)
- EPRI Charlotte - Nuclear Applications Center (installed)
- France EDF (pilot deployment)

* Pending Installation

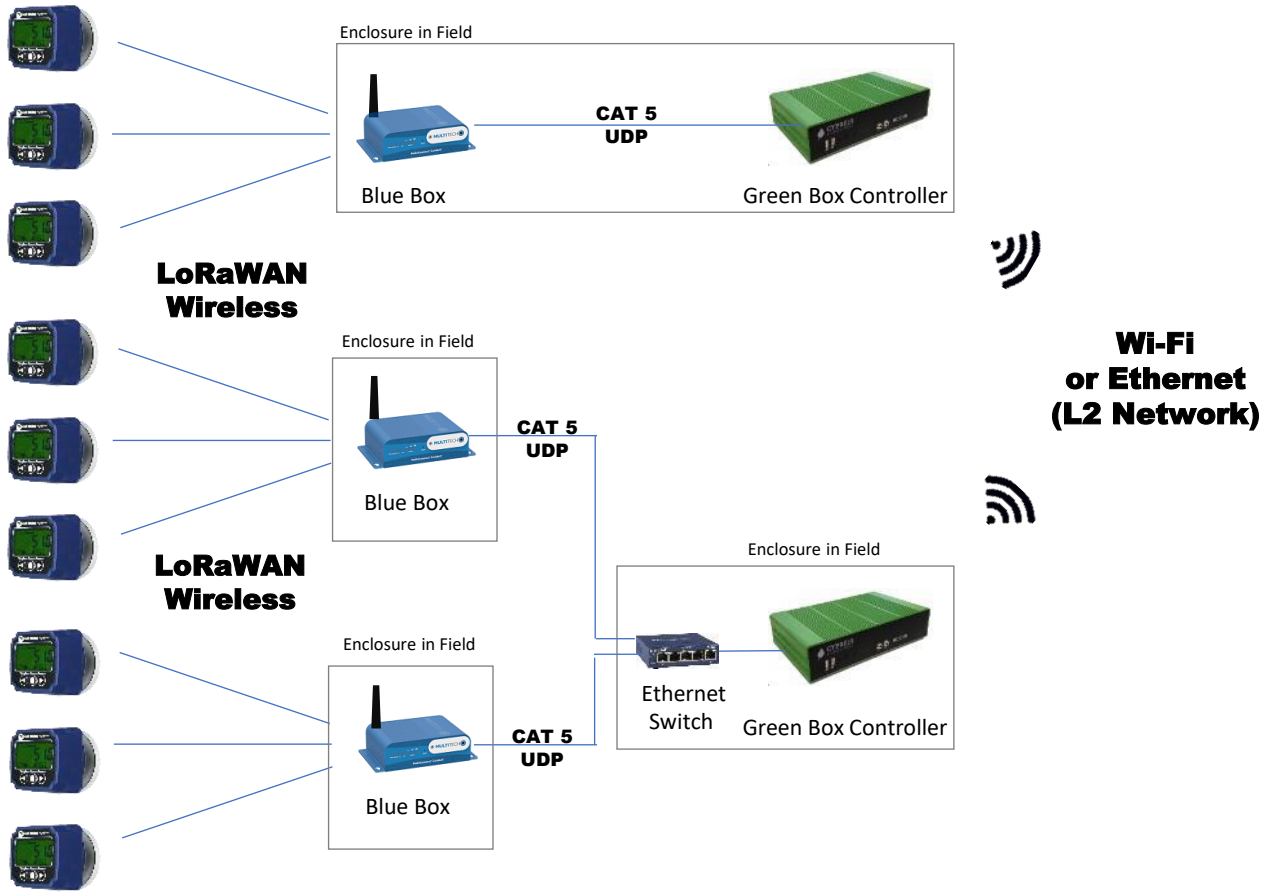
Problem: Most Plant Data is NOT Digitized

Solution: Non-invasive sensors – 5 minute install

- "Electronic Eyeball" reads gauges and numeric indicators and transmits readings wirelessly
- Already approved and installed in over 30 nuclear power plants
- Non-invasive, clamp-on to existing gauges in minutes
- No downtime, no leak check, no wiring, no drawings
- Battery life of 3+ years at 15 minute sample rate
- IP56/NEMA 4 rated for outdoor use
- Various size and types of mounting adapters to fit most existing gauges

Typical Installation

Typical Deployment Architecture – Option 1



Wireless Gauge Reader

Wi-Fi or Ethernet (L2 Network)

Connection via RESTful API, OPC UA, or OPC DA

OSI PI / R*Time Historian

3rd Party App

Web Application Clients HTTPS using browser

Laptop

Smartphones/
Tablets

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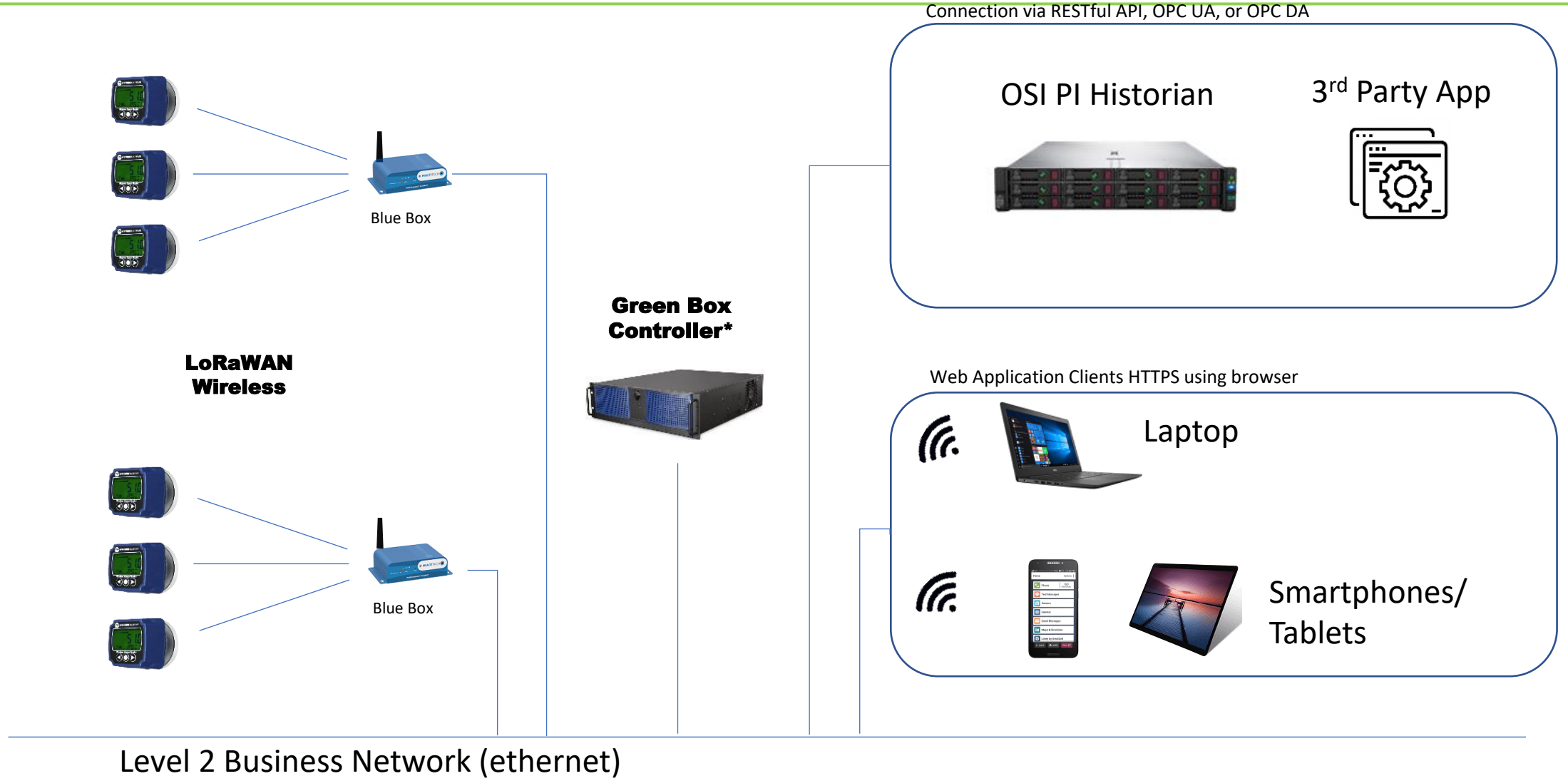
Typical Deployment Architecture – Option 2



