Increasing Operational Efficiency with the PI System at SRP

Presented by **Cory Fisher, EMS Engineer**

Agenda

- About SRP
- The Necessity of Historical Data
- PI System Value, Out-of-the-Box
- Homebrew PI Applications
- Response from Users and Management
- Enterprise Agreement Status
- Lessons Learned
- Future Plans

About Salt River Project

- US Bureau of Reclamation Project, serving Arizona since 1903

- Supply Water and Power to Salt River Valley and large portions of the Phoenix Metropolitan area

- Generation Resources
  - Gas, Coal, Nuclear, Hydro, Solar, Biomass, Wind, and Geothermal

- SRP Facts per end of FY14
  - ~1 million Customers
 - Peak System Load ~6800 MW
  - 300+ Stations and RTU's

SRP PI System Installs
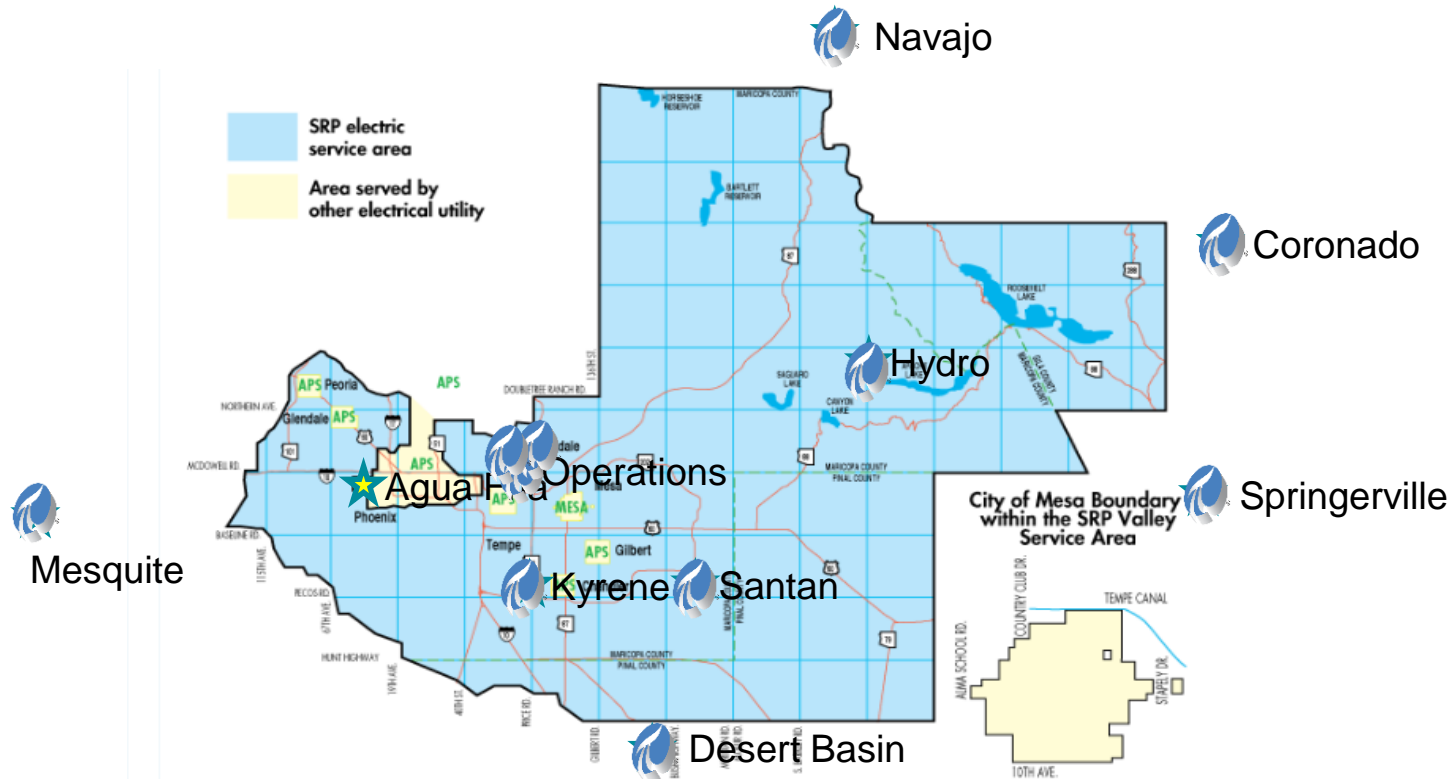
A utility can not thrive with real-time data alone…

