# **Benefits of a Connected System**

District Energy and the Industrial IoT

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



### **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

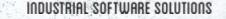
- > The path to Risk Based maintenance departments
- > Connecting real-time data with maintenance systems
- > Predictive Asset Analytics for Equipment Health
- > Success Story: Duke Energy

### Automated Meter Reading Modernize Existing Infrastructure with IIoT

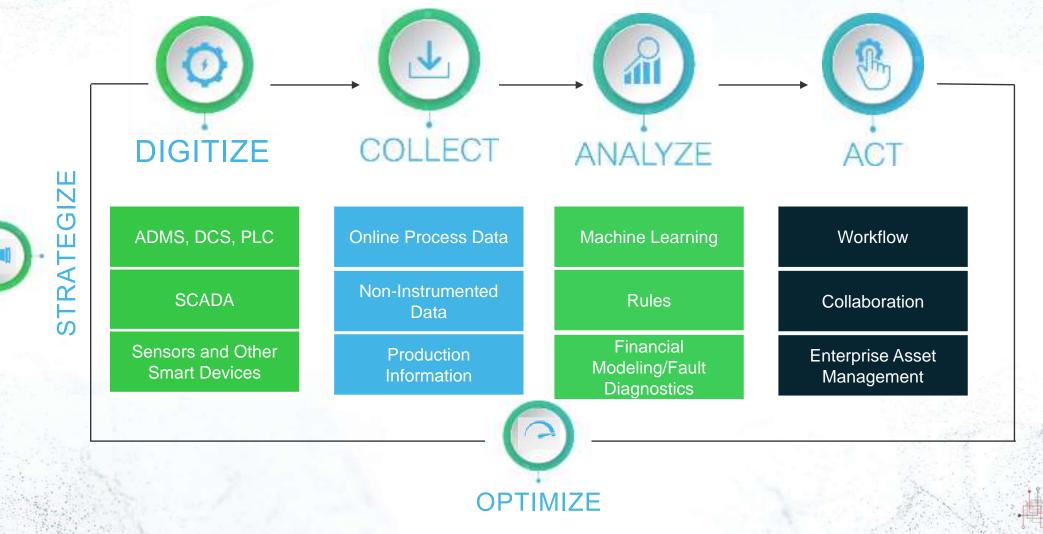
Creative Energy, Vancouver BC

# Moving along the path to actionable intelligence





# Strategy



# **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

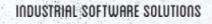
Real-Time System Modeling Leveraging Data You Already Own

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



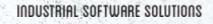
# **District Energy Optimization**

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:

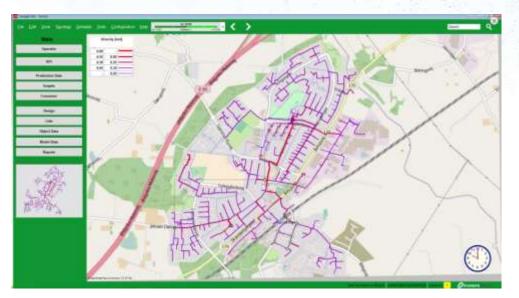
- Transforms network management approach from reactive to proactive
- Enhances real-time supervision in SCADA, providing:
  - > More data for real-time decision making
  - > Additional data for predictive analysis
- Reduces energy usage, costs, and CO2 emissions while ensuring required level of service
- 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