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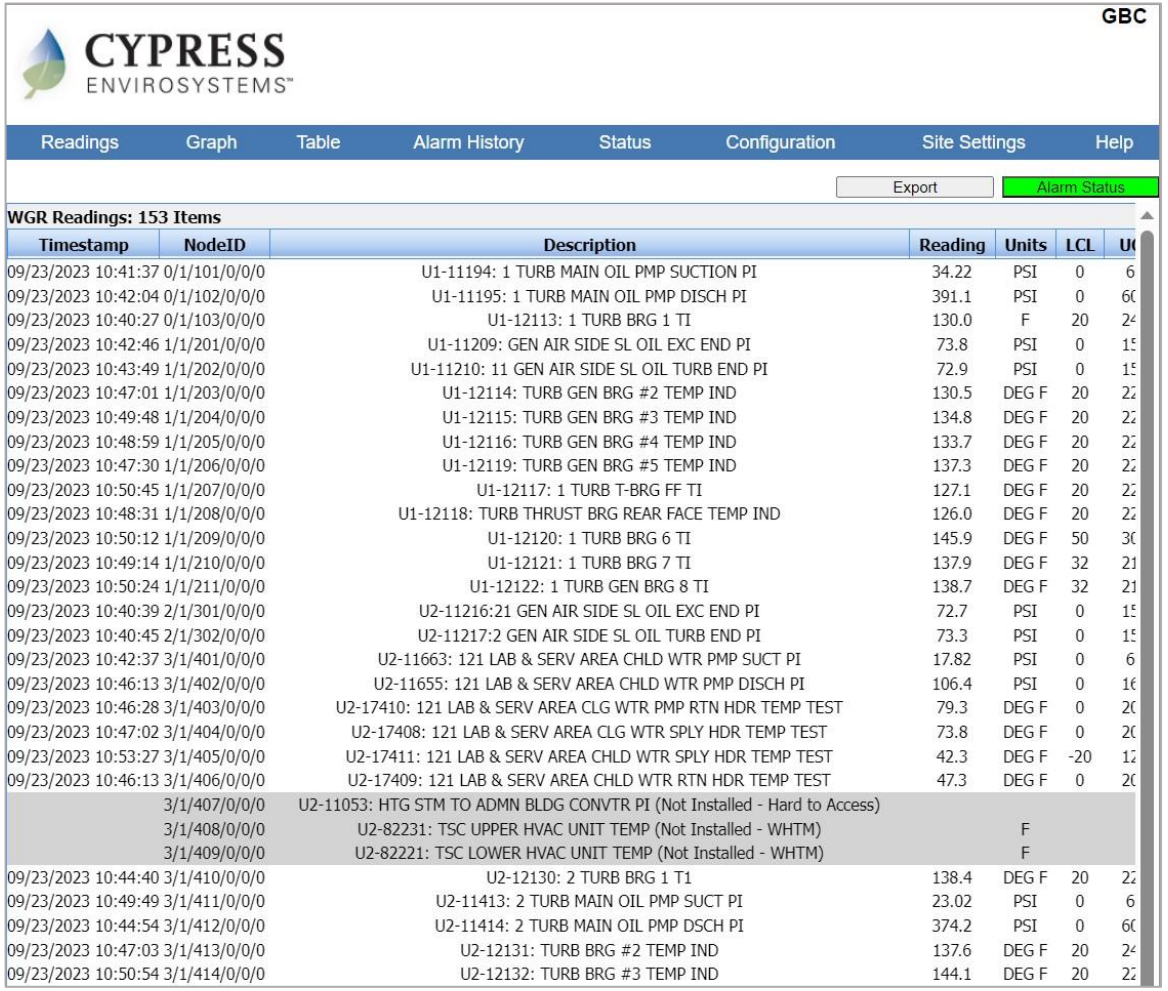
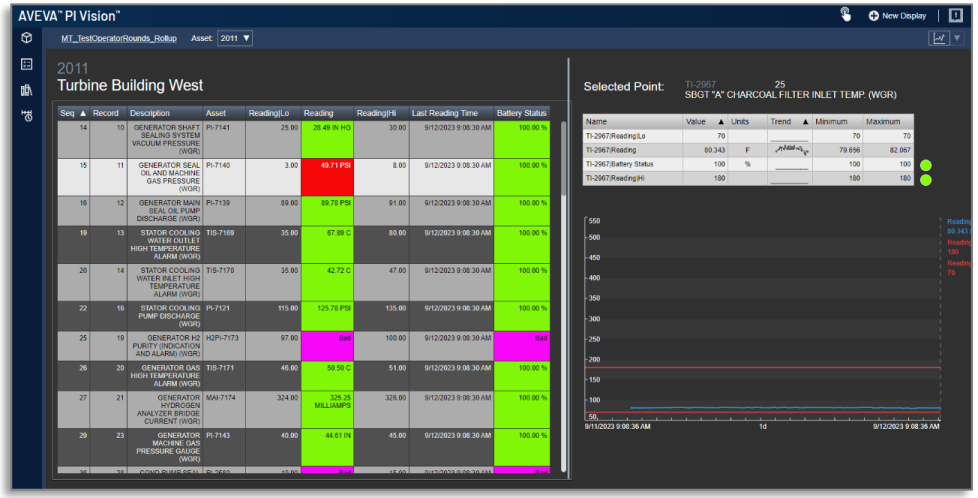
Data Visibility on Tablets or PI Historian





- Current Readings
- Historical Trending
- Download to Excel (.csv)
- Configurable Alarm Limits
- Configurable Notifications

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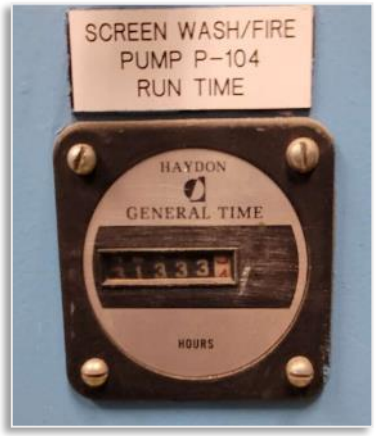
Cypress Family of Non-Invasive Digitization Solutions

