Regional Seminar Series

Anchorage, Alaska

Leveraging real-time data UAF

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University of Alaska Fairbanks

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Empowering Business in Real Time.

About UAF

- We are “America’s Arctic University”
- Established in 1917
- Approximately 10,000 students.
- 3,000,000 square feet of academic, research, administrative and housing space
- UAF ranks fifth among small research universities in the nation and among the top 10 universities in atmospheric science and environmental sciences.
- Research dollars coming to UAF have increased substantially, from $56.4 million in FY97 to $113 million in FY07.

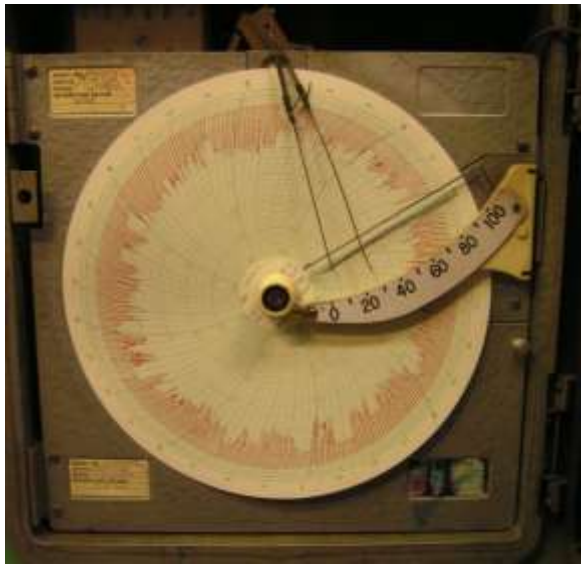
UAF Central Utilities at a Glance

- Steam Heat
  - Two 50,000 lb/hr coal boilers (1964)
  - One 100,000 lb/hr oil boiler (1972)
  - One 100,000 lb/hr oil or gas boiler (1986)
- Electricity
  - 10 MW steam turbine (1980)
  - 9.6 MW diesel engine generator (DEG) (1999)
  - 4,160 volt distribution system (1964-present)
  - 12,470 volt switchgear (2010-2011)
- Drinking and Fire Protection Water
  - 1 MGD Water Treatment Plant (1979)
- Walk Through Utilidor System
- 1,800 ton district Chilled Water system(Lower Campus Only) (2005)

History of Plant Automation

Years of constant migration:

- Originally all pneumatic controls, conceived as a teaching lab
- Converted to Analog electric controls
- Converted to DCS
- Evolving to more distributed control and monitoring including field bus

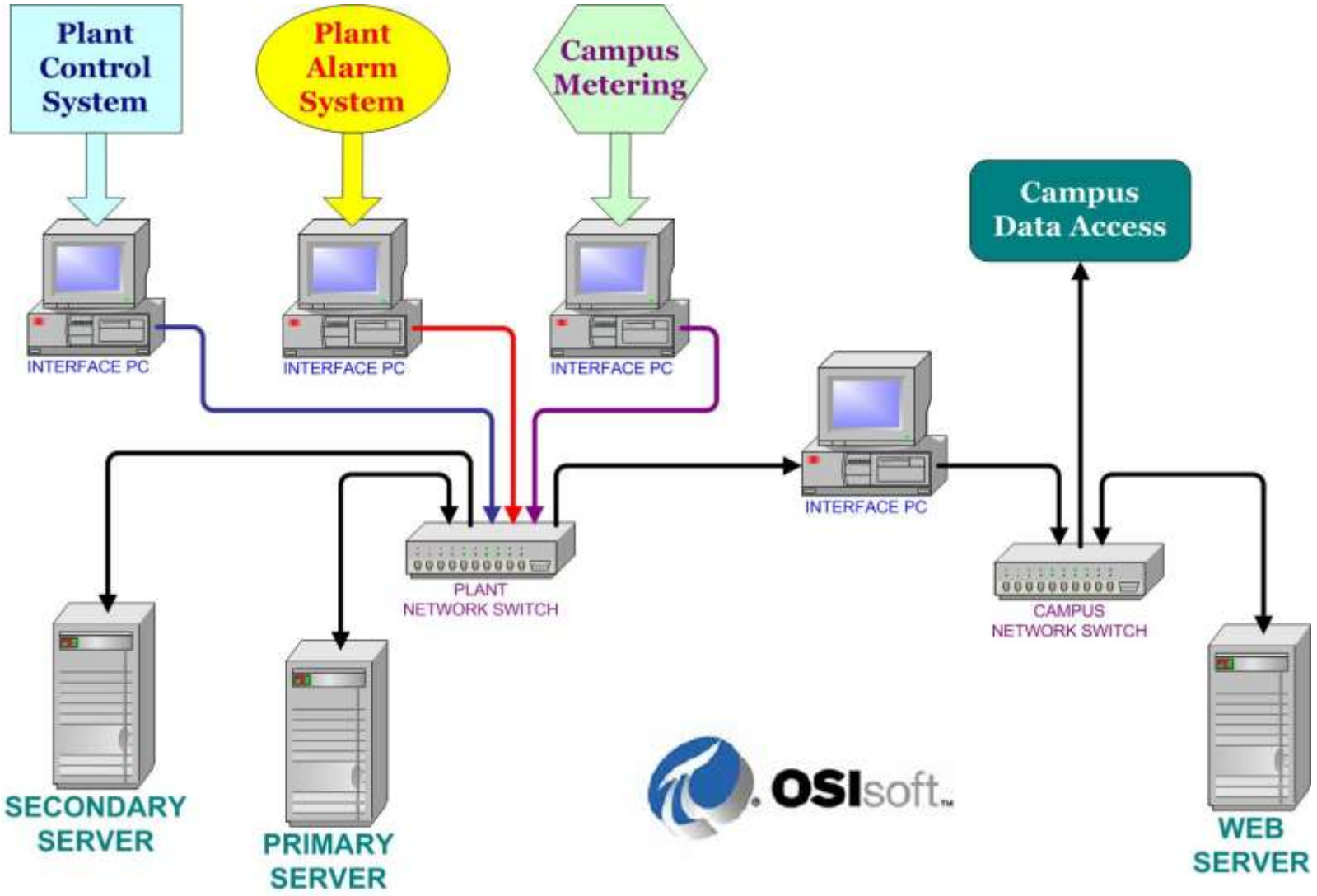


Data collection history:

- Clipboards
- Strip chart recorders (pneumatic and electric)
- Electronic collection with printing on paper
- Electronic collection with electronic storage
- Electronic collection with one database

The Data Mess at UAF

Data collection system architecture



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OSIsoft Software and Services Used

Currently UAF uses

- PI Server
- PI ProcessBook
- PI DataLink
- PI Manual Logger
- PI ActiveView
- PI to PI Interface
- PI System Management Tools (PI SMT)
- PIAlarmView
- Several PI interfaces
- PI AF

Planned software implementation

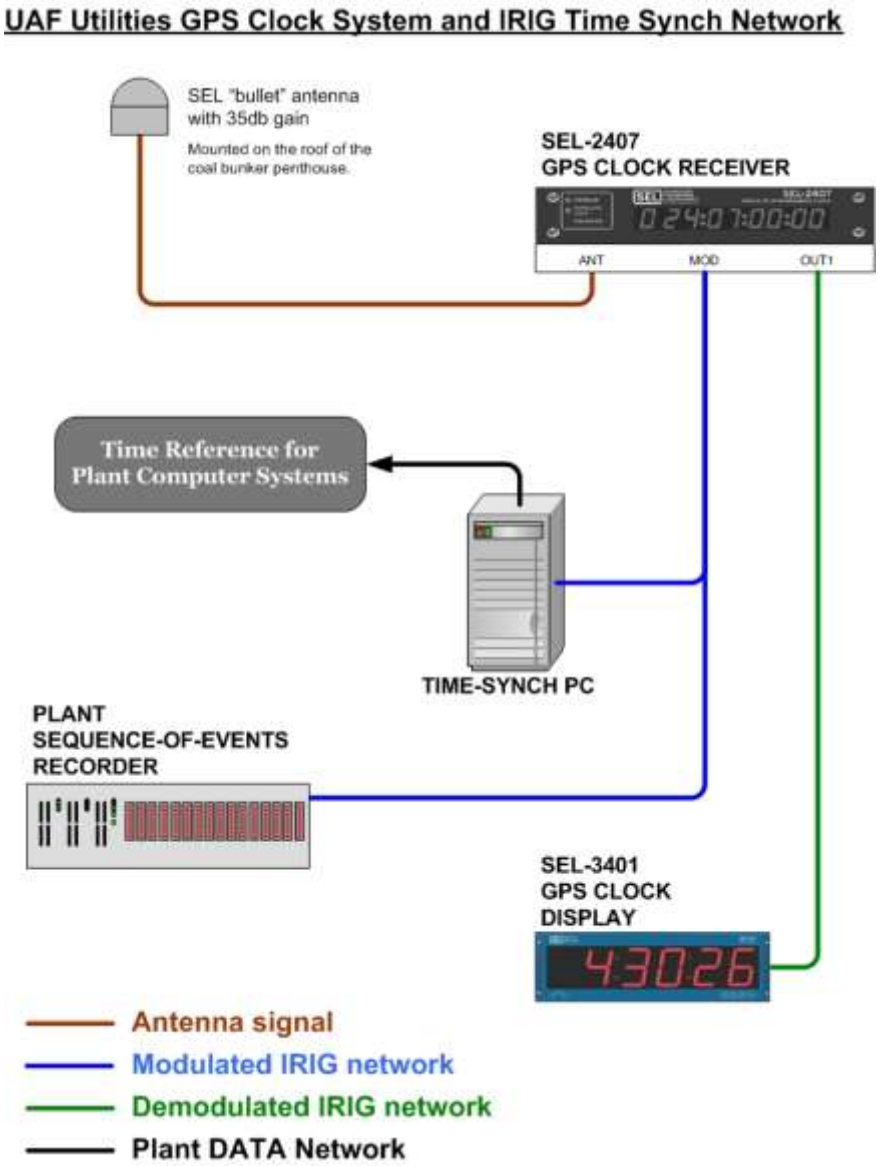
- PI OLEDB Provider
- PI DataLink for Excel Services
- PI WebParts
- PI Advanced Computing Engine (PI ACE)

Data Sources

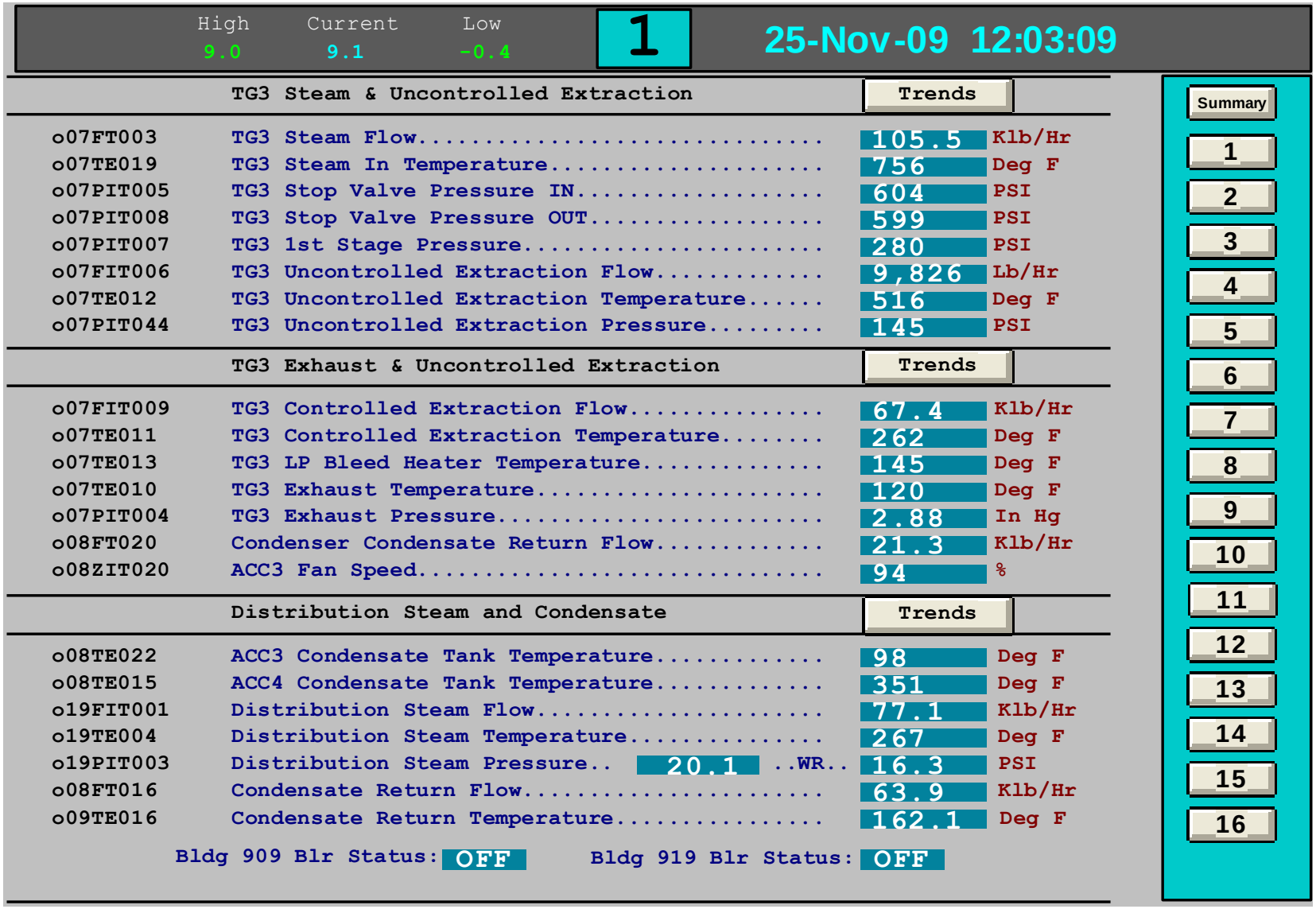
- CHP equipment
- Water treatment plant
- Chilled water plant
- Building automation system
- Campus energy monitoring system
- Or a small portion of UAF's 360+ million acre campus

Time

How to keep all the computer clocks synchronized



Old Style Displays



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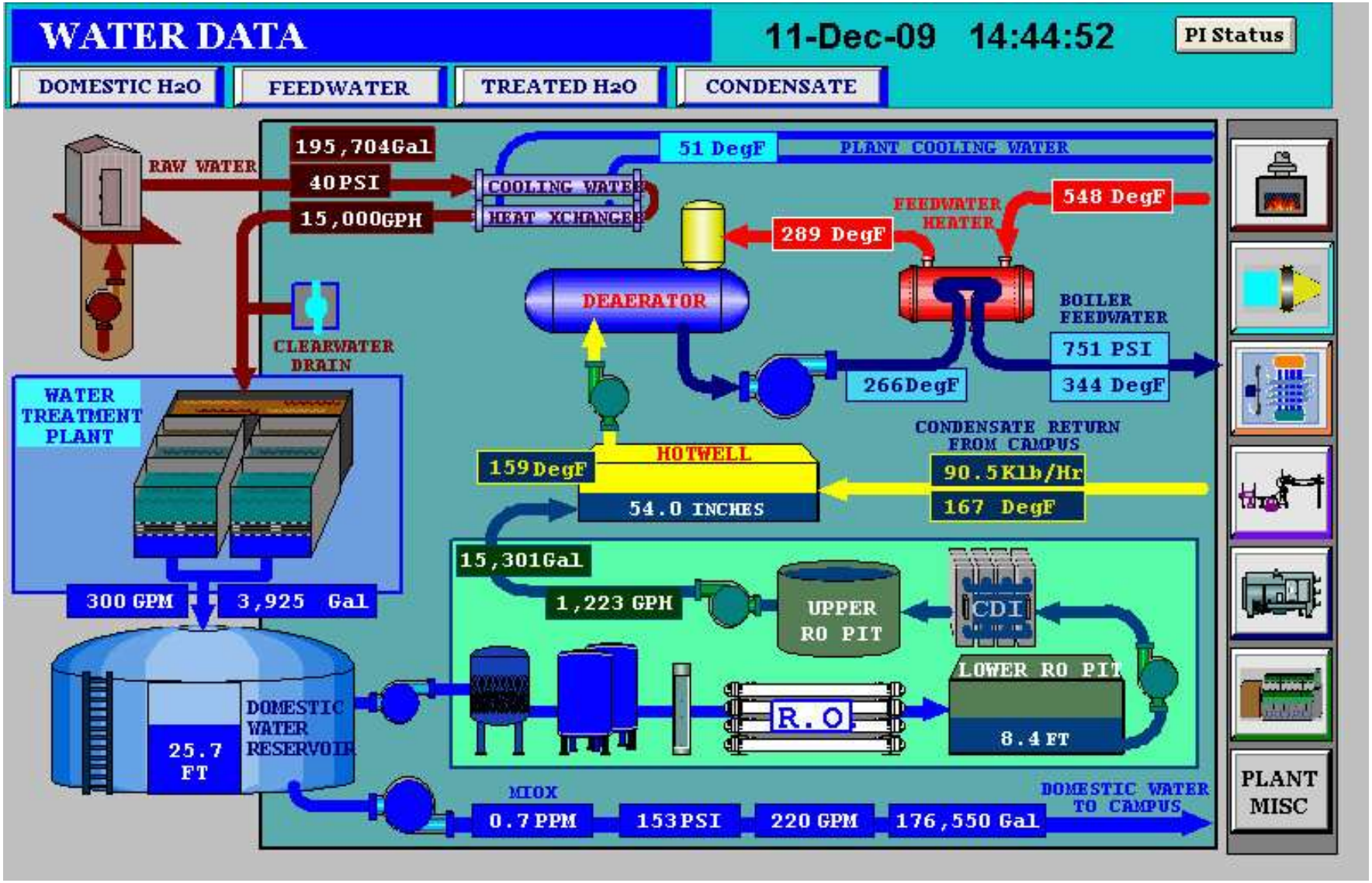
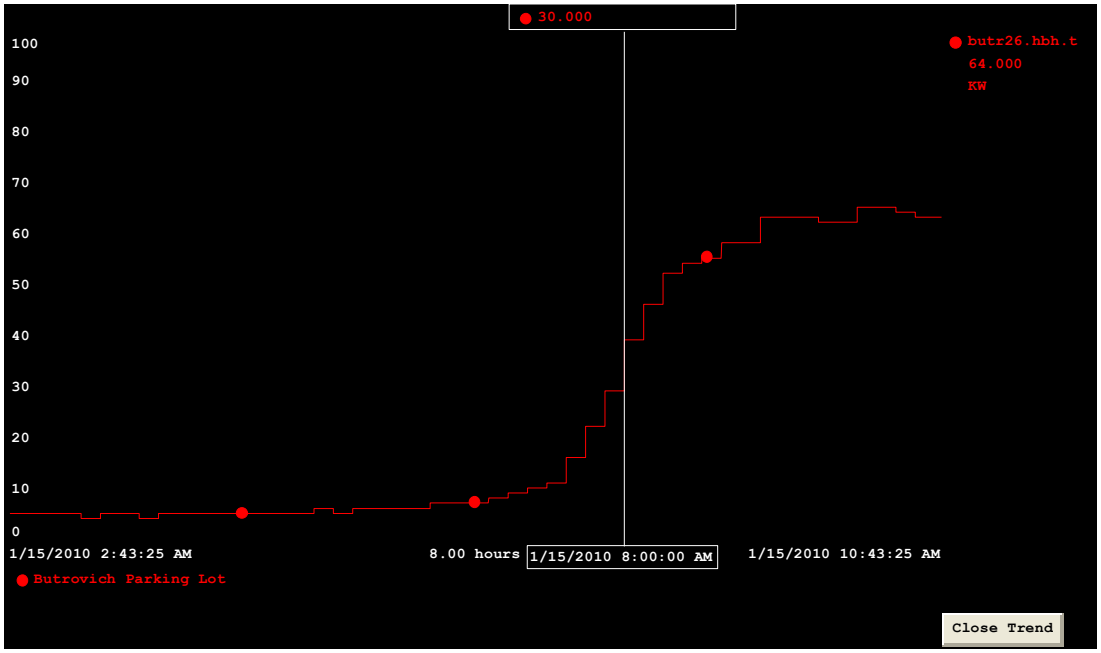
New Displays

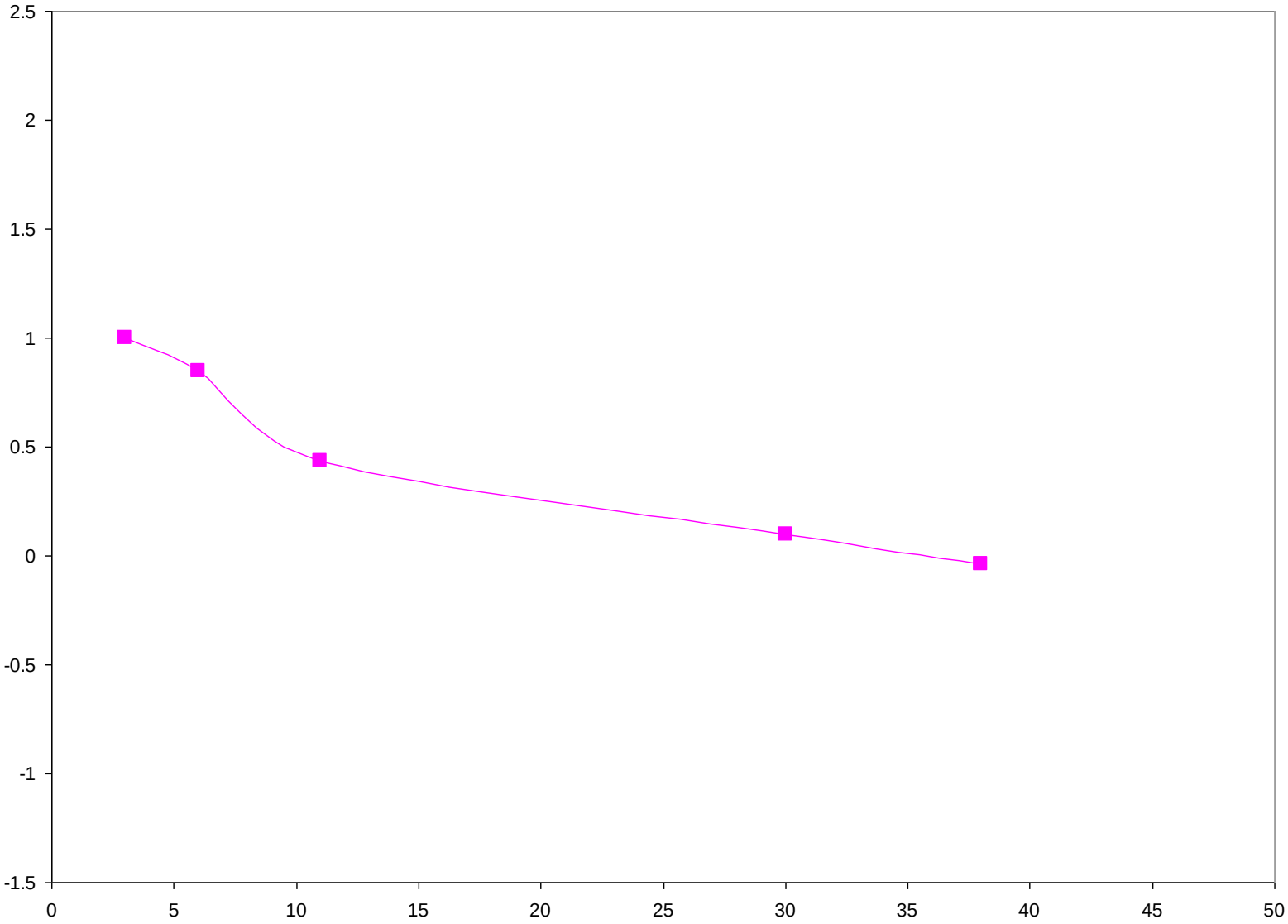


What to Measure

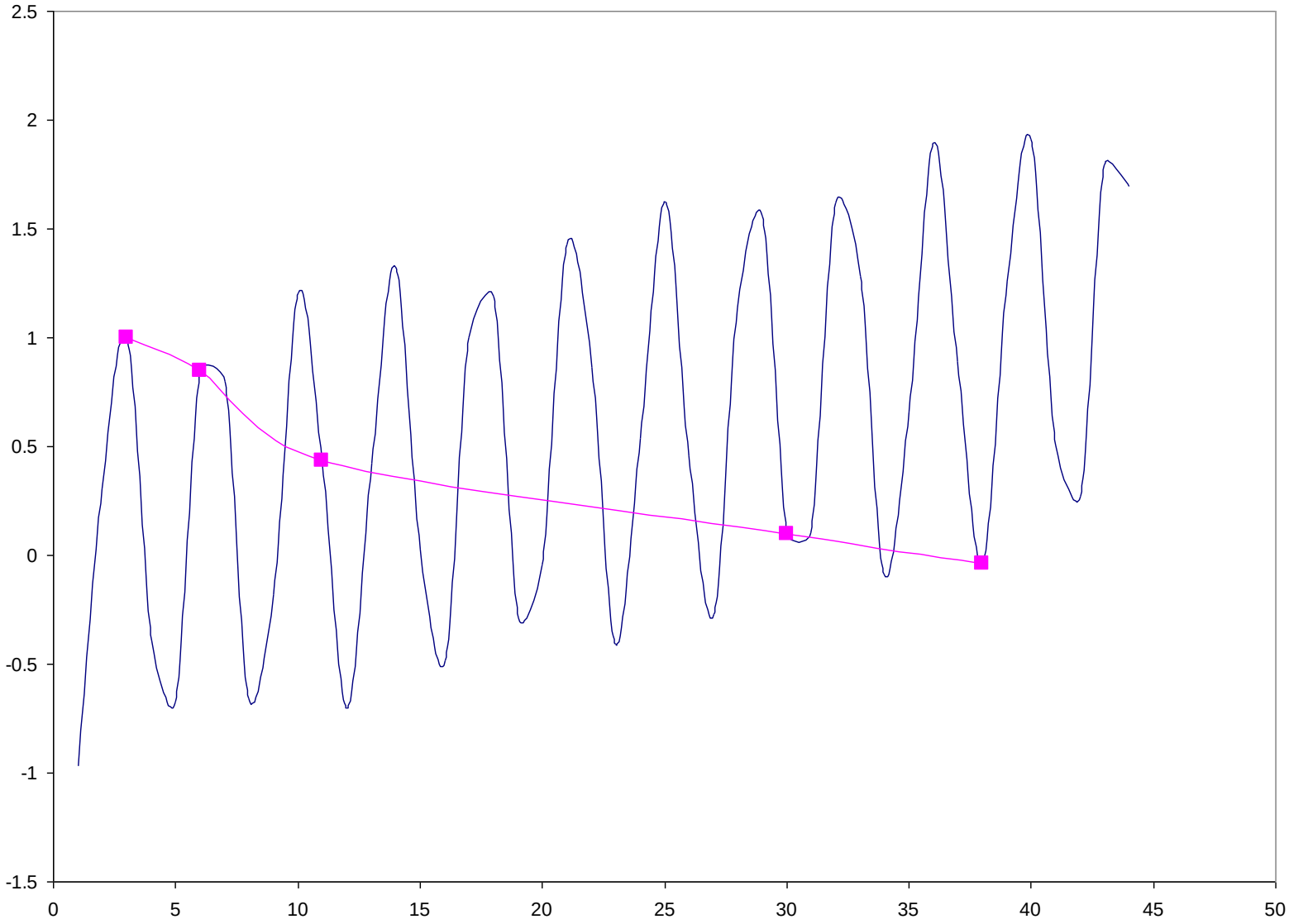
- **Measure everything**
  - Including Set points and control outputs
  - **Measure rate data whenever possible**
  - Connect to as many data points as possible
  - One Storage database with a single reporting tool
- Trend everything



Manual readings

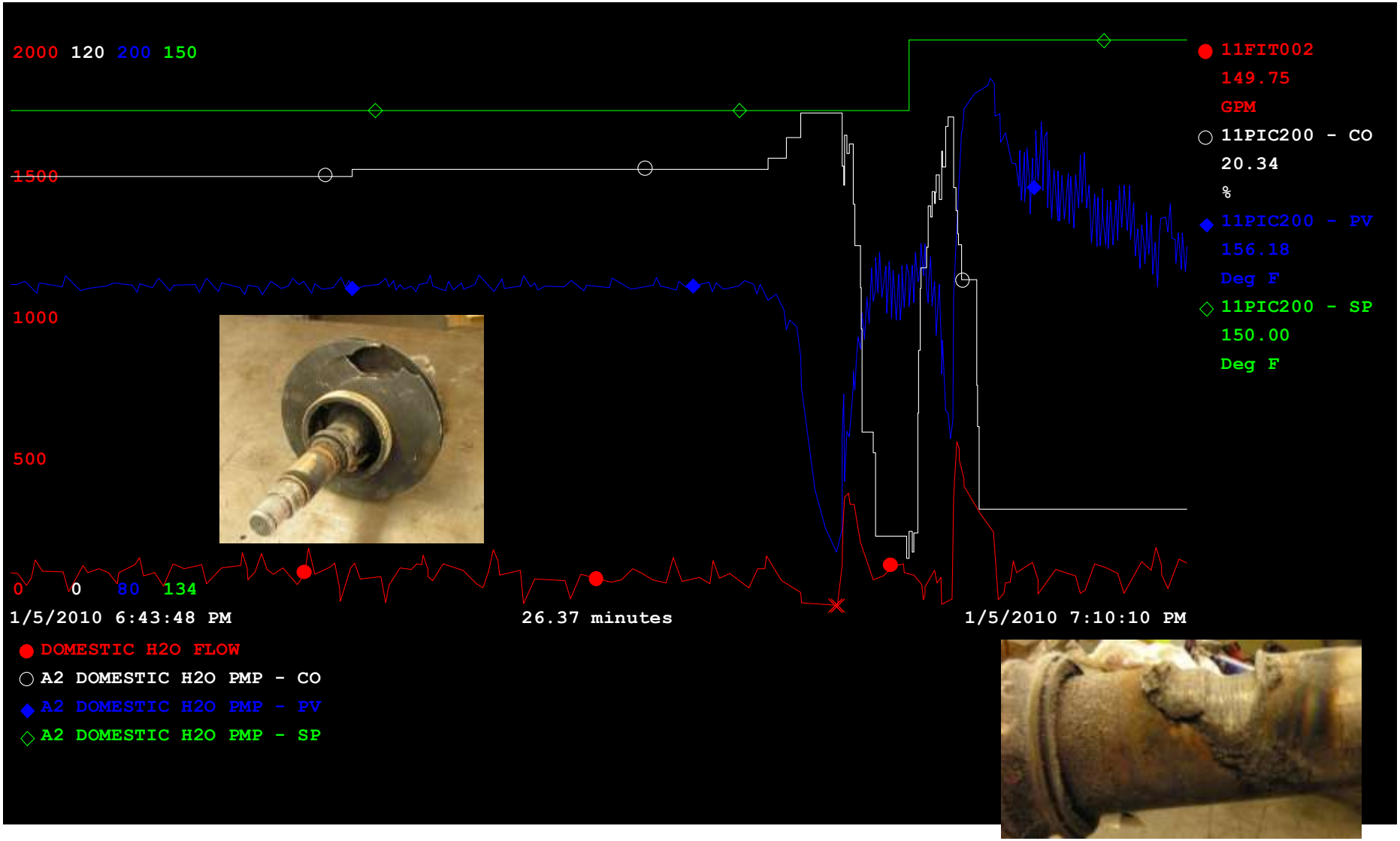


The Real data can be hidden!



Electronic clipboard

Destruction of A2 domestic water pump



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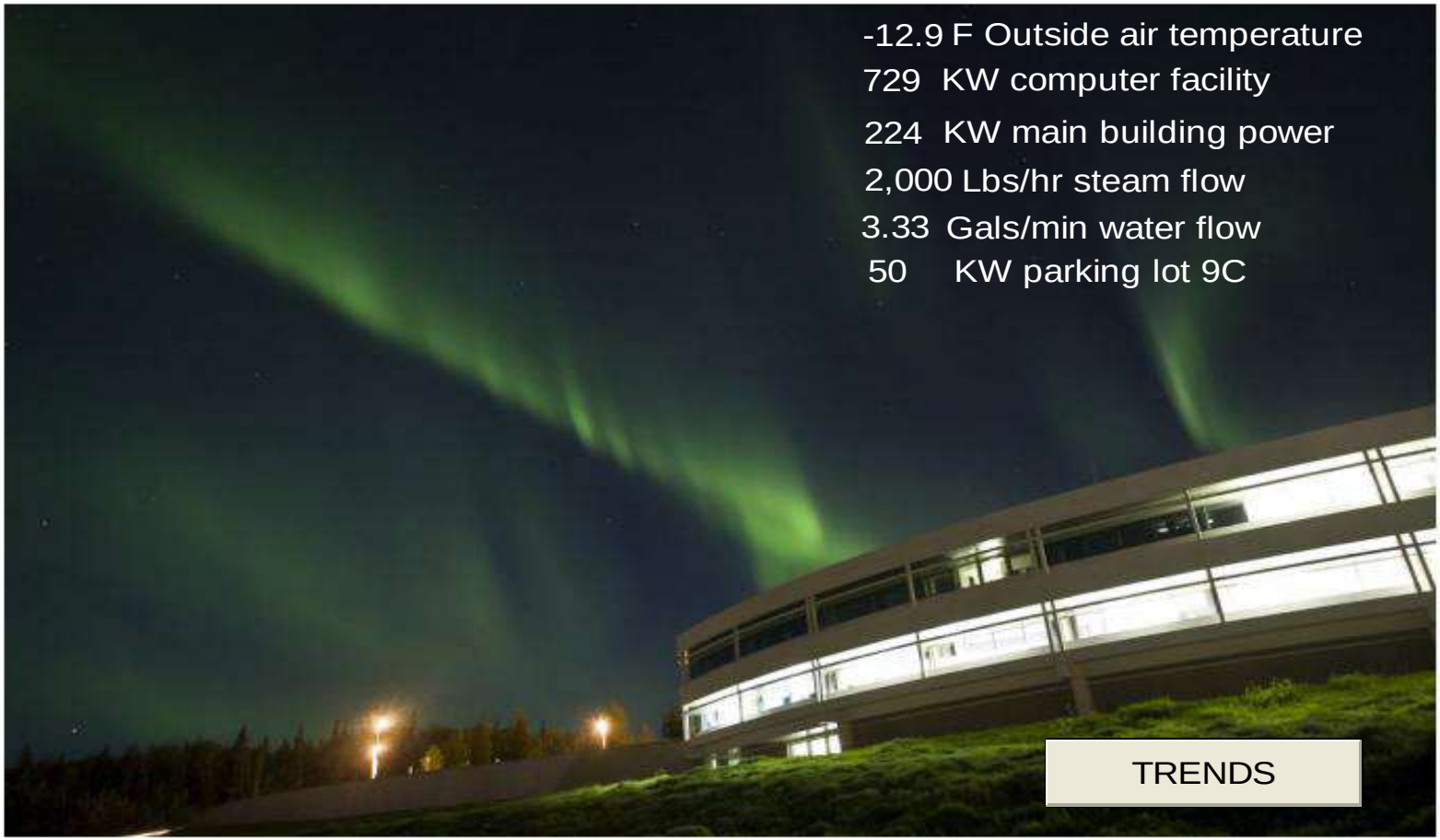
The Plan to Save

- Currently the campus users have know idea the amount of energy they consume, or what it costs.
- We are switching from a “utilities are free” model to utilities billed on actual usage.
- We will accomplish this using the same data collection system we already have in place.
- *The key to conservation success is visibility into cost and performance data that spans the entire chain of energy production and use across the university*

Energy Kiosk

CURRENT ENERGY USE



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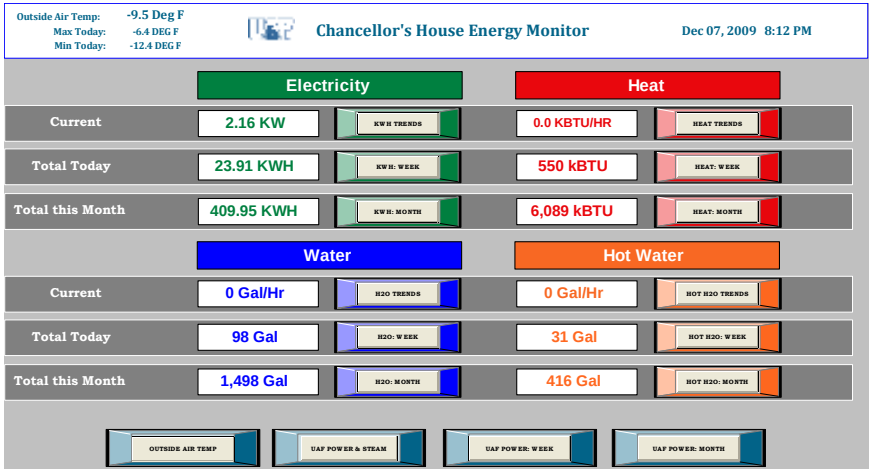
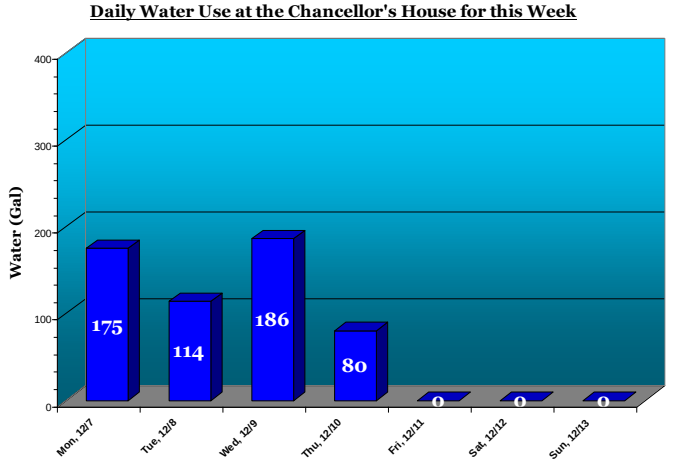
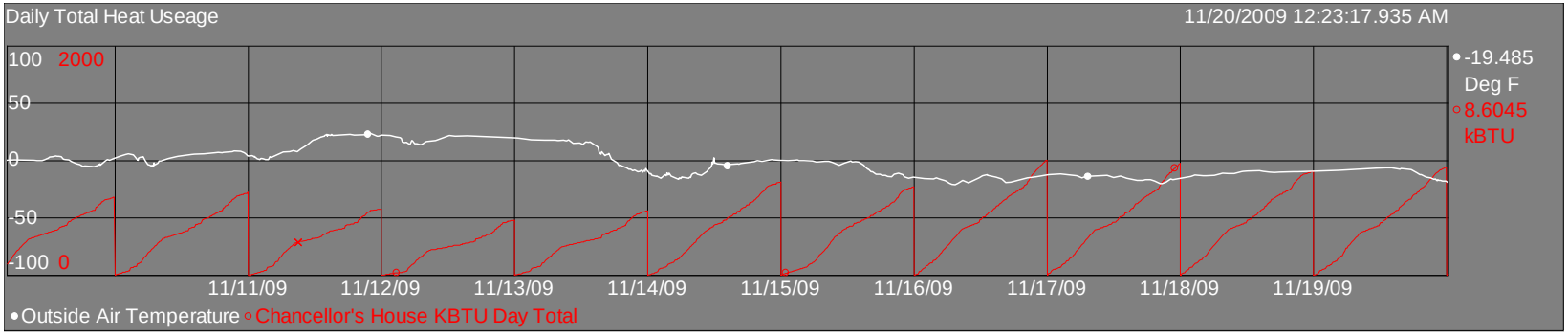
Chancellors house







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Reporting

Reports generated

- Hourly
- Daily
- Weekly
- Monthly
- Environmental
- EIA
- Ad hoc reports

UAF Utilities Operation Monthly Data
12/11/2009

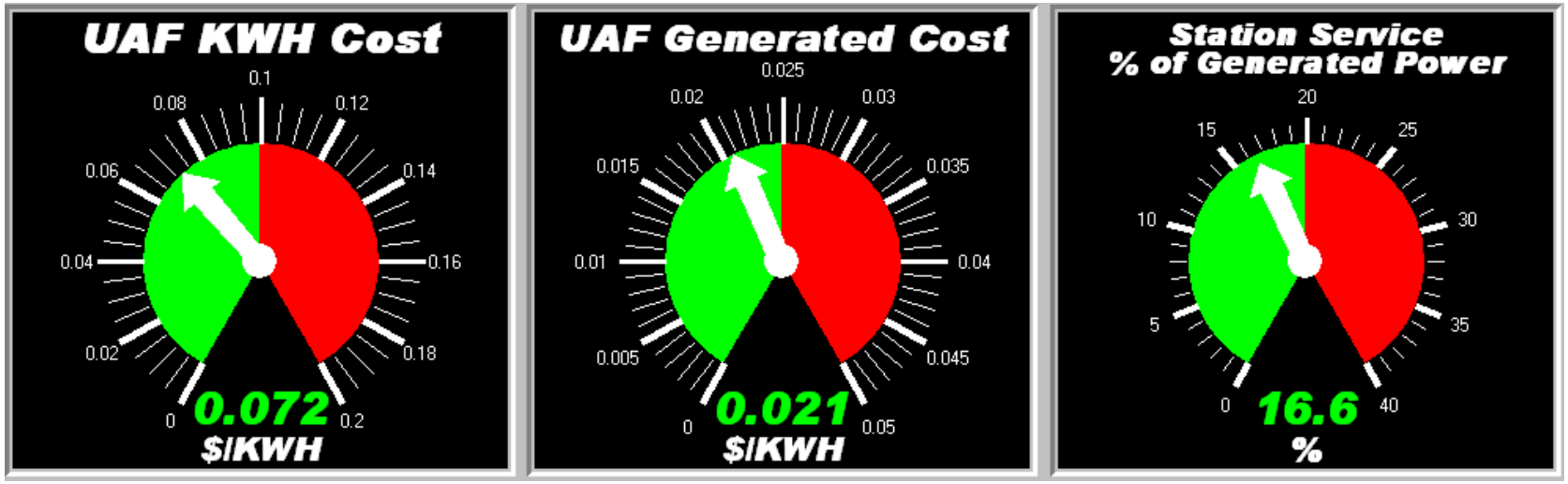
	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Summary	
Blr 1 Coal Usage	1,919.8	3,298.1	3,286.1	3,386.4	3,263.1		15,132.4	Tons
Blr 2 Coal Usage	3,447.9	1,330.2	3,135.1	3,312.9	3,220.8		14,446.9	Tons
Total Coal Usage	5,367.7	4,628.3	6,400.2	6,699.3	6,483.8		29,579.4	Tons
Blr 3 Oil Usage	14,999.8	0.0	0.0	466.5	12,360.8		27,817.2	Gal
Blr 4 Oil Usage	64,092.9	99,852.2	1,994.3	3,944.4	104,110.0		273,993.8	Gal
DGEN Oil Usage	2,300.0	0.0	0.0	0.0	0.0		2,300.0	Gal
Total Oil Usage	81,392.9	99,852.2	1,994.3	4,411.0	116,460.8		304,111.1	Gal
Blr 4 Natural Gas Useage	42,553.0	0.0	0.0	0.0	0.0		42,553.0	MCF
Blr 1 Steam Gen	19,078.2	33,557.8	33,432.4	34,019.2	33,753.9		153,841.5	Klb
Blr 2 Steam Gen	34,873.3	15,154.8	33,540.0	34,348.6	33,584.9		151,701.5	Klb
Blr 3 Steam Gen	1,414.4	0.0	0.0	38.1	1,174.3		2,626.9	Klb
Blr 4 Steam Gen	7,035.1	10,816.3	191.0	431.9	11,458.8		29,933.1	Klb
Total Steam Gen	62,401.01	59,528.91	67,263.34	68,837.86	80,071.94		338,103.04	Klb
Steam Flow Average	83.87	79.99	93.42	92.52	111.05		92.04	Klb/Hr
Steam Flow Peak	101.86	99.35	105.75	109.84	148.04		148.04	Klb/Hr
Blr 1 Max Steam Flow	51.87	53.78	52.48	52.66	53.67		53.78	Klb/Hr
Blr 2 Max Steam Flow	56.08	52.55	56.37	56.08	54.44		56.37	Klb/Hr
Blr 3 Max Steam Flow	41.16	0.17	1.04	16.18	27.03		41.16	Klb/Hr
Blr 4 Max Steam Flow	35.38	51.06	31.16	18.31	41.26		51.06	Klb/Hr
HRSG Max Steam Flow	4.94	0.00	0.00	0.00	2.97		4.94	Klb/Hr
Blr 1 Min Steam Flow		18.79	24.93	26.00	34.20		18.79	Klb/Hr
Blr 2 Min Steam Flow	15.44	0.00	22.97	26.24	32.22		0.00	Klb/Hr
Blr 3 Min Steam Flow	0.00	0.00	0.00	0.00	0.00		0.00	Klb/Hr
Blr 4 Min Steam Flow	0.00	0.00	0.00	0.00	0.00		0.00	Klb/Hr
HRSG Min Steam Flow	0.00	0.00	0.00	0.00	0.00		0.00	Klb/Hr
Blr 1 Evap Avg	2.65	4.86	4.89	4.80	5.07		4.46	Lb/Lb
Blr 2 Evap Avg	4.87	3.29	5.18	5.01	5.05		4.68	Lb/Lb
Blr 3 Evap Avg	0.94	0.00	0.00	0.04	1.16		0.43	Lb/Lb
Blr 4 Evap Avg	6	8	0	1	13		5	Lb/Lb
Coal BTU	7,946.00	7,650.00	8,071.00	7,250.00	8,432.00		7,870	BTU
Blr 1 Efficiency Avg (%)	36.94	65.03	66.10	66.02	65.81		59.98	%
Blr 2 Efficiency Avg (%)	67.62	46.95	71.20	68.68	67.12		64.31	%
HRSG Steam Gen	60.2	0.0	0.0	0.0	7.2		67.3	Klb
Dist Steam Flow Total	41,827.79	39,992.53	41,481.36	42,153.97	58,844.50		224,300.15	Klb
Dist Steam Max Flow	65.57	62.04	69.88	73.09	108.09		108.09	Klb/Hr
Dist Steam Avg Flow	56.2	53.8	57.6	56.7	81.6		61.2	Klb/Hr
Condenser Steam Total	19,575.50	18,663.85	22,348.97	22,745.22	13,033.22		96,366.75	Klb
FNSB Cond Return	*NO VALID DATA FROM THIS METER SINCE FEB 2006*							Klb
Hotwell Makeup Total	322,484.93	369,895.18	327,807.80	488,341.49	677,776.27		2,186,305.67	Gal
Blr Makeup H2O	4.3	5.2	4.1	5.9	7.1		5.3	%
Campus RO H2O	4,620.02	5,412.00	7,558.03	9,225.10	11,932.13		38,747.27	Gal
TG1 Power Generation	10.40	0.00	0.00	0.00	0.01		10.41	MW
TG2 Power Generation	0.00	0.00	0.00	0.00	39.58		39.58	MW
TG3 Power Generation	4,446.01	4,219.95	4,832.58	4,874.35	4,683.10		23,056.00	MW
DGEN Power Generation	24.84	0.00	0.00	0.00	5.34		30.18	MW
Total Power Generation	4,480.76	4,220.00	4,832.55	4,874.42	4,728.00		23,135.73	MW
Power in from GVEA	1,435.37	1,226.68	695.11	671.26	888.45		4,916.87	MW
Power Out to GVEA	0.24	0.39	0.48	0.30	0.00		1.41	MW
Peak Power in from GVEA	5.36	4.92	3.53	3.10	3.40		5.36	MW
Peak Power out to GVEA	0.27	0.32	0.20	0.15	0.00		0.32	MW
Campus Power Use Max	9.05	8.71	8.49	7.73	8.73		9.05	MW
Campus Power Use Min	5.2	5.0	5.2	5.5	5.6		5.0	MW
Feeder 1	440.40	429.73	445.93	461.92	456.44		2,234.41	MWH
Feeder 2	693.18	673.43	648.29	653.20	553.45		3,221.55	MWH
Feeder 3	310.60	305.28	367.24	389.89	388.46		1,761.47	MWH
Feeder 4	664.53	505.68	471.88	449.39	435.46		2,526.94	MWH
Feeder 5	354.95	379.42	424.46	463.38	554.42		2,176.62	MWH
Feeder 6	326.44	317.71	316.94	341.89	340.33		1,642.32	MWH
Feeder 7	392.78	404.80	434.90	460.23	465.47		2,148.18	MWH
Feeder 8	537.99	488.87	466.71	491.03	538.03		2,522.63	MWH
Feeder 9	0.06	0.00	0.09	0.00	37.93		38.09	MWH
Feeder 10	0.00	0.00	0.00	0.85	19.46		20.31	MWH
Feeder 11	1,026.58	852.38	828.74	783.47	777.39		4,270.57	MWH
Feeder 12	264.64	268.94	274.91	289.80	301.16		1,399.45	MWH
Campus Use	5,011.79	4,624.55	4,679.42	4,772.18	4,866.85		23,954.78	MWH
Station Service 1	266.48	308.25	316.49	321.87	311.57		1,524.67	MWH
Station Service 2	273.93	182.92	230.95	270.24	247.88		1,205.92	MWH
Station Service 3	45.44	55.75	59.28	47.57	49.69		257.73	MWH
Station Service - DGEN	53.5	47.9	45.5	51.2	50.3		248.36	MWH
Plant Usage	639.34	594.78	652.26	690.89	659.40		3,236.67	MWH
Total Usage	5,651	5,219	5,332	5,463	5,526		27,191	MWH
Oddity Factor	265	227	196	82	90		860	MWH
Domestic H2O	11,845,588.3	8,722,966.7	9,203,399.0	9,138,869.2	8,014,083.1		46,924,906.3	Gal
Chiller Tonnage	1,023,590.59	641,822.57	580,509.08	0.00	0.00		2,245,922.24	Tons
OSA Temp Max	233.69	87.64	75.97	56.83	33.84		233.69	Deg F
OSA Temp Min	43.55	33.64	20.06	10.88	-29.00		-29.00	Deg F

Info on data collection system

- Over 5,000 data points connected
- Data from 330 building energy meters
- 10 years of historical data online (9 more stored)
- This is accomplished with 15 computers
- Data interfaces using either OPC, Modbus TCP/IP, Batch file, or API
- Uses OSIsoft. high availability PI system

Uses of Data

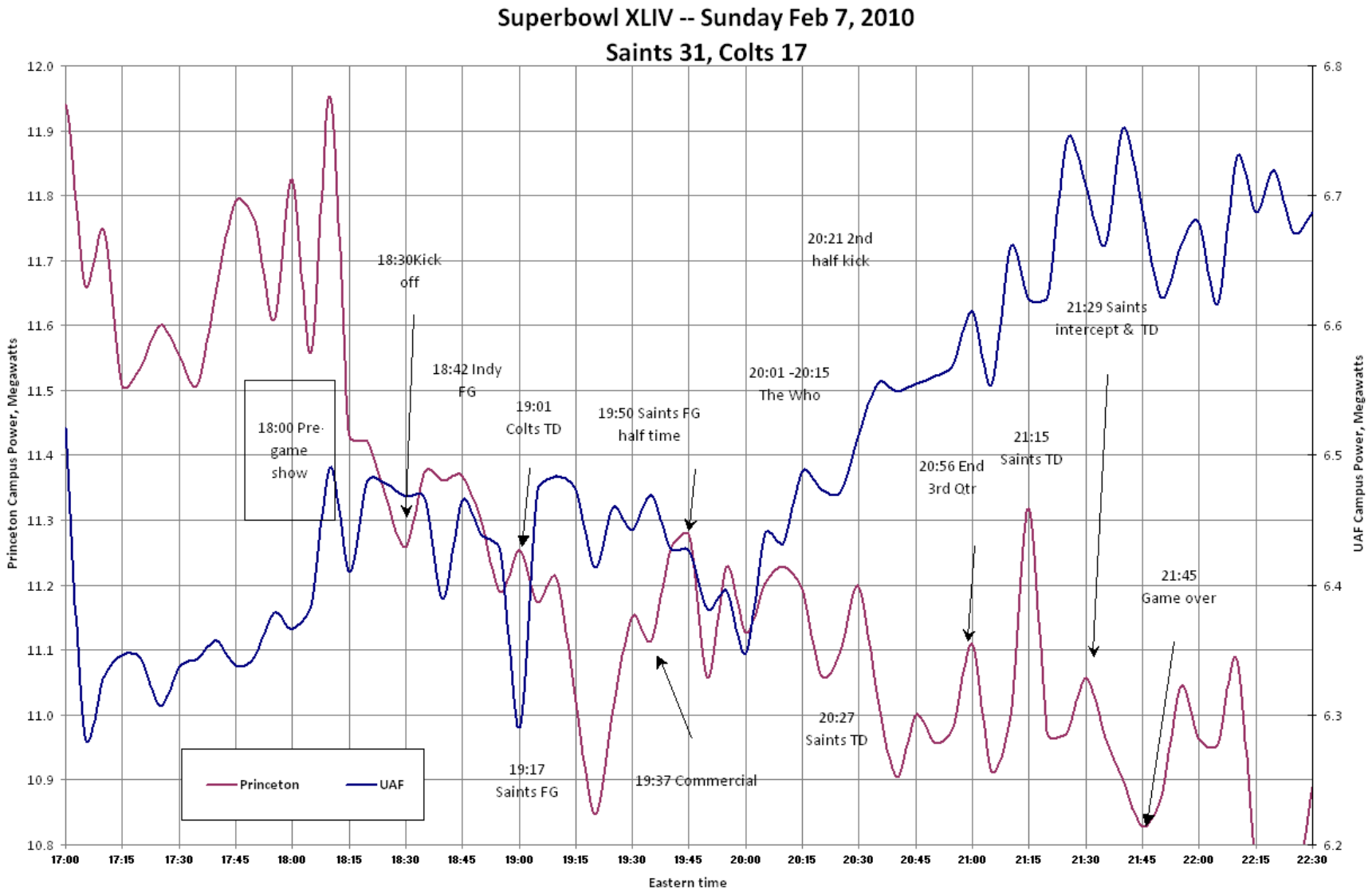
- Intelligent Ash system
- Soot blowing optimization
- Utilities master planning including building modeling
- Baghouse improvements
- Tuning process loops
- Key performance indicators (KPI)



Academic uses of Plant Data

- Live plant data is used in the introduction to engineering classes
- Live data is used in the process technology classes
- Historical data is being used in engineering design projects

Intangible Benefits



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Questions

Photos by Todd Paris

UAF Marketing and Publications

Thank you

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