



ENERGY STAR

# **Submetering For Strategic Energy Management**

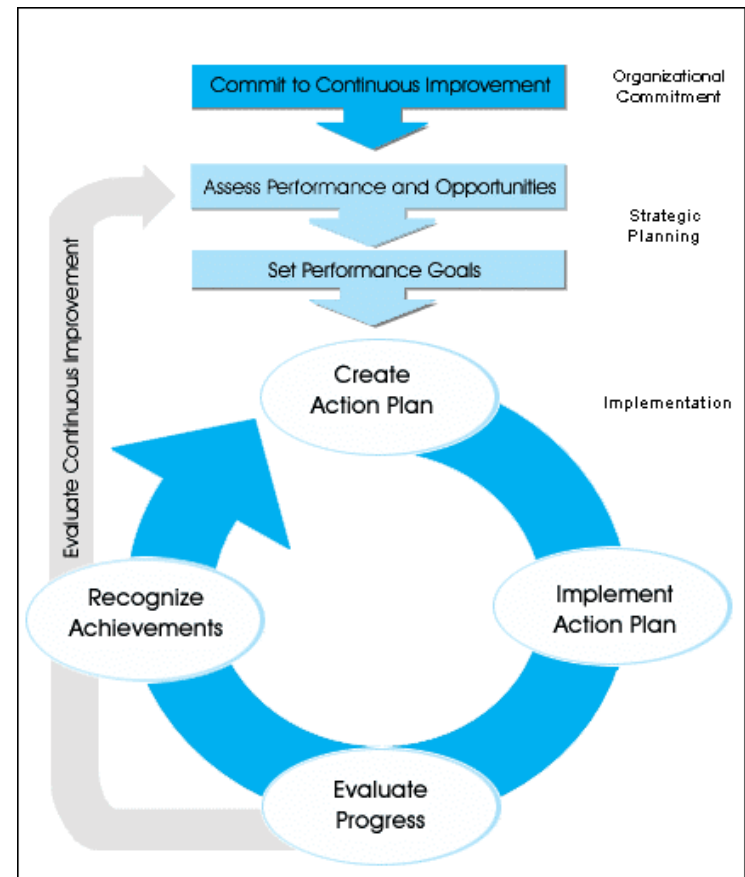
August 20, 2003



ENERGY STAR

# About the Web Conferences

- **Monthly**
- **Topics are structured on a strategic approach to energy management**
- **Help you continually improve energy performance**
- **Opportunity to share ideas with others**
- **Slides are a starting point for discussion**
- **Open & Interactive**





# Today's Web Conference

- Welcome
- Melinda DeLuca - Miller Brewing Co.
- Scott Martin – University of Virginia
- Questions & Discussion



ENERGY STAR

# Submetering

- Can provide robust information for setting baselines, benchmarking, and evaluating performance
- Can assist with identifying areas for improvement and trouble shooting
- Can help increase accountability for energy use with an organization



# Utility Submetering Program

University of Virginia

Facilities Management

*Utilities Department*

Submetering Program

# Overview

- University of Virginia (UVA) “at a glance”
- Utility consumption at UVA
- Origins and goals of submetering at UVA
- UVA submetering “at a glance”
- Submetering decisions
- Data tracking
- Information systems
- Submetering rewards
- Lessons learned
- Resources

# UVA “At a glance”

- Founded by Thomas Jefferson in 1819
  - Over 500 facilities including
    - Hospital/ patient care
    - Research/ vivaria
    - Libraries
    - Classrooms
    - Offices
  - Over 12 million gross square feet
  - Over 23,000 students
  - Over 12,000 faculty and staff

# Utility Consumption at UVA

- **Electricity** - Power is primarily distributed to university buildings (almost 90% of the GSF) through four (4) university owned electrical substations. Dominion Virginia power is responsible for their direct service drops to buildings and for the transformer yards in the UVA substations.
  - Overall current annual consumption is about 250 million kWh
- **Steam/ MTHW/ HTHW** – Heat is generated at two University plants, the Main Heat Plant, which produces steam, MTHW, and DHW, and the North Grounds plant which produces HTHW.
  - Overall current annual production is about 800,000 MMBTU



# Utility Consumption at UVA (continued)

- **Chilled Water**– Chilled water is generated at twelve University plants, comprising seven chilled water “loops”, with a combined capacity of almost 25,000 tons.
  - Overall current annual production is about 650,000 MMBTU
- **Natural gas** – Overall current consumption is about 400,000 MMBTU

# Utility Consumption at UVA (continued)

- **Oil** – Overall current annual consumption is about 12,000 MMBTU
- **Water** - The University owns, maintains, and operates its own storage tanks, pumps and distribution system. Current daily consumption ranges from 0.8 to 1.8 million GPD. Current annual consumption is about 600 million gallons.

# Origins and Goals of Submetering at UVA

- Origins - Paradigm shift in early 90s
  - University had few fiscal customers and costs were apportioned (primarily)
  - Fiscal complexity grew
  - Concurrently, the Utilities Department began to dedicate money to grow the metering base, focusing on larger utility customers and plant systems.
    - Utilities director emphasized the need to understand facility consumption to target energy conservation work.
      - “You can’t manage what you don’t measure.”

# Origins and Goals (continued)

- Energy program is multi-faceted
  - Traditional Simpler Items (calculated savings)
    - lighting retrofits
    - motor replacements
  - Complicated improvements
    - Studies of infrastructure systems such as plants or facilities identified as large, or disproportionately large, energy users, through the implementation of metering and comparative reporting.

# Origins and Goals (continued)

## ■ Goals

- Provide Accurate Customer Billing
- Target Energy Opportunities
- Provide Planning Tool
  - Identify plant, infrastructure, and building capacity issues
  - Identify production and consumption trends
  - Benchmarking
- Provide Troubleshooting tool

# UVA Submetering “At a glance”

- Over 1900 Active Real and Virtual Meters
  - Over 1300 real meters
    - About 750 University meters
      - About 300 Electric meters
      - About 200 Water meters (including irrigation, cooling tower makeup/ blow-down for sewer credits)
      - About 100 Chilled water meters
      - About 50 Steam meters
      - About 50 MTHW/ HTHW meters

# UVA Submetering “At a glance” (continued)

- About 600 Vendor meters, reporting data from utility bills such as periodic consumption information (usually monthly)
  - Over 500 virtual meters (Trash Hauling, Building Automation, etc.)
- A Variety of Meter Technologies are Installed (all hard-wired or piped)
  - Ultrasonic, Magnetic, Vortex Shedding, Orifice, Paddle/Turbine, Venturi, V-Cone, 4-Wire Wye, 3-Wire Delta, Variable Area, Disc

# Submetering Decisions

- Established priorities for submetering are multifold:
  - Regulatory requirements.
    - Run-time on emergency generators for Title V.
    - Fuel consumption at heating plants for air-permitting, etc.
  - Utility plants to track efficiencies and help reconcile plant production/distribution to facility use.
  - Large consumers.
  - Auxiliary consumers.
  - Special data needs (especially relates to connecting metering to BAS such as with vivaria).
  - Opportunistic (new construction/ renovation).



# Data Tracking

- Basically a few mechanisms:
  - In-house meters, read monthly (more and more linked to BAS for real-time/ near real-time trending).
  - Vendor bills received either monthly or as commodities are delivered (oil for example).
- On-line examples of meter readings.

# Information Systems

- In-house developed system
  - Origins for metering in
    - Dbase;
    - Access, Access w/ Gupta SQLBase, Access w/ Microsoft SQL Server;
    - Visual Basic w/ SQL Server;
    - Currently Visual Studio.NET (web-based) w/ SQL Server.

# Submetering Rewards

- Jordan Hall (an example)
- Planning (Plant/ Infrastructure Loading & Profiles)
- Annual Report (<http://utilities.fm.virginia.edu/anrpt.htm>)
- EPA & other awards
- Drought
  - Metering the use of water in closed loop heating and cooling systems to track leaks and repair them.
  - Metering the use of water through master meters to assess progress.  
Reviewing metering data to target high water consumption (leaks, process cooling, etc.)

# Lessons Learned (Tips)

- Successful metering takes work!
  - Contractors may not have familiarity with correctly installing and configuring meters. They often welcome your help.
    - Don't hesitate to get involved with installation/ commissioning.
- Metering helps bring control problems to forefront (Jordan Hall steam/ chw example).
- Sometimes we don't understand what the meters are telling us! Reconciling plants vs consumers helps work out anomalies.
- Building Automation System (BAS) resets

# Resources

- Individuals (contact info available through web site)
  - Cheryl Gomez – Director of Utilities
  - Tony Motto – Energy Programs Manager
  - Ed Brooks – Metering Superintendent
  - Scott Martin – Utility Systems Analyst
- Documents
  - Design Guidelines (for minimal metering requirements)
  - Motor repair/ replacement policy
  - Procurement policies
- Web (Internet)
  - UVa Utilities Department - <http://utilities.fm.virginia.edu>

# Sample Reports

- Meter Plan
- Meters Needing Action
- Plant Reconciliation
- Monthly Pre-Billing Checks
- Building Cost Summary
- Building Cost History

Contents

- 1150 - University Hospital
  - Electricity
    - Dominion Virginia Power
    - Water & Sewer
      - Water Pumping Stations
  - 1142 - Jordan Hall
    - East End Substation
  - Chilled Water
    - Health System Chilled Water Loop (
  - Trash Removal
    - Waste Management, Inc.
  - 0256 - Chemistry Building
    - Alderman (West End) Substation
  - Steam
    - Main Heating Plant
  - 1157 - Medical Research Lab (MR-
    - 1172 - Multistory Building
  - MTHW
    - 0210 - Gilmer Hall
    - 1181 - Medical School Bldg
    - 0082 - Alderman Library
  - Newcomb Road Chilled Water Loop
    - 0204 - Thornton Hall
  - Propane Gas
    - Tiger Fuel
  - 0527 - Withers-Brown Hall
    - HTHW
      - North Grounds Heating Plant
    - 0122 - Newcomb Hall
    - 5271 - Aquatic & Fitness Center
  - McCormick Road Chilled Water Loop
    - Water



Building	Plant	Meter	Action Required	Note
<b>1150 - University Hospital</b>				
Gross SF =			875896	BLDG Value
<b>Electricity</b>			<b>FY2002 Cost</b>	<b>\$1,709,729</b>
Dominion Virginia Power				
ELEV1150A - Hospital Expansion Trailer			<b>Priority 1</b>	<b>Investigate</b> Investigate Alarm
<b>Water &amp; Sewer</b>			<b>FY2002 Cost</b>	
Water Pumping Stations				
WATUV1150A - University Hospital Upper Meter			<b>Priority 2</b>	<b>Connect SCC</b> Will have to upgrade meter. Conduit and
WATUV1150B - University Hospital Lower Meter			<b>Priority 2</b>	<b>Connect SCC</b> Will have to upgrade meter. Conduit and
<b>1142 - Jordan Hall</b>				
Gross SF =			442438	BLDG Value
<b>Electricity</b>			<b>FY2002 Cost</b>	<b>\$1,124,011</b>
East End Substation				
ELEUV1142A - Jordan Hall # 1 M461 - Chillers E.End Feed			<b>Priority 3</b>	<b>Connect SCC</b> Will have to upgrade meter.
ELEUV1142B - Jordan Hall # 2 M462 - Chillers E. End Feed				

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### Meters Needing Action

Meter ID	Description	Entered	Priority	Notes
<b>Add Actual Meter</b>				
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 0067 - Add actual meter. Halsey Hall - also feeds Dawson Rm. Conduit and wire in place.
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 0069 - Add actual meter. Kerckof Hall.
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 0082 - Add actual meter. Alderman, JC.
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 0083 - Add actual meter. Monroe Hall. This will require two meters-one coverter in the old side and one in the addition. JC
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 0126 - Add actual meter. Clemons, JC. Need to wait until aft Special Collection area work is complete. JC. Conduit and wire in place.
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 0136 - Add actual meter. Wilson Hall. WD module CM 14 available. Verified 8/1/02.
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 0204 - Add actual meter. Thornton Hall. JC. Conduit and wire in place.
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 0221 - Add actual meter. Old Physics. JC.
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 1181 - Add actual meter for MTHW
MTWUV7103A	MTHW - Unmetered Bldgs "MASTER"	2/21/2002	1	<input type="checkbox"/> 1195 - Add actual meter. McKim Hall.
WATUV7375C	Unmetered Bldg's. Water/Sewer "MASTER"	2/21/2002	1	<input type="checkbox"/> 0204 - Add actual meter for Water & Sewer
WATUV7375C	Unmetered Bldg's. Water/Sewer "MASTER"	2/21/2002	1	<input type="checkbox"/> 0210 - Add actual meter for Water & Sewer
WATUV7375C	Unmetered Bldg's. Water/Sewer "MASTER"	2/21/2002	1	<input type="checkbox"/> 0221 - Add actual meter for Water & Sewer
WATUV7375C	Unmetered Bldg's. Water/Sewer "MASTER"	2/21/2002	1	<input type="checkbox"/> 0527 - Add actual meter for Water & Sewer
WATUV7375C	Unmetered Bldg's. Water/Sewer "MASTER"	2/21/2002	1	<input type="checkbox"/> 1142 - Add actual meter for Water & Sewer
WATUV7375C	Unmetered Bldg's. Water/Sewer "MASTER"	2/21/2002	1	<input type="checkbox"/> 1181 - Add actual meter for Water & Sewer

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<b>Period Avg HDD</b>	<b>0.9</b>	<b>Temperature Data for period</b>	<b>Period Avg CDD</b>	<b>242.0</b>
<b>Billing Period HDD</b>	<b>0.0</b>	<b>7/19/2003 through 8/8/2003</b>	<b>Billing Period CDD</b>	<b>206.0</b>
	<b>-%100.0</b>			<b>-%14.9</b>

**Health System Chilled Water Loop (Combined)**

	Consumption	Units	Cost	30 Day Normal	Low Alarm	High Alarm	Last Date
CHWUJ1155A	5,061	mmBTU	\$43,856	4,745	15	3,266	8/1/2003
CHWUJ1157A	6,763	mmBTU	\$58,605	6,763	300	3,900	8/1/2003
CHWUJ1157B	3,177	mmBTU	\$27,530	3,177	224	4,468	8/1/2003
CHWUJ1172B	6,343	mmBTU	\$54,961	5,946	500	6,400	8/1/2003
CHWUJ1173A	259	mmBTU	\$2,242	259	200	1,000	8/1/2003
CHWUJ1176A	1,307	mmBTU	\$11,326	1,307	150	1,400	8/1/2003
CHWUJ1180A	83	mmBTU	\$718	83	20	103	8/1/2003
CHWUJ1181A	774	mmBTU	\$6,705	774	168	900	8/1/2003
CHWUJ1181B	95	mmBTU	\$827	95	118	1,621	8/1/2003
CHWUJ1181C	387	mmBTU	\$3,357	387	16	1,890	8/1/2003
	55,739	mmBTU	\$483,003				

**Health System Chilled Water Loop (South Plant)**

	Consumption	Units	Cost	30 Day Normal	Low Alarm	High Alarm	Last Date
<b>University - Auxiliary Meters</b>							
CHWUJ7185A	21,110	mmBTU	\$182,933	21,110	0	22,000	8/1/2003
<b>Auxiliary Meters</b>							
SEWUVMU7185A	3,477	hGals	\$769	3,477	0	4,000	8/1/2003
ELEUV7185B	723,036	kWh	\$45,117	699,712	0	800,000	8/1/2003
ELEUV7185C	178,937	kWh	\$11,166	173,165	0	200,000	8/1/2003

Contents

- Check External Readings
- Check for Month to Month Unit Duplication
- Check Meter Allocations
- Check Sewer Credits for Zeroes
- Check WO Share Totals



**Type of Check**

Check External Readings	Account
<b>Meter</b>	
ELEVP0000A , Late Payments	995899999
ELEVP0000C , WTJU Radio Station Transmitter	6352175902
ELEVP0000D , Whitehead Lane; Emerg Telephone	8463542509
ELEVP0000E , Lane Rd. Parking Lot - behind MR4 *	3425807504
ELEVP0207A , Zehmer Hall And Support Bldgs	3256267505
ELEVP0207C , Zehmer Hall Uplink Dish	7185222507
ELEVP0208A , Zehmer Annex; Midmont Lane	2375077506
ELEVP0223A , Thompson Road 1910-Lambeth Hse	0324945005
ELEVP0250A , Peyton House Trailer	8439763288
ELEVP0254A , Stone Hall (NRAO)	2796375000
ELEVP0290B , Student Activities Bldg	1813615000
ELEVP0317A , Fluids Research Lab	3373702509
ELEVP0321A , Resrch Lab/Eng Sci; 13 Edgemont Rd	3436227502
ELEVP0331B , McCormick Observatory	3933655007
ELEVP0334A , Nuclear Reactor Bldg	2766425009
ELEVP0334B , Nuclear Reactor Temporary Air Monitors	8150888983
ELEVP0356A , Nuclear Physics Accelerator Bldg	8436287505
ELEVP0436A , Sprigg Lane - Bemiss House	9835100000
ELEVP0439A , Rugby Road 164-Peyton House	5434757505
ELEVP0441A , Univ. Circ. 21-International H	3114725009
ELEVP0444A , Peyton Cottage	6464742508
ELEVP0603A , Faulkner House; Bldg 0603	9431902500

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Contents

- Check External Readings
- Check for Month to Month Unit Duplication**
- Check Meter Allocations
- Check Sewer Credits for Zero
- Check WO Share Totals

**Check for Month to Month Unit Duplication**

**Meter**

- CHWUV0125B , Cent.Grds.Prk./Bookstore Police Station
- ELEUV0556C , Sponsors Hall West Addition and Garage \*
- STEUUV0056A , Varsity Hall Condensate
- STEUUV0125B , Cent. Grds.Prk/Bookstore Police Station
- WATUV0061A , Cocke Hall Water
- WATUV0209T , O Hill Diner Construction Trailer

**Check Meter Allocations**

**Meter**

		WONUM	WOSHARE
5	ELEUV3277A , Dining Services & Business Ops Temp	U02459	0.00
	ELEUV3277A , Dining Services & Business Ops Temp	U02460	0.00
	MTWUV7103A , MTHW - Unmetered Bldgs "MASTER"	U01534	0.00
	SEWCV3480A , 1939 Ivy Road	U01272	0.00
	TIPUV0000E , Tipping Charges (Roll-Off) Master	UT0102	0.00
	TIPUV0000E , Tipping Charges (Roll-Off) Master	UT0146	0.00
6	TIPUV0000E , Tipping Charges (Roll-Off) Master	UT0149	0.00
	TIPUV0000E , Tipping Charges (Roll-Off) Master	UT0163	0.00
	TIPUV0000E , Tipping Charges (Roll-Off) Master	UT0164	0.00
	TIPUV0000F , Tipping Charges (Non Roll-Off) Master	UT0101	0.00
	TIPUV0000F , Tipping Charges (Non Roll-Off) Master	UT0103	0.00
	TIPUV0000F , Tipping Charges (Non Roll-Off) Master	UT0127	0.00
	TIPUV0000F , Tipping Charges (Non Roll-Off) Master	UT0131	0.00
7	TIPUV0000F , Tipping Charges (Non Roll-Off) Master	UT0132	0.00
	TIPUV0000F , Tipping Charges (Non Roll-Off) Master	UT0134	0.00
	TIPUV0000F , Tipping Charges (Non Roll-Off) Master	UT0145	0.00
	TIPUV0000F , Tipping Charges (Non Roll-Off) Master	UT0151	0.00
	TRAUV0850A , Hauling Charges (Entire Grounds)	UT0101	0.00
	TRAUV0850A , Hauling Charges (Entire Grounds)	UT0134	0.00
	TRAUV0850A , Hauling Charges (Entire Grounds)	UT0151	0.00
8	TRAUV2210E , Bonnycastle	UT2293	0.00
	TRAUVFMATDIV , Materials Division Surcharge Allocation &	UT0101	0.00
	TRAUVFMATDIV , Materials Division Surcharge Allocation &	UT0134	0.00

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<b>Check WO Share Totals</b>		<b>Total Shares</b>
<b>Meter</b>		
CHMUUV1172B	, Multistory Hospital CHW `MASTER`	100.00
UV7533B	, North Grounds Chilled Water "MASTER"	100.00
HTWUV7533F	, N. Grounds Mech. Plt. "MASTER"	100.00
TIPUV0000E	, Tipping Charges (Roll-Off) Master	100.00
TRAUV0850A	, Hauling Charges (Entire Grounds)	100.00
TRAUVFMATDIV	, Materials Division Surcharge Allocation &	200.00
WATUV2381A	, Dillard Gooch H2O Meter	200.00
WATUV7103D	, Multistory DHW-feed from Heat	200.00
WATUV7375C	, Unmetered Bldg`s Water/Sewer `MASTER`	200.00



## Monthly Pre-Billing Analysis Check 2

### Type of Check

#### Check for High or Low Consumption Alarms

Meter	Read Date	Reading	Current Units	Current Total	Notes
CHWUV0082A , Alderman Library	7/29/2003	56,465	2,514.38	21,788.32	
CHWUV0125C , Central Grds Bookstore "MASTER"	7/29/2003	0	0.00	0.00	
CHWUV0204D , Thornton Hall Chilled H2O "MASTER"	7/29/2003	0	0.00	0.00	
CHWUV1155A , Biomedical Engineering (MR5)	7/29/2003	0	5,061.00	43,856.09	
CHWUV1157A , MR4 (OLD) CHW	7/29/2003	60,647	6,763.04	58,605.11	
CHWUV1172A , Multistory Hospital CHW *	7/29/2003	56,619	6,601.26	57,203.23	
CHWUV1181B , Medical School Bldg North Loop	7/29/2003	7,090	95.45	827.12	
CHWUV1194A , Cobb Hall CHW	7/29/2003	9,726	1,103.66	9,563.77	
CHWUV7104C , HSC Chiller Plant "MASTER" *	7/29/2003	0	23,200.72	201,045.84	
ELEAP9705A , MT LAKE BIO STA PEMBROKE VA -	7/29/2003	55,367	2,729.00	136.05	
ELEUV0001B , Rotunda Elect "MASTER" (Unmetered)	7/29/2003	0	0.00	0.00	
ELEUV0006B , Jeff. Hall & Hotel A. Elect. "MASTER"	7/29/2003	0	0.00	0.00	
ELEUV0054C , Randall Hall Elect. "MASTER"	7/29/2003	0	0.00	0.00	
ELEUV0055B , Garrett Hall Electricity "MASTER"	7/29/2003	0	0.00	0.00	
ELEUV0060C , New Cabell "MASTER"	7/29/2003	0	0.00	0.00	
ELEUV0068D , Clark Hall "MASTER"	7/29/2003	0	0.00	0.00	
ELEUV0082F , Alderman Lib. Elect. "MASTER"	7/29/2003	0	0.00	0.00	
ELEUV0094D , Bryan Hall Ele. "MASTER"	7/29/2003	0	0.00	0.00	
ELEUV0122E , Newcomb Hall Elect. "MASTER"	7/29/2003	0	0.00	0.00	
ELEUV0125C , Cent. Grds. Prk/Bkstr/Police Sta.	7/29/2003	0	0.00	0.00	
ELEUV0126E , Clemons Library "MASTER"	7/29/2003	0	0.00	0.00	
ELEUV0221E , Phys Xform Vault Emon48HI	7/29/2003	96	6,000.00	374.40	

Contents X

- Check for High
- Check for Month**
- Check for Zero
- Meter Reading

Meter	Description	Read Date	Reading	Current Units	Current Total
WATUV7103E	, Heating plt. Domestic H2O "MASTER"	7/29/2003	0	0.00	0.00
WATUV7375C	, Unmetered Bldg's. Water/Sewer	7/29/2003	0	0.00	0.00
WATUV7533B	, N Grounds Mech Plant H2O "MASTER"	7/29/2003	0	0.00	0.00

**Check for Month to Month Unit Duplication**

Meter	Description	Read Date	Reading	Current Units	Current Total
CHWUV0125B	, Cent.Grds.Prk./Bookstore Police	7/29/2003	0	3.00	0.00
ELEUV0556C	, Sponsors Hall West Addition and	7/29/2003	688	59,000.00	0.00
STEUV0056A	, Varsity Hall Condensate	7/29/2003	226,400	2.50	0.00
STEUV0125B	, Cent. Grds. Prk/Bookstore Police	7/29/2003	0	3.00	0.00
WATUV0061A	, Cocke Hall Water	7/29/2003	2,712,500	47.00	0.00
WATUV0209T	, O Hill Diner Construction Trailer	7/29/2003	8,100	7.00	0.00

**Check for Zero Units or Zero Total**

Meter	Description	Read Date	Reading	Current Units	Current Total
BASUV0001A	, Rotunda - Building	7/29/2003	0	104.00	0.00
BASUV0001B	, Rotunda - Chiller Plant	7/29/2003	0	16.00	0.00
BASUV0022A	, Pavilion VII	7/29/2003	0	35.00	0.00
BASUV0022B	, Pavilion VII CHW	7/29/2003	0	9.00	0.00
BASUV0054A	, Randall Hall	7/29/2003	0	52.00	0.00
BASUV0055A	, Garrett Hall	7/29/2003	0	4.00	0.00
BASUV0056A	, Varsity Hall	7/29/2003	0	2.00	0.00
BASUV0058A	, Rouss Hall	7/29/2003	0	9.00	0.00
BASUV0059A	, Old Cabell Hall	7/29/2003	0	117.00	0.00
BASUV0060A	, New Cabell Hall	7/29/2003	0	2.00	0.00
BASUV0061A	, Cocke Hall	7/29/2003	0	1.00	0.00
BASUV0063A	, University Chapel - Building	7/29/2003	0	17.00	0.00
BASUV0063B	, University Chapel - Chiller Plant	7/29/2003	0	13.00	0.00

Contents X

- Check for High
- Check for Mont
- Check for Zero
- Meter Reading**

Meter Reading Unit Comparison		Read Date	Reading	Current Units	Current Total
Meter					
CHWUV0001A	, Rotunda	7/29/2003	2,501	218.36	1,892.20
CHWUV0054A	, Randall Hall	7/29/2003	2,004	71.14	616.46
CHWUV0058A	, Rouss Hall	7/29/2003	4,422	146.64	1,270.71
CHWUV0059A	, Old Cabell Hall	7/29/2003	0	346.00	2,998.26
CHWUV0065A	, Minor Hall	7/29/2003	0	228.00	1,975.73
CHWUV0066A	, Maury Hall CHW	7/29/2003	0	165.00	1,429.81
CHWUV0067A	, Halsey Hall CHW	7/29/2003	0	167.00	1,447.14
CHWUV0068A	, Clark Hall	7/29/2003	15,555	2,594.99	22,486.85
CHWUV0082A	, Alderman Library	7/29/2003	56,465	2,514.38	21,788.32
CHWUV0094A	, Bryan Hall CHW	7/29/2003	445	208.24	1,804.53
CHWUV0122A	, Newcomb Hall	7/29/2003	43,804	2,758.91	23,907.37
CHWUV0123A	, Peabody Hall	7/29/2003	0	246.00	2,131.71
CHWUV0126A	, Clemons Library	7/29/2003	53,922	2,394.63	20,750.66
CHWUV0136A	, Wilson Hall	7/29/2003	0	563.00	4,878.68
CHWUV0203A	, Albert H. Small Building	7/29/2003	1,210	68.97	597.62
CHWUV0204B	, Thornton Hall E Wing Chilled H2O *	7/29/2003	5,060	393.10	3,406.43
CHWUV0204C	, Thornton Hall A-Wing Chilled Water *	7/29/2003	8,396	563.62	4,884.02
CHWUV0204E	, Thornton Hall "C" Wing CHW *	7/29/2003	10,905	1,097.98	9,514.57
CHWUV0210B	, Gilmer Addition	7/29/2003	0	557.00	4,826.68
CHWUV0221B	, Physics Addition	7/29/2003	21,675	665.28	5,764.96
CHWUV0222A	, Chemical Engineering	7/29/2003	11,199	534.89	4,635.08
CHWUV0256A	, Chemistry Addition Chilled Water	7/29/2003	77,407	3,681.31	31,900.41
CHWUV0256B	, Chemistry Building CHW	7/29/2003	95,928	5,699.62	49,390.03
CHWUV0270A	, Material Science CHW	7/29/2003	224	391.00	3,388.21
CHWUV0396A	, Runk Dining Hall	7/29/2003	15,989	450.95	3,907.72
CHWUV0396B	, Hereford College Chilled Water	7/29/2003	19,669	527.87	4,574.22
CHWUV0531A	, North Grounds Student Faculty Center	7/29/2003	825	336.24	2,913.68
CHWUV0534A	, JAG School Addition Chilled Water	7/29/2003	735	488.47	4,232.80
CHWUV1141A	, Health Sciences Library	7/29/2003	34,479	867.12	7,514.04
CHWUV1142A	, Jordan Hall Addition Chilled Water	7/29/2003	10,725	5,210.03	45,147.54
CHWUV1142B	, Old Jordan Hall	7/29/2003	3,376	3,452.00	29,913.30
CHWUV1143A	, Primary Care Center	7/29/2003	10,588	523.00	4,532.06
CHWUV1150A	, University Hospital	7/29/2003	65,027	21,437.79	185,769.19



**Monthly Pre-Billing Analysis  
Check 3**

**Type of Check**

Check Unit/Cost Comparisons		PY 3 Mo Averages		TY 3 Mo Averages		Prior Year		This Year		Perce
Meter	WONUM	Units	Cost	Units	Cost	Units	Cost	Units	Cost	Av. Un
BA SUV0373A	U00272	2	\$10	7	\$37	2	\$10	7	\$37	25
BA SUV1994A	U02506	3	\$16	56	\$298	3	\$16	56	\$299	176
CHW UV0059A	U01502	182	\$1,494	237	\$2,040	172	\$1,454	346	\$2,998	3
CHW UV0065A	U01501	37	\$311	182	\$1,564	46	\$389	228	\$1,976	38
CHW UV0066A	U02285	51	\$428	135	\$1,157	73	\$617	165	\$1,430	16
CHW UV0067A	U01500	52	\$432	121	\$1,043	101	\$854	167	\$1,447	13
CHW UV0082A	U00032	2,027	\$16,811	1,945	\$16,725	2,165	\$18,301	2,514	\$21,788	-
CHW UV0083A	U01296	160	\$1,331	112	\$966	202	\$1,707	126	\$1,092	-3
CHW UV0126A	U01297	3,446	\$28,728	1,973	\$16,975	4,368	\$36,922	2,395	\$20,751	-4
CHW UV0136A	U02601	379	\$3,148	516	\$4,429	512	\$4,328	563	\$4,879	3
CHW UV0202A	U01504	770	\$6,393	418	\$3,587	866	\$7,320	353	\$3,056	-4
CHW UV0210A	U00753	2,232	\$18,591	2,700	\$23,204	3,144	\$26,575	2,998	\$25,978	2
CHW UV0210B	U00753	798	\$6,707	541	\$4,636	870	\$7,354	557	\$4,827	-3
CHW UV0221A	U00038	445	\$3,682	105	\$905	502	\$4,243	114	\$985	-7
CHW UV0221B	U00038	909	\$7,586	738	\$6,352	1,191	\$10,067	665	\$5,765	-1
CHW UV0222A	U00039	545	\$4,531	450	\$3,868	662	\$5,596	535	\$4,635	-1
CHW UV0256A	U01329	2,519	\$21,039	2,418	\$20,862	3,459	\$29,239	3,681	\$31,900	-
CHW UV0256B	U01329	4,172	\$34,915	3,817	\$32,926	6,204	\$52,442	5,700	\$49,390	-
CHW UV0259A	U00894	755	\$6,274	887	\$7,644	1,200	\$10,143	895	\$7,754	1
CHW UV0270A	U02150	376	\$3,137	346	\$2,976	504	\$4,260	391	\$3,388	-
CHW UV0396A	U00040	42	\$353	370	\$3,188	92	\$778	451	\$3,908	78
CHW UV0532A	U00046	871	\$7,261	756	\$6,510	1,173	\$9,918	919	\$7,966	-1
CHW UV0534A	U00047	806	\$6,782	336	\$2,900	739	\$6,247	498	\$4,233	-5
CHW UV1141A	U02105	650	\$5,419	289	\$2,476	528	\$4,463	217	\$1,879	-5
CHW UV1141A	U02105	1,051	\$8,268	968	\$7,129	1,591	\$13,390	650	\$5,626	5





Monthly Pre-Billing Analysis  
Check 4

Unit Cost Comparison

Meter	Units	Total	Volume	Notes	Unit Cost	Average
ELEAP0700A	147.00	\$6.98	Moderate		0.0475	0.0759
ELEUV0396D	57,288.00	\$2,231.34	High		0.0389	0.0620
ELEUV7899A	58,238.00	\$2,268.34	High		0.0389	0.0620
ELEUV7899B	26,743.00	\$1,041.63	High		0.0389	0.0620
ELEUV0319A	3,950.00	\$0.00	Moderately High		0.0000	0.0613
ELEVP0000B	40,060.00	\$5,187.03	High		0.1295	0.0512
ELEVP0661A	99,907.00	\$19.09	High		0.0002	0.0512
ELEVP3712C	97,441.00	\$0.00	High		0.0000	0.0512
ELEVP5501A	14,100.00	\$1,277.66	High		0.0906	0.0512
ELEVP1600D	890.00	\$204.97	Moderate		0.2303	0.1282
ELEVP1693B	888.00	\$73.05	Moderate		0.0823	0.1282
ELEVP2164A	520.00	\$46.98	Moderate		0.0903	0.1282
ELEVP2411A	916.00	\$167.44	Moderate		0.1828	0.1282
ELEVP2415A	363.00	\$66.25	Moderate		0.1825	0.1282
ELEVP3691A	910.00	\$74.62	Moderate		0.0820	0.1282
ELEVP2413B	1,789.00	\$250.03	Moderately High		0.1398	0.0787
ELEVP2417A	1,473.00	\$217.05	Moderately High		0.1474	0.0787
GASCV0127A	4.10	\$54.45	Low		13.2805	20.8448
GASCV0207A	0.13	\$9.44	Low		75.5200	20.8448
GASCV0210A	3.60	\$48.97	Low		13.6028	20.8448
GASCV0259A	0.20	\$10.30	Low		51.4765	20.8448
GASCV0439A	0.40	\$12.59	Low		31.4765	20.8448
GASCV0441A	8.80	\$103.39	Low		11.7489	20.8448
GASCV0491A	0.10	\$0.15	Low		01.4770	20.8448



Building Cost Summary Report, Fiscal 2003

Building	Product	WO#	Meter_ID	Consumption	Cost	Energy Use
0221 - Physics/J Beams Lab					<b>Gross SF</b>	<b>136723</b>
	Electricity					
		U00112				
			ELEU\0221A	1,162,624.00 kWh	\$71,733.90	3,966.87 mmBTU
			ELEU\0221C	342,612.00 kWh	\$21,139.17	1,168.99 mmBTU
			ELEU\0221D	295,924.00 kWh	\$18,258.50	1,009.69 mmBTU
			ELEU\0221E	248,896.00 kWh	\$15,356.87	849.23 mmBTU
			ELEU\0221G	180,410.00 kWh	\$11,131.30	615.56 mmBTU
			ELEU\0221H	161,414.00 kWh	\$9,959.24	550.74 mmBTU
			<b>Total for Electricity</b>	<b>2,391,880.00 kWh</b>	<b>\$147,578.98</b>	<b>8,161.09 mmBTU</b>
			<b>Total per Gross Sq. Ft.</b>	<b>17.49</b>	<b>\$1.08</b>	
	MTHW					
		U00394				
			MT\UW\0221A	1,748.00 mmBTU	\$17,188.44	1,748.00 mmBTU
			MT\UW\7103A	8,179.45 mmBTU	\$80,430.21	8,179.45 mmBTU
			<b>Total for MTHW</b>	<b>9,927.45 mmBTU</b>	<b>\$97,618.65</b>	<b>9,927.45 mmBTU</b>
			<b>Total per Gross Sq. Ft.</b>	<b>0.07</b>	<b>\$0.71</b>	
	Natural Gas					
		U01218				
			GASC\0221A	8.70 MCF	\$188.51	9.13 mmBTU
			<b>Total for Natural Gas</b>	<b>8.70 MCF</b>	<b>\$188.51</b>	<b>9.13 mmBTU</b>
			<b>Total per Gross Sq. Ft.</b>	<b>0.00</b>	<b>\$0.00</b>	
	Chilled Water					
		U00038				

COST SUMMARY



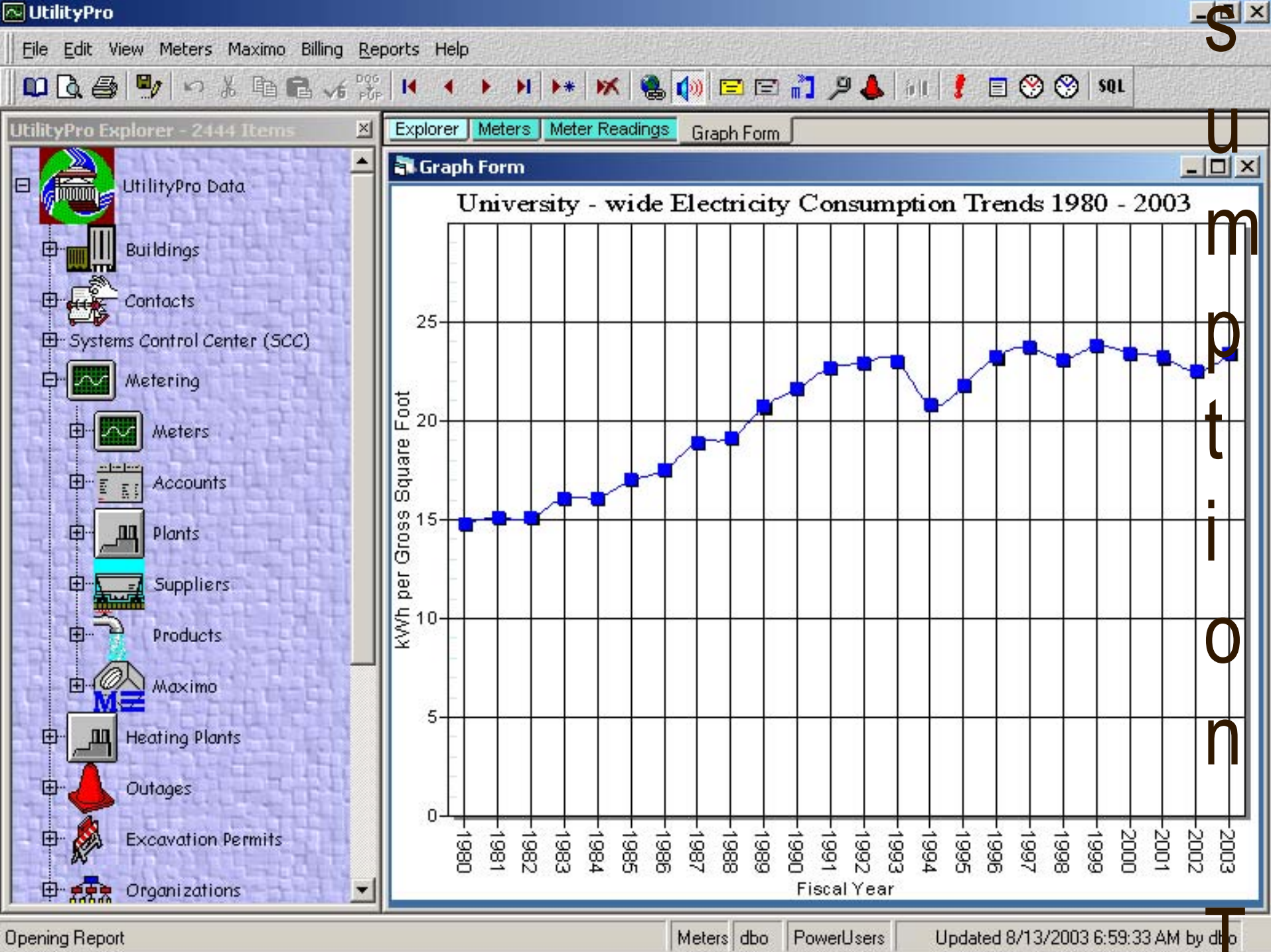
# Building Cost History

## Annual Totals

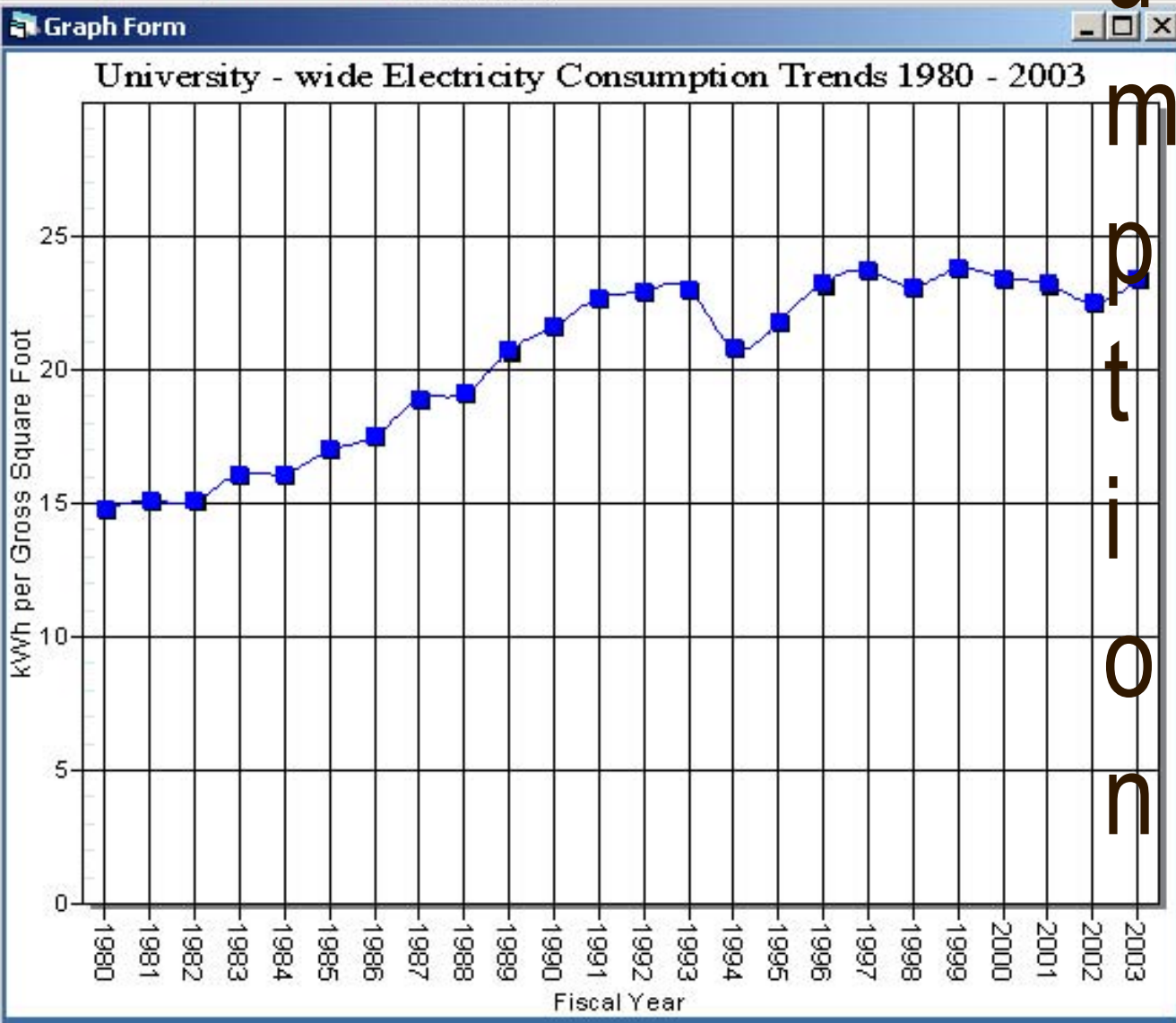
Building	Fiscal Year	Consumption	Cost	Energy Use	Normalized Use
0221 - Physics/J Beams Lab			Research Lab	Gross SF	136,723
1996		<b>Heating Degree Days</b> 4,656		<b>Cooling Degree Days</b> 1,355	
Electricity		1,546,369 kWh	\$60,923	5,276 mmBTU	11.3 kWh/GSF
MTHW		8,982 mmBTU	\$69,055	8,982 mmBTU	14.1 BTU/GSF-HDD
Natural Gas		8 MCF	\$100	8 mmBTU	0.0 BTU/GSF-HDD
Chilled Water		7,204 mmBTU	\$32,694	7,204 mmBTU	38.9 BTU/GSF-CDD
Water		52,502 hGals	\$7,423		
Sewer		52,502 hGals	\$7,506		
BAS Points		4,080 Points	\$13,554		
<b>Totals for 1996</b>			\$191,254	21,470 mmBTU	
<b>Total per Gross Sq. Ft.</b>			\$1.40	0.16 mmBTU/GSF	
1997		<b>Heating Degree Days</b> 4,234		<b>Cooling Degree Days</b> 1,013	
Electricity		1,496,329 kWh	\$91,276	5,105 mmBTU	10.9 kWh/GSF
MTHW		7,052 mmBTU	\$56,399	7,052 mmBTU	12.2 BTU/GSF-HDD
Natural Gas		8 MCF	\$152	8 mmBTU	0.0 BTU/GSF-HDD
Chilled Water		6,957 mmBTU	\$51,495	6,957 mmBTU	50.2 BTU/GSF-CDD
Water		68,997 hGals	\$10,882		
Sewer		68,997 hGals	\$12,470		
BAS Points		4,080 Points	\$20,322		
<b>Totals for 1997</b>			\$242,995	19,122 mmBTU	