Wireless Digit Reader

- Reads numeric indicators
- Exactly same form factor as Wireless Gauge Reader
- Should not require additional engineering review/approval
- Has different firmware than WGR
- Wireless transmission duty cycle is higher - battery life about 30% of WGR. Use slower sample rate to compensate



Wireless Pipe Temperature Monitor

- Clamp on Type K thermocouples to pipe wall
- Thermocouples may also be inserted between pipe insulation and pipe wall
- Small form factor, slim profile – can fit in tight spaces
- Low weight – less than 1 lb – reduces civil and seismic concerns.
- 500 deg F maximum temperature at thermocouple
- Electronics module max temperature of 158 F. Thermocouple wires may be up to 100 ft long.
- Battery life of 3+ years at 15 minute sample rate
- Optional IP67 enclosure available

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Wireless Steam Trap/Pipe Wall Temp Monitor

Leaking Traps Waste Energy

Typical Steam Trap

- Traps are a necessary part of the steam distribution system, usually hundreds of units per site
- 15-20% average failure rate; leaks steam
- Failed traps lose $5,000 per year (1/8” orifice)
- Manual inspection typically done annually – labor intensive, do not catch problems in timely manner
- Solution: Wireless steam trap monitor detects faults and alarms on error, avoiding expensive leak loss
- Non-invasive installation: no breaking seals, wireless, integrates with BMS
- Battery life of 3+ years at typical sample rates
- IP65/NEMA 4 rated for outdoor use
- One year payback on investment

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Wireless Transducer Reader

- Software configurable I/O and signal conditioning
- Enables wireless remote monitoring of virtually any analog transducer or instrument with the following outputs: 4-20mA, 0-5V, or 0-10V, RS-232, RS-485, thermocouple, thermistor, dry contacts
- 2 channels per device
- Configurable sample rates from three seconds to four hours
- Compatible with most existing flow meters, current meters, particle counters, thermocouples, weigh scales, etc.
- Battery life of 3+ years at 15 minute sample rate, also accepts 110VAC line power
- IP 67 protection
- Enables data logging to enable trend analysis, notification, or statistical process control

Wireless Humidity, Temperature, Wet Bulb Monitor

- -20 ºC to +70 ºC (-4 ºF to 158 ºF) Temperature Range
- 0 – 100% Relative Humidity Range
- Displays Temperature, Relative Humidity, and Wet Bulb Temperature (optional)
- Used for worker heat stress management, materials life tracking etc.
- Magnetic Mounting for steel walls or columns
- Adhesive Mounting for other surfaces
- Battery life of 3+ years at 15 minute sample rate
- IP56/NEMA 4 rated for outdoor use

Wireless Indicator Light Reader

- Non-invasive stick-on light sensor
- Small form factor, does not obscure operator view of indicator
- Light weight, optical detection only - minimal engineering review
- Optical detection is “air-gapped” – minimal cyber security review
- Will require EMI exclusion distance consideration depending on type of equipment

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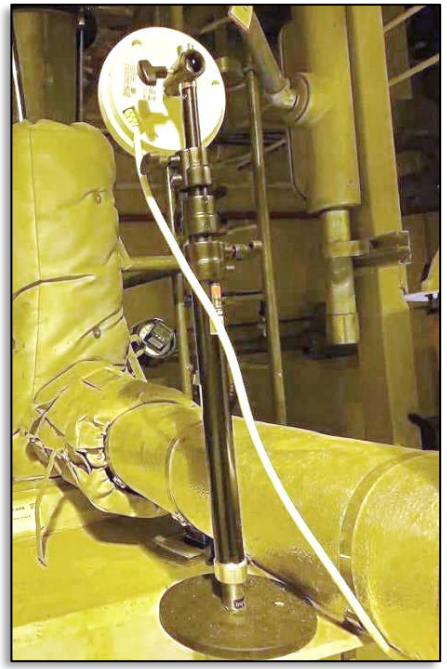
IP Camera Monitoring Automation



- Capture images from 3rd party IP Cameras
- Use GBC machine vision engine to automatically convert to digital value and store for history, trending, alarming
- No need for human operator to always check camera feed
- Leverage existing approved data architecture

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Vibration Monitoring

HONEYWELL
VERSATILIS TRANSMITTER

Multi-Variant Sensing

Honeywell Versatilis™ Transmitter is a multi-variant sensing platform based on the latest LoRaWAN® protocol communication technology. Its inherently low-power compact design coupled with quick & easy installation, and commission helps manufacturers to deploy them at scale with the lowest CAPEX and negligible OPEX. These sensors are designed to monitor and predict the health of rotating equipment like motors, pumps, blowers, fans, compressors, and gearboxes. In addition, they can be deployed to remotely monitor the position of manual valves, the health of steam traps, and the surface temperature of static process equipment. They can also be deployed to monitor environmental conditions in life science facilities.

Figure 1– Honeywell Versatilis Transmitter

MEASUREMENT PARAMETERS:

Surface Temperature	Ambient Humidity	Ambient Pressure
Vibration	Audio Acoustics	Ambient Temperature

SENSORS AND COMMUNICATIONS:

The Honeywell Versatilis platform contains a suite of sensors encompassing versatile sensing parameters such as pressure, temperature, humidity, triaxial accelerometer, and audio acoustics MEMS to provide insightful measurements. Sensors on the platform are selected to cover a broad frequency spectrum enabling adequate sensing coverage of process and physical phenomena. Sensor fusion analysis on the acquired measurements can be performed. Any specific parameter is customizable in either software or hardware according to the requirement of a specific application. Each measured parameter contributes a unique dimension thereby augmenting the system into a multi-dimension sensing platform. Sensor data can be transferred over the LoRaWAN® network which is protected through secure key authentication. The Honeywell Versatilis Transmitter can be configured to notify the application through Event Triggers and FFT (Fast Fourier Transform) Triggers.

