
AVEVAWORLD

PGE: Empowering Operational Excellence

Our Journey with the AVEVA PI System

Jagdish Konathala – Principal System Integration Specialist

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PGE at a glance

Leading the way to a clean energy future for Oregon

Portland General Electric is a publicly traded Fortune 1000 company and fully integrated energy utility based in Portland, Oregon. PGE serves nearly 950,000 customers with a service area population of 1.9 million Oregonians in 51 cities. The Company was founded in 1888 and has more than 2,900 employees across the state.

We are committed to building a clean energy future for Oregon and setting an example for the world of what's possible when customers, stakeholders, and the Company align behind a common clean energy purpose.

Business description

- Nearly 950,000 retail customers within a service area of 1.9 million residents
- Roughly half of Oregon's population lives within the PGE service area, encompassing 51 incorporated cities entirely within the State of Oregon
- More than two-thirds of Oregon's commercial and industrial activity occurs in the PGE service area
- 16 generating plants, 14 of which are in Oregon
- More than 30,000 circuit miles of transmission and distribution lines(1)

3,300+ MWs of generation

Wind Turbine Power Curve Analysis

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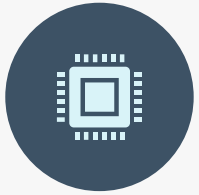
Power Curve Performance Monitoring

Wind turbine performance is measured against design power curve

Power output vs. wind speed relationship is critical



PI System enables real-time performance monitoring

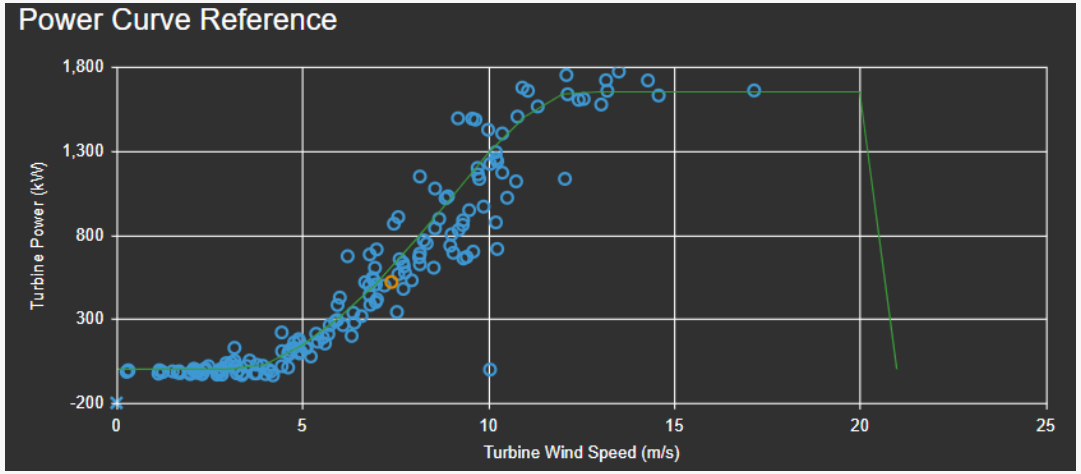
Deviations from expected curve indicate potential issues

Early detection prevents significant revenue loss

Performance Comparison

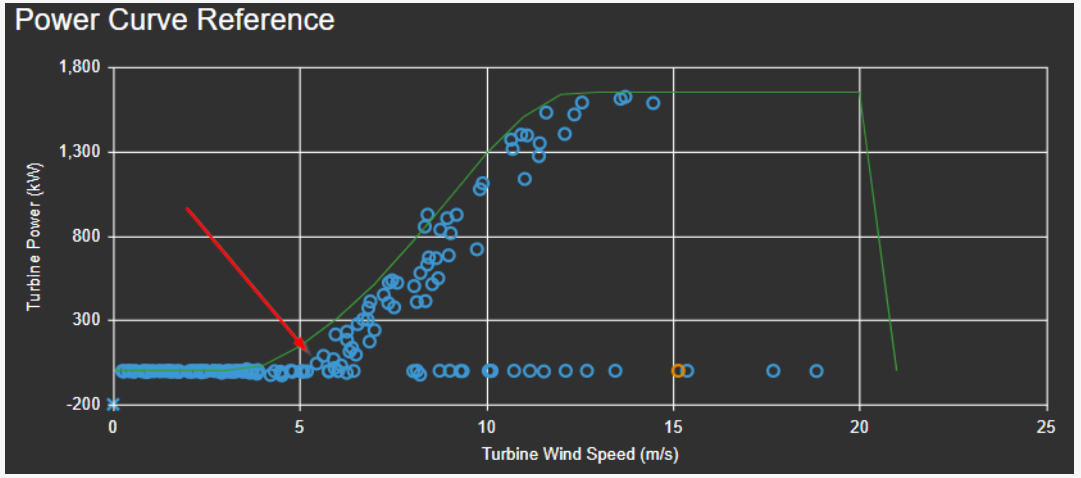
Normal Performance

- Turbine power output follows design curve
- Consistent energy production
- Expected revenue generation
- Optimal operation