- Dispatchers primary tool – the Energy Management System (EMS)
  - Data snapshot
  - Real-time monitoring/alarming
- After implementing the PI System…
  - Preemptive issue identification
  - Time-based alarms
  - Data analytics
  - Simplified data disbursement

Remote Terminal
Units (RTUs)

Energy Management
System (EMS)

PI Server

PI User Tools
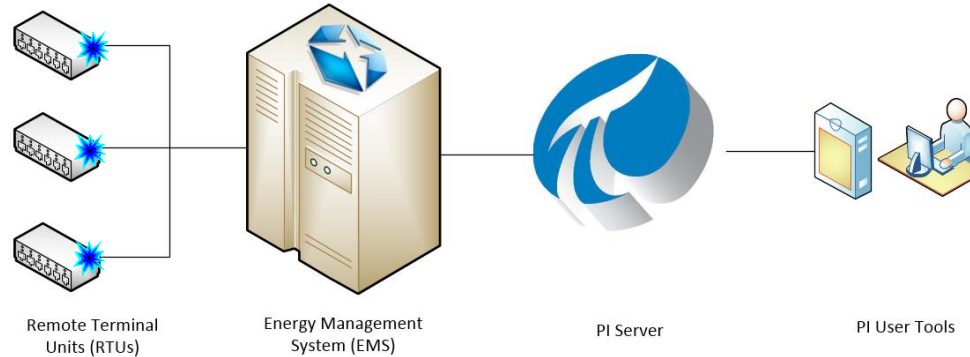
PI System value is realized right out of the box

- PI ProcessBook
- PI DataLink
- PI Asset Framework (AF)
  - Asset Analytics
  - Notifications
  - Event Frames
- PI Coresight
- PI Development Tools (PI SDK)
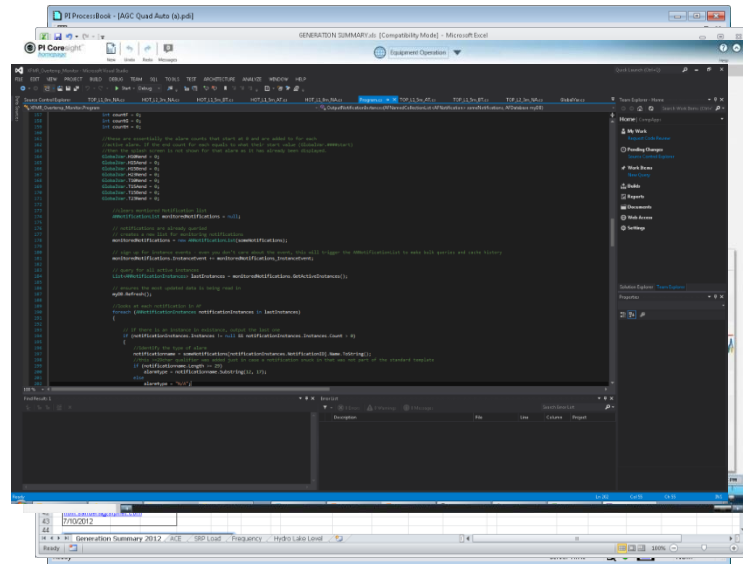
Project 1: Transformer Over-temperature Alarming

- Background
  - Removal of automatic trip on temperature excursions
  - False reads, temporary conditions, ambient conditions

- Problem
  - Operators need notifications of time-based temperature performance (e.g. Oil Temp > 100 degC for 5 minutes)

Solution: PI AF and Notifications

- PI AF Model of all 500kv, 230kv and 115kv transformers, using one Transformer Template

- Only ONE set of PI Notifications rules using Templates

- Easily add, remove, or modify transformer elements

- Process Flow
  - Notification on desktop and/or PI ProcessBook, directing Operator to proper PI ProcessBook Element Relative Display

Transformer Overtemp Desktop App using AF SDK

Transformer Overtemp ProcessBook ERD

*Simulated data

Overtemp application is keeping the lights on

Since implementation…

## 15+ oil temperature reading spikes

=

15+ inadvertent transformer trips avoided

Project 2: Loss Calculator

- Background
  - EMS measuring State Estimated MW values from both sides of transformers and lines
  - Pricing strategies incorporated small sample seasonal MW loss data