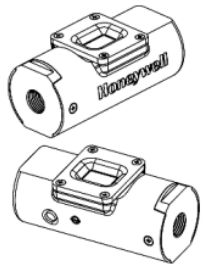

Figure 2– Assembly

Honeywell

Honeywell Versatilis™ Transmitter Technical Specification Honeywell Proprietary

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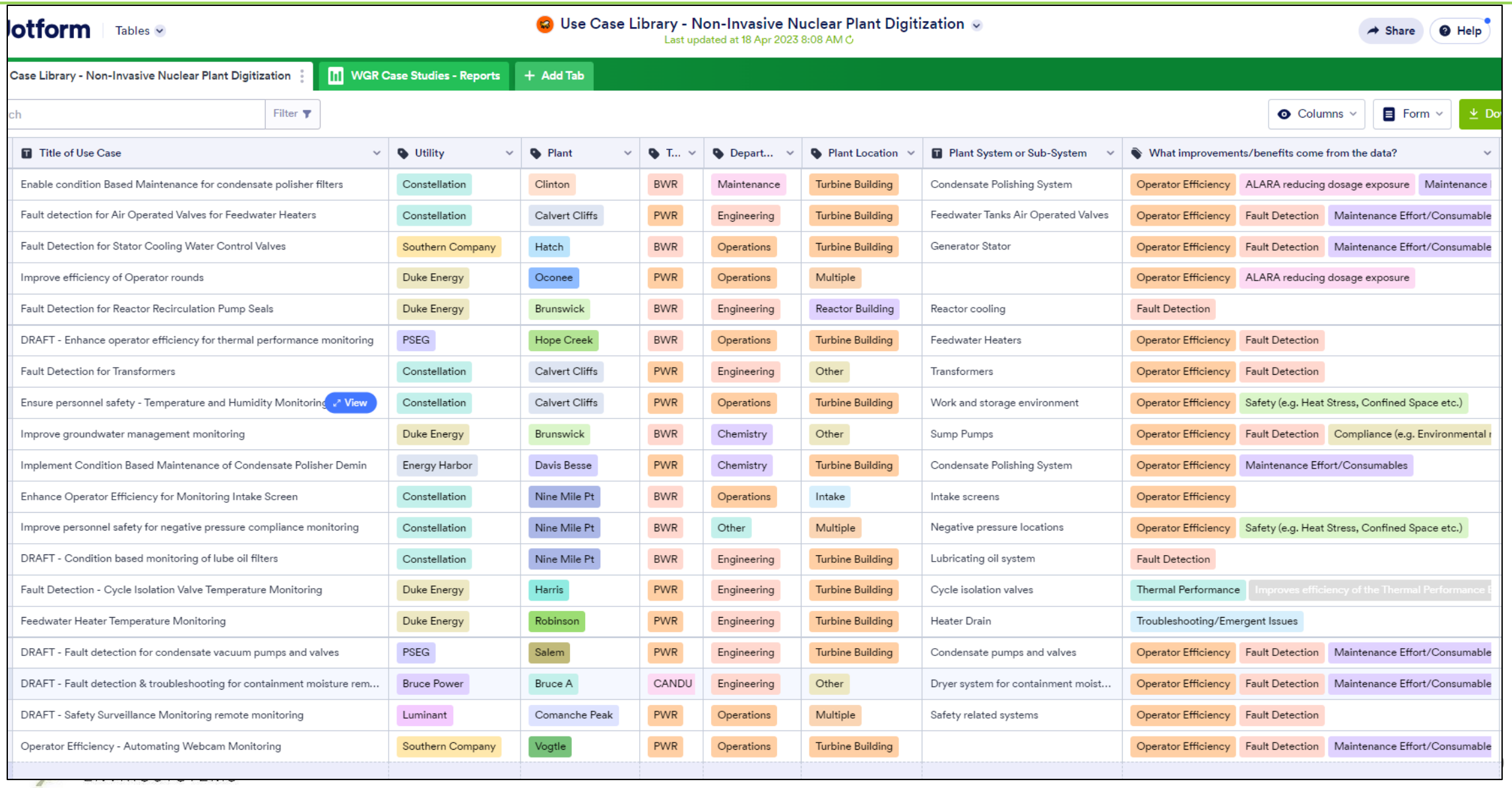
Return on Investment
Use Cases

Benefit Categories

- Improve operator efficiency
- Equipment fault detection/reduce unplanned downtime, feed data to OSI PI and Advanced Pattern Recognition models (e.g. Predix, SmartSignal, Prism)
- Reduce maintenance cost – transition from scheduled preventive to condition-based maintenance
- Optimizing plant thermal performance
- Improve worker safety – minimize exposure to hazardous locations, ALARA
- Environmental compliance monitoring
- Troubleshooting via crash cart, emergent needs

Use Case Library – Available to WGR Users Group



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Use Case Library - Non-Invasive Nuclear Plant Digitization

Last updated at 18 Apr 2023 8:08 AM

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Case Library - Non-Invasive Nuclear Plant Digitization | WGR Case Studies - Reports | + Add Tab

ch | Filter | Columns | Form | Do

Title of Use Case	Utility	Plant	T...	Depart...	Plant Location	Plant System or Sub-System	What improvements/benefits come from the data?
Enable condition Based Maintenance for condensate polisher filters	Constellation	Clinton	BWR	Maintenance	Turbine Building	Condensate Polishing System	Operator Efficiency; ALARA reducing dosage exposure; Maintenance
Fault detection for Air Operated Valves for Feedwater Heaters	Constellation	Calvert Cliffs	PWR	Engineering	Turbine Building	Feedwater Tanks Air Operated Valves	Operator Efficiency; Fault Detection; Maintenance Effort/Consumable
Fault Detection for Stator Cooling Water Control Valves	Southern Company	Hatch	BWR	Operations	Turbine Building	Generator Stator	Operator Efficiency; Fault Detection; Maintenance Effort/Consumable
Improve efficiency of Operator rounds	Duke Energy	Oconee	PWR	Operations	Multiple		Operator Efficiency; ALARA reducing dosage exposure
Fault Detection for Reactor Recirculation Pump Seals	Duke Energy	Brunswick	BWR	Engineering	Reactor Building	Reactor cooling	Fault Detection
DRAFT - Enhance operator efficiency for thermal performance monitoring	PSEG	Hope Creek	BWR	Operations	Turbine Building	Feedwater Heaters	Operator Efficiency; Fault Detection
Fault Detection for Transformers	Constellation	Calvert Cliffs	PWR	Engineering	Other	Transformers	Operator Efficiency; Fault Detection
Ensure personnel safety - Temperature and Humidity Monitoring View	Constellation	Calvert Cliffs	PWR	Operations	Turbine Building	Work and storage environment	Operator Efficiency; Safety (e.g. Heat Stress, Confined Space etc.)
Improve groundwater management monitoring	Duke Energy	Brunswick	BWR	Chemistry	Other	Sump Pumps	Operator Efficiency; Fault Detection; Compliance (e.g. Environmental
Implement Condition Based Maintenance of Condensate Polisher Demin	Energy Harbor	Davis Besse	PWR	Chemistry	Turbine Building	Condensate Polishing System	Operator Efficiency; Maintenance Effort/Consumables
Enhance Operator Efficiency for Monitoring Intake Screen	Constellation	Nine Mile Pt	BWR	Operations	Intake	Intake screens	Operator Efficiency
Improve personnel safety for negative pressure compliance monitoring	Constellation	Nine Mile Pt	BWR	Other	Multiple	Negative pressure locations	Operator Efficiency; Safety (e.g. Heat Stress, Confined Space etc.)
DRAFT - Condition based monitoring of lube oil filters	Constellation	Nine Mile Pt	BWR	Engineering	Turbine Building	Lubricating oil system	Fault Detection
Fault Detection - Cycle Isolation Valve Temperature Monitoring	Duke Energy	Harris	PWR	Engineering	Turbine Building	Cycle isolation valves	Thermal Performance; Improves efficiency of the Thermal Performance
Feedwater Heater Temperature Monitoring	Duke Energy	Robinson	PWR	Engineering	Turbine Building	Heater Drain	Troubleshooting/Emergent Issues
DRAFT - Fault detection for condensate vacuum pumps and valves	PSEG	Salem	PWR	Engineering	Turbine Building	Condensate pumps and valves	Operator Efficiency; Fault Detection; Maintenance Effort/Consumable
DRAFT - Fault detection & troubleshooting for containment moisture rem...	Bruce Power	Bruce A	CANDU	Engineering	Other	Dryer system for containment moist...	Operator Efficiency; Fault Detection; Maintenance Effort/Consumable
DRAFT - Safety Surveillance Monitoring remote monitoring	Luminant	Comanche Peak	PWR	Operations	Multiple	Safety related systems	Operator Efficiency; Fault Detection
Operator Efficiency - Automating Webcam Monitoring	Southern Company	Vogtle	PWR	Operations	Turbine Building		Operator Efficiency; Fault Detection; Maintenance Effort/Consumable