Anomalous Performance

- Four turbines underperforming
- Deviation detected after overhaul
- Power output below design curve
- Immediate investigation triggered



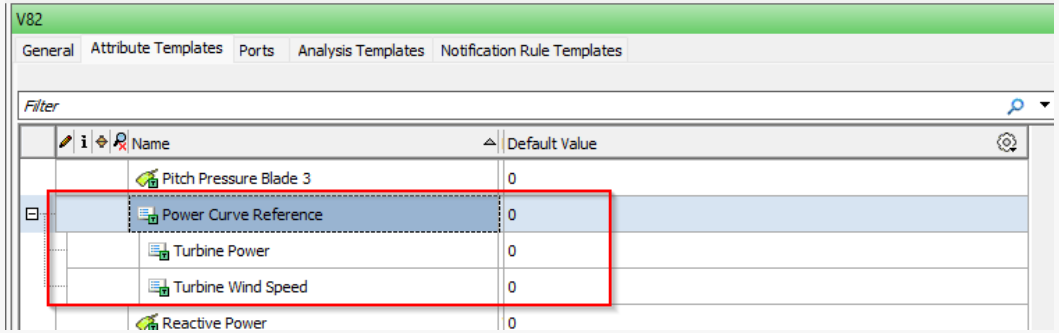
PI System Implementation

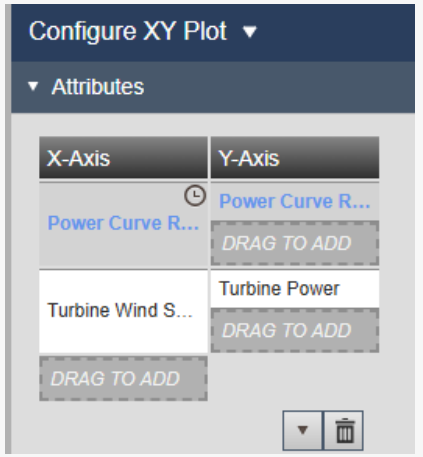
Data Visualization

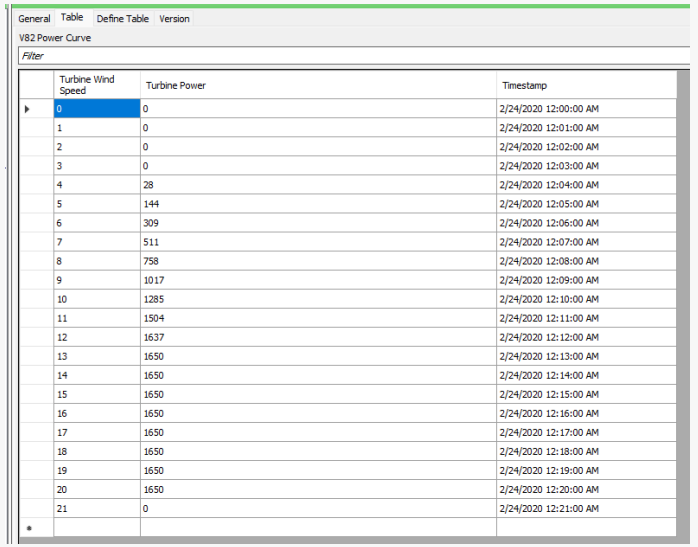
- XY Plot in PI Vision
- Real-time performance tracking
- Historical trend analysis
- Intuitive visual comparison

Advanced Configuration

- Design curve integration
- Tables and Attribute Templates
- Automated deviation alerts
- Performance threshold monitoring







Business Impact

$$Avoided\ Cost\ Value = (4\ turbines)\left(732\frac{Lost\ MWH}{turbine}\right)(\$50/MWH) = \$146{,}400$$

- 732 MWh/year loss per underperforming turbine
- $146,400 annual revenue for 4 turbines
- Early detection enables prompt maintenance
- Prevents cascading performance issues
- Optimizes maintenance scheduling and resource allocation

Transformer Monitoring

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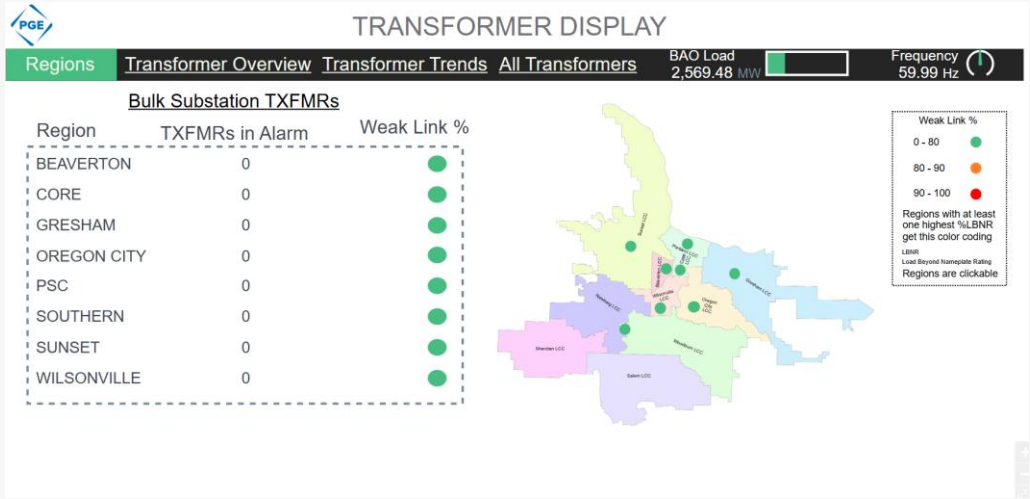
Transformer Display

