Colorado Springs Utilities

It's how we're all connected

Improving Business Processes through Operational Intelligence in the Utility Industry

Presented by *David Mora ~ Water Quality Assurance Lead*

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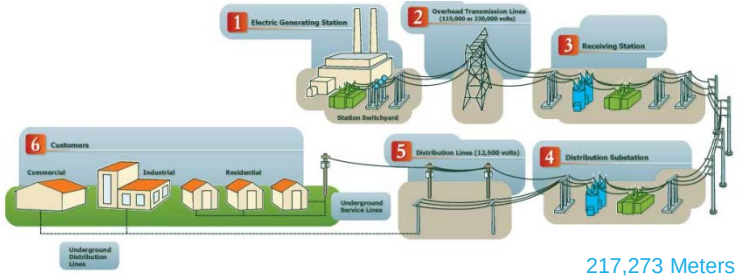
Colorado Springs Utilities – 4 Service Utility



ELECTRIC

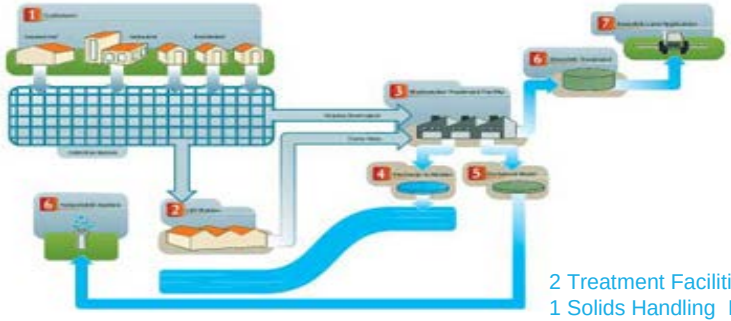
217,273 Meters
4 Hydro Electric Plants
2 Gas Plants
2 Coal Plants
Contracted Solar
Generating Capacity 1164MW's

WATER

137,619 Meters
7 Water Plants
Treatment Capacity 286 MGD's

GAS

192,872 Meters
7 Gate Stations
Net Volume Throughput 269.8 MCF's



WASTEWATER

2 Treatment Facilities
1 Solids Handling Facility
19 Lift Stations
Treatment Capacity 38 MGD's

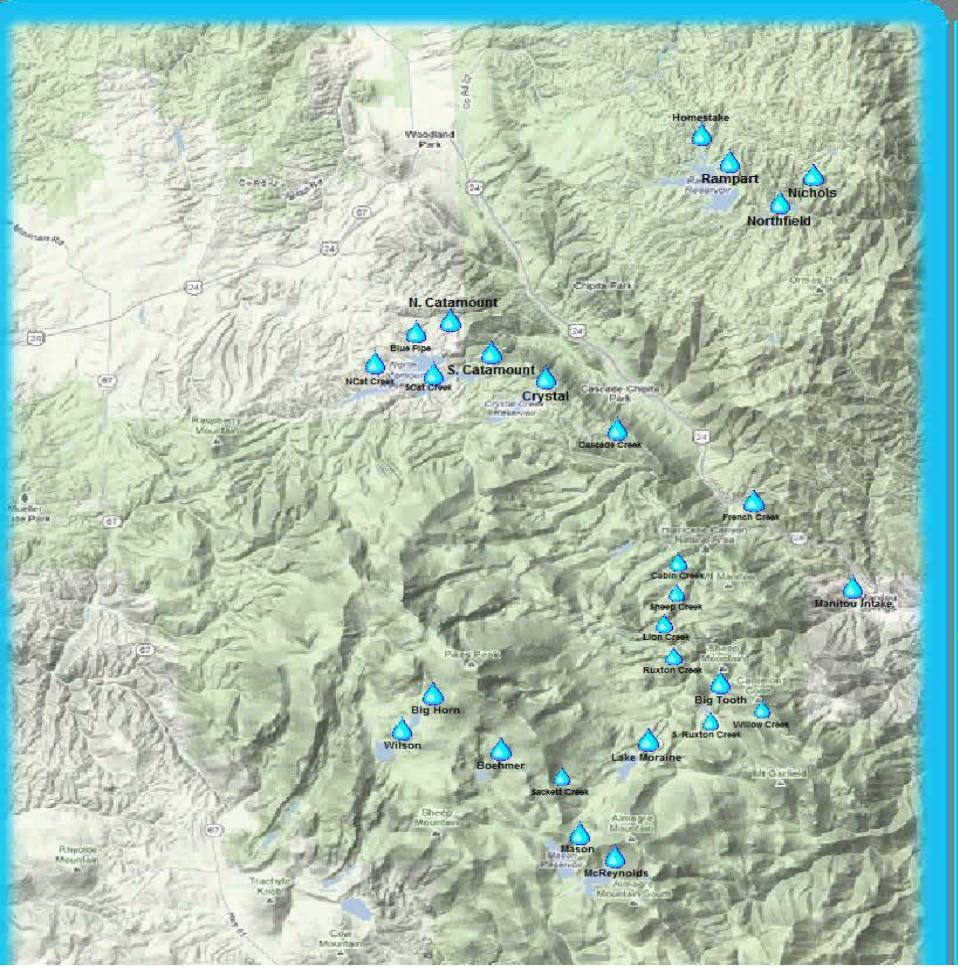
CSU Business Challenges

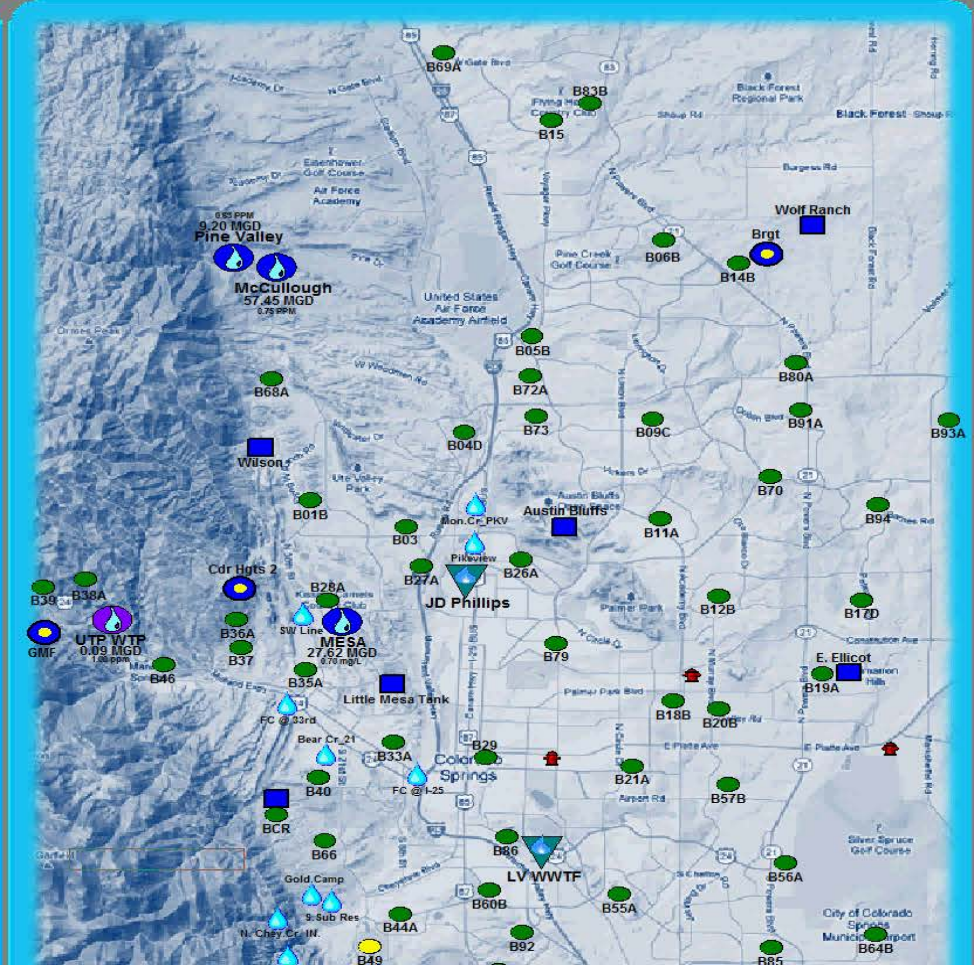
- Adequate resources to meet Growth and Stringent Regulatory Drivers
- Cultural Change
- Multiple Enterprise Interfaces and Dissimilar Systems
- Enterprise integration issues
  - Data redundancy and disconnected technologies
- Dependent upon other departments for information
  - SCADA Operators tasked to monitoring assets
  - Expanding Infrastructure with limited resources
- Obsolete business process
  - Hard Coded Static Reports (SQR)