Best Practices Library – Available to WGR Users Group

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WGR Users Group Repository
Last updated at 03 May 2023 10:31 AM

WGR Users Group Repository | + Add Tab

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	Title	Organization	Plant	Type of document / su...	Description		Submitter Name	Submitter Email	Submitter Phone	Submission
1	Constellation Fleet Admin Proc...	Constellation	Multiple Plants	Procedure	Fleet administrative proce...		Bill Ansley	William.Ansley@constellat...	(856) 981-1348	Oct 18, 2023
2	WGR Battery Replacement Trai...	Cypress Envirosystems	Other or N/A	Training	Training document to sho...	PDF	Harry Sim	harry.sim@cypressenviros...	(408) 307-0922	Oct 18, 2023
3	NITSL Paper 2023 - Non-Invasi...	Southern Company	Multiple Plants	Technical Paper	Technical paper presented...	PDF	Josh Patrick	jbpatric@southernco.com	(912) 531-3394	Oct 18, 2023
4	Specification: Equipment Monit...	Duke Energy	Multiple Plants	Specification	Fleet specification for inst...	PDF	Steve Putnam	Steven.Putnam@duke-ene...	(704) 770-8415	Oct 18, 2023
5	Members Contact List	Cypress Envirosystems	Other or N/A	Meeting Minutes / Materials	List of Users Group Memb...	PDF	Harry Sim	harry.sim@cypressenviros...	(408) 307-0922	May 3, 2023
6	Tech spec for wireless devices	PSEG	Multiple Plants	Specification	Equipment installed under ...	PDF	Emmanuel Darko	Emmanuel.Darko@pseg.c...	(540) 424-6582	May 2, 2023
7	April users group meeting minu...	Cypress Envirosystems	Other or N/A	Meeting Minutes / Materials	Discussion package and a...	PDF	Harry Sim	harry.sim@cypressenviros...	(408) 307-0922	Apr 18, 2023
8	Magnehelic Gauge adapter for ...	Constellation	Nine Mile Pt	Best practice	Magnehelic gauges have a...	PDF	Sila Hoffstaetter	Silas.Hoffstaetter@constel...	(607) 229-2491	Apr 18, 2023
9	Duke - Fleet Specification	Duke Energy	Other or N/A	Specification	Duke Fleet Specification c...	PDF	Steve Putnam	Steven.Putnam@duke-ene...	(704) 770-8415	Apr 17, 2023
10	Duke - WGR Installation Guidel...	Duke Energy	Other or N/A	Best practice	This document contains th...	DOCX PD	Steve Putnam	Steven.Putnam@duke-ene...	(704) 770-8415	Apr 14, 2023
11	Charlotte Meeting Package	Cypress Envirosystems	Other or N/A	Meeting Minutes / Materials	Discussion package from ...	PDF	Aline Sim	aline.sim@cypressenviros...	(408) 219-1657	Apr 12, 2023
12	WGR Training Manual	Cypress Envirosystems	Other or N/A	Training	WGR Installation and Cali...	PDF	Harry Sim	harry.sim@cypressenviros...	(408) 307-0922	Apr 12, 2023

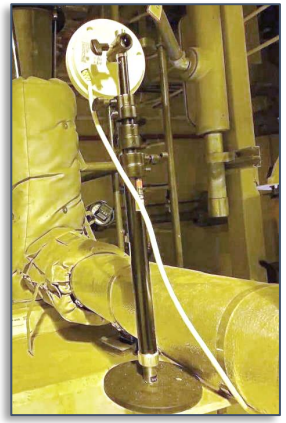
Selected Operational Experience - Discussion

- Duke Energy Oconee: improved efficiency of operator rounds after implementation of WGRs.
- Constellation Calvert Cliffs: Early fault detection in feedwater heater tank level controls - avoided unplanned downtime
- Constellation Clinton: Implement condition-based maintenance for condensate polishing filter changeout
- Duke Brunswick (BWR): ALARA, to reduce dose rates for workers where possible for routine tasks
- Duke Harris: improve thermal performance by detecting and eliminating leaks in steam isolation valves
- NextEra Turkey Point: Monitor bearing temperatures and head pressure for condensate pumps, recirc pumps, component cooling pumps etc. to detect early failure signs
- Duke Brunswick: Monitor run-time for certain sump pumps as part of groundwater protection plan
- Limerick Comanche Peak: monitor ambient temperature, humidity and wet bulb for worker heat safety and material life impact
- Constellation Three Mile Island: crash cart for troubleshooting emergent issues (prior to decommissioning)