- Problem
  - Amount of loss data used in corporate pricing structure is not sufficient nor easily accessible
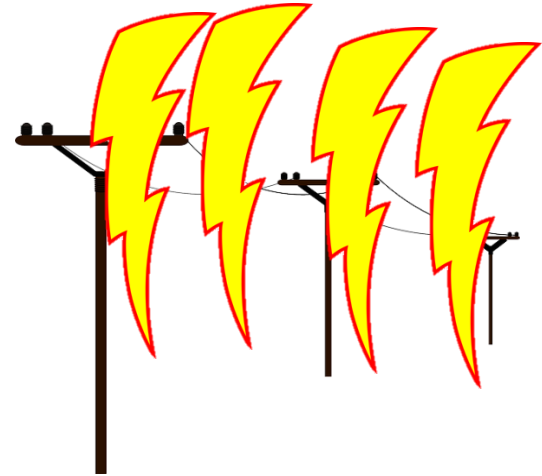
Solution: Send SE data to PI and report with PI DataLink

- Set up AF model for all transformers and lines
- Roll-up losses into voltage categories
- Report on hourly basis
- Allow user to modify date-range query

Hourly Loss Tracker

| | | | | Beginning Date: 3/1/2015 0:00 | | Ending Date: 3/30/2015 8:00 | | Update PI Data / Run Hourly Loss Calculator |

	69 KV Lines (MW)	115 KV Lines (MW)	230 KV Lines (MW)	500 KV Lines (MW)	230 KV Transformers (MW)	500 KV Transformers (MW)	GSU (MW)	TOTAL
Average:	8.43	2.66	8.34	7.94	1.65	0.15	1.22	30.39
Maximum:	16.65	5.68	14.68	16.22	2.95	0.25	3.34	48.64
Total:	5,936.81	1,875.54	5,867.87	5,589.93	1,160.53	102.95	857.77	21,391.41
Time Stamp								
3/1/2015 1:00	5.81	3.82	8.04	4.66	1.32	0.13	1.18	24.97
3/1/2015 2:00	5.46	3.76	7.23	4.75	1.21	0.13	1.32	23.87
3/1/2015 3:00	5.49	3.69	6.54	5.45	1.18	0.14	1.47	23.95
3/1/2015 4:00	5.25	3.74	7.01	5.68	1.16	0.14	1.44	24.42
3/1/2015 5:00	5.18	3.70	7.49	5.45	1.19	0.15	1.34	24.49
3/1/2015 6:00	5.64	3.65	7.90	5.99	1.25	0.15	1.38	25.96
3/1/2015 7:00	5.69	1.82	7.54	4.96	1.26	0.12	0.96	22.35
3/1/2015 8:00	6.14	1.88	7.94	5.50	1.34	0.14	0.84	23.78
3/1/2015 9:00	7.17	1.96	8.69	7.11	1.56	0.15	1.13	27.78
3/1/2015 10:00	7.72	2.03	9.12	7.78	1.70	0.15	1.34	29.84
3/1/2015 11:00	7.51	2.06	9.51	6.81	1.68	0.14	1.44	29.16
3/1/2015 12:00	7.81	2.04	9.29	8.46	1.73	0.15	1.54	31.02
3/1/2015 13:00	7.61	1.97	9.09	8.49	1.68	0.15	1.53	30.52
3/1/2015 14:00	7.66	1.96	9.33	7.49	1.72	0.14	1.53	29.84
3/1/2015 15:00	7.24	1.97	9.24	7.16	1.63	0.14	1.38	28.74
3/1/2015 16:00	7.44	1.97	8.96	7.71	1.64	0.14	1.39	29.26
3/1/2015 17:00	7.57	2.01	9.44	7.92	1.72	0.15	1.51	30.31
3/1/2015 18:00	8.27	1.89	9.78	7.54	1.89	0.15	1.54	31.06
3/1/2015 19:00	10.23	2.00	12.79	8.15	2.30	0.17	1.59	37.23
3/1/2015 20:00	10.07	2.10	14.06	7.98	2.19	0.17	1.66	38.23
3/1/2015 21:00	9.62	1.94	12.63	8.09	2.11	0.16	1.61	36.16
3/1/2015 22:00	8.54	2.11	10.82	7.87	1.88	0.15	1.62	32.98
3/1/2015 23:00	6.58	2.04	8.38	7.96	1.51	0.14	1.52	28.12
3/2/2015 0:00	5.95	2.09	7.88	5.42	1.30	0.12	1.11	23.87
3/2/2015 1:00	5.38	2.20	7.14	4.47	1.16	0.11	0.86	21.32
3/2/2015 2:00	5.44	2.26	7.01	3.95	1.12	0.10	0.85	20.73
3/2/2015 3:00	4.93	2.37	6.62	3.75	1.06	0.10	0.64	19.48
3/2/2015 4:00	5.16	2.27	6.76	3.99	1.10	0.10	0.65	20.02
3/2/2015 5:00	5.41	2.30	7.07	4.06	1.17	0.10	0.73	20.83
3/2/2015 6:00	6.96	2.19	8.28	6.19	1.53	0.12	1.34	26.61
3/2/2015 7:00	8.25	2.15	9.01	7.70	1.89	0.14	1.54	30.67
3/2/2015 8:00	8.11	2.04	7.88	7.79	1.68	0.15	1.51	29.15