Key Features

- Real-time regional overload monitoring
- Seasonal weak link value automation
- Historical heat event analysis
- Oil temperature anomaly detection

System Components

- Regional dashboard with visual indicators
- Transformer-specific trend analysis
- Fleet-wide sorting and comparison
- Weak Link % monitoring

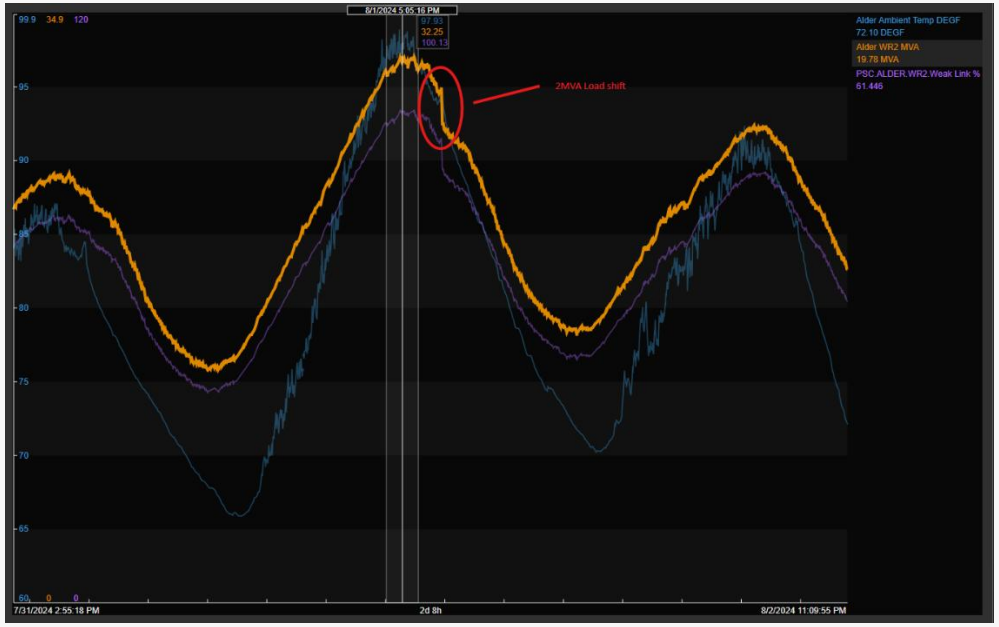


Region	Substation	Asset	Weak Link % ▼	Oil Temp	View Trends	One-Line
PSC	HARRISON	WR1	91.02	84.00		
PSC	ALDER	WR1	84.23	85.00		
SOUTHERN	LIBERTY	WR2	83.75	72.01		
OREGON CITY	LELAND	BR1	81.79	64.00		
SOUTHERN	INDIAN	WR1	80.60	72.38		
WILSONVILLE	BOONES FERRY	WR2	80.53	64.16		
SUNSET	HILLSBORO	BR2	80.06	54.79		
BEAVERTON	OAK HILLS	WR2	79.85	68.62		
SOUTHERN	NEWBERG	WR1	78.91	71.17		
WILSONVILLE	OSWEGO	WR3	78.24	58.39		
BEAVERTON	HUBER	WR2	78.08	0.06		
BEAVERTON	MURRAYHILL	WR1	78.00	64.48		