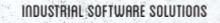
# **Going Beyond SCADA**

From reactive control to proactive management

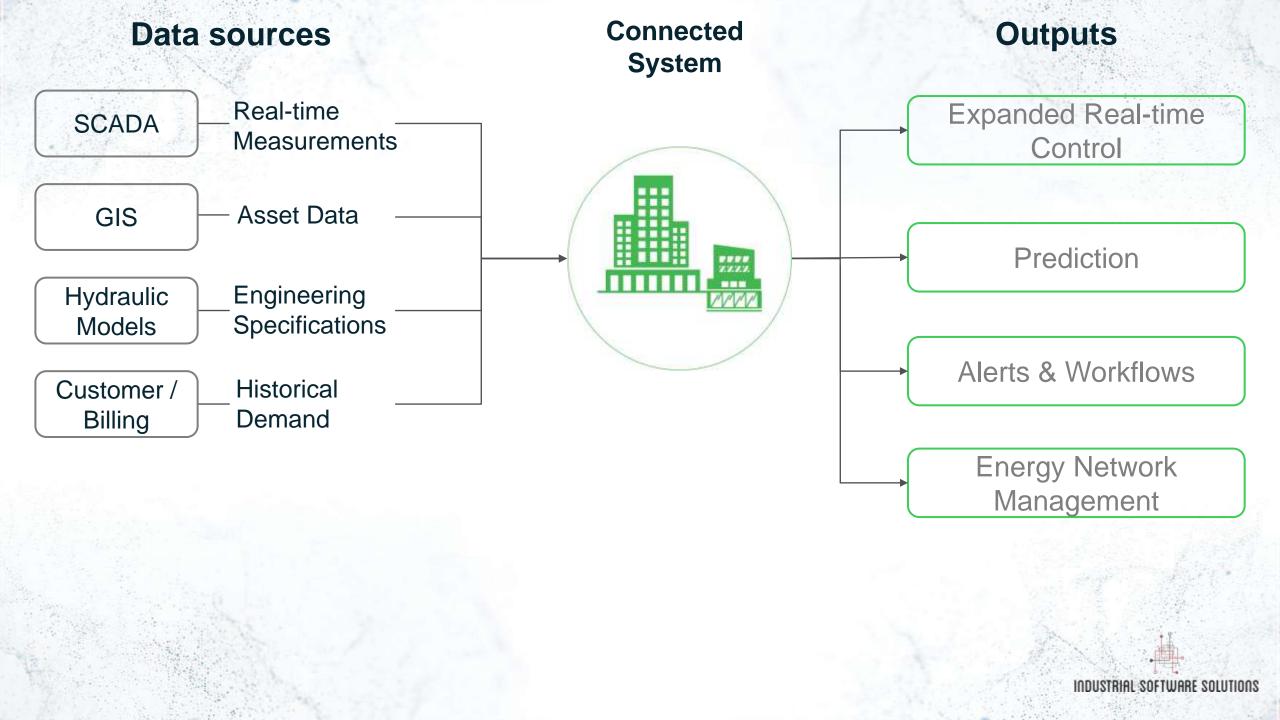
- Expanded real-time control augmented reality of distribution and transmission network
  - > Incorporate virtual sensors for insight into parameters at any point in network
  - > View current levels of service
  - > Detailed analysis of zone behavior, status, and trends over previous 24 hours
  - >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