OSIsoft.

Loss Calc is keeping money in the bank

- Reduced data collection labor hours by >99%
- Higher frequency of data allows for more efficient rate structures

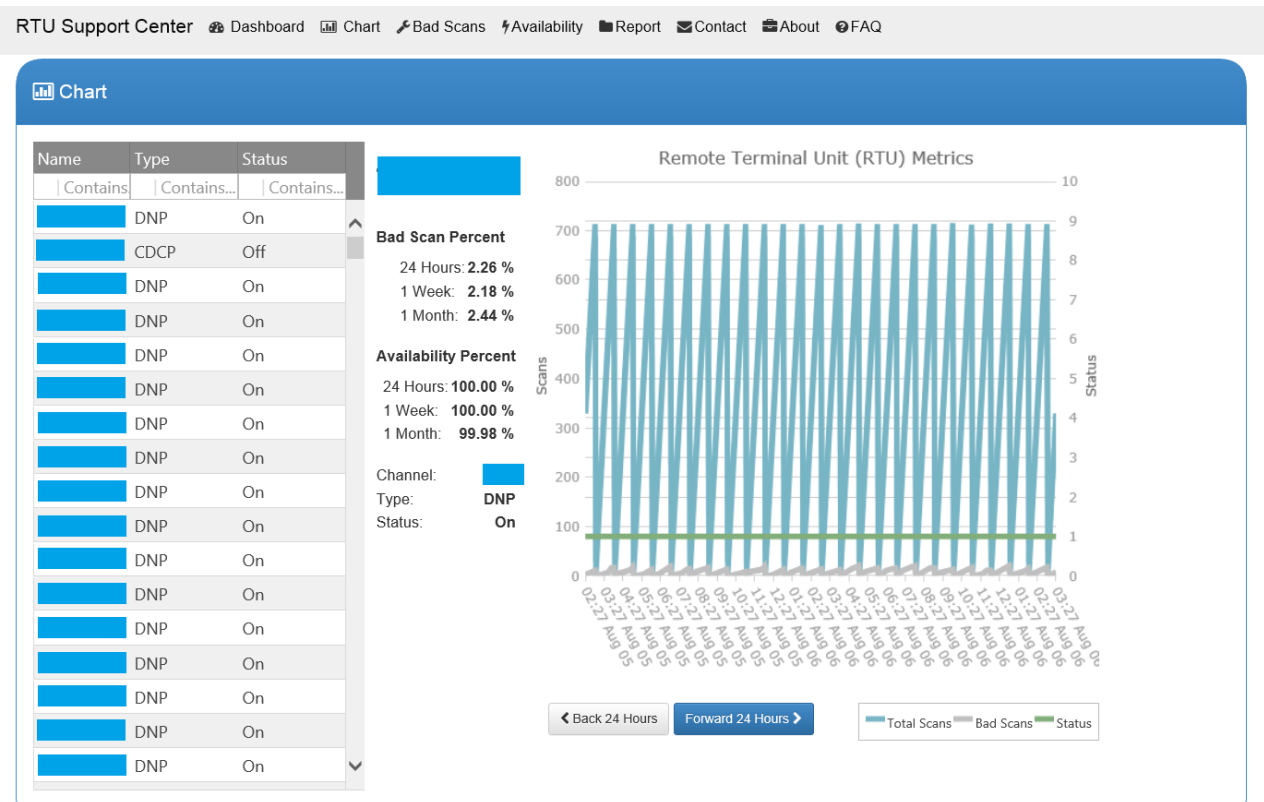- Side benefit: Easy to spot underperforming equipment

