Benefits of a Connected System

District Energy and the Industrial IoT

Adam Strynadka
Managing Director
Industrial Software Solutions **(formerly Wonderware PacWest)*

IDEA2018 | Local Solutions, Global Impact
109TH ANNUAL CONFERENCE & TRADE SHOW
June 11-14 | Vancouver Convention Centre | Vancouver, BC

District Energy – Benefits of a Connected System

Presentation Agenda

1. **Automated Meter Reading: Modernizing Existing Infrastructure with IIoT**
   - > Benefits for System Operator
   - > Benefits for Customers
   - > *Success Story: Creative Energy, Vancouver BC*

1. **Real-Time System Modeling: Leveraging Data You Already Own**
   - > Day to Day Operation: modeling “what-if” scenarios
   - > Energy Optimization: temperature, pump & pressure
   - > *Success Story: University of Texas, Austin*

1. **Predictive Asset Analytics: Equipment Health Monitoring for Critical Assets**
   - > The path to Risk Based maintenance departments
   - > Connecting real-time data with maintenance systems
   - > Predictive Asset Analytics for Equipment Health
   - > *Success Story: Duke Energy*

Automated Meter Reading

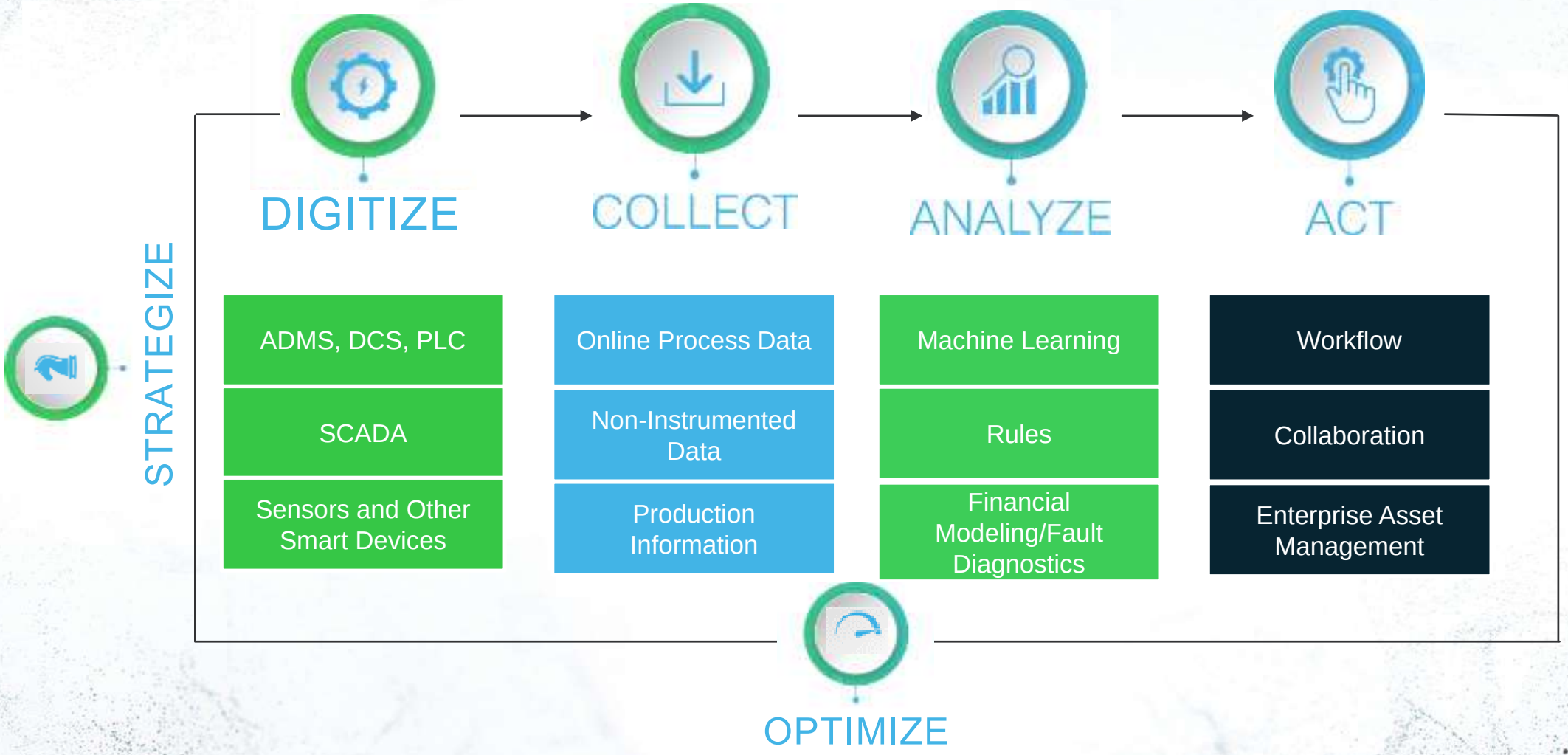
Modernize Existing Infrastructure with IIoT