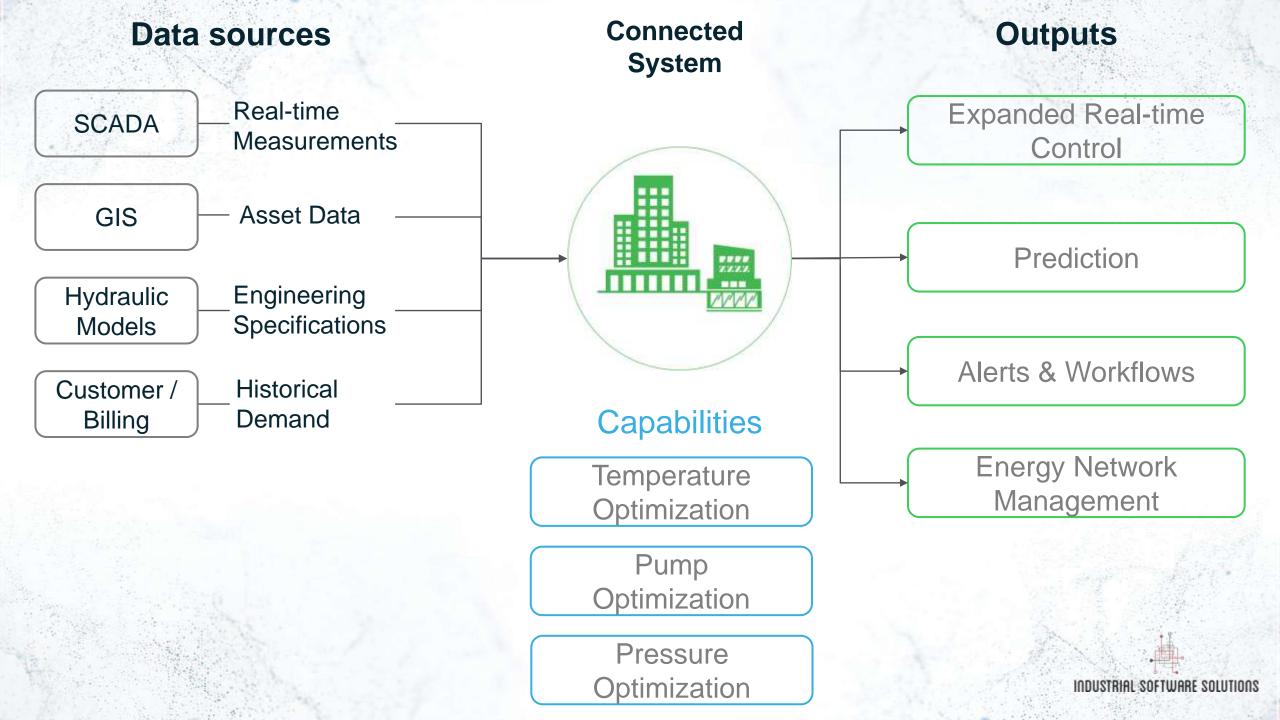


Full Network Visibility









# **Customer Success Story**

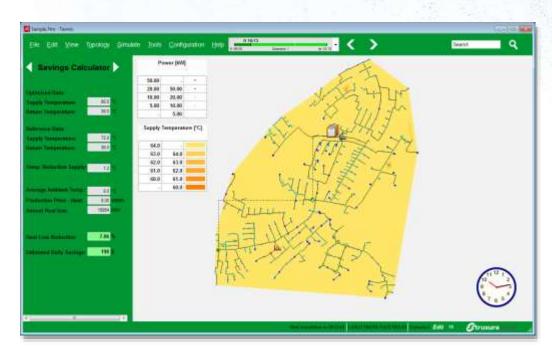
### University of Texas, Austin Energy Network Management

### **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



INDUSTRIAL SOFTWARE SOLUTIONS

UTA Facts: 3<sup>rd</sup> 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)

### **Predictive Asset Analytics** Equipment Health Monitoring for Critical Assets

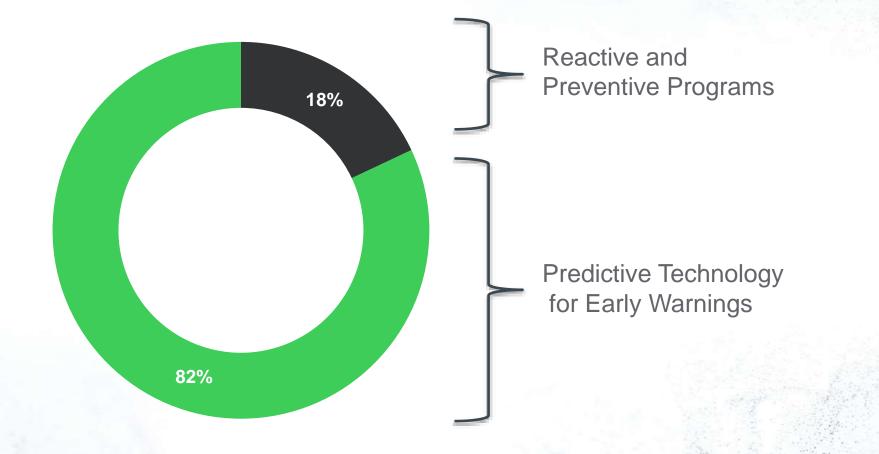
Duke Energy

# Organizations are evolving beyond traditional maintenance practices to become predictive

### **Failure Patterns**

Age-related failure

Random failure

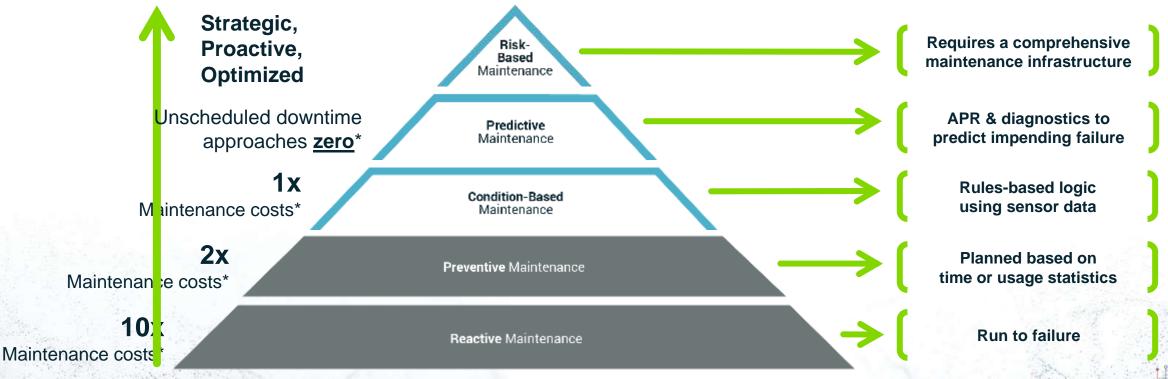


INDUSTRIAL SOFTWARE SOLUTIONS

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

# Organizations are evolving beyond traditional maintenance practices to become predictive

### **Maintenance Maturity Pyramid**



INDUSTRIAL SOFTWARE SOLUTIONS

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

# **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

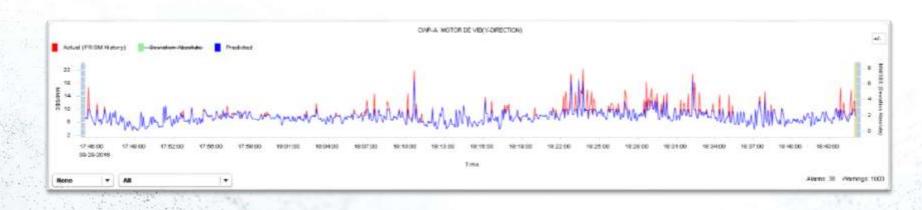
	Condition	Manage	r Configuration	Wizard - Simple Expr	essions Trigge	r Properties	i X
		e operatio	n that should be	on monitoring of the set applied on the set of co			
	-Simple expre	ssion(s)					
	Real Time P	oint	Operator	Value	Operator	Value	
	ReactTemp		>	<b>.</b> 50	•		
			!= Between Not betwe	ser			
	Value rule		>=	v			
	Rule name		(Select A Val	ue)			
	David kines an	Contr.	Base+Tame	94 <u>0</u>			-
Condition Mana	ger Configuration Wi	zard - Ac	tion Properties		×		+ 5
	to perform when an ac ed in all actions to pro			ed. The same			
Vorik order/Work red		-				cted numeri	c value
None	Template:	- Anna	der Repair and Ma	aintenance	▼ 15	ics is select isfied. The	ed).
Work Order	Description:	Moto	r Over Heating		<b>^</b> 12	43), hex (e.)	p 0x0CA3)
Work Request		Pump Pump	<ul> <li>Leaking Leaking at Seal ick pump</li> </ul>	į.			
quipment activity re Generate	Template:	-	ct A Value)		- 0	Cancel	Finish
Generate	Description:	1000	si n tauti		10		
S8 events							
Raise events							
mail alert		1. 1000000					
Email alert	Address:	maint	enance@se loca	1			
	Subject:	Bean	ng temperature e	xceeds optimal range			
	Description:	Pleas	e inspect Bearing	2 on Motor 2030A	0		
leissue Interval	1280012.0					Sec.	
	Interval	1 we	ek		-		透行计
ep 5 of 5	12	<back< td=""><td>Ninto</td><td>Cancel</td><td>Finish</td><td></td><td></td></back<>	Ninto	Cancel	Finish		