Alder Transformer Case Study

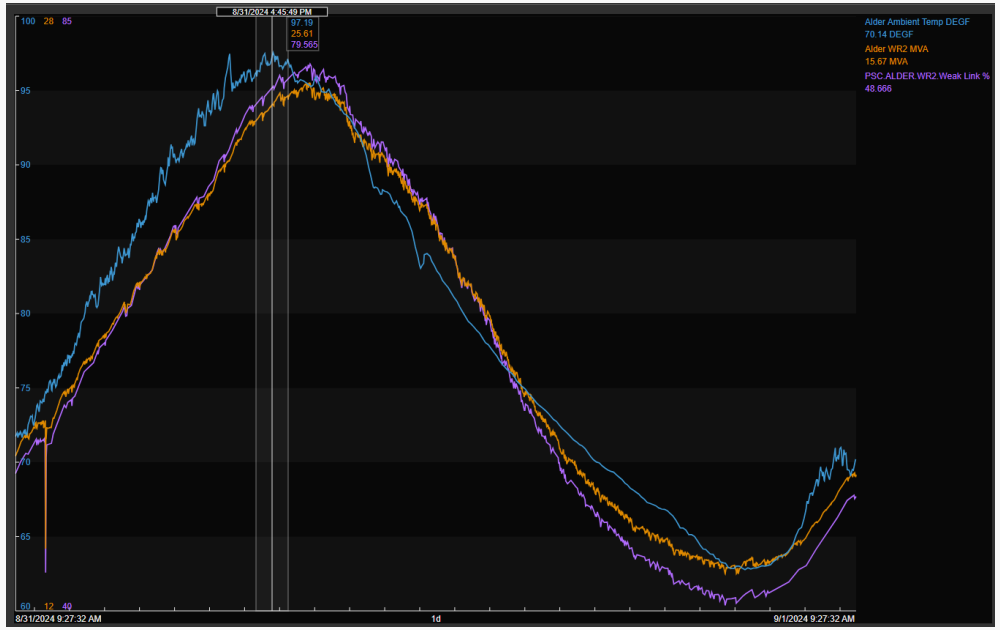
Challenge & Response

- Alder WR1 offline during heat wave
- Alder WR2 reached 100% weak link
- 2MW proactively shifted to Glencoe WR1
- Early intervention based on PI data



Results & Impact

- Second heat event: load at 79.5% weak link
- Prevented potential transformer failure
- Optimized field crew dispatching
- Enhanced grid resilience



Merchant Real Time Operations

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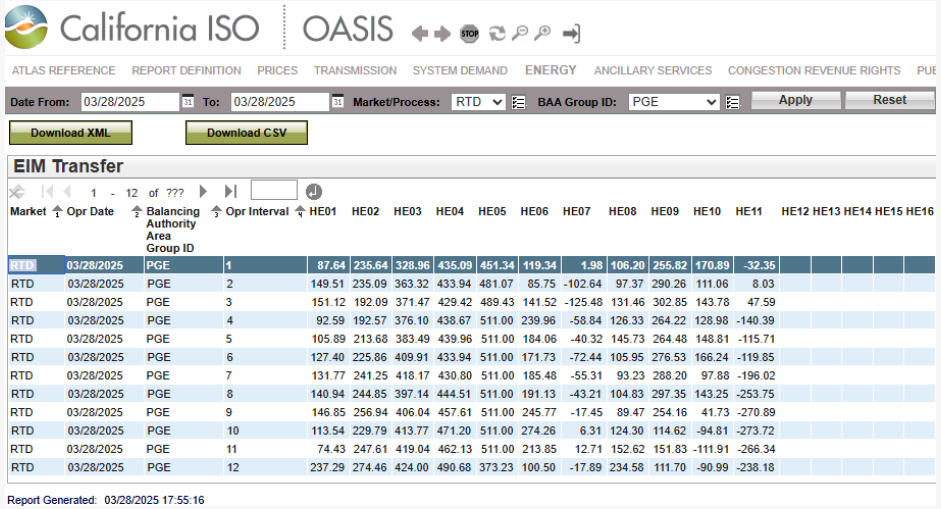
Challenges & Solutions

Previous Challenges

- Manual tracking processes
- Constant back-and-forth with CAISO
- Fragmented data across systems
- Limited battery performance visibility
- Reactive transmission monitoring

PI System Solutions

- Automated alarming in PI Vision
- Streamlined interface
- Real-time battery monitoring
- Proactive Battery site warranty compliance
- Integrated transmission monitoring



Market	Opr Date	Balancing Authority Area Group ID	Opr Interval	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16
RTD	03/28/2025	PGE	1	87.64	235.64	328.96	435.09	451.34	119.34	1.98	106.20	255.82	170.89	-32.35					
RTD	03/28/2025	PGE	2	149.51	235.09	363.32	433.94	481.07	85.75	-102.64	97.37	290.26	111.06	8.03					
RTD	03/28/2025	PGE	3	151.12	192.09	371.47	429.42	489.43	141.52	-125.48	131.46	302.85	143.78	47.59					
RTD	03/28/2025	PGE	4	92.59	192.57	376.10	438.67	511.00	239.96	-58.84	126.33	264.22	128.98	-140.39					
RTD	03/28/2025	PGE	5	105.89	213.68	383.49	439.96	511.00	184.06	-40.32	145.73	264.48	148.81	-115.71					
RTD	03/28/2025	PGE	6	127.40	225.86	409.91	433.94	511.00	171.73	-72.44	105.95	276.53	166.24	-119.85					
RTD	03/28/2025	PGE	7	131.77	241.25	418.17	430.80	511.00	185.48	-55.31	93.23	288.20	97.88	-196.02					
RTD	03/28/2025	PGE	8	140.94	244.85	397.14	444.51	511.00	191.13	-43.21	104.83	297.35	143.25	-253.75					
RTD	03/28/2025	PGE	9	146.85	256.94	406.04	457.61	511.00	245.77	-17.45	89.47	254.16	41.73	-270.89					
RTD	03/28/2025	PGE	10	113.54	229.79	413.77	471.20	511.00	274.26	6.31	124.30	114.62	-94.81	-273.72					
RTD	03/28/2025	PGE	11	74.43	247.61	419.04	462.13	511.00	213.85	12.71	152.62	151.83	-111.91	-266.34					
RTD	03/28/2025	PGE	12	237.29	274.46	424.00	490.68	373.23	100.50	-17.89	234.58	111.70	-90.99	-238.18					

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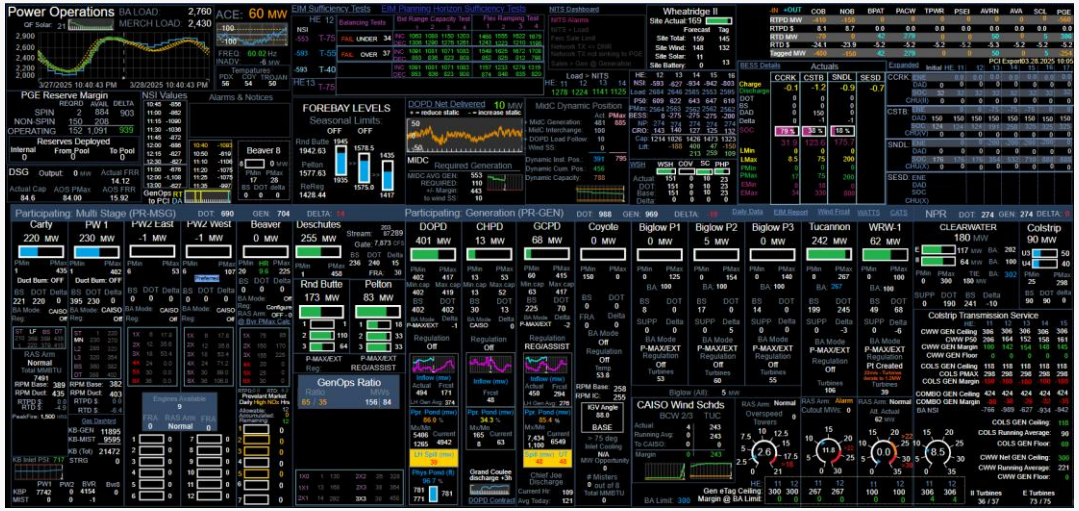

Measurable Business Impacts

Key Metrics

- Prevented transmission violations ($2,000/MW savings)
- Battery warranty compliance protection
- Minimum 2 FTE efficiency gain
- More effective transmission utilization

Operational Improvements

- Enhanced reliability through proactive monitoring
- Improved test preparation and tracking
- Comprehensive situational awareness
- Day-ahead planning integration
- Optimized decision-making

“

The PI System has become an indispensable tool for our market operations. It provides real-time situational awareness of precise tracking and understanding of system constraints and flexibilities. With advanced features like PI Vision and PI Analysis, we gain the best forward-looking insights—spanning variable energy forecasts, storage optimization, hydro resource management, and market performance within the Western Energy Imbalance Market. This integration empowers us to make data-driven decisions and stay ahead in a dynamic energy landscape.

Imad Deeb, Principal Real Time Trader

Coyote Springs Generating Facility

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Eliminating Manual Data Entry Errors

Challenge

- Multiple instances of "Fat-Fingering"
- Overpayment for water use
- Increased oversight needed
- Loss of confidence in data

Data Entry

New Month	COMMON FACILITIES					
	TOTAL CT MAKEUP			WASTE	CT MAKE UP	
Mar	Well 3	Carl/Tod	City	Evap Pond	City	Wells
2025						
Day	60,861,405	24,473,095	85,122,089	566,781	14,225,646	66,000,951
1	60,861,405	24,841,658	87,225,216	566,781	15,392,201	66,242,071
2	60,861,406	25,174,025	89,144,865	566,781	16,426,774	66,394,153
3	60,861,406	25,538,065	91,249,749	566,781	17,588,537	66,598,429
4	60,861,593	25,907,661	93,441,692	566,781	18,819,349	66,814,500
5	60,872,108	26,302,774	95,805,085	566,781	20,171,137	67,071,570
6	60,878,957	26,716,189	98,282,420	566,781	21,593,568	67,338,030
7	60,880,711	27,073,722	357,418	566,781	22,763,786	67,549,947
8	60,889,312	27,447,024	2,536,019	566,781	23,990,551	67,780,129
9	60,889,318	27,774,506	4,461,270	566,781	25,041,905	67,969,963
10	60,898,451	28,177,720	6,921,193	566,781	26,415,603	68,235,455
11	60,913,589	28,580,852	9,370,200	566,781	27,845,574	68,525,324