To Manage you must be able to Measure

- Communicate effectively and provide visibility
- Monitoring system health
- Manage Risk
  - Informed operational changes
  - Identify and correct problems earlier
- Trade-offs
- Defend and justify decisions
- Optimize system performance

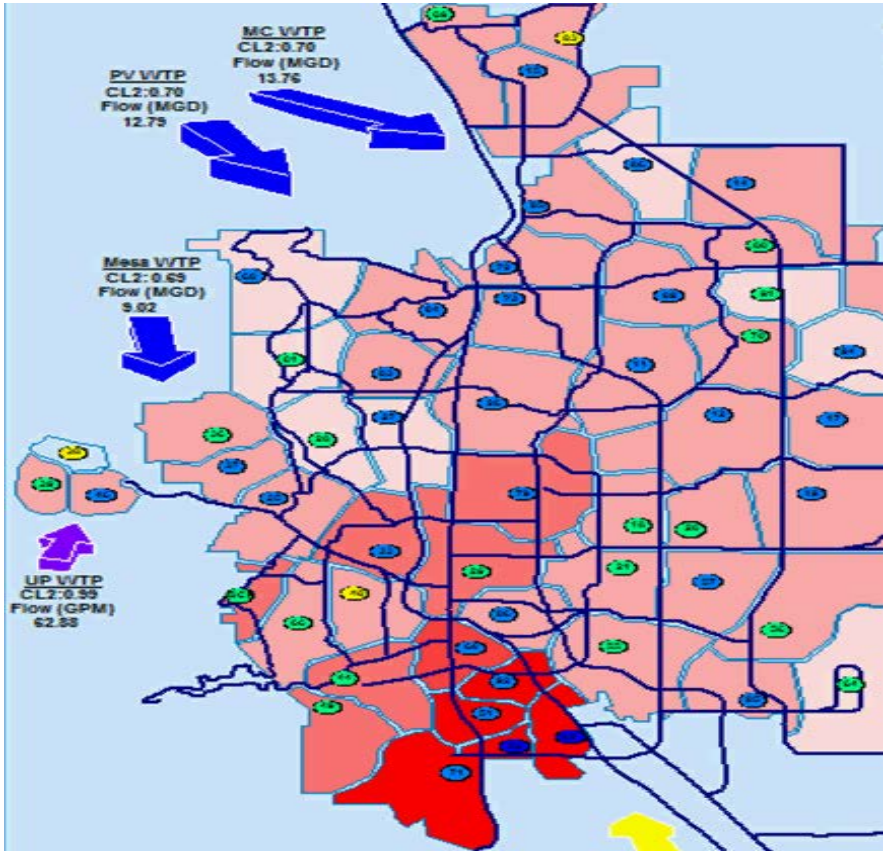
DYNAMIC REAL-TIME DATA PROVIDES VALUE BEYOND EXPECTATIONS





Treatment Source Trace Dynamic Mapping

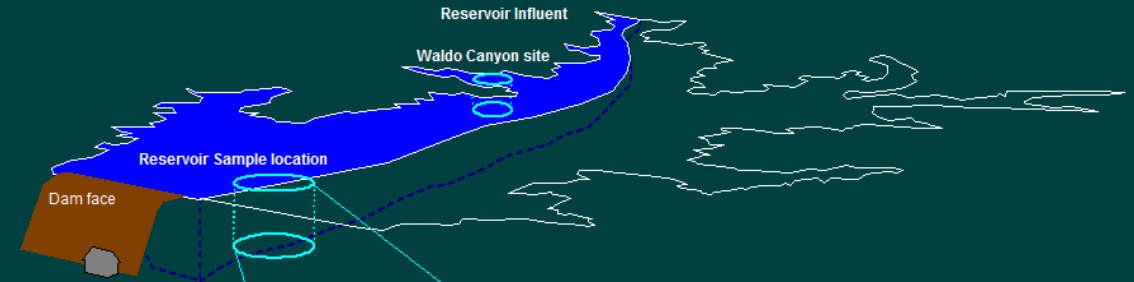
- Centralized data source
- Leverage Data Sources
- Visualization Data
- System awareness
  - Event Analysis
  - Understand
  - Predict
  - Mitigate
  - Operational Efficiency
- Creates Training opportunities



Reservoir Water Quality Display

Rampart Reservoir

Waldo Canyon Fire Study



Rampart Reservoir Burn Area

Sample Date:
10/14/2014 9:20:00 AM

	Top	Middle	Bottom
Chlorophyll	0	2	2 ug/L
Conductivity	68	68	68 umhos/cm
DO	6.4	6.5	6.3 mg/L
pH	7.2	7.3	7.3 SU
Temperature	12	12	12 degree C
Secchi Depth	22	NA	NA Ft.

Rampart Valve House

Reservoir Effluent

Sample Date 3/10/2015 8:45:00 AM

Aluminum	0 mg/L
Chlorophyll	2 ug/L
Conductivity	72 umhos/cm
E. coli	0 MPN/100mL
Fluoride	0.16 mg/L
Hardness	28.1 mg/L
Iron	62.9 ug/L
Magnesium	1500 ug/L
Manganese	44.7 ug/L
Nitrate	0 mg/L
TOC	1.86 ug/L
pH	7.3 SU
Phosphate	0 ug/L
Temp	5 degree C
Coliform	1 CFU/100mL
Organisms	30 P/ml
Turbidity	0.65 NTU

Reservoir Level: 172 FT

	pH	Temp	Turbidity	Conductivity	Alkalinity	DO	Chlorophyll	TOC	Ammonia	Fluoride	Nitrate	Nitrite	Iron	Magnesium	Manganese
TOP Secchi Depth: 22 FT	6.8	12	0.35	68	15	6.3	0	1.67	0	0.15	0	0	0	1440	0
MIDDLE	7.1	12	0.4	67	15	4.9	1	1.79	0	0.14	0	0	0	1440	0
BOTTOM	7.1	12	0.4	68	15	5.5	1	1.76	0	0.14	0	0	20.8	1450	7.82

Utilization PI System Real-Time Data

Maintaining operational efficiency

- Proactively identify treatment plant zone of influence and system disruptions
- Optimize system control by decreasing water age
- Reduce treatment plant effluent chlorination usage

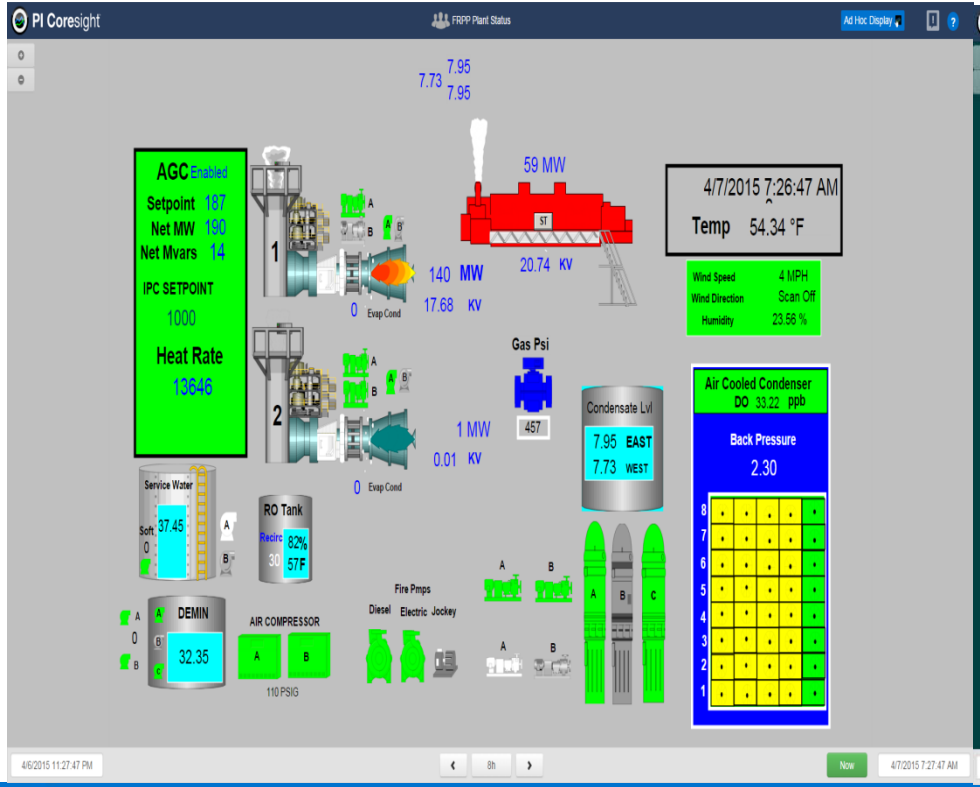
Lead to Improved operational efficiencies