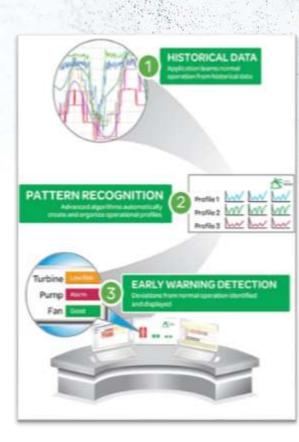
# **Equipment Health Monitoring**

Predicting Asset Failure with Machine Learning

### Provides early failure warning through predictive asset performance

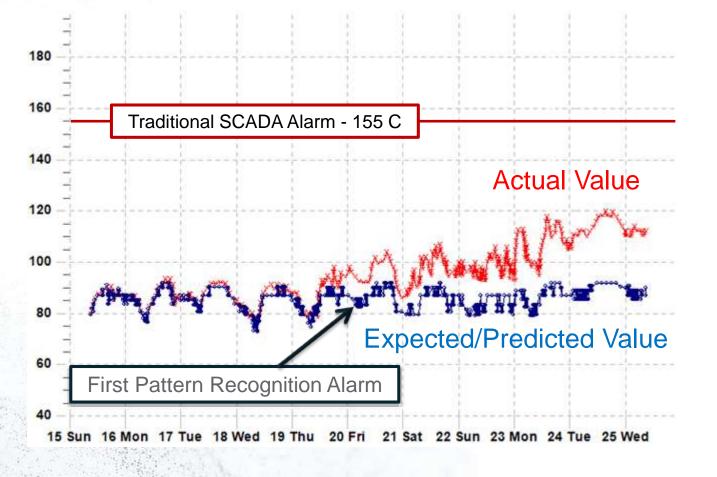
- Advanced pattern recognition
- Uses historical data to build a model of how equipment normally operates
- Continuously monitors behavior in real-time
- Alerts when the operation differs from the historical norm
- Early warning detection of equipment problems
- Advanced analysis capabilities including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