Creative Energy, Vancouver BC

Moving along the path to actionable intelligence

INDUSTRIAL SOFTWARE SOLUTIONS

Strategy



INDUSTRIAL SOFTWARE SOLUTIONS

Benefits of a Connected System

District Energy System Operator - Generation Facility

- Manage the network efficiently with fluctuations in demand and changing weather conditions
- Increased visibility provides improved decision making
- View key plant data remotely - without affecting production
- Reduce operations and maintenance risks and costs
- Fully optimize pressure, temperature, production to reduce production costs
- Forecast system behavior using real-time data

Mobile Workforce

- Save time and money by automating meter-reads
- Access to operational data any time, any where
- Early detection of malfunctioning / inaccurate equipment

Customer (building operator)

- Provides easy access to usage data via web portal
- Integrate BAS & usage data into a single dashboard
- Relate usage data to external factors (weather, etc…)
- Insight into service status & maintenance

Customer Success Story

Creative Energy – Vancouver, BC

Vancouver based Creative Energy seeks remote monitoring solution for automated metering, customer retention, and more efficient system utilization.

Project goals:

- Automate system-wide meter reading
- Provide customers with visibility into energy usage and billing
- Enable mobile maintenance staff with real-time data on mobile devices
- Make generation facility data available outside the control room

Project Requirements:

- Customer Retention
  - > Detailed explanation of historical & real-time usage information to backup monthly bill
  - > Information to enable customers to make smart, energy saving investments
  - > Customer portal for real-time viewing
- Automated Data Collection (Meter Reading)
  - > Enhance existing infrastructure
- Connect with Building Automation System of customer
- **Integration with District Energy provider's billing software**
- Fully interface and compliment energy generation control system
- **Provide customer data into CE's enterprise database for advanced analysis**

"Based on the data being brought into our dashboard, I already see items that should be addressed in the Building Automation System."

- Lori Parker, Operations Manager, on behalf of Creative Energy,
4 Hours after gaining access to DeviceLynk's Actionable Intelligence

INDUSTRIAL SOFTWARE SOLUTIONS

Real-Time System Modeling

Leveraging Data You Already Own

University of Texas, Austin

Challenges in District Energy Today

- Increasing efficiency, while reducing costs, and lowering emissions
  - > Companies expected to reduce energy consumption and CO2 emissions
  - > Little to no visibility once energy leaves plant
  - > Energy supply / energy optimization: what levels, temperature, flow, and pressure should plants run at?

- Limitations of current systems and network
  - > SCADA only allows for partial monitoring of the network
  - > SCADA does not provide option to efficiently manage fluctuations in demand and weather conditions
  - > No software for temperature optimization
  - > Limited software for online operations
  - > No software for offline simulations

District Energy Optimization

From reactive control to proactive management

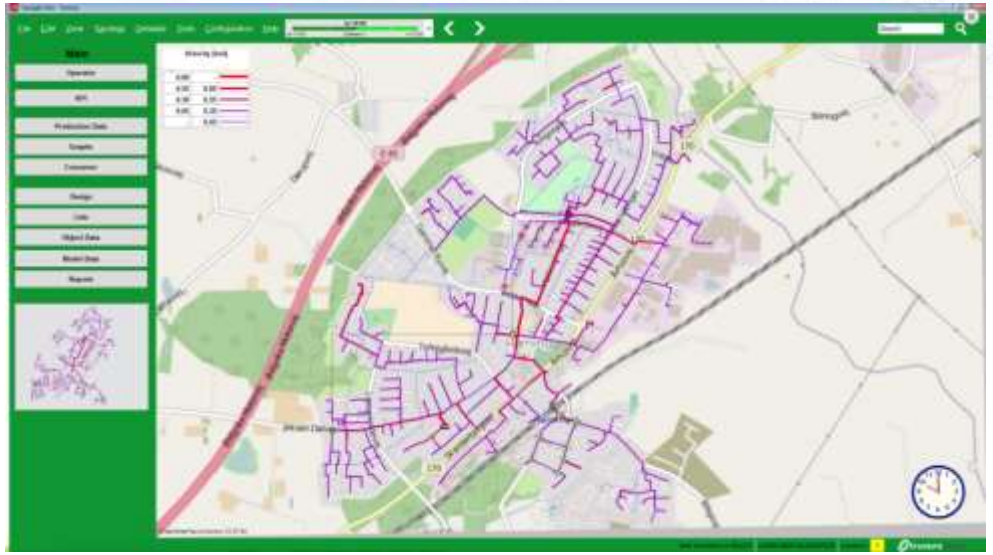
Modeling networks in real-time through the use of **advanced operational tools**, linking data from multiple sources - optimizing cooling and heating systems:

- Transforms network management approach from reactive to proactive
- Enhances real-time supervision in SCADA, providing:
  - > More data for real-time decision making
  - > Additional data for predictive analysis
- Reduces energy usage, costs, and CO2 emissions while ensuring required level of service
- Reduces operations & maintenance risks and costs: predict network behavior and see what happens before it happens
- Improves service and planning: plan ahead to save time and money
- Builds on existing data and IT: gives existing software and systems new functionality

Going Beyond SCADA

From reactive control to proactive management

- Expanded real-time control - augmented reality of distribution and transmission network
  - > Incorporate virtual sensors for insight into parameters at any point in network
  - > View current levels of service
  - > Detailed analysis of zone behavior, status, and trends over previous 24 hours
  - > Get data on areas that are not instrumented



Full Network Visibility

INDUSTRIAL SOFTWARE SOLUTIONS

Data sources

SCADA	Real-time Measurements
GIS	Asset Data
Hydraulic Models	Engineering Specifications
Customer / Billing	Historical Demand

Data sources

- SCADA — Real-time Measurements
- GIS — Asset Data
- Hydraulic Models — Engineering Specifications
- Customer / Billing — Historical Demand

Connected System

Outputs

- Expanded Real-time Control
- Prediction
- Alerts & Workflows
- Energy Network Management

INDUSTRIAL SOFTWARE SOLUTIONS

Data sources

- SCADA — Real-time Measurements
- GIS — Asset Data
- Hydraulic Models — Engineering Specifications
- Customer / Billing — Historical Demand

Connected System

Capabilities

- Temperature Optimization
- Pump Optimization
- Pressure Optimization

Outputs

- Expanded Real-time Control
- Prediction
- Alerts & Workflows
- Energy Network Management

INDUSTRIAL SOFTWARE SOLUTIONS

Customer Success Story

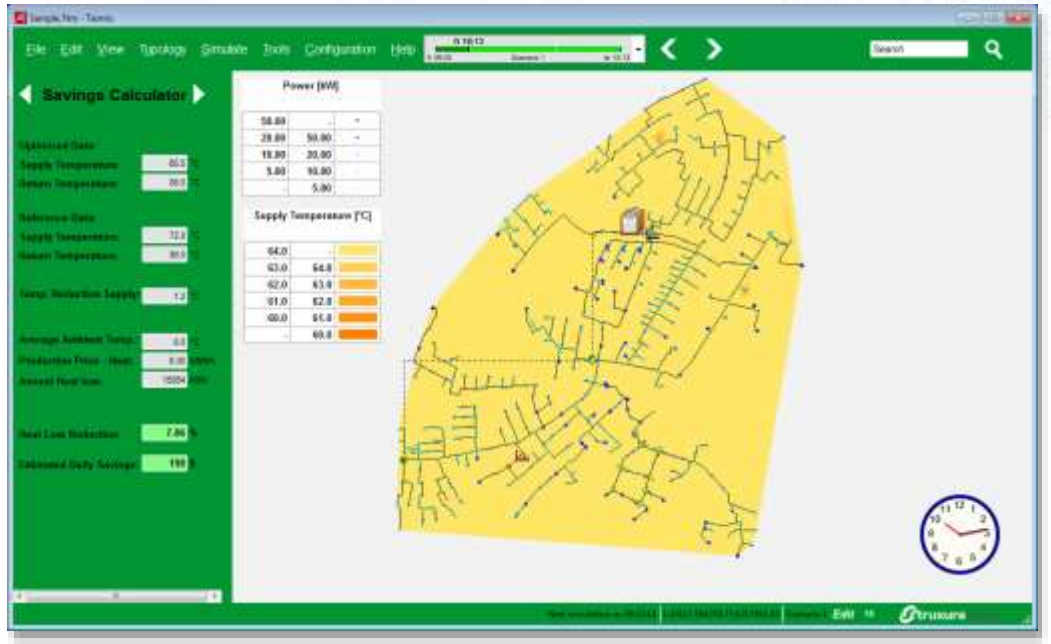
University of Texas, Austin
Energy Network Management

Project goals:

- Reduce energy consumption and environmental impact
- Improve contingency planning
- Optimize expansion and maintenance
- Ensure operational continuity and high levels of reliability

Solution: District Energy Platform with a Connected System

- Access to real-time application for prioritizing production
- Reduced overhead production costs
- Optimized system pressures and temperatures
- Knowledge of impact of operational actions beforehand
- Decreased operational man-hours