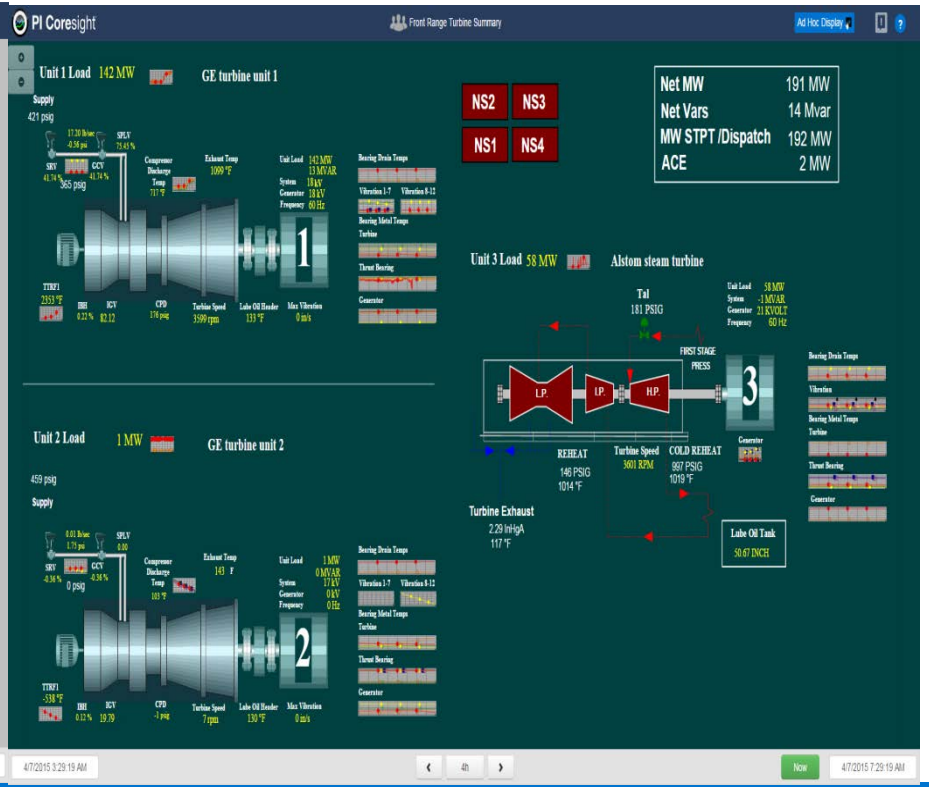
- Accessibility to data
- Heightened internal and external customers service
- Sustain operational needs

Ad-Hoc Trending using PI Coresight

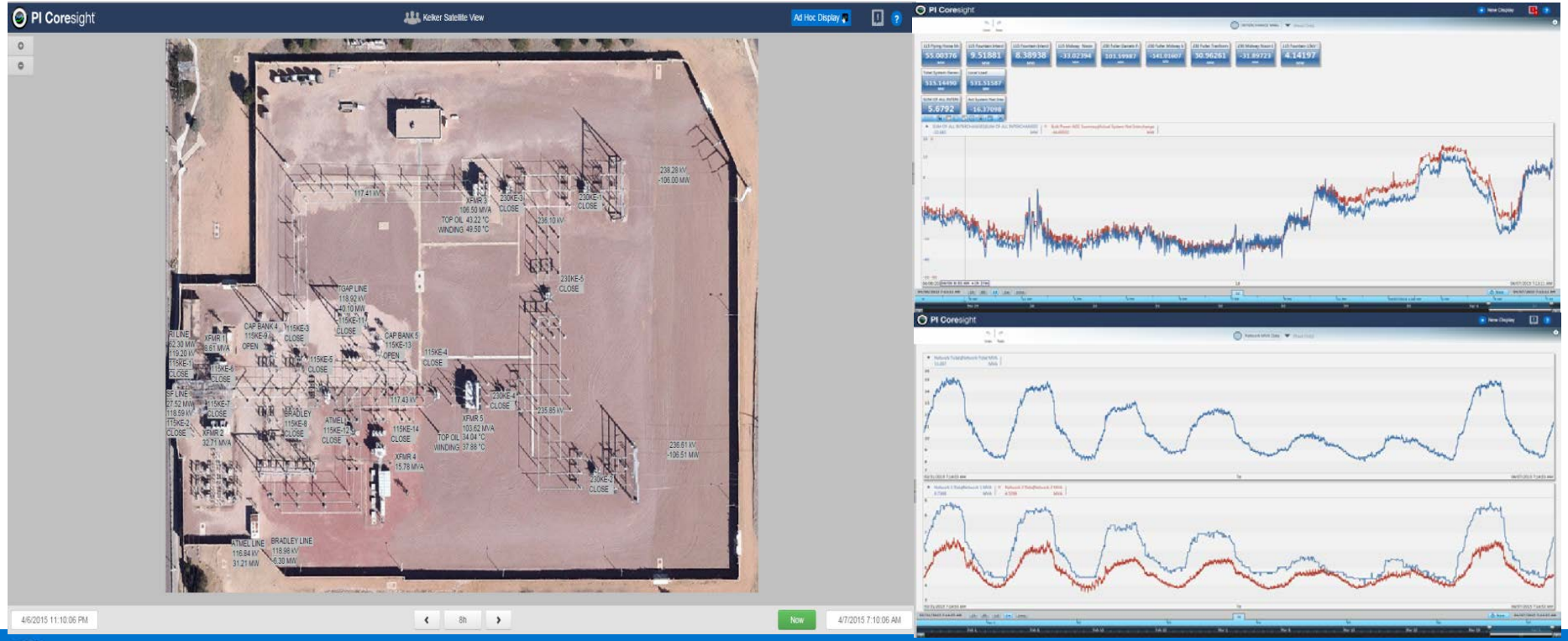
- Web-based client
  - Users to analyze enterprise data
  - Empowering end-users
  - Increased ownership of the data and autonomy
- Ability to access real-time data
  - Displays that meet business needs
  - Mobile accessibility
  - Device agnostic
  - Improves field decision
  - Reduces operational costs

Operational Intelligence for Electric Generation
Turing Raw Data Into Information