# **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.

# **Equipment Health Monitoring**

### Asset Health Index

mats future   Butters Lysel   Butters <td< th=""><th>đ</th><th>Avantis.PRO*</th><th><b>8</b>1</th><th>Farmet - Cabinet</th><th>🖬 🔄 "Ereity Details (Asset 🛓 🕈</th><th>× E Cashboard Nar</th><th>menn. X</th><th>🛛 Wark Reg</th><th>prest Octail</th><th>a 📖 🗶 📳 Work Sequent - 2000.014 - 20</th><th></th><th>二 単 ()</th><th>唐] 唐</th><th>HCkOM</th></td<>	đ	Avantis.PRO*	<b>8</b> 1	Farmet - Cabinet	🖬 🔄 "Ereity Details (Asset 🛓 🕈	× E Cashboard Nar	menn. X	🛛 Wark Reg	prest Octail	a 📖 🗶 📳 Work Sequent - 2000.014 - 20		二 単 ()	唐] 唐	HCkOM
Entry       Entry       Entry       Entry       Entry       Activity	keurks	View Hore	•	Asset Health Inde	a Layout Default	• • *			T <sub>1</sub>		Asset Heulth Index			
Ameri Jandy         Number         Number         Entry Location         Curcuity         Interdiant           Ameri Jandy         Image Jandy         Main Sunge Lifty Name         Image Jandy         Imag	Durlington : Vilen	ra Work Tickat Operator	Color		) · [] • I = = =	Unink	+ Action *							
And Haddin Tudes:	Entitity Hierarachy				Entity Name 1	Entity Location	E Criticality							
Maintanance Dualhouid         P 100         PLMP SUMP CAULE VALLET GT         DEVELOPER AREA         Catabrio, 363           Work Request Cabiner (Saturi of Hy Reyr)         PU01         WASTE RPT PLMP 1A         DEVELOPER AREA         Catabrio, 363           Work Request Cabiner (Saturi of Hy Reyr)         PU01         WASTE RPT PLMP 1A         DEVELOPER AREA         Catabrio, 363           Entry Calanel (by Name)         PU01         PU01         WASTE RPT PLMP 1A         DEVELOPER AREA         Catabrio, 363           Work Order Tasis, Sasking (br Frish Num)         PU01         PU01         Catabrio, 363         Catabrio, 363         Catabrio, 363           Work Order Tasis, Sasking (br Frish Num)         PU01         Pump         Catabrio, 100         PU01         Signal         Catabrio, 100         Catabrio,	Asset Health Inde		1.25	2580	Man Sewage Lift Pumps			281		N N				
Work Request Cabinet (Status of My Rey Processor)       Note Note Rev Matter W/TER N/T PAIN® 10       Color Contracter Calabody       Color Con			- 194	M100	RAW WATER PLMP 1A MOTOR	DEVELOPER AREA	Cetastion.	363					0	
Week Reguet Cohere (Schur of My Regue Intro; Cashing Of My Regue Intro;	Maintenance Dasi	hboard	- 103	P100	PUMP SUMP CABLE VAULT GT	DEVELOPER AREA	Catastrop_	383						
Intry Calande (by Name)     Intry Mining     Pumpy     Eventsold     323       Intry Calande (by Name)     Intry		in the second		P181	WASTE WATER PIT PUMP 1A	DEVELOPER AREA	Cataloop.	384					0	
Thethy Calibrate ((by Name))       Image       Pump       Description       Diversition       Diversition </td <td>more neguesi car</td> <td>oust forators or wheely</td> <td></td> <td>M101</td> <td>HOT WATER PUMP SAMOTOR</td> <td>DEVELOPER AREA</td> <td>Catastrop</td> <td>365</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	more neguesi car	oust forators or wheely		M101	HOT WATER PUMP SAMOTOR	DEVELOPER AREA	Catastrop	365						
week Order Tasks: Backing (fly Finsh Mu) S PDAV(Finsh Mu) S PDAV(Finsh Mu) PD Eventual 232   Week Order Cast Distribution (Gost Di	Entity Cabinal (b)	(Name)		PDA0791-118	Pump		Eventual	332					.0	
Work Order Tasks Section (III) Finish Will   Work Order Tasks Oodds Pump, 100GPM   Work Order Tasks Oodds Pump, 100GPM   Work Order Tasks Section (IIII) Finish Will   Work Order Tasks Oodds Pump, 100GPM   Work Order Tasks Section (IIII) Finish Will   Work Order Tasks Oodds Pump, 100GPM   Work Order Tasks Golds Pump, 100GPM   Wark Order Tasks Golds Pump, 100GPM   Wark Order Tasks Golds Pump, 100GPM <td< td=""><td></td><td></td><td></td><td></td><td>Pump</td><td></td><td>Eventual</td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td></td<>					Pump		Eventual						0	
Week Order Coat Distribution [Cost	work Order Tasks	Backlog (By Finish No.)	- 10	POADINI US.	WHITE A								1.000	
Aurtochos Aurilio Condes Condes France Condes France Condes France Condes France Condes Condes France Condes </td <td></td> <td>Natural States (Print Print)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>0</td> <td></td> <td></td>		Natural States (Print Print)										0		
Image: State of the	HORE OTHER COLD	Neuropenen (cost pourse												
Image: Status of the status of th	Austineters : March	Audoctors Annaly 1										0		
ty Veset Ves Mole. ty Veset Veset Veset Mole. thy Veset														
thy Weeked View More, Standar View More, Standar Pump, Standar Nixot to rectamation vol Instructular, It3 Outer Maintenance Dashboard Leader Leader View Maintenance Dashboard L					and the second of the second se							0		
Nase Health Index Nase Health		-			Provide Contraction of the Providence of the Pro				3					
Asset Health Index Maintonance Dashboard C C C C C C C C C C C C C C C C C C C	thy Viewed	Vex Notes	19	30344	Goulda Pump, 100GPM	Next to reclamation val	brumodiato.	83		0				
Narrowand Userboard O	Asset Health Index									0				
PMTasks 0	Maintenance Dash	écant								Q				
	Entity Hieranachy									0	A			
www.Request Cabinet (Status of My Re	PM Tasks									0				
	work Request Cals	enet (Status of My Ro								0				

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

#### 

a<sup>R</sup> 수 당 이 235 PM

## **Industrial Software Platform**

Seamless Integration of OT Data with Maintenance System



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

Viewed in Context of your Asset Hierarchy

### 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