UTA Facts:
3rd Largest Campus in USA
Consumers: 50,000
Campus Buildings: 160
Plants: 11
Chillers: 4
Piping: 9.7km (~6 miles)
Temperature: 3.9° C (~39°F)

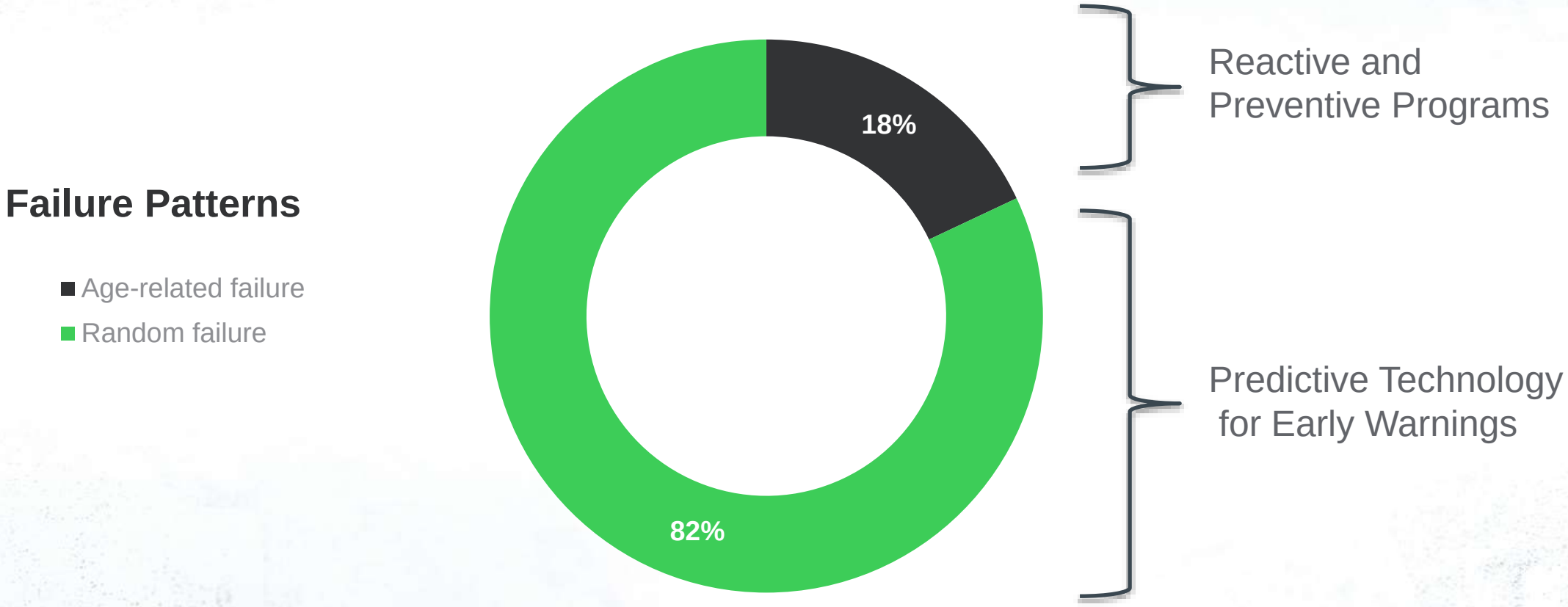
INDUSTRIAL SOFTWARE SOLUTIONS

Predictive Asset Analytics

Equipment Health Monitoring for Critical Assets

Duke Energy

Organizations are evolving beyond traditional maintenance practices to become predictive