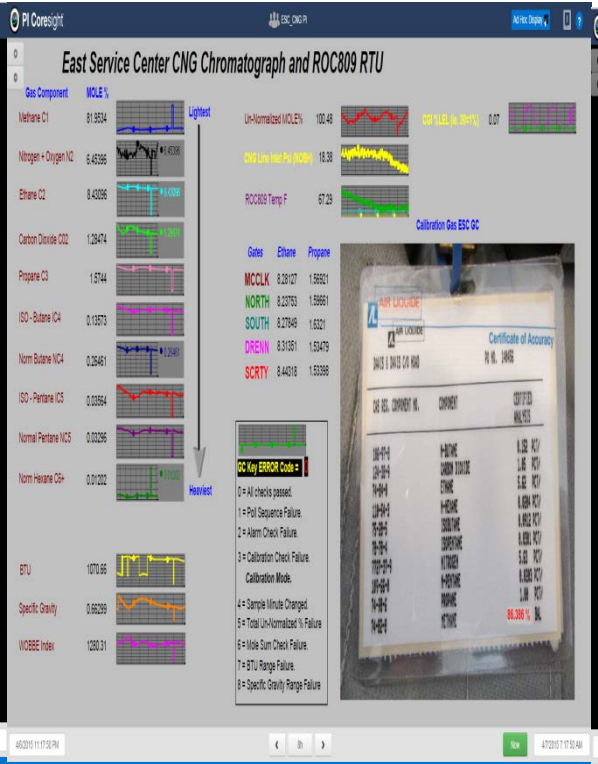


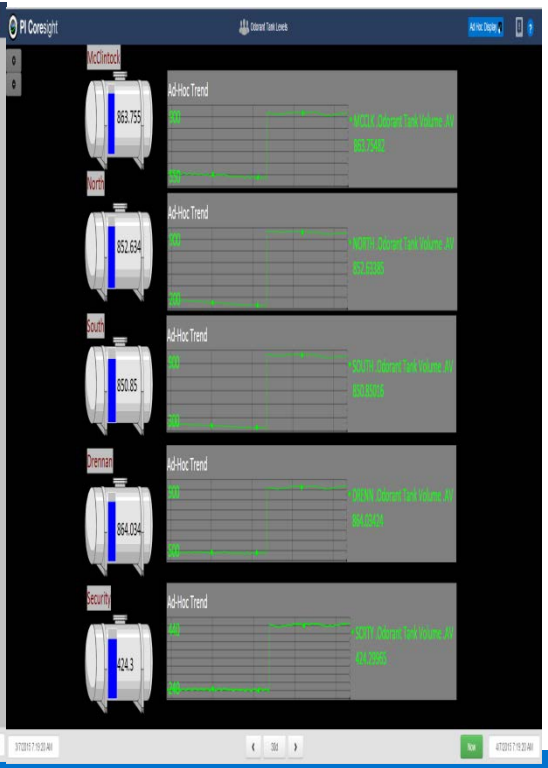


Operational Intelligence for Electric T&D

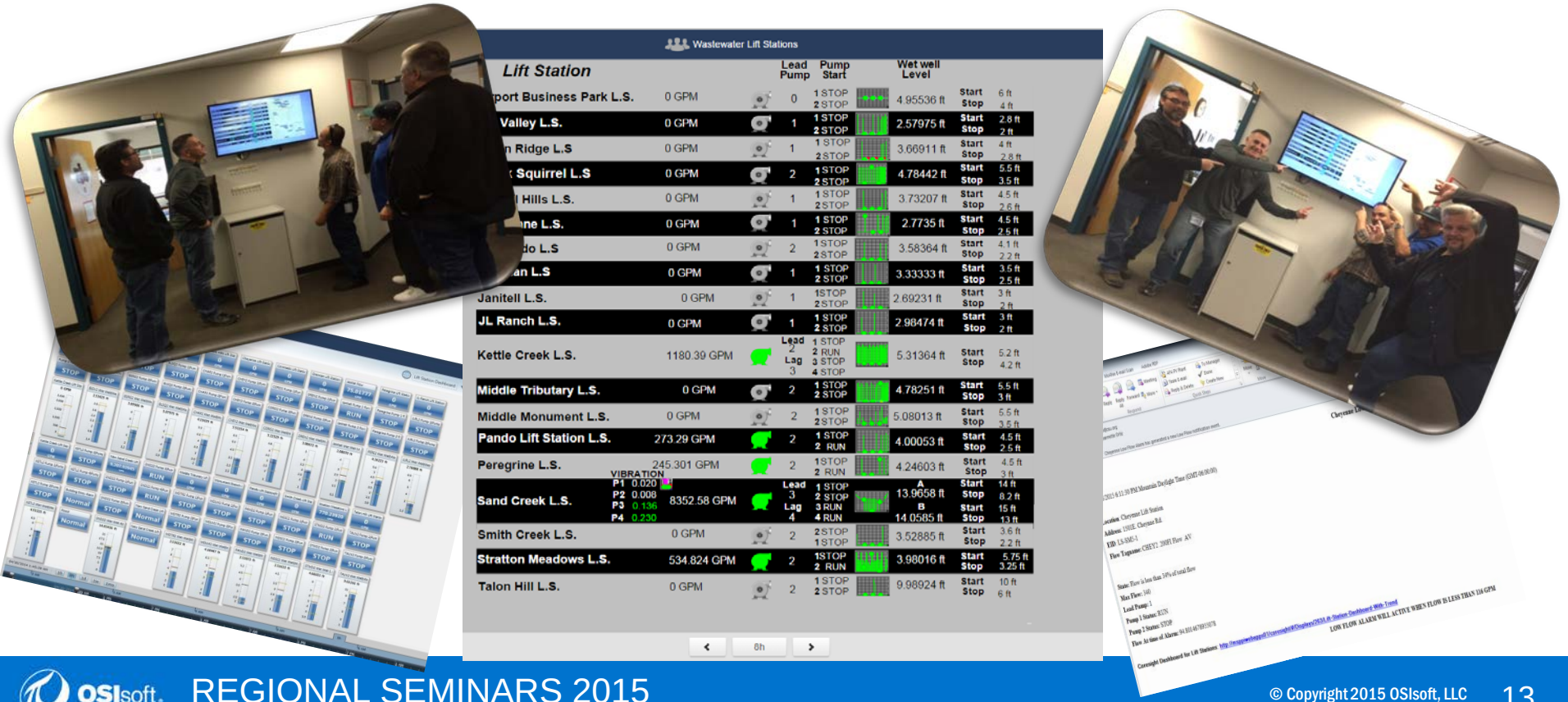


Operational Intelligence for Natural Gas



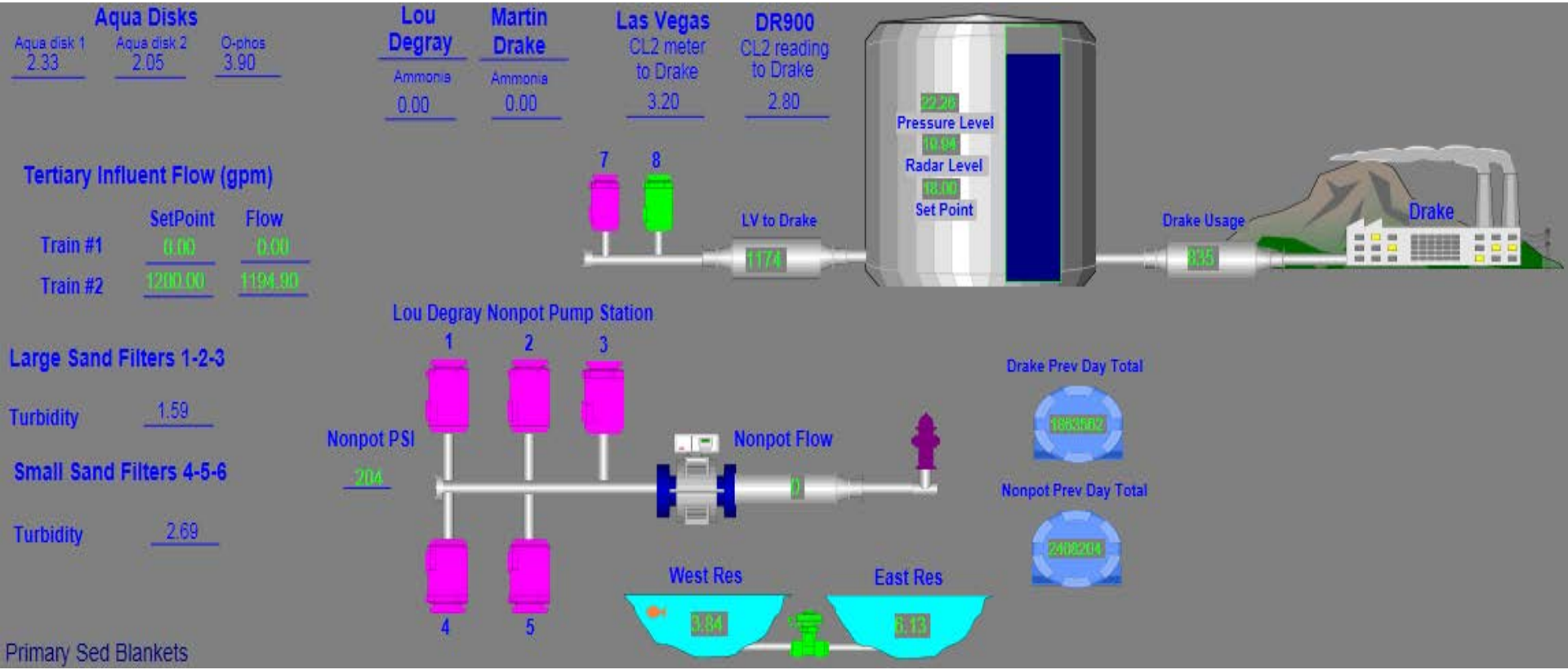


Operational Intelligence for Wastewater Lift Stations
Situational Awareness meets Operations

