



# Increasing Operational Efficiency with the PI System at SRP

Presented by Cory Fisher





# Agenda

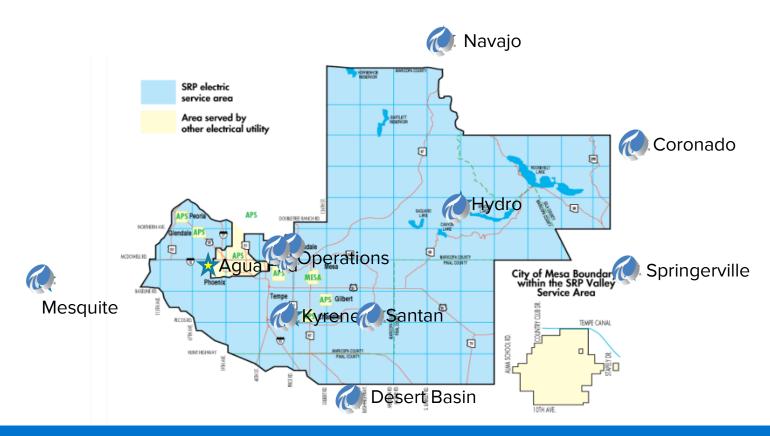
- About SRP
- The Necessity of Historical Data
- PI System Value, Out-of-the-Box
- Homebrew PI System Applications
- Response from Users and Management
- Enterprise Agreement Status
- Lessons Learned
- Future Plans

# **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

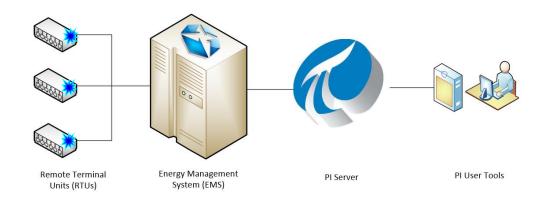


# SRP PI Server Installs



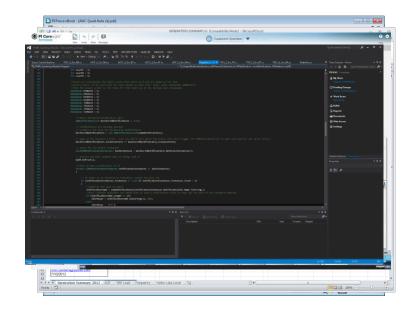
# A Utility Can Not Thrive with Real-time Data Alone...

- 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



# Pl System Value is Realized Right Out-of-the-Box

- PI ProcessBook
- Pl DataLink
- PI Asset Framework (AF)
  - Asset Analytics
  - Notifications
  - Event Frames
- Pl 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 timebased temperature performance (e.g. Oil Temp > 100 degC for 5 minutes)



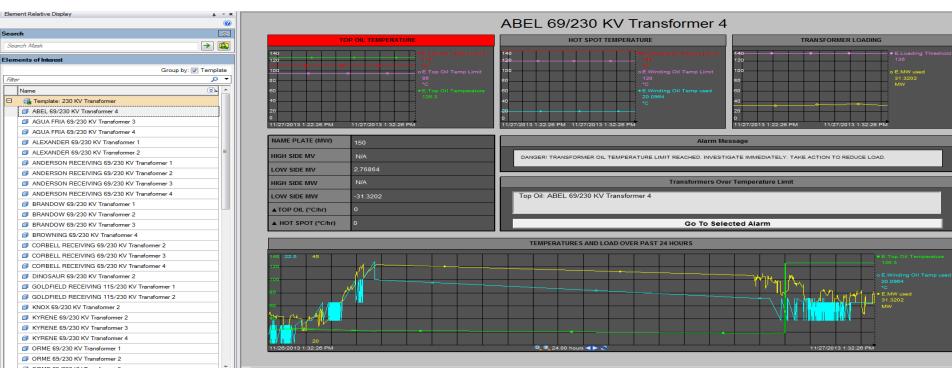
# Solution: Asset Framework and Notifications

- Asset Framework model of all 500kv, 230kv and 115kv transformers, using one Transformer Template
- Only ONE set of PI System 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 PI ProcessBook ERD



\*Simulated data

# Overtemp Application is Keeping the Lights on

Since implementation...

15+ oil temperature reading spikes

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15+ inadvertent transformer trips avoided

Est. savings per trip avoided: \$10,000-\$20,000

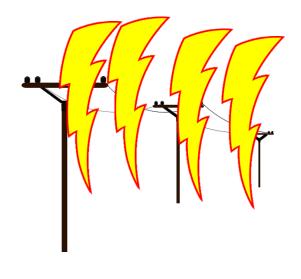
# Project 2: Loss Calculator

#### 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 the PI System 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