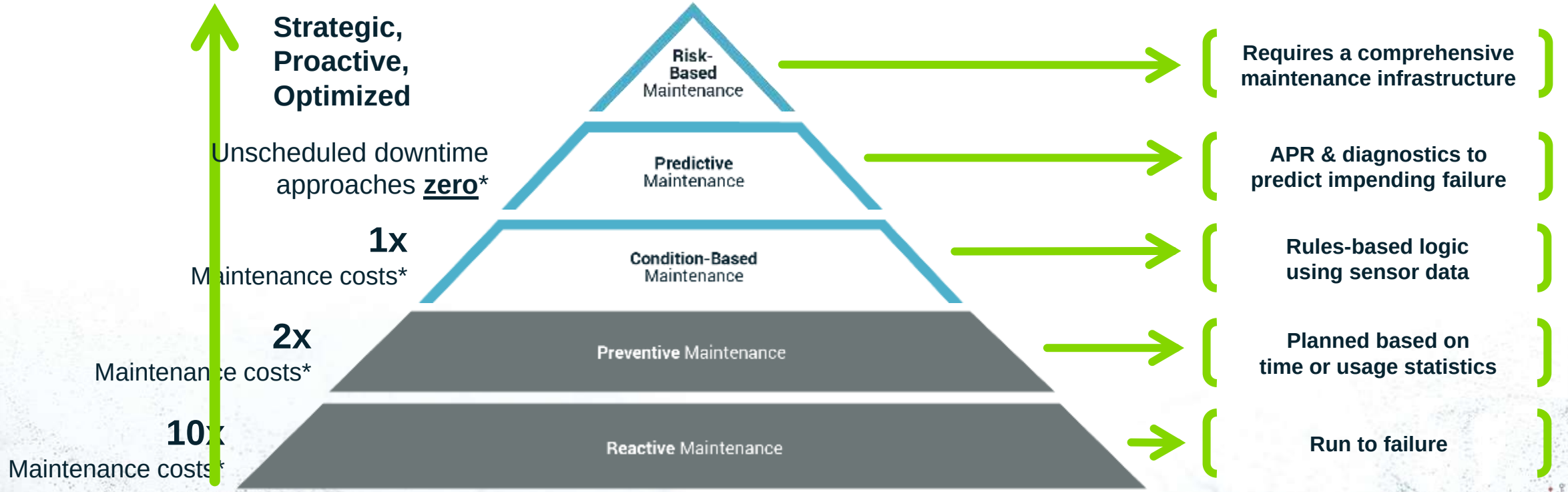


ARC studies show only 18% of asset failure is age-related. Based on these data, preventive maintenance provides a benefit for just 18 percent of assets, and monitoring for predictive maintenance is a recommended option for the rest.
www.arcweb.com/Lists/Posts/Post.aspx?ID=260

INDUSTRIAL SOFTWARE SOLUTIONS

Organizations are evolving beyond traditional maintenance practices to become predictive

Maintenance Maturity Pyramid



*Source: *Proactive Asset Management with IIoT and Analytics* (ARC View, January 2015)

INDUSTRIAL SOFTWARE SOLUTIONS

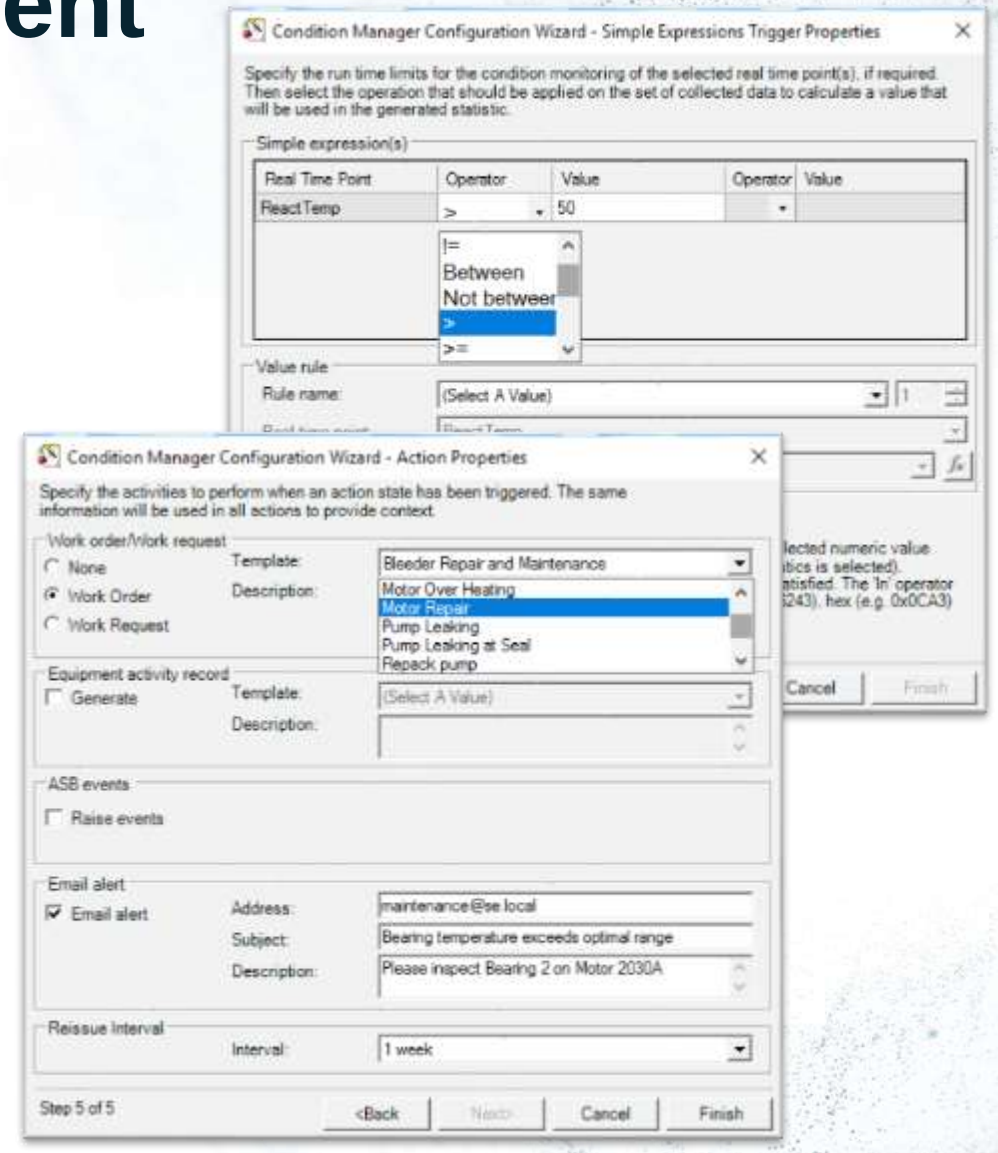
Operating Condition Management

Rule-based Asset Monitoring System

- Continuous monitoring of process data stored in your Process Historian for asset conditions that require preventative maintenance, automatically generates Work Requests based on asset data vs. calendar schedule.

- Rule-based system monitors asset data to alert known conditions
  - > Automate maintenance process by automatic initiation of maintenance activity
  - > Reduce unplanned downtime with faster WR and WO generation
  - > Reduce operator fatigue and reliance on manual data sharing

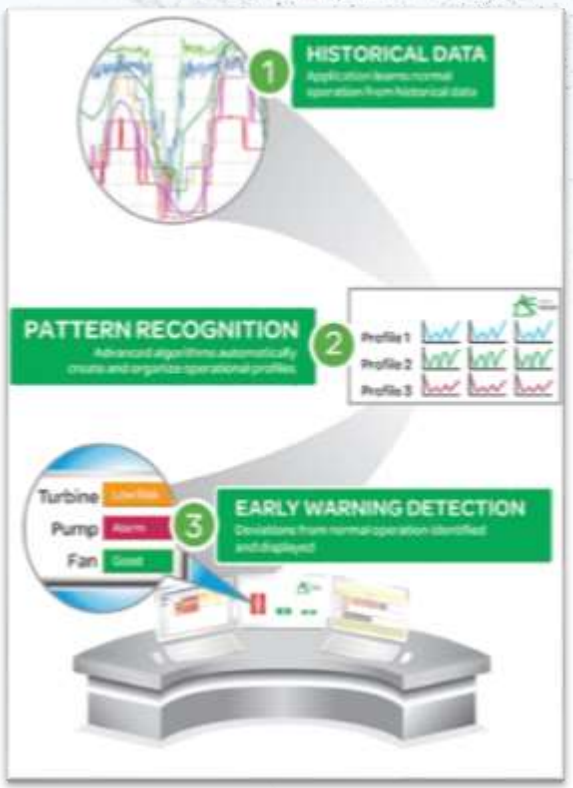
- Drive maintenance work processes
  - > Provide notification about asset conditions
  - > Generate workflows that trigger maintenance activities
  - > Update EAM/CMMS with asset conditions and actions