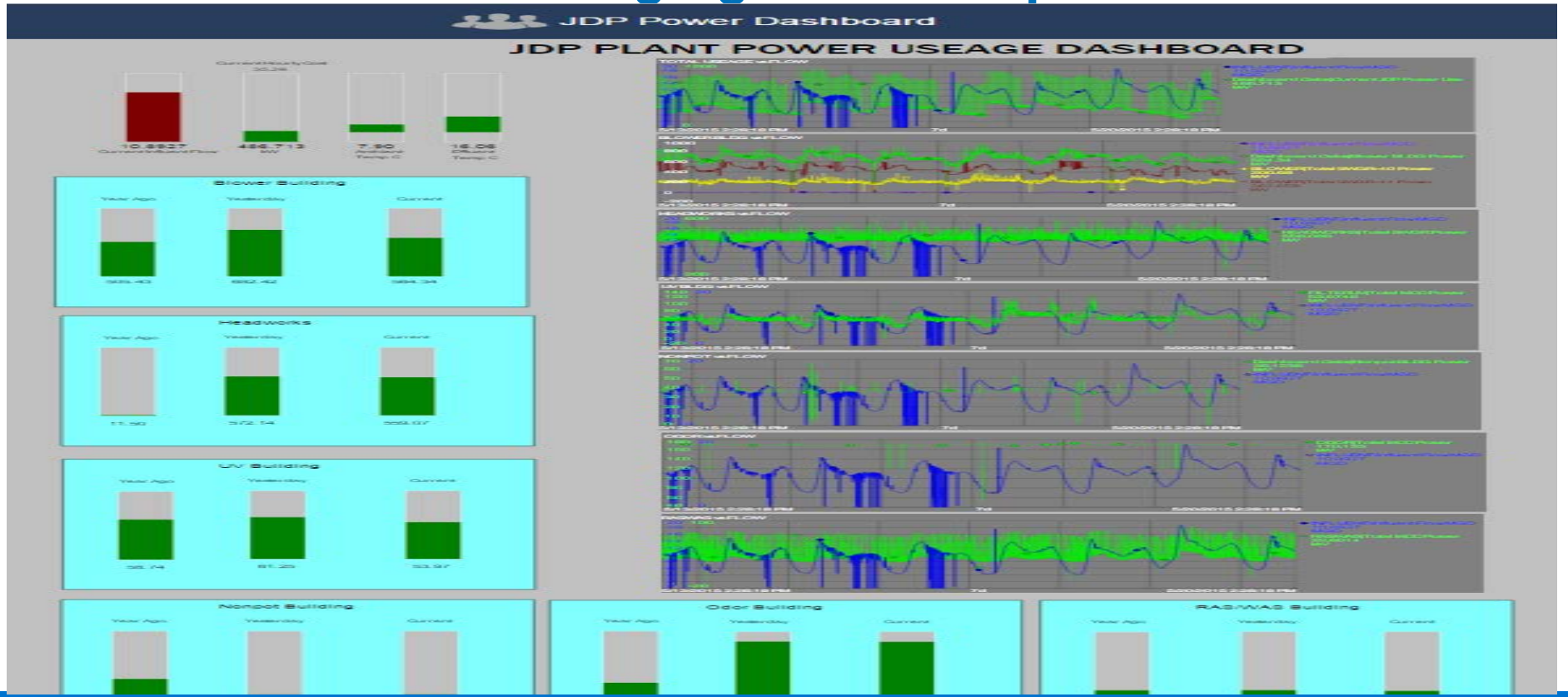


Water & Wastewater Plant Process Monitoring
Turning Data Into Information for Monitoring

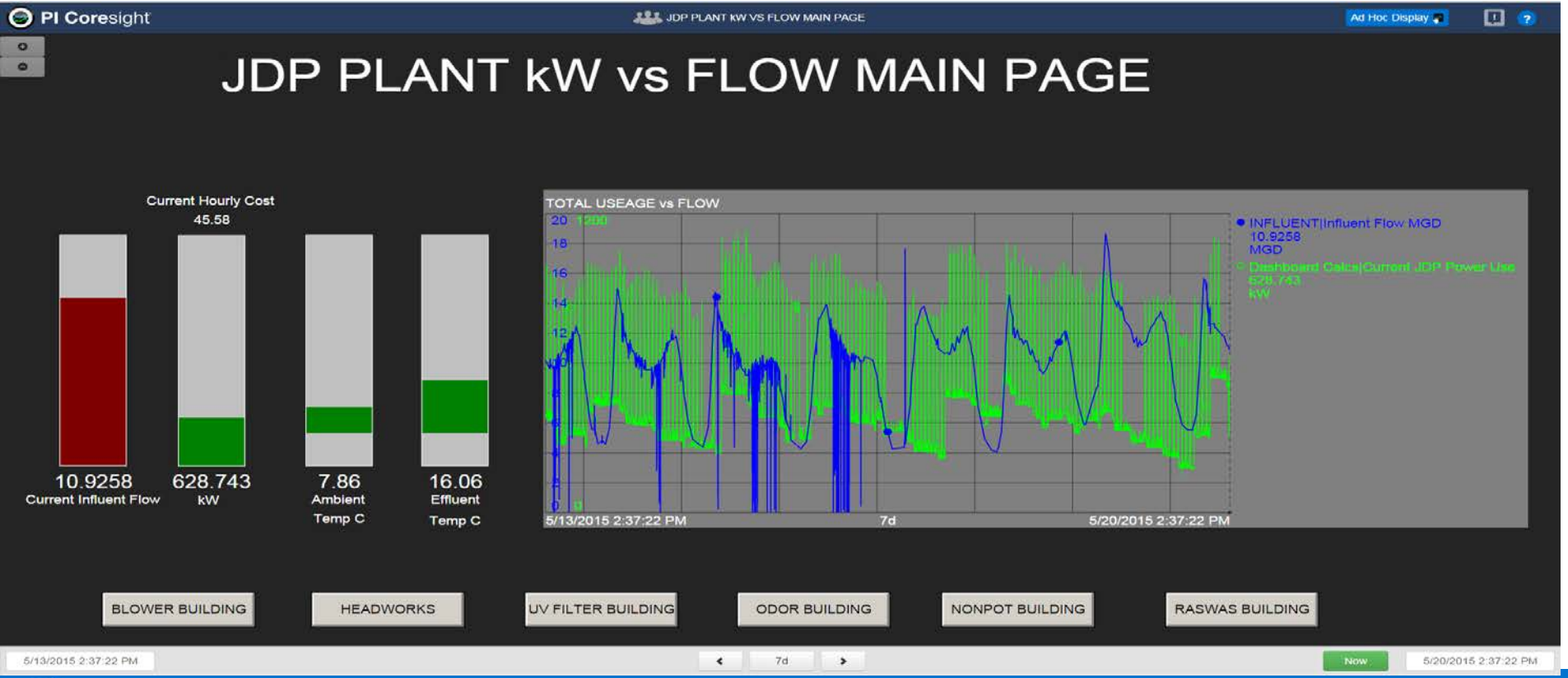
Operational Intelligence for Wastewater Treatment Innovators from our Treatment Plants



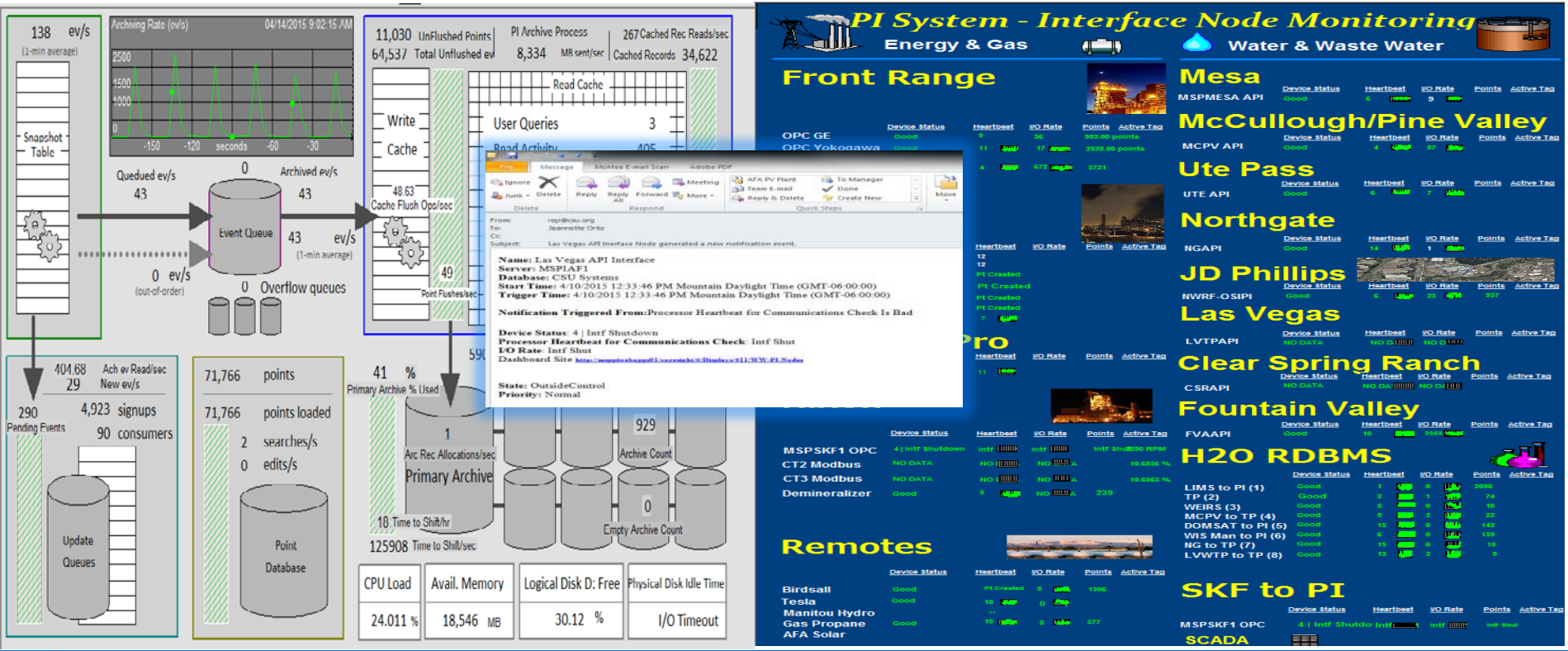
Wastewater Plant Power Usage Monitoring
PI is Changing how we Operate