PI System Solution

- PI AF monthly datasheet automation
- Consistent timing for data capture
- Shifted focus to data validation
- 20+ hours saved monthly

Name	Value	Time Stamp
Category: <None>		
Cooling Tower Blowdown	76179.47 US kgal	3/31/2025 11:16:47.268 AM
Cooling Tower Make-Up Water	346054.60 US kgal	3/31/2025 11:16:15.432 AM
Cooling Tower Wells Make-Up Water	103421.10 US kgal	3/31/2025 11:18:06.259 AM
MMF BackWash Throughput Totalizer Monthly	30.31256 US kgal	3/31/2025 10:00:59.458 AM
Nuet Tank Throughput	1607.40600 US kgal	3/31/2025 11:23:51.449 AM
RO Concentrate Discharge	29872.72 US kgal	3/31/2025 11:21:30.738 AM
Well 4 Water Flow	598.11 US kgal	3/31/2025 11:15:10.702 AM
Category: Daily Totalizers		
Daily Cooling Tower City Make-Up	260.23438 US kgal	3/31/2025 12:00:00 AM
Daily Cooling Tower Wells Make-Up	137.06250 US kgal	3/31/2025 12:00:00 AM
Daily MMF BackWash Throughput	0.00000 US kgal	3/31/2025 12:00:00 AM
Daily Nuet Tank Discharge	0.00000 US kgal	3/31/2025 12:00:00 AM
Daily RO Concentrate Discharge	0.00000 US kgal	3/31/2025 12:00:00 AM
Daily Water Usage Cooling Tower Blowdown	1.12891 US kgal	3/31/2025 12:00:00 AM
Daily Well 4 Flow	0.61 US kgal	3/31/2025 12:00:00 AM

Eliminating Single-Point Failures

Challenge

- Critical reports known by one person
- NERC/GADS, water usage reports
- Reporting delays during absences
- Anxiety around reporting deadlines

PI System Solution

- Automated reports via PI AF
- One-click data access for all staff
- Eliminated compliance delays
- 5-10 hours saved monthly

Year: 2021

Summary of Gas and Megawatt Data 2021

	Net Plant Output (switchyard)	Household from Aux Transformer	GT Breaker Closed	ST Breaker Closed	Back Feed from BPA & UEC	AB Hrs	*Full Factored Hrs*	*Part. Factored Hrs*	**Final Factored Hours**	Gas HHV BTU's
	MW	MW	Hrs.On-Line	Hrs.On-Line						
April	181,518	3,403	720.00	720.00	(0.70)	4.00	720.00	0.00	720.00	1,037
May	66,346	1,452	276.37	274.94	143.70	519.00	272.00	2.50	274.50	1,034
June	12,837	402	75.45	71.55	91.61	720.00	41.00	19.00	60.00	1,033
July	167,368	3,193	740.53	738.94	9.88	744.00	667.00	37.00	704.00	1,038
Aug	172,653	3,200	732.24	731.01	37.17	744.00	703.00	16.00	719.00	1,041
Sept	179,638	3,137	720.82	720.82	0.00	720.00	717.00	1.50	718.50	1,054
Oct	173,815	3,324	695.84	693.61	118.78	205.00	683.00	6.50	689.50	1,046
Nov-DS	163,287	3,412	698.15	698.13	55.52	30.00	656.00	20.50	676.50	1,047
Dec	0	0	0.00	0.00	0.00	744.00	744.00	0.00	744.00	-
YTD	1,568,917.52	31,067.89	6,539.81	6,524.48	891.59	4,889.00	7,003.52	143.74	7,147.26	1,041

Summary | Dec | Nov | Oct | Sep | Aug | Jul | Jun | May | Apr | Mar | Feb | Jan

Pick A Year

Year: 2021

Start: Feb 02 2021

End: Jan 01 2022

CS1 Summary of Gas and Megawatt Data 2021

	Gas Turbine Gas Burn	Aux Boiler Gas Burn	GT Output	ST Output	Net Plant Output (switchyard)	Household from Aux Transformer	GT Breaker Closed	ST Breaker Closed	Back Feed from BPA & UEC	AB Hrs
	MMBTU	MMBTU	MW-Hrs	MW-Hrs	MW-Hrs	MW	Hrs.On-Line	Hrs.On-Line	MW	Hrs
Jan	820,255.31	19,052.06	79,264.70	36,370.57	112,387.35	2,718.30	473.26	468.50	420.50	406.10
Feb	1,128,978.88	2,162.10	106,715.05	50,566.07	153,399.38	3,298.38	672.00	672.00	0.00	42.00
Mar	1,357,836.13	0.00	132,257.20	59,252.34	187,251.59	3,543.39	743.00	743.00	0.00	0.00
April	1,316,754.38	0.00	128,030.97	57,586.25	181,518.28	3,403.38	720.00	720.00	0.00	0.00
May	485,705.28	27,878.92	46,618.57	21,579.87	66,346.01	1,452.01	276.19	274.76	143.70	519.00
June	100,137.79	37,726.30	8,898.04	4,600.05	12,836.99	402.11	75.76	71.87	91.60	720.00
July	1,206,538.63	39,542.84	114,228.91	56,996.66	167,368.02	3,193.05	739.68	738.09	9.88	744.00
Aug	1,233,646.88	38,868.93	118,549.51	58,028.62	172,689.83	3,199.58	731.44	730.21	37.16	744.00
Sept	1,264,796.50	37,920.11	124,347.55	59,117.82	179,638.27	3,136.85	720.00	720.00	0.00	720.00
Oct	1,236,875.00	11,084.50	122,562.29	55,261.47	173,815.20	3,320.85	695.12	692.89	119.13	205.00
Nov	1,179,631.00	1,433.96	113,892.17	53,411.10	163,286.63	3,408.35	696.95	696.92	55.52	30.00
Dec	1,135,264.25	10,589.96	109,590.00	50,330.39	155,830.22	3,429.44	658.15	656.29	133.84	206.76
YTD	12,466,420.01	226,259.68	1,204,954.95	563,101.21	1,726,367.76	34,505.69			1,011.33	4,336.86

Business Impact Summary

- 25+ hours saved monthly across reporting processes
- Prevented costly forced outages through early detection
- Eliminated compliance risks from reporting delays
- Increased staff engagement and data confidence
- Shifted focus from data entry to data analysis
- Removed single-point failures in critical processes

Monitoring & Diagnostics Center

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PI System Governance Group

Bring different groups using PI System together in one forum

Prioritize business PI needs and work with IT

Share knowledge and help resolve PI System data needs

Discuss Use Cases and roadmaps with AVEVA

Help extract maximum value out of the Enterprise Agreement

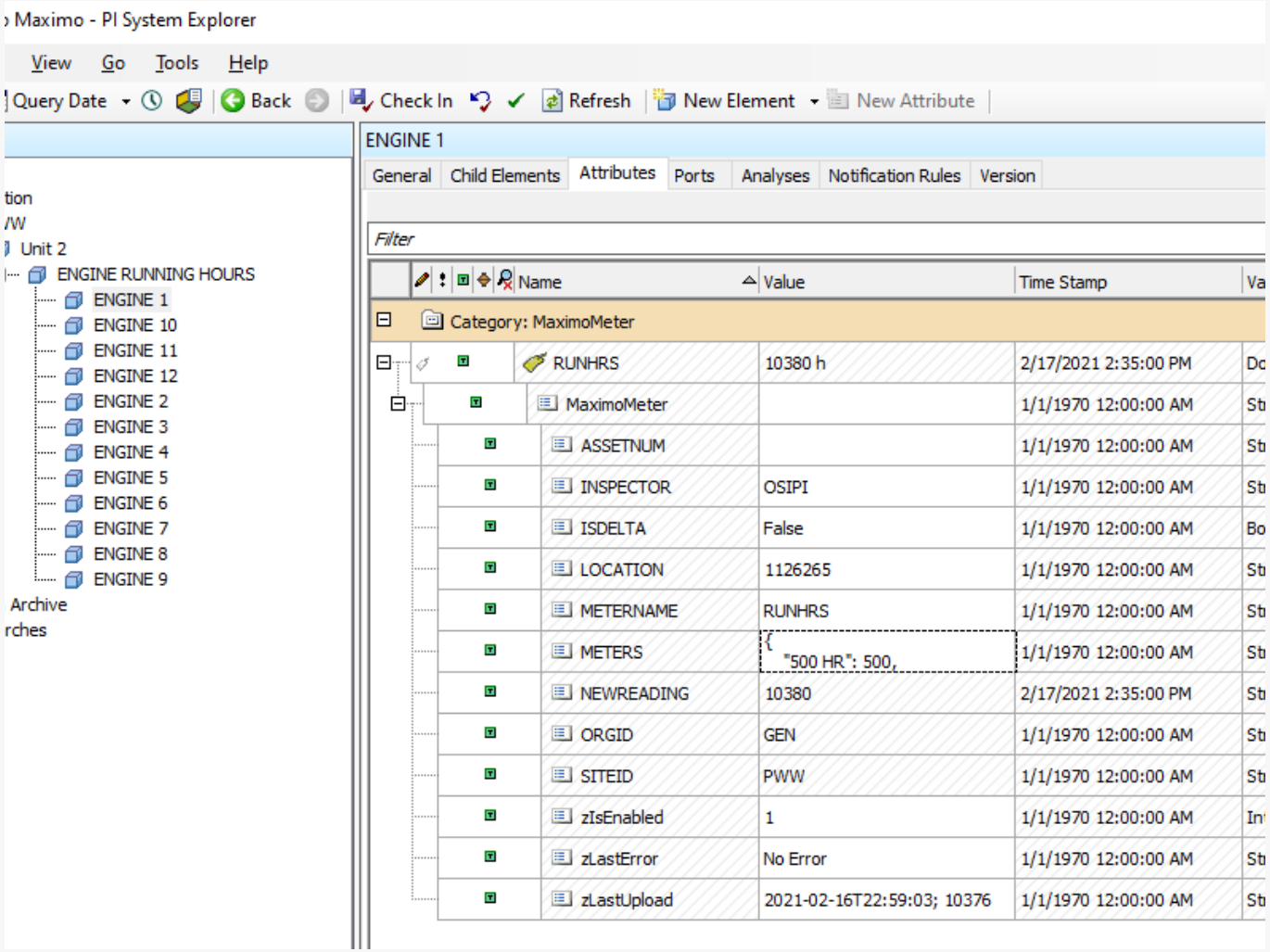
PI System to Maximo

Successful Port Westward Pilot

Savings of over $52,000 per year with just this pilot alone

132 Maximo Engine Location meters get updated with runhour information from PI System every night

Fleetwide rollout planned (Hydro and Thermal sites)



eRounds

Fleetwide Hydro and Thermal rollout

Implemented at Carty, CSP, Sullivan, Beaver, Port Westward