INDUSTRIAL SOFTWARE SOLUTIONS

Equipment Health Monitoring

Predicting Asset Failure with Machine Learning



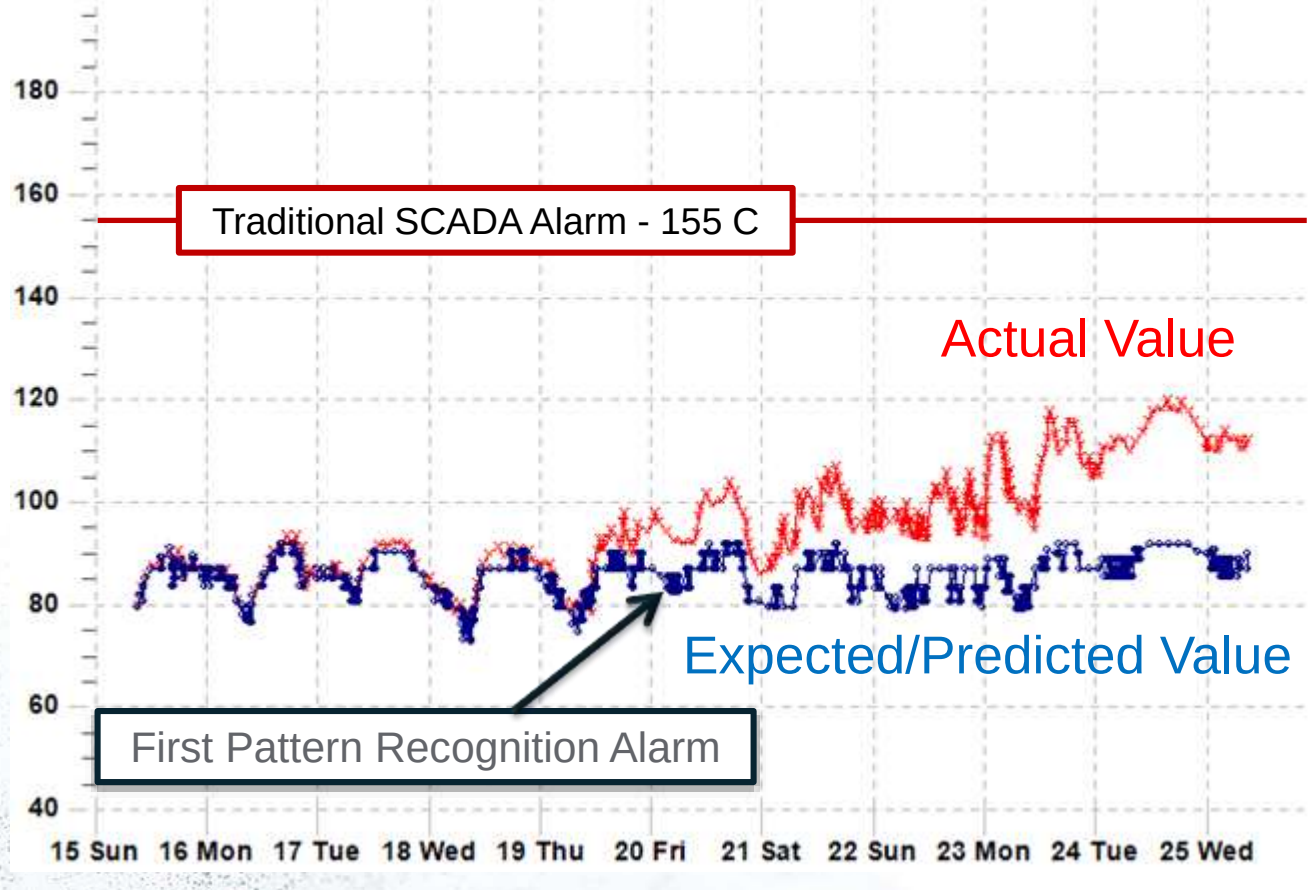
Provides early failure warning through predictive asset performance

- Advanced pattern recognition
- Uses historical data to build a model of how equipment normally operates
- Continuously monitors behavior in real-time
- Alerts when the operation differs from the historical norm
- Early warning detection of equipment problems
- Advanced analysis capabilities including problem identification and root cause analysis
- Generally use proprietary analysis algorithms
- Can monitor assets regardless of equipment type, vendor, or asset age

INDUSTRIAL SOFTWARE SOLUTIONS

Equipment Health Monitoring

Predicting Asset Failure



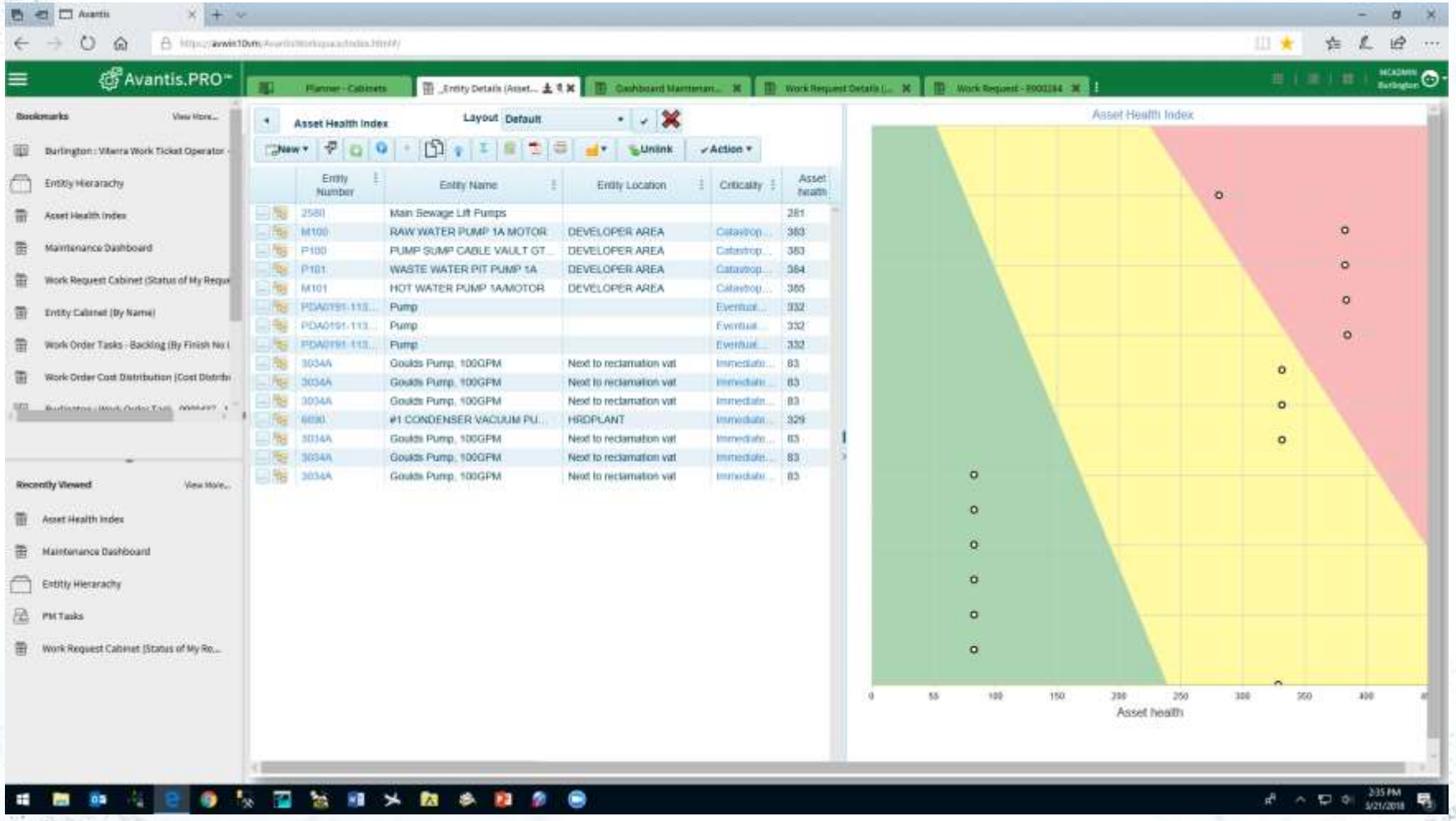
Predictive monitoring allows for finer discrepancies to be detected than what traditional SCADA alarms can provide.

Detecting issues as early as possible can mean big differences in the damage to the unit, length of downtime required to repair and cost of that repair.

INDUSTRIAL SOFTWARE SOLUTIONS

Equipment Health Monitoring

Asset Health Index



Data from predictive analytics system viewed as an Asset Health Index from within Maintenance System

INDUSTRIAL SOFTWARE SOLUTIONS

Industrial Software Platform

Seamless Integration of OT Data with Maintenance System

Entity	Entity Name	Statistic	Type	Reading Date To	Reading Time To	Previous Reading Date From	Previous Reading Date From UOM	Previous Reading Time From	Reading Value	Reading Value UOM
2030A	Engine	Temperature	Rea...	11/23/2017 10:...	11/23/2017 ...	95	F	Yes	95	F
2030A	Engine	Hours of O...	Rea...	11/23/2017 10:...	11/18/2016 ...	663	hr	Yes	663	hr
2030A	Engine	Temperature	Rea...	7/13/2017 7:2...	7/13/2017 ...	176	F	Yes	176	F
2030A	Engine	Temperature	Rea...	7/13/2017 7:2...	7/13/2017 ...	178	F	Yes	178	F
2030A	Engine	Temperature	Rea...	7/13/2017 7:1...	7/13/2017 ...	155	F	Yes	155	F
2030A	Engine	Temperature	Rea...	7/13/2017 7:1...	7/13/2017 ...	125	F	Yes	125	F
2030A	Engine	Temperature	Rea...	7/13/2017 7:1...	7/13/2017 ...	71	F	Yes	71	F

Real-Time & Historical Data from Operations (System Platform)

Viewed in Context of your Asset Hierarchy

INDUSTRIAL SOFTWARE SOLUTIONS

Success Story – Duke Energy

About Duke Energy

- 60+ plants in 6 states & 1,000+ U.S. Wind & Solar Assets
- 7.2 million customers
- Proposed CHP Facility Clemson University, Kite Hill

Turbine Blade Separation

- Unit was restarted after an outage, shortly after a vibration step change on one of the turbines was detected
  - Vibration levels were well below the control system alarm level
- Bolts on lower half of flow sleeve had broken off and flow sleeve contacted blade edge
- Minor damage to the blades, avoided damaging multiple stages of blades, packing, and diaphragms if a severe blade liberation had been allowed to occur.
- **Estimated avoided cost - $4.1M**

INDUSTRIAL SOFTWARE SOLUTIONS

Q&A