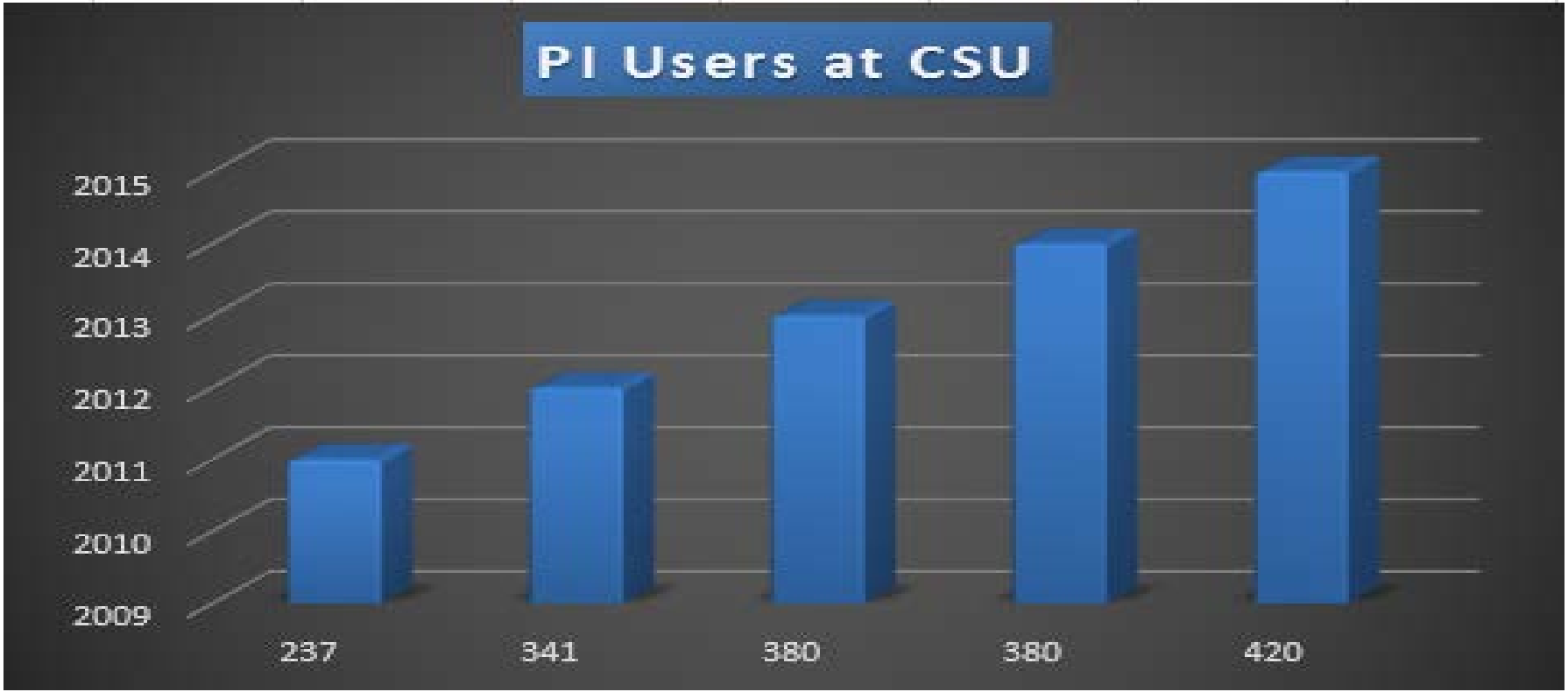
Energy Management & Monitoring



PI to Monitor PI

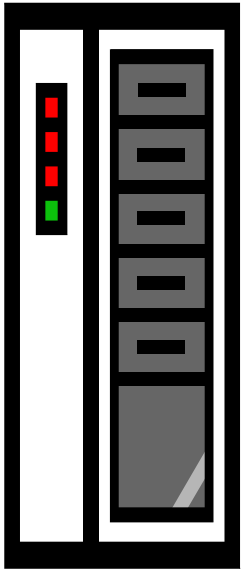


Evolution of PI Users
People with Data has Transformed CSU

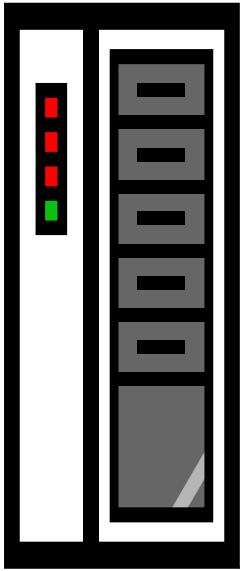


Enterprise PI Infrastructure

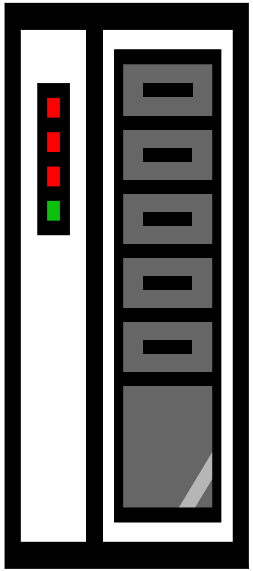
CSU PI Collective



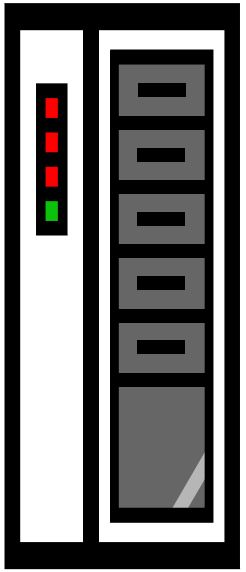
Primary PI Server



Secondary PI Server

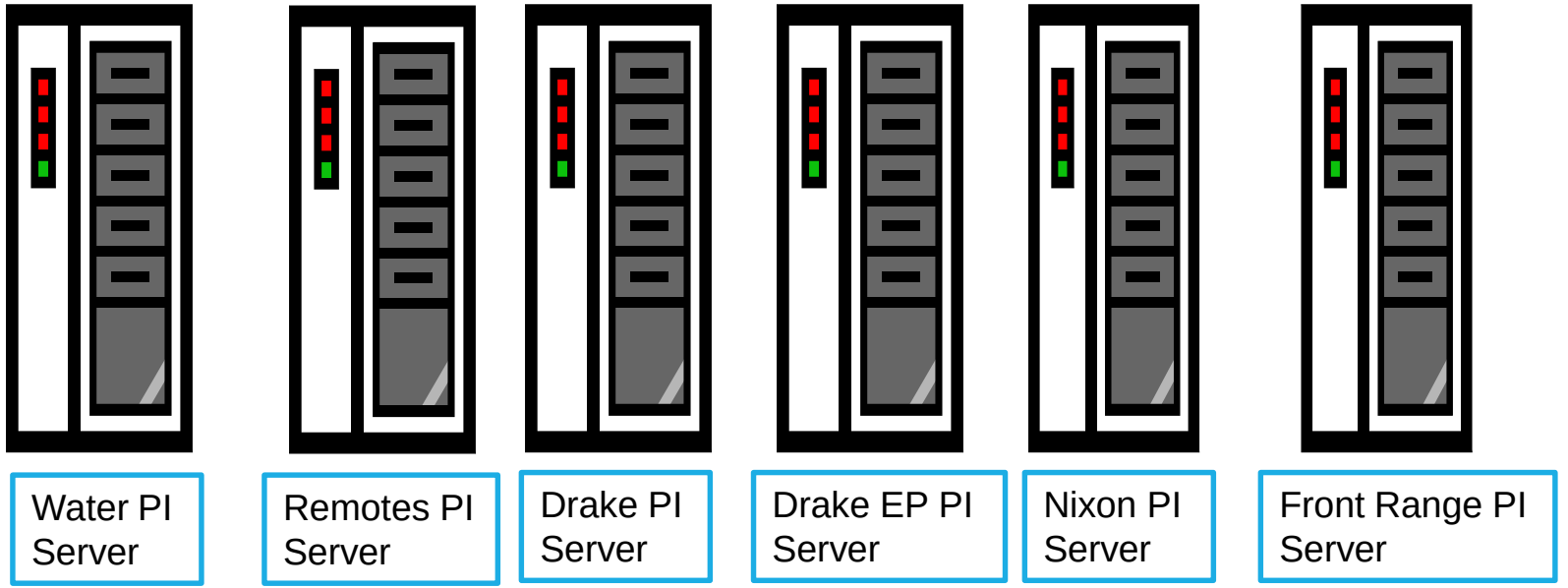


PI Asset Framework
PI Notifications
PI Analyses

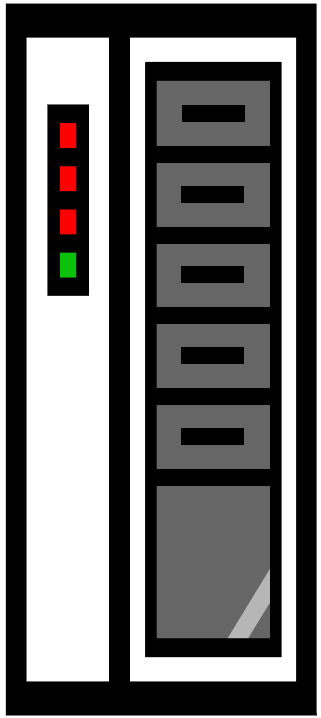


PI WebServer
PI Coresight
PI Manual Logger

Source PI Servers

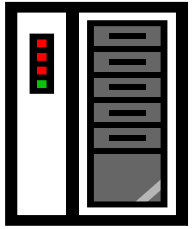


PI to PI

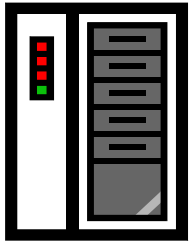


Water PI Server

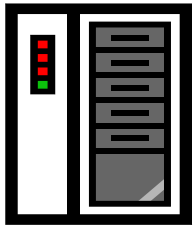
PI Collective



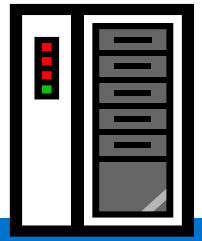
Primary PI



Secondary PI

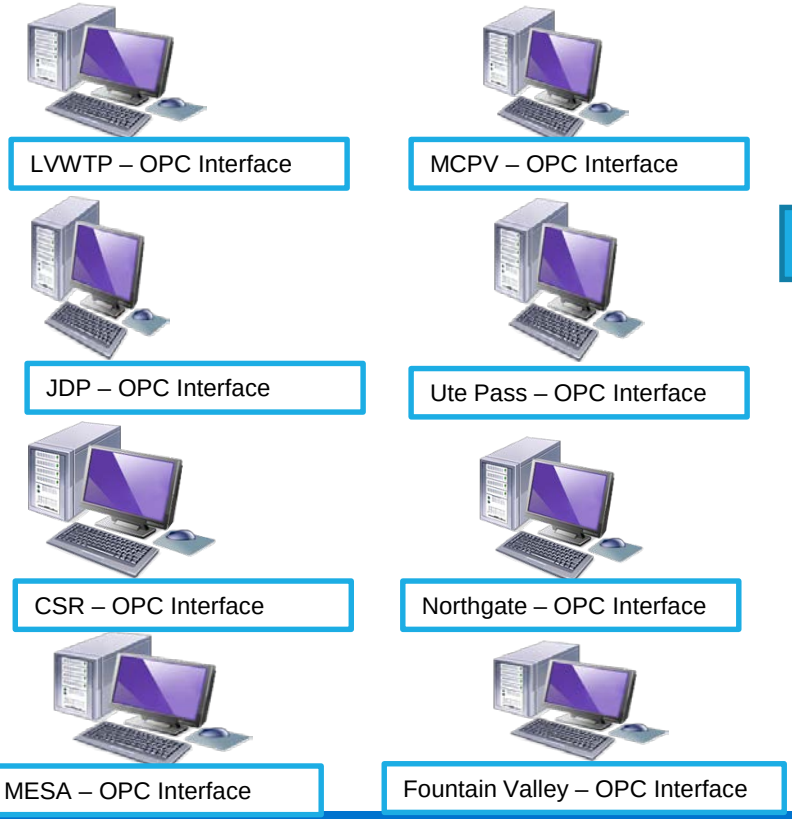


PI AF & PI Notifications

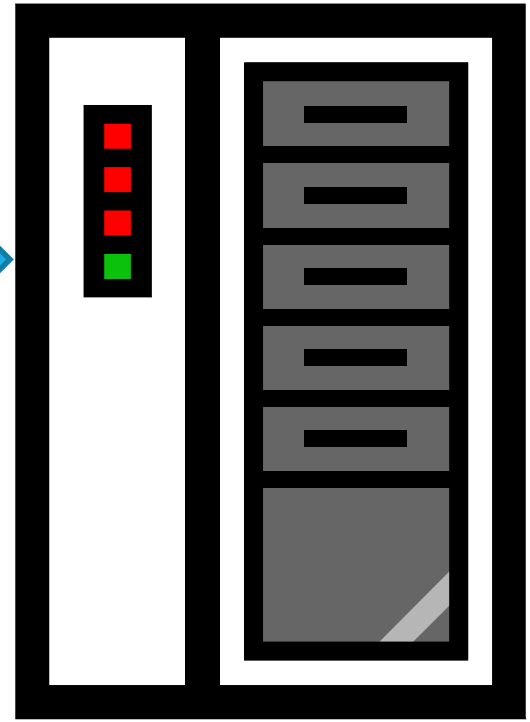


PI Web Server –
PI Coresight

H2O PI Server & 17 Interfaces



RDBMS Interfaces
LIMS
TP
WEIRS
MCPV –TP
DOMSAT
WIS Manual
NG to TP
LVWTP to TP
WSI – Weather