Project 3: RTU Metrics

- Background
  - EMS (Energy Management System) receiving scan information from RTUs (Remote Terminal Units) in the field
  - RTUs in failed state for extended periods of time before corrective action is taken

- Problem
  - No visibility of poor RTU health until bad data is seen

Solution: Use time-based analytics to monitor RTU health

- Set up AF model for RTUs
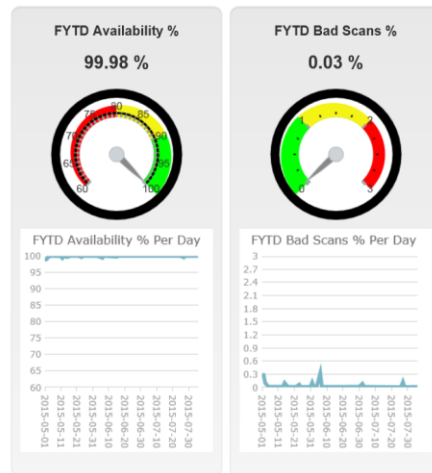- Implement PI Notifications for failures
- Push performance data to web interface

Bonus visibility for supervisors

- Track individual RTU performance as well as overall availability

RTU Metrics is ensuring a reliable system

- Increased technician response time for failing RTUs

- Improved troubleshooting capabilities

- Supervisors have enhanced
  visibility of performance

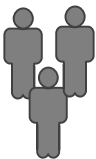# More and more positive feedback everyday

"Current **investment is undervalued**."

T&D

"PI provides reliable results, and even complex algorithms have been designed to deliver with great certainty. PI is instrumental in the situational awareness and control exhibited today.

Planning

"**The enterprise should expand PI**, with an intelligent design for better integration across functions and single source of common operations/engineering/asset data across SRP. "

"I could see so many benefits to a PI EA, including **greater and simplified data cleansing and location-to-location consistency**, reduced number of tools or applications sitting atop the architecture, and assets organized in hierarchical framework."
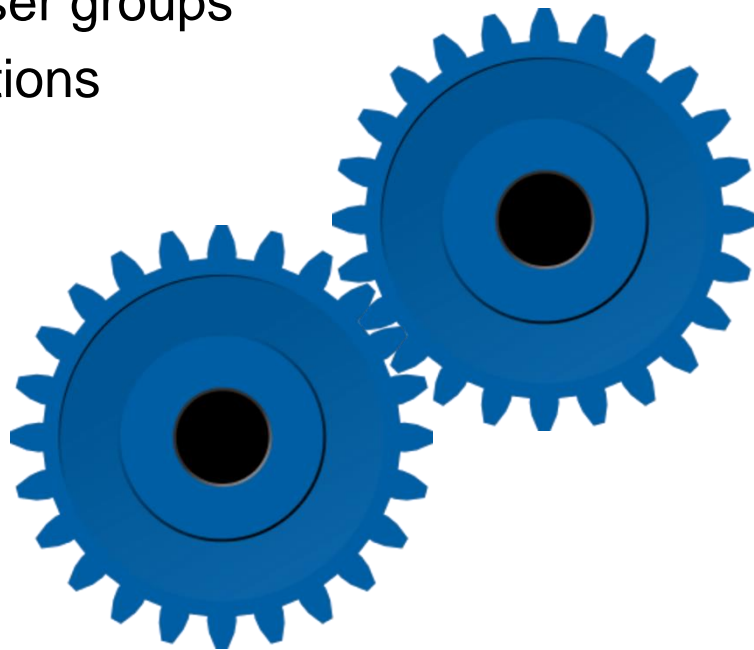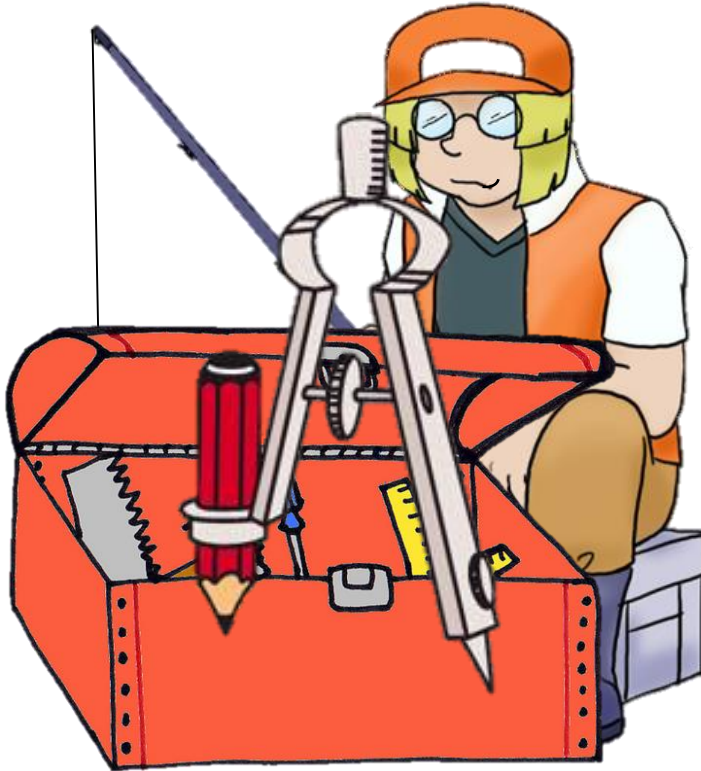
Information Systems