Operator Efficiency Use Case: Webcam Monitoring Automation

Webcam Monitoring – current practice

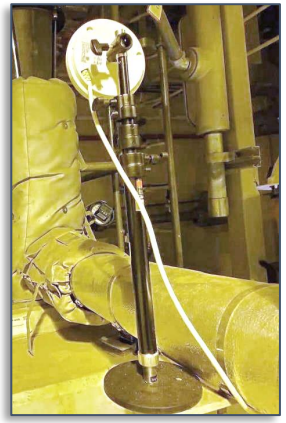
Webcams in the field



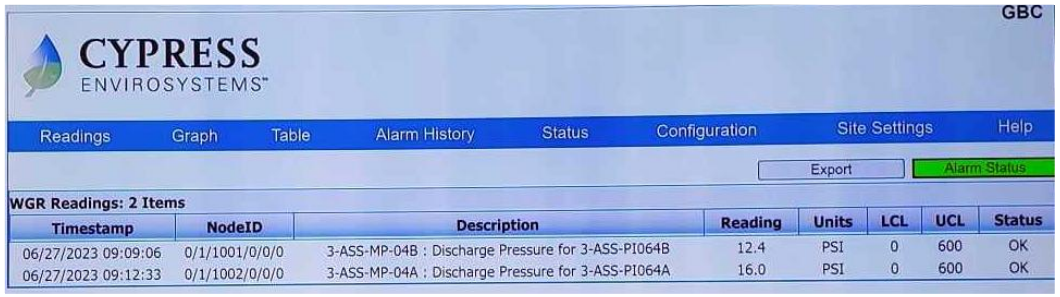
Operator watching video feed

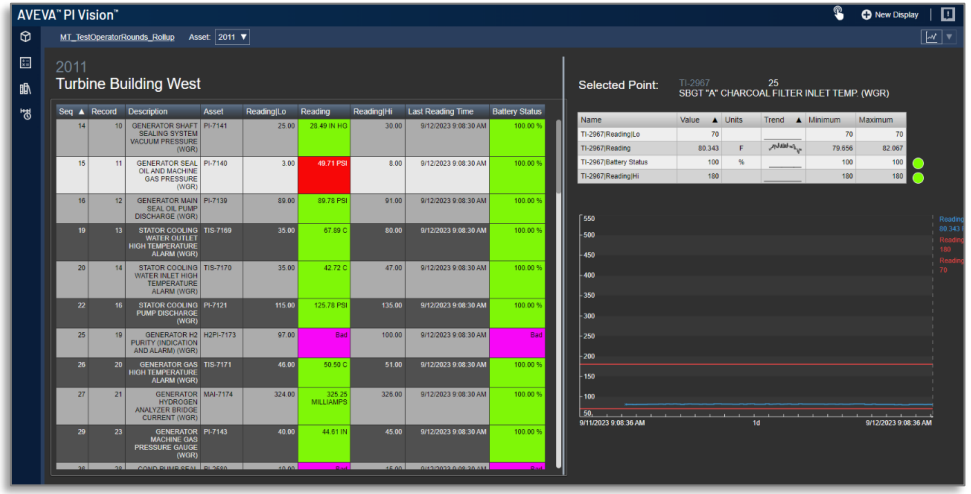
Webcam Monitoring – with Machine Learning

Webcams in the field



Data stored for trending / alarming / reporting
(accessible via operator tablets or PI Historian)

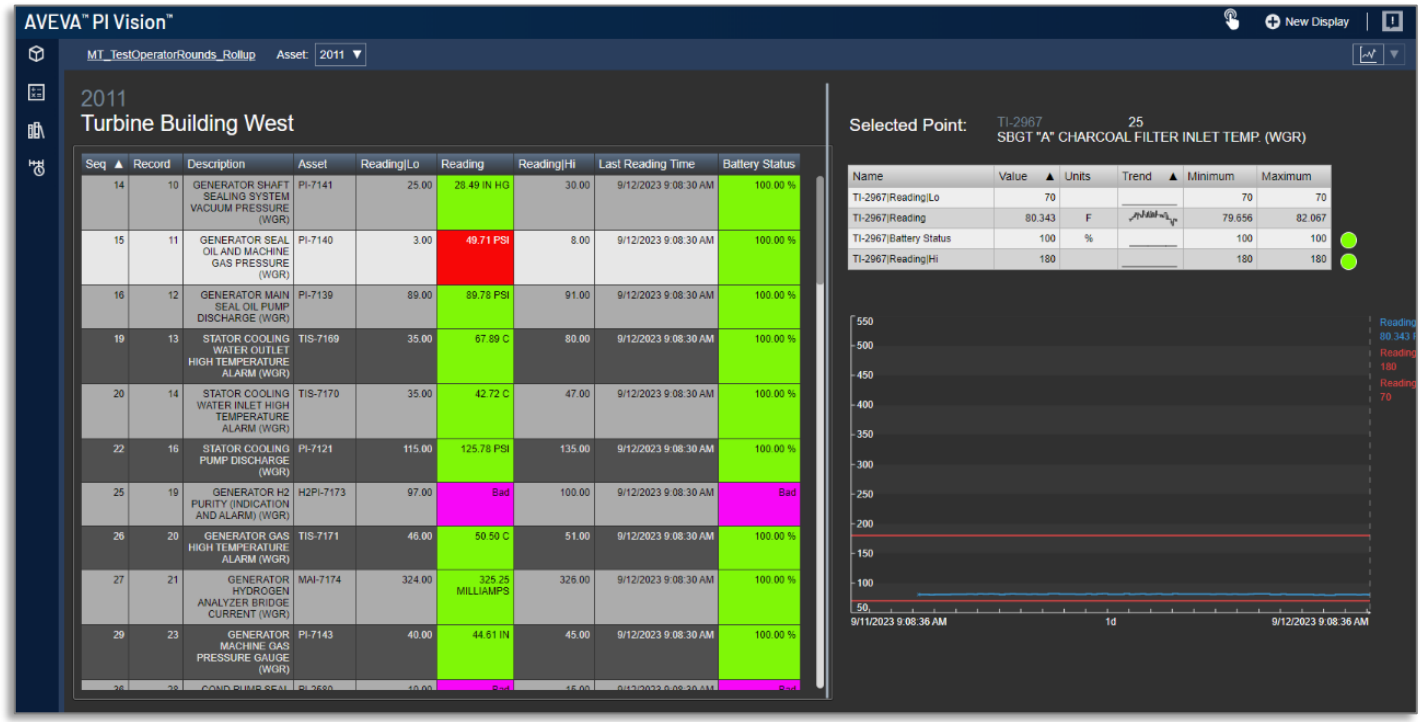




Operator Efficiency Use Case: Shift Dashboard

Operator Shift Dashboard

- Developed by Xcel Energy and Duke Energy
- Dashboard tool used by operators at start of shift
- Shows status of readings in Red, Yellow, or Green representing status of equipment monitored on rounds
- Operators can review history trend, set alarms, or compare to other points for analysis
- Helps to identify and focus on potential issues, before taking rounds

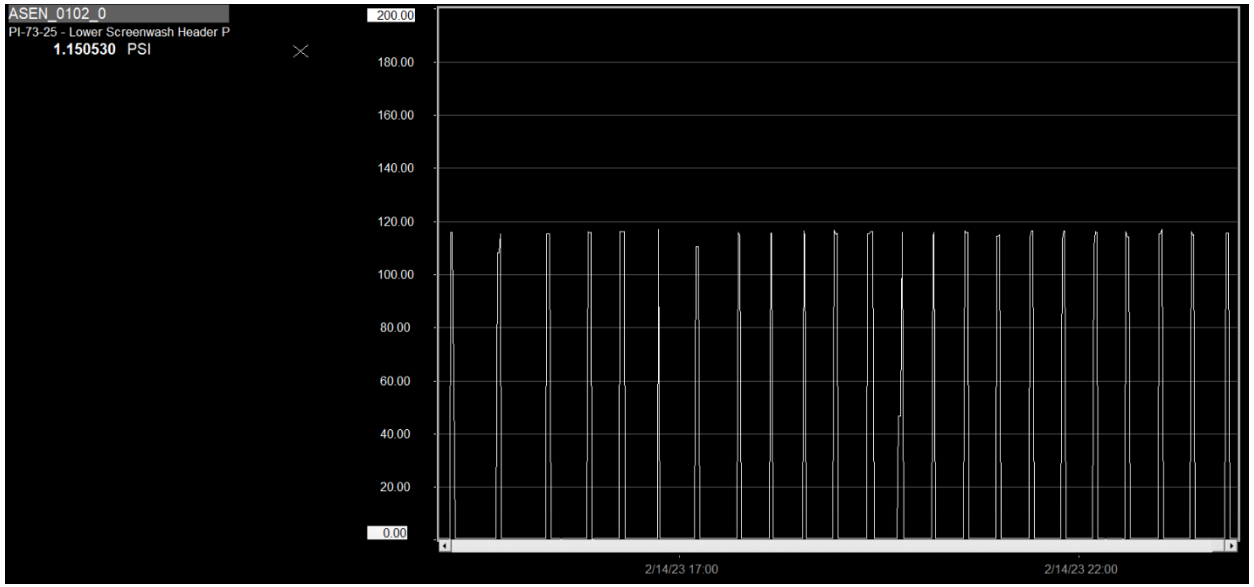


PI Vision Dashboard, implemented by Tim Tvrdik, I.T, Xcel Energy

Operator Efficiency Use Case: Minimizing Operator Wait Time for Equipment Response

Minimize Operator Wait Time for Equipment Response

- Certain rounds tasks require operators to wait and watch equipment to confirm functionality.
- Example: Constellation (Nine Mile Point) operators must confirm intake screen pump action each shift. Pump typically actuates once every 20 minutes, and operators may wait idle for response.
- Non-invasive monitoring and trending of pump head pressure allows operators to be freed up from non-productive waiting.



Silas Hoffstaetter – Constellation Nine Mile Point

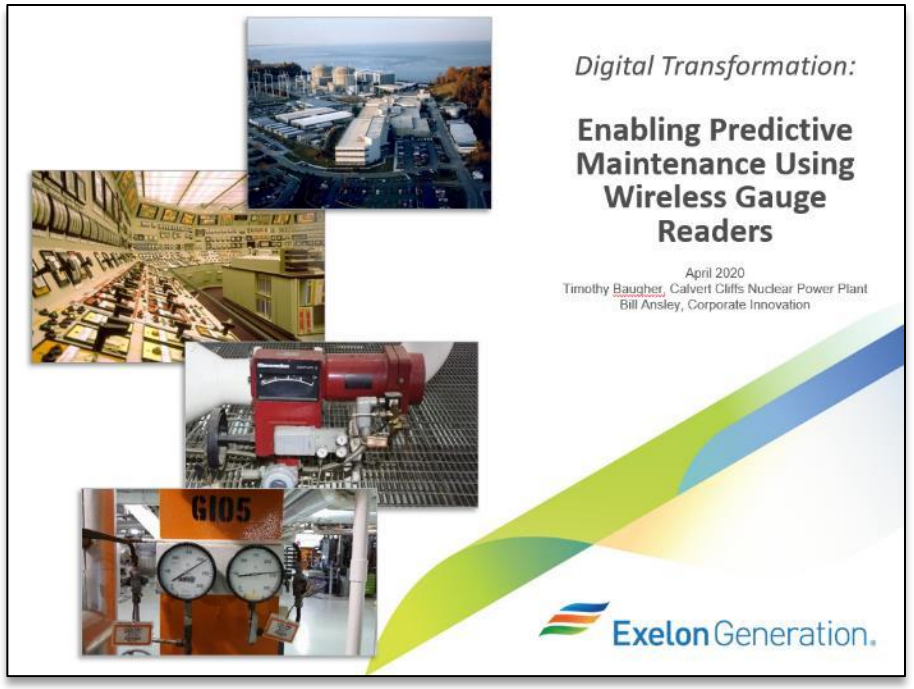
Operator Efficiency Use Case: Enabling Condition Based Maintenance and ALARA

Condition Based Maintenance + ALARA

- Automated monitoring of filter delta-pressure for condensate polisher filters – minimize time and dosage exposure (BWR)
- Clinton observed problems with their condensate polisher – suspect that filters are clogging up.
- Short term fix to replace filters more often, but expensive and time intensive.
- Need to monitor filter delta pressure more often to detect when a change is needed – condition based maintenance.
- Only way to do this is sending operators to read pressure gauges. This is a BWR. Dose rates in CP area about 25 mrem/hr.
- WGR used to remotely monitor and trend filter pressures.

Fault Detection – Exelon/Constellation Calvert Cliffs

- Monitor performance and detect failures of Air Operated Valves used to control and maintain feedwater heater tank levels.
- AOV's fail when there is an air leak, drift from calibration, stuck actuator, worn out cam.
- Prior failures caused high-level dump of heater tank and unit shutdown, with costly overtime work to repair.
- Since installing WGR's, Calvert Cliffs detected two emerging failures and repaired them before there was any operational disruption.



Environmental Compliance – Duke Brunswick

- As part of a Groundwater Protection Plan, Cypress installed wireless gauge readers on sump pump hour meters to track electrical manhole sump pump run-time.
- No current method to monitor sump levels automatically.
- If tritium is detected the sump pump runtime data may be useful to determine where it came from.
- Catch two types of faults:
  - Pumps not running when they should (sump level too high)
  - Pumps running too much (must be a leak)

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Fault Detection – NextEra Turkey Point

- Turkey Point identified Pump Failures as a key contributor to unplanned downtime.
- Pump bearing temperatures are good predictive indicators of impending failure.
- Existing temperature monitors have only manual indicators.
- Cypress installed WGR's to capture data to send to PI Historian, Advanced Pattern Recognition algorithms, to enable early fault detection and correction.

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Personnel and Equipment Safety – Southern

- Monitoring SF6 Gas for switchyard and substation circuit breakers
- SF6 gas used for arc quenching
- Gas leak can cause unintended dangerous arcing
- SF6 is highly toxic, do not want to send people to detect leaks
- WGR's can be used to retrofit existing circuit breakers for remote monitoring without risk of introducing leaks

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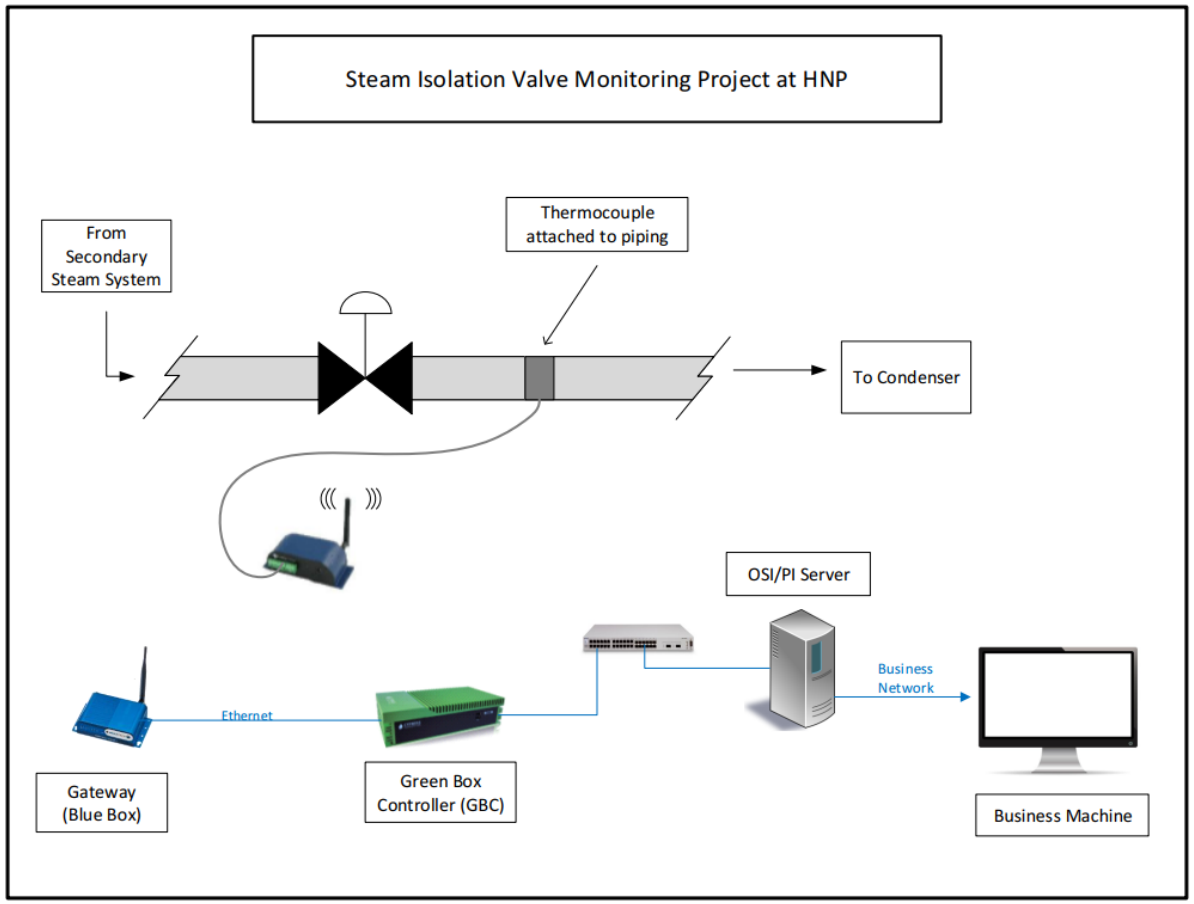
Thermal Performance – Duke Harris