Water PI Server

Data Flow from Water Treatment Plants

PLC's at each Plant

RSLINX

RSVIEW

RSVIEW Data Logging

RW API – RSLINX and PI OPC Interface

Data Flow from SCADA to the Collective

SCADA Interfaces

Electric Backup 1-2

SCADA Interfaces

Electric 1-2

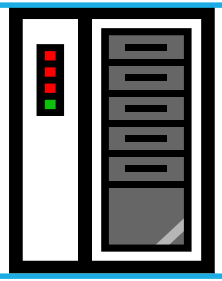
Gas Backup 1-2

Gas 1-2

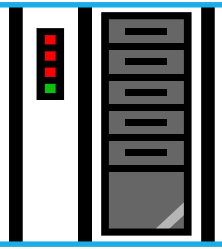
Water Backup1-2

Water 1-2

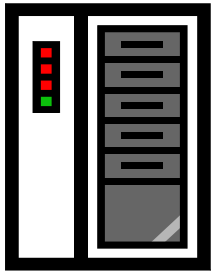
PI Collective



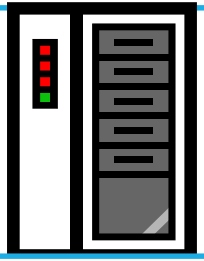
Primary PI Server



Secondary PI Server



PI AF



PI Web Server - PI Coresight

Operational Sustainable Future

Centralized Data Platform

- Interface with multiple enterprise data sources
- Leverage all related enterprise systems
- Access Real-Time data
- Provides Situational Awareness

Capture sensor-based data

- Maximize Real-time Data Intelligence
- Improved decision quality
- End-User Ownership/Empowerment
- Data Sharing across the organization

The Value of the PI system

- Lead to Convergence with IT and OT
- Continue to with the transformation of business process and utilization of KPI's
- Eliminate the need for assistance from other operating areas
- Identify System disruptions
- Improved decision quality
- Disaster Recovery and Event Analysis
- Quick access and visualize data in real-time
- Leveraging data has truly revolutionize our team dynamics and our impact to the organization
- Transformed from a static and reactionary team to a **SOLUTION** based team

Financial Gains Realized

- **Significant O&M Reductions Realized**
  - 29% Reduction in resource allocation for online Instrumentation Inspections
  - 30% Reduction in Vehicle Usage Annually
  - 58% Reduction in Overtime

- **Saving has helped with reallocation of O&M dollars**
  - To expand our Water Quality Instrumentation Program
    - Pre PI System utilization we had only 6 operating WQ systems
    - Compared to 18 operational by end of year 2015

COLLABORATION, TEAMWORK AND INFRASTRUCTURE

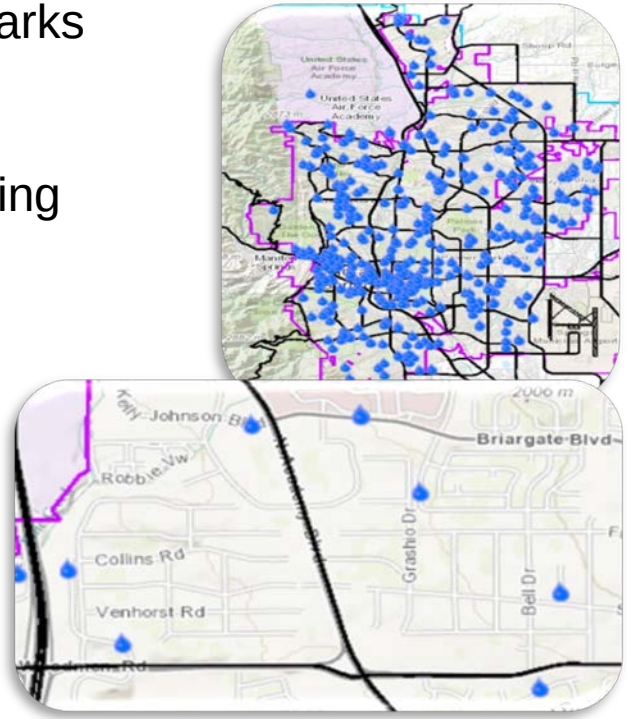
Leveraging PI System Successes

Evolution of Business Efficiencies using Real-Time Data
Appling PI systems successes to other business processes
Leverage the Convergence of IT and OT
    Combine applications into a single application
     Leveraging enterprise business applications
     Establishing strategic plans
     Provide team value and usability

- Ease of access
- Efficient, quick, flexible mobile application
- Continue to Streamline business process with data intelligence

Future Plans

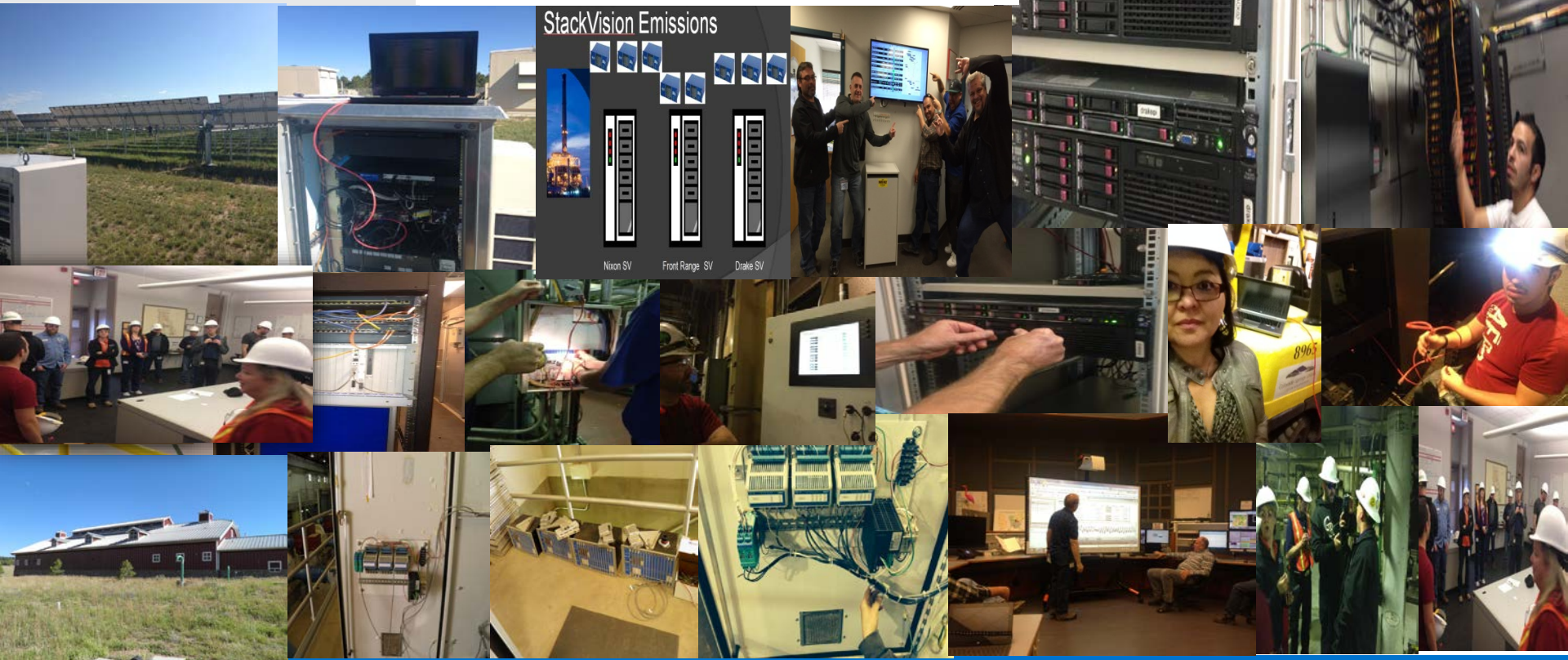
- Leveraging our KPI's and improving our operational efficiencies
  - Continuous Calibration of Baselines and Benchmarks
  - Continue to capture institutional knowledge
- Discontinued Antiquated Reporting Systems
  - Improve Compliance and Process Control Reporting
  - Continued to expand data sharing opportunities
- Integrate with Esri ArcGIS
  - Visualization and spatial analytics
    - Customer service inquires
    - System disruptions
- Integration with Maximo
  - Asset management
  - Expanding PI Notifications



QUESTIONS?

Colorado Springs Utilities

It's how we're all connected



Contact Information

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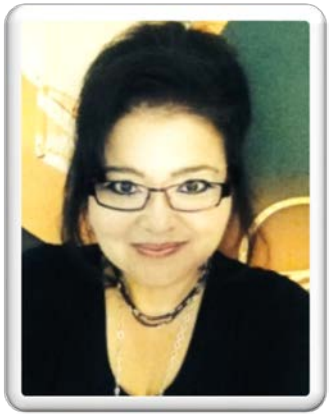

COLLABORATION, TEAMWORK AND INFRASTRUCTURE

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THANK YOU

IT IS A NOT ONLY A PI THANG BUT ALSO A TEAM THANG!