Enterprise Agreement: Coming soon to a utility near you!

- Favorable preliminary response from general managers
- Interviews conducted with potential user groups
- Building justification / budget expectations
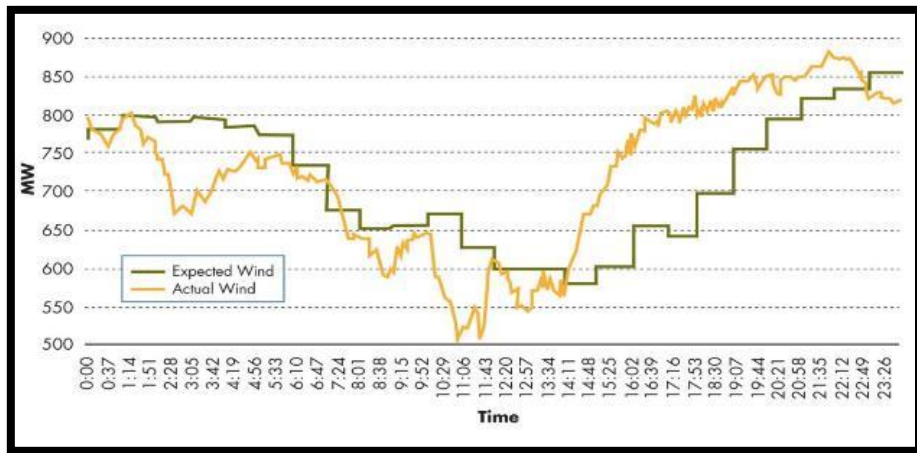- Goal of next fiscal year

Lessons Learned

- Planning, planning, planning
- Know your tools!
- Teach a man to fish
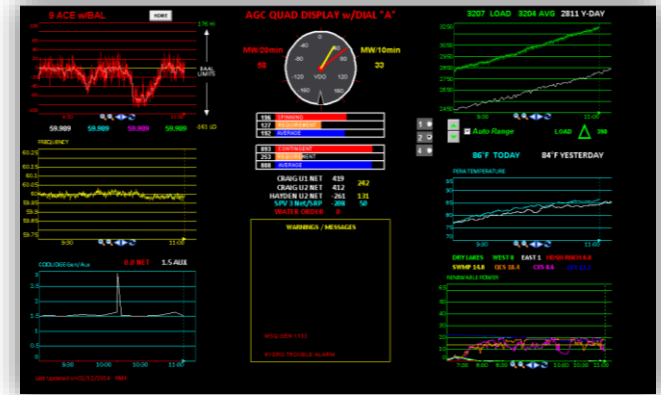
The future is bright (and full of data)!

- 40+ PI-related projects on the horizon
- PI System of Operator Training Simulator
- PI Server 2015 Install
- Future Data implementation

Summary

"Giving access to and training other groups on how to use PI would allow our resources to focus on the business, rather than answer data requests."

-Operations Supervisor

BUSINESS CHALLENGES	SOLUTION	RESULTS AND BENEFITS
A. Need more **advanced monitoring and troubleshooting tools** B. New complex rate structures require **more comprehensive data** C. **Improve performance and lifespan** of electrical equipment	A. Implement the PI System at various sites throughout the company B. Train users to be self-sufficient C. Take advantage of PI development tools (PI SDK / AF SDK)	• **Saving labor hours** and equipment replacement costs • **Preventing outages** due to erroneous data • Advanced pricing structures **saving money** for SRP and its customers

Contact Information

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Salt River Project

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