y Lc	oss Tracker						Uį	date PI Data	
		Beginning Date:	3/1/2015 0:00		Ending Date:	3/30/2015 8:00	Run Ho	ırly Loss Cal culato	or
Average:		8.43	2.66	8.34	7.94	1.65	0.	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		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
	3/1/2015 1:00	5.81	3.82	8.04	4.66	1.32	0.3	13 1.18	24.97
	3/1/2015 2:00		3.76	7.23	4.75	1.21	0.1	1.32	23.87
	3/1/2015 3:00			6.54	5.45		0.1		
	3/1/2015 4:00		3.74	7.01	5.68	1.16	0.0	1.44	24.42
	3/1/2015 5:00	5.18	3.70	7.49	5.45	1.19	0.1	1.34	24.49
	3/1/2015 6:00	5.64	3.65	7.90	5.99	1.25	0.1	1.38	25.96
	3/1/2015 7:00	5.69	1.82	7.54	4.96	1.26	0.1	12 0.96	22.35
	3/1/2015 8:00	6.14	1.88	7.94	5.50	1.34	0.1	14 0.84	23.78
	3/1/2015 9:00	7.17	1.96	8.69	7.11	1.56	0.1	1.13	27.78
	3/1/2015 10:00	7.72	2.03	9.12	7.78	1.70	0.1	1.34	29.84
	3/1/2015 11:00	7.51	2.06	9.51	6.81	1.68	0.	1.44	29.16
	3/1/2015 12:00	7.81	2.04	9.29	8.46	1.73	0.0	1.54	31.02
	3/1/2015 13:00	7.61	1.97	9.09	8.49	1.68	0.	1.53	30.52
	3/1/2015 14:00	7.66	1.96	9.33	7.49	1.72	0.0	1.53	29.84
	3/1/2015 15:00	7.24	1.97	9.24	7.16	1.63	0.0	1.38	28.74
	3/1/2015 16:00	7.44	1.97	8.96	7.71	1.64	0.1	1.39	29.26
	3/1/2015 17:00	7.57	2.01	9.44	7.92	1.72	0.0	1.51	30.31
	3/1/2015 18:00	8.27	1.89	9.78	7.54	1.89	0.0	1.54	31.06
	3/1/2015 19:00	10.23	2.00	12.79	8.15	2.30	0.0	1.59	37.23
	3/1/2015 20:00	10.07	2.10	14.06	7.98	2.19	0.0	1.66	38.23
	3/1/2015 21:00	9.62	1.94	12.63	8.09	2.11	0.	1.61	36.16
	3/1/2015 22:00	8.54	2.11	10.82	7.87	1.88	0.0	1.62	32.98
	3/1/2015 23:00	6.58	2.04	8.38	7.96	1.51	0.1	1.52	28.12
	3/2/2015 0:00	5.95	2.09	7.88	5.42	1.30	0.	1.11	23.87
	3/2/2015 1:00	5.38	2.20	7.14	4.47	1.16	0.1	11 0.86	21.32
	3/2/2015 2:00			7.01	3.95		0.	10 0.85	
	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			6.76	3.99	1.10	0.	10 0.65	
	3/2/2015 5:00	5.41	2.30	7.07	4.06	1.17	0.	10 0.73	
	3/2/2015 6:00			8.28	6.19	1.53	0.0	L2 1.34	
	3/2/2015 7:00		2.15	9.01	7.70		0.	1.54	30.67
	3/2/2015 8:00	8.11	2.04	7.88	7.79	1.68	0.1	1.51	29.15

# 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

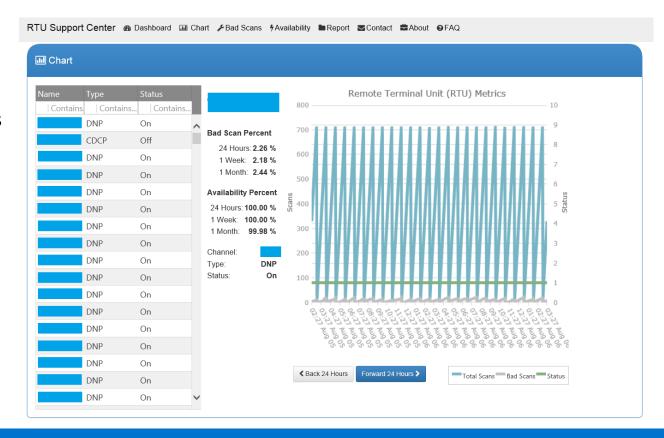
#### Problem

 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
- Implementing
  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."



"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.



"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



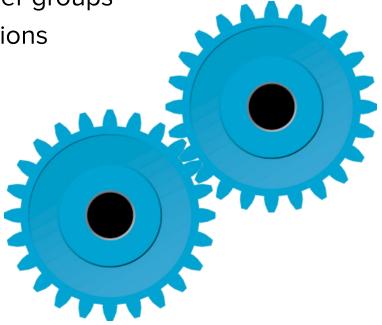
# Enterprise Agreement: Coming Soon to a Utility Near You!

Favorable preliminary response from general managers

Interviews conducted with potential user groups

Building justification / budget expectations

Goal of next fiscal year



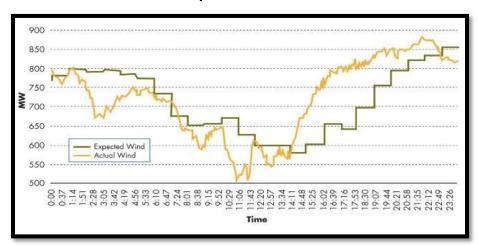
# Lessons Learned

- Planning, planning
- Know your tools!
- Teach a man to fish



# The Future is Bright (and Full of Data)!

- 40+ PI System 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 the PI System would allow our resources to focus on the business, rather than answer data requests."

-Operations Supervisor



#### **BUSINESS CHALLENGES**

- 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

#### **SOLUTION**

- A. Implement the PI System at various sites throughout the company
- B. Train users to be self-sufficient
- C. Take advantage of PI System development tools (PI SDK / AF SDK)

#### **RESULTS AND BENEFITS**

- 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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**EMS** Engineer

Salt River Project



# Questions

Please wait for the microphone before asking your questions



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감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado