Application 1
Natural Gas and Medium Voltage Distribution Systems

I. Institutional benefit:

This project involved the negotiation of a contract with our local utility company that caused that company to replace the university's substation, natural gas and medium voltage (12.500) distribution systems throughout campus.

A. This increased the utility's revenue stream in return for their capital investment. The conditions:

    1. The university would go into the utility's regulated rate structure.
    2. The university would purchase these two commodities from the utility company until such time the initial investment was recovered (36 months).
    3. The university granted the utility its current site for their new substation, saving the utility a long, expensive process to acquire real estate.
    4. The university granted the utility the ability to serve other local customers from that substation, so it improved their system.

B. The advantages for the university:

    1. Eliminated millions of dollars in deferred maintenance.
    2. Eliminated power factor issues and demand charge issues.
    3. A gas and electric pulse sensor was installed at each meter with dual contacts and permission for the university to get the signal so that we can monitor each building.
    4. University staff no longer have to maintain either system:
        a. Less maintenance expense on the two systems.
        b. Labor could be reallocated to other tasks.
        c. No more confined space issues in these manholes (and equipment and training that go with confined space).
        d. No line loss in power since power is measured at the building.
        e. Greatly simplified our billings as they are now, for both utilities, by building.
    5. This new substation is fed from two different power plants.
    6. The campus received a back up feed from an opposite direction to give us redundancy.

II. Innovative, Creative, and Original:

A. The general trend on higher education campuses is to provide a central substation and for the campus to maintain these systems. On many campuses there are good reasons for this strategy.

B. On our 320-acre campus, we are reasonably compact. The gas and electric systems were installed in the late 1950's and early 1960's and were at/beyond their life expectancy. The campus was moving through and into a construction period in which:

1. Many of the current utility lines were in the path of construction.
2. All of the utilities were grossly undersized.

C. The decision stemmed from several factors: no internal funding available, the urgent need due to system breakdowns/no dependability, and pending new construction with insufficient capacity. The idea emerged to look for a partner who would package a capital plan to replace the system, maintain it, and allow us to pay for it via a rate structure.

We eventually found the best partner was our local utility company.

III. Portability and Sustainability:

A. Portability. There may be other campuses that could employ this same strategy with the same set of advantages. This might be particularly true if:

1. The local utility does not offer credits/support for green programs.
2. It offers a context to work with a partner to site such things as solar panels or wind turbines.
3. If #2 is possible, there may be opportunities for research and development of alternate power production.

B. Sustainability: The sustainability discussion for this project is rather modest.

1. We did eliminate all transformers from manholes and from inside of buildings. All transformers are above ground and out of doors. This greatly improved safety from this source and for workers servicing these devices.
2. The electric system has a transformer and a switch at each building. As a part of the project, we heavily landscaped these devices, thereby not only hiding them, but greatly enhancing our landscape. Part of the landscape uses wood chips from our campus and community of Valparaiso.

IV. Management Commitment and employee involvement.

A. The university's leadership, including the Board of Directors first approved the concept of a partnership to overcome the issues of the old natural gas and electric systems more than a year before we found a partner.
B. When we approached the local utility we found unusually high support at the Board of Directors level.
C. Once we began contract negotiations it took support from the university leaders and legal counsel to work through many details. The university also worked with the utility and the City to get the approvals and right-of-ways approved for the substation and the pole line into the substation.
D. Within the Facilities Department, our staff was involved during the 1-year planning process which involved data collection and logistics/routing. The 6-month construction process which included the following: marking old lines in advance, coordinating outages/startups, minimizing start up loads, verifying equipment came back on-line, lighting pilots, making sure meters were sending pulse, cleaning natural gas filters until lines were purged, then organizing the landscaping.

V. Documentation

The documentation for the success of this project is two fold. The first is from the annual Sightlines report that demonstrates we have decreased our energy consumption and been able to reallocate labor. This was done in the same time frame that we brought on line our new library at 105,000 sq. ft. and new meteorology building at 16,780 sq. ft.

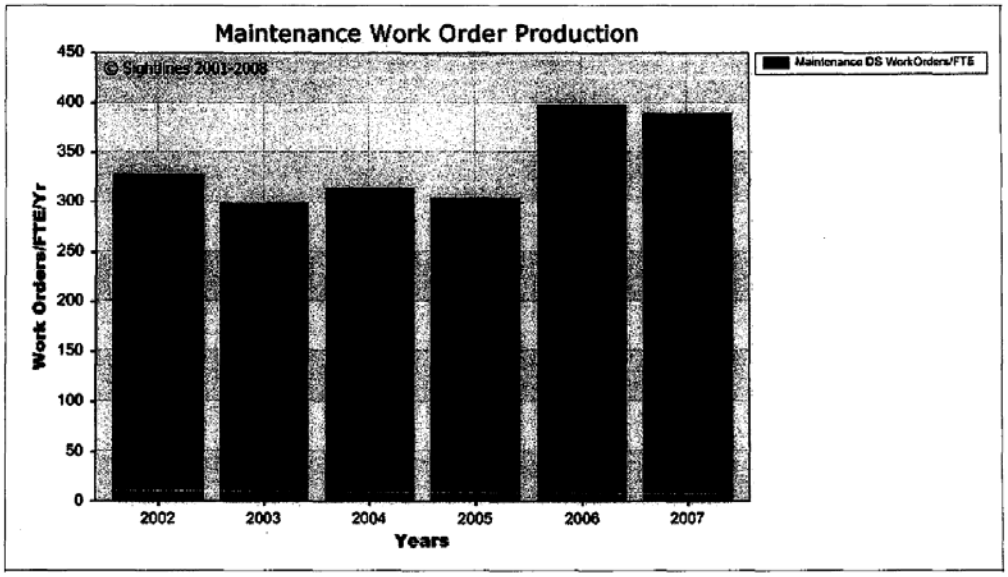
This same Sightlines information will be used in application # 2 as these projects were nearly concurrent.

In general, the two projects described allowed us to reduce supervision, to reallocate personnel from the utilities and the boiler house to our maintenance work force. Secondly, all of the inefficiencies in these systems and hazardous operations were eliminated. The full explanation of this work was published in *Facilities Manager* in an article "Reduce and Simplify", for your convenience I have included that article in this presentation.

Focus on the changes that are documented between 2005 and 2006 then in 2007 where we have a full year of results.

Notice also, that change in asset investment as we solved these issues. This is shown both in the Sightlines analysis and in the 10 Year Repair and Renovations plan. In the 10 Year Repair and Renovation plan these are referred to as ECPH (east campus power house which is the old name for Domke Center) and HTHW (high temperature hot water system)

Sightlines



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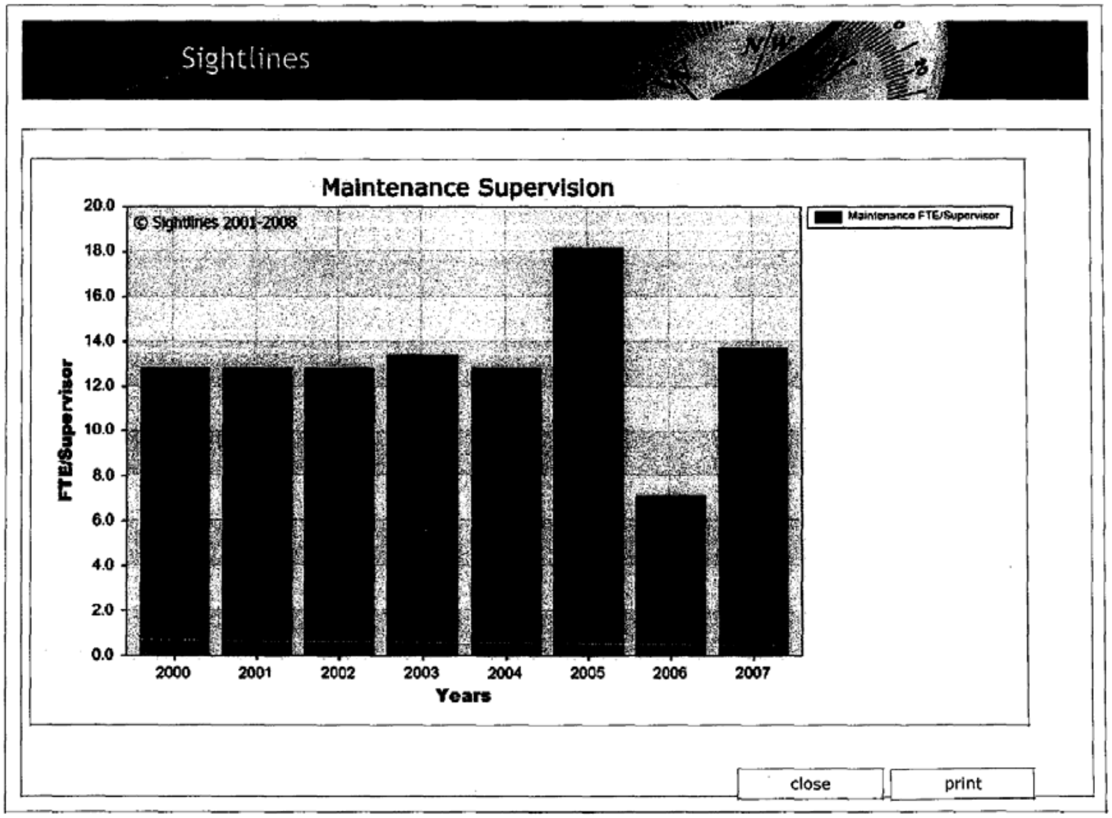
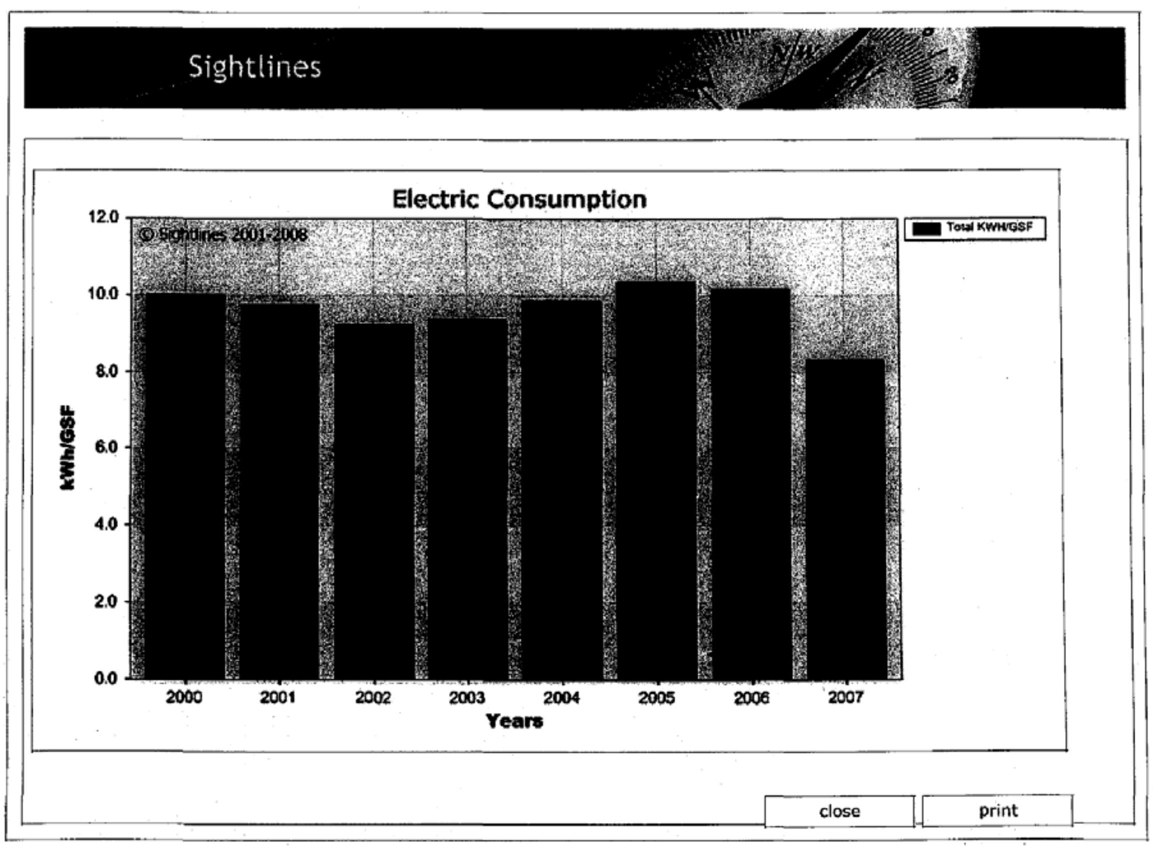
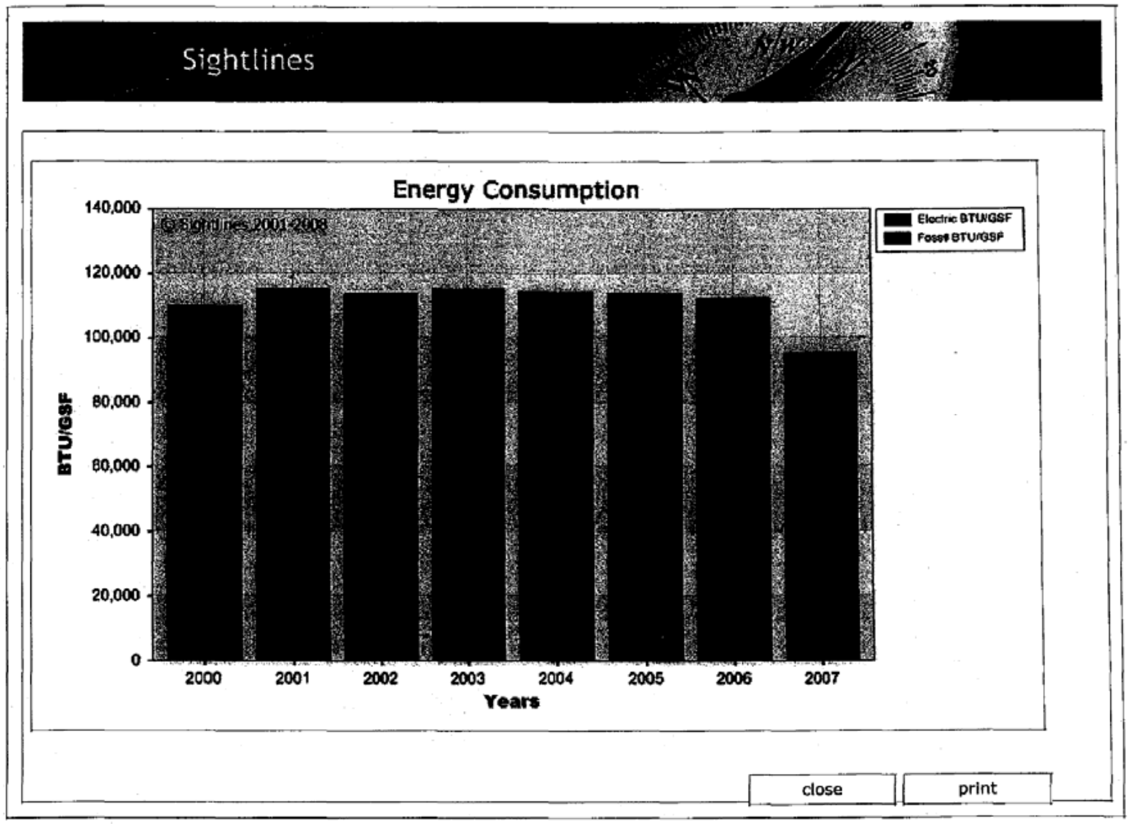
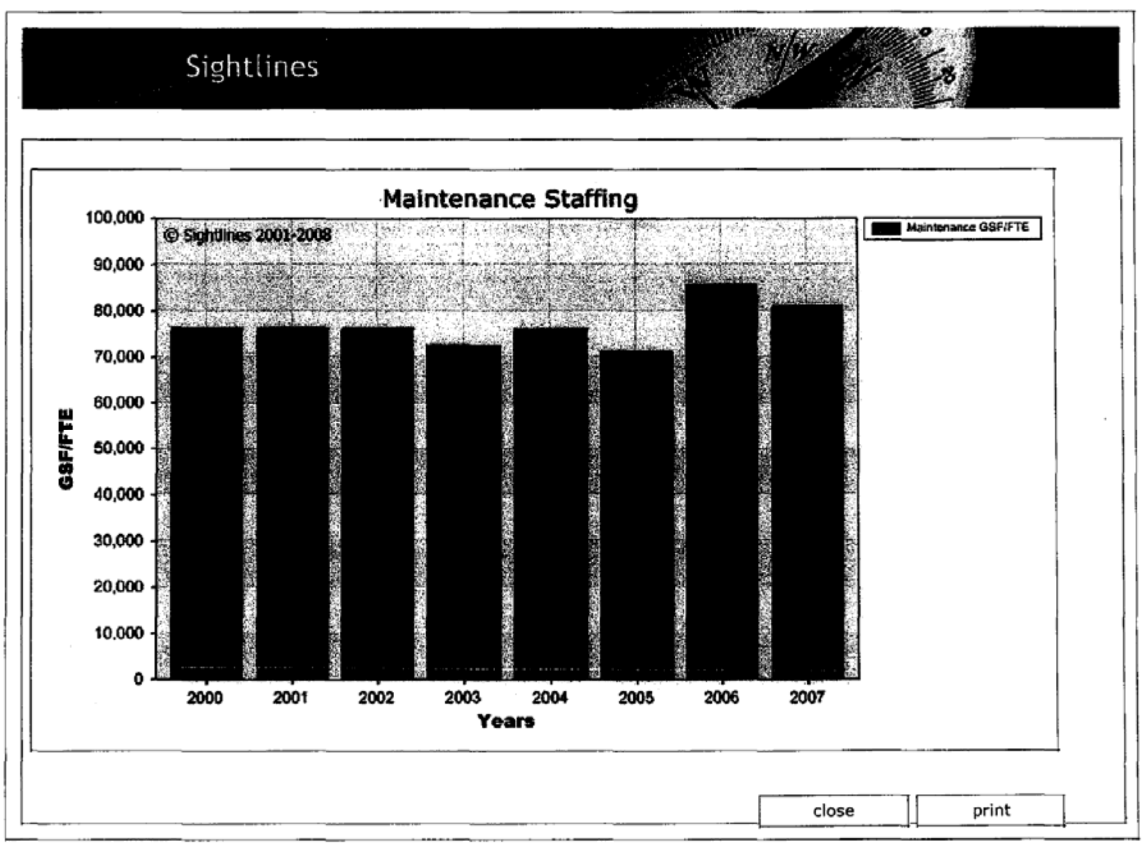

Sightlines
Maintenance Supervision
© Sightlines 2001-2008
Maintenance FTE/Supervisor
FTE/Supervisor
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2000
2001
2002
2003
2004
2005
2006
2007
Years
close
print


Sightlines
Electric Consumption
© Sightlines 2001-2008
Total KWH/GSF
kWh/GSF
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2000
2001
2002
2003
2004
2005
2006
2007
Years
close
print


Sightlines
Energy Consumption
© Sightlines 2001-2008
Electric BTU/GSF
Fossil BTU/GSF
BTU/GSF
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
2000
2001
2002
2003
2004
2005
2006
2007
Years
close
print

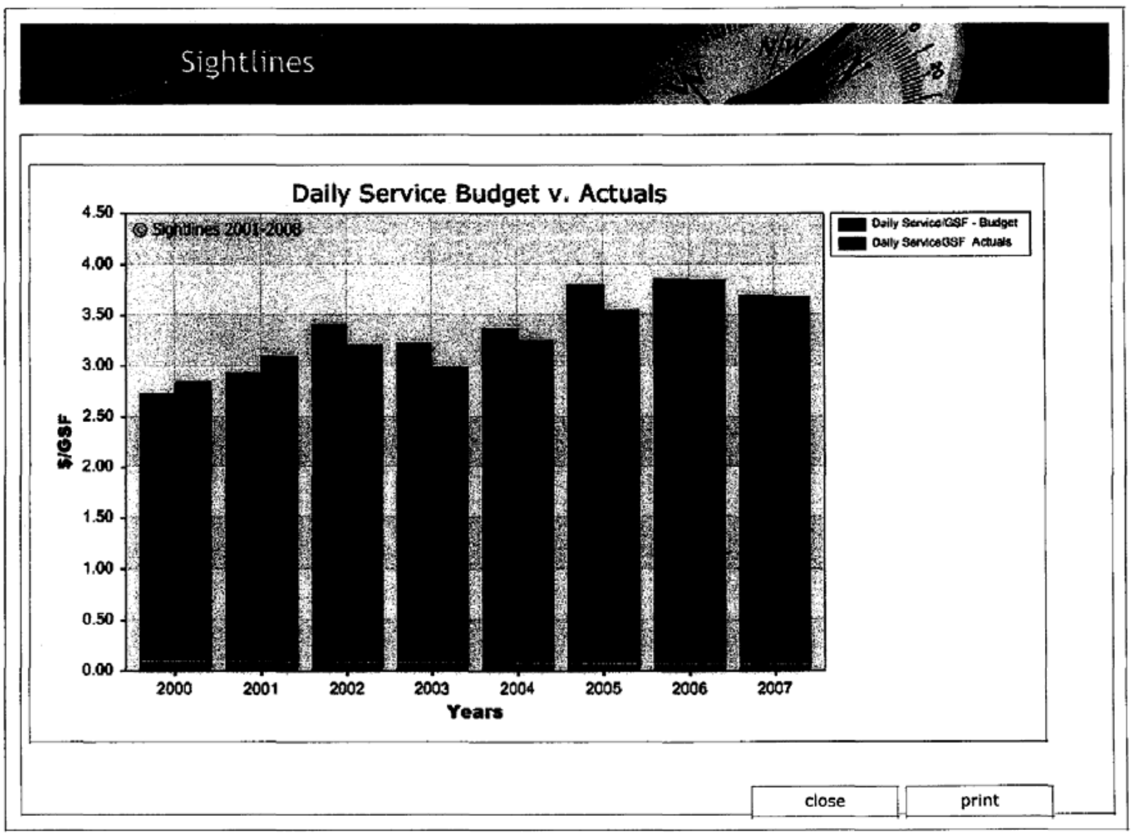

Sightlines
Maintenance Staffing
© Sightlines 2001-2008
Maintenance GSF/FTE
GSF/FTE
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
2000
2001
2002
2003
2004
2005
2006
2007
Years
close
print

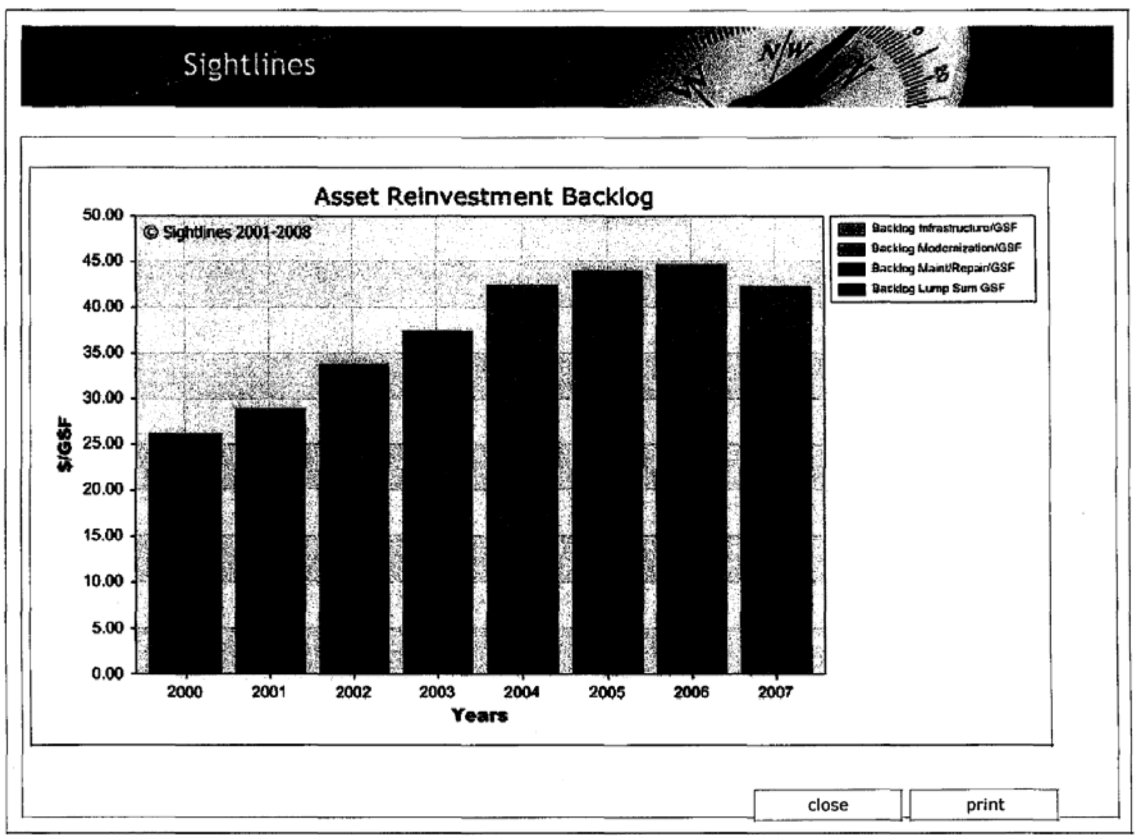
Valparaiso University - Physical Portfolio

Staffing and Labor Allocation

	2000	2001	2002	2003	2004	2005	2006	2007
Trades FTEs								
Mechanical	15.5	15.5	15.5	15.5	14.5	14.2	12.2	13.0
Structural	4.9	4.9	4.9	5.9	5.9	8.5	7.0	7.5
General	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Utilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Custodial	61.3	61.3	61.3	53.6	53.6	57.1	51.2	50.0
Grounds	13.7	13.7	13.7	13.7	13.7	13.5	12.5	11.7
Total	**95.4**	**95.4**	**95.4**	**88.7**	**87.7**	**93.3**	**82.9**	**82.2**
Labor Calculations								
Maintenance GSF/FTE	76,361.0	76,361.0	76,361.0	72,793.0	76,135.0	71,303.0	85,979.0	80,991.0
Maintenance FTE/Super	12.8	12.8	12.8	13.4	12.8	18.2	7.1	13.7
D.S. Work Order/FTE			328	299	314	304	398	389
Maintenance Mater./FTE						11,312	10,011	9,511
Custodial GSF/FTE	23,608	23,608	23,608	26,999	26,999	26,804	30,744	31,451
Custodial FTE/Super	9.9	9.9	9.9	9.9	9.9	30.5	34.1	24.4
Custodial Mater/FTE	2,873	2,884	2,789	3,233	3,157	3,074	2,006	2,145
Grounds Acres/FTE	23	23	23	23	23	24	26	27
Grounds FTE/Super	10.5	10.5	10.5	10.5	10.5	27.0	25.0	19.5

Export to excel collapse


Sightlines
Daily Service Budget v. Actuals
© Sightlines 2001-2008
Daily Service/GSF - Budget
Daily ServiceGSF Actuals
$/GSF
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
2000
2001
2002
2003
2004
2005
2006
2007
Years
close
print


Sightlines
Asset Reinvestment Backlog
© Sightlines 2001-2008
Backlog Infrastructure/GSF
Backlog Modernization/GSF
Backlog Maint/Repair/GSF
Backlog Lump Sum GSF
$/GSF
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2000
2001
2002
2003
2004
2005
2006
2007
Years
close
print

Sightlines

Valparaiso University - Physical Portfolio

Facilities Operating Budget

	2000	2001	2002	2003	2004	2005	2006	2007
Budget								
Daily Service ($/GSF)	2.73	2.93	3.41	3.23	3.37	3.81	3.86	3.69
Planned Maintenance ($/GSF	0.20	0.24	0.46	0.34	0.35	0.55	0.51	0.45
Utilities ($/GSF)	1.04	1.06	0.99	1.13	1.26	1.25	1.41	1.57
Total	**3.97**	**4.23**	**4.86**	**4.70**	**4.98**	**5.61**	**5.78**	**5.71**
Actuals								
Daily Service ($/GSF)	2.84	3.10	3.21	2.98	3.25	3.55	3.85	3.68
Planned Maintenance ($/GSF	0.27	0.34	0.30	0.27	0.34	0.44	0.54	0.43
Utilities ($/GSF)	1.02	1.30	1.04	1.09	1.11	1.33	1.55	1.57
Total	**4.13**	**4.74**	**4.55**	**4.34**	**4.70**	**5.32**	**5.94**	**5.68**

Export to excel

collapse

Valparaiso University
Utilities Infrastructure Analysis

	Estimate at April 29,2006		With Allowance for Unknowns	
Included in Infrastructure Costs:				
VU Cost to Connect Bldgs	$ 2,036,000		$ 2,036,000	
Voice/Data	2,500,000	(A)	3,200,000	(B)
KJWW Consulting/Engineering	900,000		1,000,000	
Sewer/Water	550,000	(C)	1,000,000	(C)
Landscaping/Other	300,000		300,000	
	6,286,000		7,536,000	
VU Share to NIPSCO	2,783,622	(D)	2,783,622	(D)
Grand Total	$ 9,069,622		$ 10,319,622	use 9.7M as midpoint

(A) Based on current proposal from contractor for data duct bank.

(B) Includes estimates for cable and telephone. Amount of work required for cable and telephone has not been determined.

(C) This an estimate of what is needed for Union/Parking ramp and other projects before 1/01/09. The project has not been designed and this is a rough estimate.

(D) Amount will be included in NIPSCO billing for utilities over 30 to 36 months. Amount will be charged to existing buildings and amortized over 20 years.

Infrastructure Costs Allocated to Projects:

Union	$ 2,100,000	
Academic/Education	2,300,000	
Gellersen	700,000	
Parking Ramp	500,000	
Existing Buildings	2,783,622	(D)
Unallocated	1,316,378	
Total	$ 9,700,000	

Description	Life Expectancy	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Flooring		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 209,321	$ -	$ -	$ 209,321
Doors		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Window/treatments		$ -	$ 125,201	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 120,000	$ 245,201
Furniture		$ -	$ -	$ 23,603	$ -	$ -	$ -	$ -	$ -	$ -	$ 22,000	$ 45,603
Paint		$ -	$ -	$ 2,360	$ -	$ 3,756	$ -	$ 4,500	$ -	$ 6,000	$ -	$ 16,616
Ceiling Tile		$ -	$ -	$ 2,360	$ 2,431	$ -	$ -	$ 2,300	$ -	$ -	$ 2,500	$ 9,591
Subtotal Cosmetic		$ -	$ 125,201	$ 28,323	$ 2,431	$ 3,756	$ -	$ 6,800	$ 209,321	$ 6,000	$ 144,500	$ 526,333
Chapel Total		$ 541,910	$ 229,445	$ 28,323	$ 488,651	$ 3,756	$	$ 6,800	$ 209,321	$ 6,000	$ 144,500	$ 1,658,707
Dickmeyer Maintenance	20 yrs											
Dickmeyer exterior doors		$ -	$ 81,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 81,000
Dickmeyer windows		$ -	$ -	$ -	$ 66,855	$ -	$ -	$ -	$ -	$ -	$ -	$ 66,855
Subtotal Maintenance		$ -	$ 81,000	$ -	$ 66,855	$ -	$ -	$ -	$ -	$ -	$ -	$ 147,855
Dickmeyer Cosmetic												
Flooring		$ -	$ -	$ -	$ -	$ -	$ 36,366	$ -	$ -	$ -	$ -	$ 36,366
Doors		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Window/treatments		$ -	$ -	$ -	$ -	$ -	$ 3,869	$ 3,985	$ 5,472	$ -	$ -	$ 13,326
Furniture		$ -	$ -	$ -	$ -	$ -	$ 12,896	$ -	$ 13,681	$ -	$ -	$ 26,578
Paint		$ -	$ -	$ -	$ -	$ 3,756	$ 3,869	$ -	$ -	$ -	$ 4,000	$ 11,625
Ceiling Tile		$ -	$ -	$ -	$ -	$ 3,756	$ 3,869	$ 3,985	$ -	$ -	$ 4,200	$ 15,810
Subtotal Cosmetic		$ -	$ -	$ -	$ -	$ 7,512	$ 60,868	$ 7,970	$ 19,154	$ -	$ 8,200	$ 103,704
Dickmeyer Total		$ -	$ 81,000	$ -	$ 66,855	$ 7,512	$ 60,868	$ 7,970	$ 19,154	$	$ 8,200	$ 251,560
ECPH Maintenance	50 yrs											
ECPH AHU (boiler combustion air)		$ 81,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 81,000
ECPH chemical pump		$ 3,780	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,780
ECPH Remove co-gen **(D)**		$ -	$ 28,644	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 28,644
ECPH roof		$ 53,395	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 53,395
ECPH spare parts circ. Pump **(E)**		$ 27,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,000
ECPH feed water system		$ -	$ 37,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 37,800
Subtotal Maintenance		$ 165,175	$ 66,444	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 231,620
ECPH Cosmetic												
Flooring		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Doors		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Window/treatments		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Furniture		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Paint		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Ceiling Tile		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal Cosmetic		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
ECPH Total		$ 165,175	$ 66,444	$	$	$ -	$ -	$	$	$	$ -	$ 231,620
Gellersen Maintenance	30 years											
Gellersen AHU's (roof units) a/c shops		$ -	$ -	$ -	$ 303,887	$ -	$ -	$ -	$ -	$ -	$ -	$ 303,887
Gellersen asbestos removal		$ -	$ 91,662	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 91,662
Gellersen chiller convert to air cooler **(F)**		$ 515,597	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 515,597
Gellersen insulate perimeter (energy)		$ 11,124	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,124
Gellersen locks (security/function)		$ 5,562	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,562
Gellersen roof ladder (safety)		$ -	$ -	$ -	$ 3,647	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,647
Gellersen roof		$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 200,000
Subtotal Maintenance		$ 532,283	$ 291,662	$ -	$ 307,534	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,131,479
Gellersen Cosmetic												
Flooring		$ -	$ -	$ 73,169	$ -	$ -	$ -	$ 82,352	$ -	$ -	$ -	$ 155,521
Doors		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Window/treatments		$ -	$ -	$ 3,540	$ 4,862	$ 5,008	$ -	$ -	$ -	$ -	$ 4,800	$ 18,210
Furniture		$ -	$ -	$ 11,801	$ 12,155	$ 25,040	$ -	$ -	$ -	$ -	$ -	$ 48,996
Paint		$ -	$ -	$ 5,901	$ 6,078	$ 6,260	$ 6,448	$ -	$ -	$ -	$ 6,200	$ 30,887
Ceiling Tile		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,092	$ 14,514	$ 28,606
Subtotal Cosmetic		$ -	$ -	$ 94,411	$ 23,096	$ 36,307	$ 6,448	$ 82,352	$ -	$ 14,092	$ 25,514	$ 282,220
Gellersen Total		$ 532,283	$ 291,662	$ 94,411	$ 330,630	$ 36,307	$ 6,448	$ 82,352	$	$ 14,092	$ 25,514	$ 1,413,700

R&R UTILITY INFRASTRUCTURE

G:\FINANCE OFFICE\BOD Facilities\06 July\Repair & Replacement List Rev. 3-06

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Boilerhouse											
ECPH boiler feed pump seal	$ 5,156	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,156
HTHW ECPH to Schnabel/Urschel **(A)**	$ -	$ -	$ -	$ 834,300	$ -	$ -	$ -	$ -	$ -	$ -	$ 834,300
Annual Capital upgrades	$ -	$ -	$ -	$ -	$ 25,040	$ 25,791	$ 26,565	$ 27,362	$ 28,183	$ 29,028	$ 161,969
HTHW pumps	$ 27,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,000
HTHW System upgrades	$ -	$ -	$ -	$ -	$ 12,520	$ 12,896	$ 13,283	$ 13,681	$ 14,092	$ 14,514	$ 80,987
Subtotal Boilerhouse	$ 32,156	$ -	$ -	$ 834,300	$ 37,560	$ 38,688	$ 39,848	$ 41,043	$ 42,274	$ 43,542	$ 1,109,412
Energy Management											
EMS convert alerton to ALS	$ -	$ 160,408	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 160,408
EMS convert Guild/Memorial to ALS	$ -	$ 27,499	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,499
EMS convert Kade to ALS	$ -	$ 20,624	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,624
Utilities digital electric meters	$ -	$ -	$ 73,759	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 73,759
Wesemann VAV box replacement	$ -	$ 73,329	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 73,329
Utility upgrade to network or automated logic	$ 114,577	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 114,577
Subtotal Energy Management	$ 114,577	$ 281,860	$ 73,759	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 470,196
Storm Drainage											
Storm drainage	$ 22,582	$ 11,458	$ 11,801	$ 12,155	$ 12,520	$ 12,895	$ 13,283	$ 13,681	$ 14,092	$ 14,514	$ 138,982
Replace large cistern near Loke	$ -	$ -	$ -	$ -	$ 62,601	$ -	$ -	$ -	$ -	$ -	$ 62,601
Kretzmann phase II & III	$ -	$ 22,915	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 22,915
Southloop west	$ -	$ -	$ -	$ -	$ 250,403	$ -	$ -	$ -	$ -	$ -	$ 250,403
Subtotal Storm Drainage	$ 22,582	$ 34,373	$ 11,801	$ 12,155	$ 325,525	$ 12,895	$ 13,283	$ 13,681	$ 14,092	$ 14,514	$ 474,902
Sanitary Sewer											
Alumni - sewer	$ 55,620	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 55,620
Sanitary drainage	$ 22,582	$ 11,458	$ 11,801	$ 12,155	$ 12,520	$ 12,895	$ 13,283	$ 13,681	$ 14,092	$ 14,514	$ 138,982
Subtotal Sanitary Sewer	$ 78,202	$ 11,458	$ 11,801	$ 12,155	$ 12,520	$ 12,895	$ 13,283	$ 13,681	$ 14,092	$ 14,514	$ 194,602
Water Mains											
Water main replace (Chapel Drive)	$ 297,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 297,000
Subtotal Water Mains	$ 297,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 297,000
Mechanical Rooms											
Mech rooms pipe & tank insulation	$ 28,244	$ 16,041	$ 17,702	$ 19,449	$ 25,040	$ -	$ -	$ -	$ -	$ -	$ 106,476
Mech rooms valves/coils/pumps/motors	$ 55,620	$ 22,915	$ 23,603	$ 24,311	$ 25,040	$ -	$ -	$ -	$ -	$ -	$ 151,490
Subtotal Mechanical Rooms	$ 83,864	$ 38,956	$ 41,305	$ 43,760	$ 50,081	$ -	$ -	$ -	$ -	$ -	$ 257,966
Grand Total	**$ 628,380**	**$ 366,647**	**$ 138,667**	**$ 902,371**	**$ 425,686**	**$ 64,478**	**$ 66,414**	**$ 68,406**	**$ 70,458**	**$ 72,571**	**$ 2,804,078**

NOTES:

(A) This section of HTHW piping is original path to Gellersen. This is a main that will fail at some point. Since we are disturbing it with the Schnabel project the likelihood of failure in the next 1-3 years is hig
The branch line to Urschel had an initial failure in 1991.

OUTSIDE THE BOX: Reduce and Simplify

by Frederick W. Plant

For many years, Valparaiso University Physical Plant Services staff has worked at energy conservation and management. We have been able to flatten the increased consumption in natural gas and electric consumption even while adding renovated and new buildings. We continually look for opportunities to advance plans awaiting the right time to proceed.

There are certain constants that most institutions wish to achieve: be more efficient, decrease deferred maintenance, fund future known maintenance needs, improve customer service focus, and provide system reliability. Fundamentally, all of the paths save money or allow reallocations as a by product of reducing and simplifying an operation. "Plan the work—work the plan" is the overarching theme.

Project 1

Because we continually evolve and develop our strategies, Valparaiso University (VU) was able to take the maximum advantage of opportunities in 2005-06. Our staff spent a year working with a design team planning new natural gas and high voltage electrical distribution systems. The desired outcome would be that the university would no longer own nor maintain the natural gas, the high voltage system, nor the substation.

Project 2

In October 2005, as the heating season was just beginning; our first heating distribution system leak of the season occurred. Leaks in this system had been occurring over the previous five winters because the system was deteriorating. Our president stated he wanted a recommendation for a way to replace the heating distribution system as soon as possible, with the understanding that a way would be found to fund it, but it had to be operational by October 2006. Two events—construction of a new natural gas system and the failure of the heating distribution system—had converged.

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Project 3

For some time, we had been considering the reengineering of our Physical Plant Services trades shop from several small shops for each trade to one maintenance shop. Events occurring relative to the new gas, electric, and heating system changes, coupled with several vacant positions, made the timing right to make this change as well. The replacement of the substation, high voltage, and natural gas systems were going to reduce the full-time equivalent staff required to maintain these systems, allowing these individuals to have a much greater focus on routine and preventive maintenance.

The Convergence of Projects 1 and 2

The planning for a new high voltage system, substation, and a new 50-PSI natural gas main to all campus buildings was about to begin construction and was to be completed before August 2006. This created the option for us to install high efficiency boilers in the 15 buildings served by the heating system and thereby to eliminate the 45-year-old boiler house.

The boiler house had been maintained well. Several boiler efficiency features had been added such as: electronic ignition, tube turbulators, stack sensors, energy management, aggressive management of system pressure and temperature. Our campus is southeast of Chicago in an area that has air pollution controls, thus stack emissions were monitored carefully. One of the boilers was a dual fuel (natural gas and fuel oil), thus a 20,000 gallon underground storage tank is present. This is our last UST on campus and is in the path of a future campus road project.

The boiler house operation had several operations of FTE, cost, and risk exposure. These systems require boiler water feed and chemicals, and in our area they also require the water to be softened. The distribution system also was chemically treated and the makeup water softened. The aspect of water treatment creates a potential for employee exposure to chemicals and accidents from heavy lifting. We used nitrogen to maintain pressure on the system requiring the monitoring of volumes, switching tanks, and tank exchanges. There are costs for the consumption of electricity for the circulation pumps, pumps inside the boiler house, pump and motor maintenance. The boilers were annually cleaned, serviced, and inspected. We maintained an alarm system that provided pager signals 24/7.

The heating distribution system was a jacketed direct buried system in large part. It was of various vintages and the cathodes protection was largely spent. Such a system had manholes where valves were maintained and had to be pumped out from time to time. Another aspect to this system was the confined space requirements, training, and equipment that had to be accomplished.

System failures were occurring at the rate of one to three leaks per year. Since these occur during heating season, the impacts on residence halls as well as classrooms/offices was extremely disruptive. These leaks were costing from $80,000 to $280,000 per failure and were difficult to budget and were a significant distraction to staffing efforts. These repairs left scars on the campus landscape at a time when there is a focus on campus beautification. Even though insulated, the system heat loss was sufficient to melt snow and kill grass.

of the heat system down paid for the chiller in three cooling seasons.

Thus timing, opportunity, boiler efficiency, eliminating the last UST, and getting the distribution system out of the way of potential future construction all led us in the direction of a decentralized system.

Installing the high efficiency boilers, a decentralized system, seemed the best route.

In most of the 15 buildings space is available in the mechanical rooms. In those buildings where space was not available, it could be made available. The second task was for Valparaiso University to identify the boilers, their operating characteristics, warranty, factory willingness to install and train our personnel, and to meet our delivery schedule. This selection process included site visits for each supplier being considered.

It was critical these be condensing boilers, at least one set had to operate at temperatures to satisfy an absorption chiller. All controls had to allow connection to our energy management system and had to operate in groups. The objective was to develop a controls package that kept all units working in their highest efficiency range and to allow boilers to be added in the future if there was a building addition.

Courtesy Valparaiso University

We considered rebuilding the distribution system, but to take full advantage of the new life expectancy, the boiler house should also be updated. The cost to update both was beyond our financial capability. The lead time to develop plans for both was greater than the one year available. A new distribution system might be constructed along routes that would be considered for future building construction. Further, the ability to update a central boiler house might require additional real estate, the continued maintenance of the UST, and the maintenance of emissions permits.

The most attractive option was to decentralize heating production to the 15 buildings. This could be done in the time available. We knew from previous engineering studies that technology had improved package boilers in terms of size and efficiency. We also knew that we could quantify the range of heat loss in our distribution system. Two years earlier we had replaced an absorption chiller with a DX unit with no cooling tower, the financial savings paid by being able to shut that leg

This strategy provides boilers that are much easier to service and manage. The redundancy at each locations provides a spare parts inventory for emergencies. This strategy allows the reallocation of labor. These boilers are sort of "plug and play" in that the diagnostics gives us a pretty good idea of the component part that needs to be serviced or changed. This strategy eliminated all of the UST, emissions, chemical water, water softening, and confined space issues.

As a result of the new natural gas and electric systems, every building has pulse metering. Valparaiso University has access to these pulses so that we can capture real time consumption data. The energy management system allows us to identify and manage each building's consumption. As a result, we have the ability to measure the actual gas consumed by these new boilers.

Physical Plant Staff developed an RFP to pursue the decentralized system. The RFP specified condensing boilers that operated at 95 percent efficiency over a wide load range.

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The burner specified to have a 20-year life expectancy, factory start up, and factory training. Each site had no less that two boilers sized so that with any one boiler off line the remaining boilers could carry 70 percent of the load. The boiler controls to be programmable to allow load shifting between the boilers to maintain maximum efficiency. The boilers had to fit into the existing spaces without modification. Stack location had to be approved. (This could mean the boilers could be taken apart to arrive at the space, but in that instance, they had to be re-assembled by factory representatives.)

Installation sequence was important as one system had to be capable of absorption cooling, thus it had to be operational by May 2006. Residence halls had to be operational by August 2006, and the balance of the buildings by October 2006. The project had to be coordinated in terms of schedule, contractors, and paths with the natural gas and high voltage projects. All of this work was concurrent with all the same mechanical and electrical rooms as destinations. All respondents to the RFP had to attend a pre-bid meeting and walk through.

The RFP sought funding options that would allow the university to examine options as a performance contract and/or financing rates. This was also a means for respondents to explore partners that might give each a particular advantage. To aid in this process the university provided unit costs for utilities (since this was changing as a result of natural gas and electric projects). Valparaiso University provided respondents with current system operating costs except we did not include labor or installation costs as those were being reallocated. Each respondent was to calculate the cost of operation of this new configuration and approximate payback. Each respondent was to offer the university financing options such as a Performance Contract, as a financed project, or cash where the university would secure its own financing.

Three firms completed the process. Our staff met with each respondent for: careful scope reviews, careful checking of delivery dates for the boilers, and careful checking of natural gas/electric project progress.

Project Outcomes

This project has a guaranteed payback in seven years (consistent with our in-house estimates), which depends on the price of natural gas as well as the severity of winters. The project costs were financed independent of the contractor because of more favorable rates. Central boiler house distribution and distribution system were decommissioned in May 2006. The central boiler house is now being considered for a retro fit to some other purpose…sort of "found space."

Component parts are being offered for sale to help offset the costs. Boiler and system chemicals reallocated to other buildings or returned for credit. A portion of the boiler house is being used as a contractor office for another project (reducing the general conditions cost on that project). Removal of all manholes is now underway and with that maintenance and confined space issues. The distribution system path is being worked and seeded in some locations, while in others the system is being dug up and used to route a new water main. Parts of the old high voltage system route are being used for this new water main and a new section of the storm sewer.

The deferred and planned maintenance for the boiler house and distribution system have been removed from our ten-year capital plan. There is a Physical Plant Services operating savings because of this shift with a non-PPS savings in insurance premiums that are funding the project. The budget uncertainty caused by the large breakdowns from this source is now eliminated.

The "freed" labor is now available to service the new buildings we are adding and the new high efficiency boilers. We reduced our regulated exposure (UST and air pollution), confined space, and reduced our employee exposure to chemicals for boiler water treatment.

This project has a guaranteed payback in seven years (consistent with our in-house estimates), which depends on the price of natural gas as well as the severity of winters.

Natural Gas and Electric Replacement

The university owned its natural gas, substation, and electrical distribution systems which were, in large part, 40 to 50 years old. The system had some sections and components replaced in the last ten years. A consultant assessed the system as at its life's end. The natural gas system operated at 10 PSI and did not have capacity to add the anticipated future projects. The electric system was a 4160-volt system that was increasingly experiencing component failure resulting in at least single building outages about one time every six weeks and a circuit failure about three times per year.

The system was near its maximum capacity. The 4160 system was underground with switches and link boxes in manholes. Keeping manholes dry and confined space entry permits/training were a constant task. The university did not have sufficient staff or equipment to effectively maintain the high voltage or natural gas distribution systems. The university did not have the necessary equipment or expertise to repair the natural gas distribution system. Both of these systems were resulting in large energy expenses, maintenance expenses, and service interruptions.

For about five years we looked for a partner who would:

- Provide the cash to replace these two systems.
- Provide the maintenance for these two systems.
- Bill us monthly for the capital investment, maintenance, and consumption.

The intended outcomes of our search had been to establish a larger substation at a higher voltage (12,500) and to establish capacity in both natural gas electric systems to service our facility's growth potential. Further, it was our desire to transfer the cost of labor to an outsourcer that was properly trained, equipped, and could manage the spare parts inventory to maintain reliable services. This would allow Physical Plant Services to reallocate our labor to a focus on our core mission. Secondly, personnel could focus on the maintenance of our existing buildings and the new/renovated ones planned.

Eventually the partner who presented the best opportunity was our local energy provider who provides both electricity and natural gas from a subsidiary of this provider. This provider had been the successful bidder in recent natural gas transactions. Electricity had been provided to the university substation via a single feed from their grid.

In order to advance this discussion Valparaiso University would grant a site for a substation to be owned by the provider along with all of the necessary easements via paths defined by the university. This substation would be served by two sources and would provide service to the neighboring community. The campus would also have the potential for service from a second existing substation from a third source.

Natural gas and electricity would be routed to each and every building. The capacity of the system would allow the construction, renovation, additions to all of the university plans over the life expectancy of these systems. Valparaiso University would move these two utilities into the building and connect. Since this work would involve several contractors and subcontractors; since the natural gas system had to be in place for the decentralized boiler project; since all of this had to be done before students returned in August 2006, schedule management and coordination would critical.

The payoffs for the university were that several systems old systems were replaced. All electric and heating distribution system manholes were eliminated, and with that all the con-

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fined space and maintenance issues. Many of the hours spent in chemical water treatment are now reallocated. The new electric rate structure avoids most demand rates, power factor correction, and maintenance of a capacitor bank.

Clearly, a long list of deferred maintenance and future planned maintenance has been wiped away. Future capacity issues are now gone. Reliability issues are now gone. The capital investment will be repaid over 30 or 36 months depending on the item. The "new business" construction of a new parking ramp and university union will also help offset the costs. The new union could not have been constructed without these new utilities.

The provider and university are now working together to produce an electronic billing system that can be downloaded into our spreadsheets for purposes of utility analysis. The pulse metering and energy management now allow the university to monitor consumption by building and to explore working with building occupants to influence consumption.

Valparaiso University has been able to sell many of the old high voltage system components and boiler house components to of set some of the costs. As a windfall, recent copper price increases made it feasible to pull all of the old 4160 wire and sell it, to help offset project costs.

The payoffs for the provider include a new substation that serves many other customers. This substation real estate was free with no zoning variance issues. They have locked in VU as a customer at standard rate structures, which was an aid in their relationship with the state regulatory agency. They also have a clear sense of the future campus growth and their potential revenue streams. Our work with this provider will now include exploration and testing of some new technologies.

Convergence of Projects 1 and 2 with the Physical Plant Services Reengineering Plan

With the changes discussed, it was possible to consider the reengineered organization for our trades group. Thus our carpenters (including painters and locksmiths), plumbers, electricians, and HVAC are now divided into two maintenance teams.

With the elimination of the boiler house, HTHW distribution, natural gas, and high voltage we could offer a different type of service. This now allows Physical Plant Services to hire personnel with more general maintenance skills. The buildings the university is now constructing and planning are far more high tech, but there is less potential to require an increase in the size of our workforce.

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The ability to shift our current talent to the new technology and reduce the time they spend on utilities and utility emergencies would provide improved ability to focus on our core mission, more face time with customers, and recapture a focus on preventive maintenance.

Our reengineered trades group is now a team devoted to maintenance and a team devoted to preventive maintenance, with approximately half of the staff on each team. Each team has a mixture of skills and experience. There are times when workers will move to the other team to meet some focused need. There is one billing rate for both teams, making estimates much easier to prepare and much easier to explain to customers. We also now avoid the delays and coordination issues that passing a multi-trade work order among the shops creates.

Our outcomes have been a reduction from five supervisors to two. The two former supervisors have been reassigned. The third individual is now training on the energy management system. Many training and safety equipment needs are eliminated through the elimination of the manholes. We simplified our billing and rates.

Our schedules have been met, our budgets have been met, and our reengineered trades shop is complete. Gary Greiner, associate director of maintenance; Bruce Monnier, assistant director of special services; Dick McNamara, associate director of construction and renovation; and Matt Maynard, assistant director of maintenance, represented VU in the execution of these plans. Clearly, the convergence of these plans at the implementation stage required the cooperation of many VU departments, companies, and service providers.

At the end of the summer of 2006 we held a "savor the moment" breakfast!