- Monitor and detect shutoff valve leakage via pipe wall temperature
- Undetected leaking shutoff valves can degrade thermal performance
- Use WSTM to monitor pipe wall temperature downstream (and if needed also upstream to get delta temperature)
- Non-invasive clamp-on thermocouples – up to 500 deg F
- Electronics/wireless module connected by thermocouple wire – up to 500 ft distance

Deployed at Duke Harris Nuclear Plant

Thermal Performance Monitoring - Deployment

Detect Leaking Valves Using Temperature Sensors – Duke Energy



Duke Energy
- Harris – 40 valves
- Robinson – 4 valves

PSEG
- Hope Creek – 147 valves
- Salem - ~40 valves

Vistra Luminant
- Comanche Peak – 227 valves and steam traps

Xcel Energy
- Monticello – TBD valves
- Prairie Island - ~40 valves

Transfomer Fault Detection – Exelon Calvert Cliffs

- Connect legacy transformer trace gas monitoring systems to PI Historian.
- Allow old ModBUS IP protocol to communicate and conform to latest cyber security requirements.
- Enable automated fault detection.

GE
Digital Energy

Intellix* MO150 specification sheet

Description

The Intellix MO150 is an intelligent, dynamic transformer monitoring system designed to provide comprehensive monitoring and interactive condition diagnostics for oil-insulated transformers used by electrical utilities and large industries.

Functionality

The Intellix MO150 system is designed to collect, process, analyze and interpret critical operations on data obtained from various sensors. It incorporates onboard intelligence, which utilizes the monitored transformer's characteristics along with real-time measurements to automatically compute on-line state-of-the-art mathematical transformer models based on IEEE® or IEC® standards. The on-line models of the system include:

- MVA model which computes apparent power on primary, secondary or tertiary winding
- Winding hot-spot temperature model which computes the hot-spot temperature of each winding where load current is measured
- Moisture in the thin conductor insulation and in the barrier insulation which computes the moisture content of each
- Insulation aging which computes aging acceleration factor from IEEE or IEC guidelines
- Tap changer thermal model which computes temperature difference between the LTC tank and main transformer oil tank
- Tap changer position tracking model as the tap position transitions are recorded and tracked
- Cooling control for management and operation of the transformer cooling system
- Cooling efficiency which monitors actual efficiency of the cooling system

Electronic Controller

Microprocessor based
- Watchdog
- Clock
- Memory storage
- More than 3700 historical alarms and events
- More than 6900 historical service logs (once per day)
- More than 100 days of short term logging (15 min interval)

Components
- Basic embedded software
- Backlit graphic LCD display: 128 x 66 pixels; seven lines of 20 text columns
- Membrane keypad with eight functions: up, down, left, right, escape and three interactive keys
- Four LED indicators: power, "System OK," Alarm One and Alarm Two
- Internal temperature controlled

Communications
- Local serial RS-232 link; connector type DB-9M; dielectric withstand: 1500 V RMS
- RS-485 port
- Remote communication via LAN and modem

Inputs and Outputs

Analog inputs

Quantity: eight inputs, dielectric withstand: 1500 V RMS configurable to the following two options:
- RTD input; model PT-100; range: 0-270 Ω; accuracy: ± 0.15 Ω
- 4-20 mA isolated input (active/passive); wetting: 24 Vdc; maximum load: 40 mA; maximum input impedance: 220 Ω; accuracy: ± 0.01 mA

AC Analog Inputs

Quantity: Five inputs, dielectric withstand: 2000 V RMS; input impedance: 150 Ω
- Three inputs for transformer winding currents H, X and Y (clamp-on CTs 50 mA)
- Two inputs for fan group current

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Cypress network:
Open System to Integrate with 3rd LoRaWAN sensors

Integration of 3rd Party LoRaWAN devices

MultiTech Reveal™ Wireless Proximity Sensors

MultiTech Reveal™ LoRaWAN Wireless Proximity Sensors detect contact between two wires, proximity detection with a magnet, range with an ultrasonic signal, while the Reveal UltraSonic Level Sensors provide high accuracy proximity detection and ranging in air.

MultiTech Reveal™ Wireless Push Button Sensors

The MultiTech Reveal™ LoRaWAN Wireless Push Button Sensor transmits on a button press event. They can be used as a panic button wearable device, personal emergency response system (PERS), remote control or other remote push button applications. When the button is pressed, an alert is sent to the wireless network.

MultiTech Reveal™ Wireless Movement Sensors

MultiTech Reveal™ LoRaWAN Wireless Movement Sensors use an ultra sensitive internal accelerometer to detect movement of a critical asset. When movement is detected that exceeds a certain threshold, an alert is sent over the wireless network. Reveal Tilt Sensors detect transitions between horizontal and vertical orientation, as well as reporting the angle of the tilt.

MultiTech Reveal™ Wireless Leak Detection Sensors

MultiTech Reveal™ LoRaWAN Wireless Leak Detection Sensors use a water probe to detect the presence of water or other liquids. When the presence of water or another liquid is detected, an alert is sent over the wireless network to prevent a potentially catastrophic event.

- Integrate devices with Cypress Gateway and GBC
- Same wireless network infrastructure
- Same cyber security approval
- Same OSI PI connectivity

CYPRESS ENVIROSYSTEMS™

Integration of 3rd Party Sensors

3rd party LoRaWAN sensor

Enclosure in Field

Blue Box

CAT 5
UDP

Green Box

Plant Wi-Fi or Ethernet (L2 Network)

Connection via RESTful API, OPC UA, or OPC DA

OSI PI Historian

3rd Party App

Web Application Clients HTTPS using browser

Laptop

Smartphones/ Tablets

CYPRESS ENVIROSYSTEMS™

Integration of 3rd Party IP Cameras

3rd party
IP camera

Ethernet

Green Box

Plant Wi-Fi or Ethernet (L2 Network)

Connection via RESTful API, OPC UA, or OPC DA

OSI PI Historian

3rd Party App

Web Application Clients HTTPS using browser

Laptop

Smartphones/
Tablets