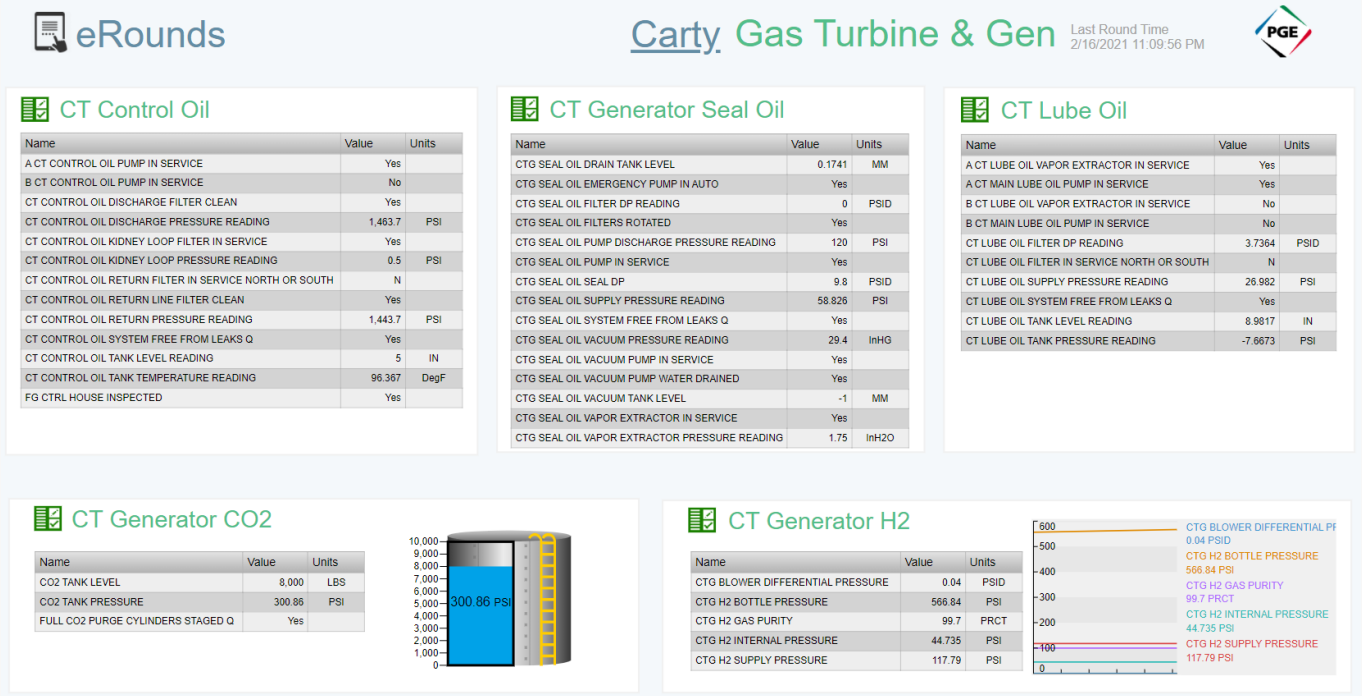
3rd Party License savings and data remained within PGE

iPad and iPhones deployed

Ability to scan QR code and enter data

Third-party license savings

PI System to Maximo tie-in planned



POWER & UTILITIES | USA

PGE drives operational excellence through data-driven insights

Challenge

- Manual processes and fragmented data systems created inefficiencies across operations
- Single-point failures in reporting created compliance risks and operational anxiety
- Limited visibility into critical asset performance hindered proactive maintenance

Solution

- Deployed AVEVA™ PI System™ with PI AF, PI Vision and PI Analysis to create a unified operational intelligence platform across wind, thermal, and distribution assets

Results

- **Prevented $146,400 annual revenue loss across four wind turbines through early performance deviation detection**
- **Saved 25+ hours monthly by automating manual data collection and reporting processes**
- **Enhanced grid resilience by enabling data-driven load management during extreme weather events**

Thank you