# Graph Samples

- Electric Consumption Trends
- Chiller Plants performance
- Benchmarks – Facility Energy
- Benchmarks – Facility Energy by Category (Summary)
- Benchmarks – Facility Energy by Category (Detail)



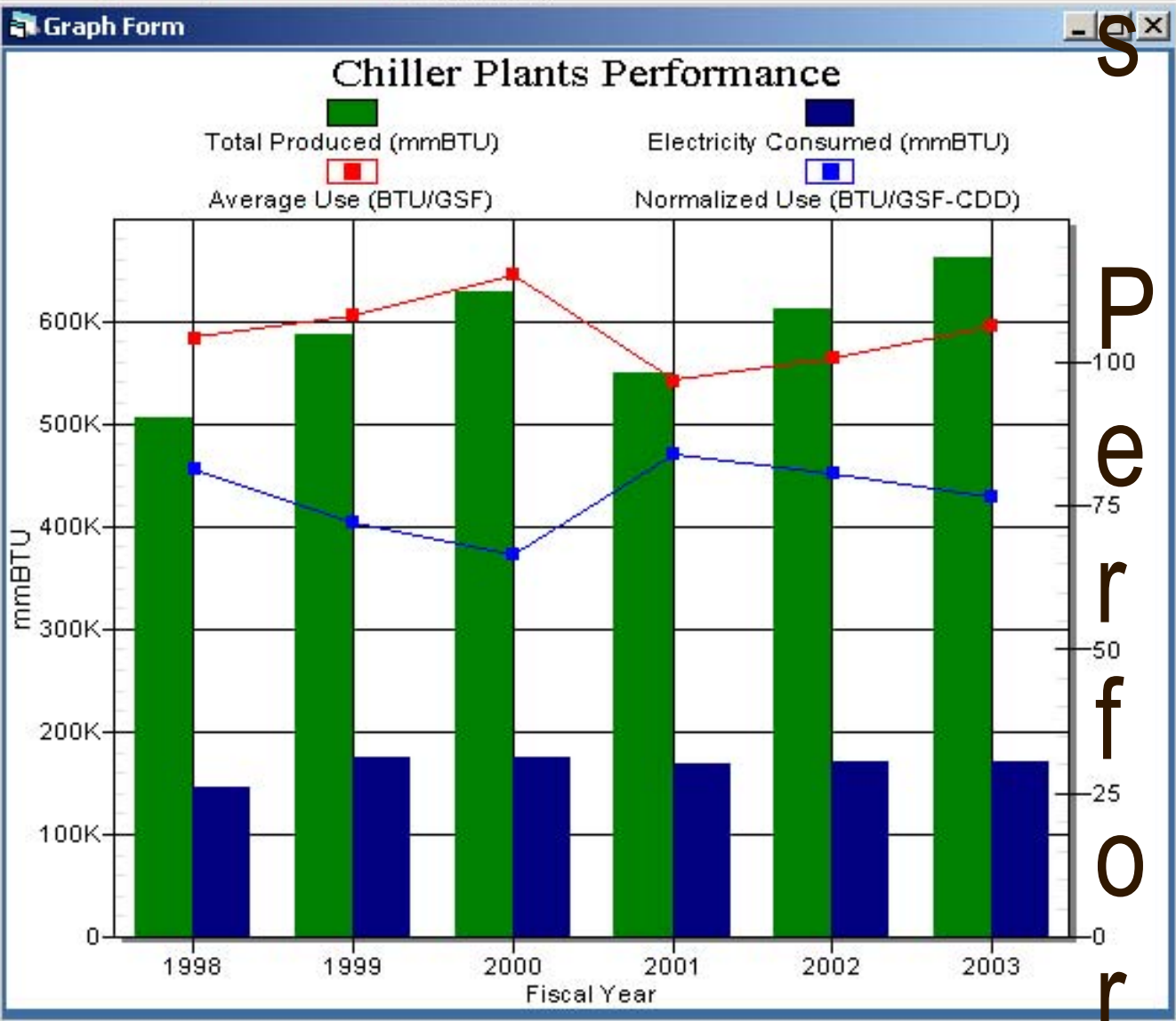
- UtilityPro Data
  - Buildings
  - Contacts
  - Systems Control Center (SCC)
  - Metering
    - Meters
    - Accounts
    - Plants
    - Suppliers
    - Products
    - Maximo
    - Heating Plants
    - Outages
    - Excavation Permits
    - Organizations



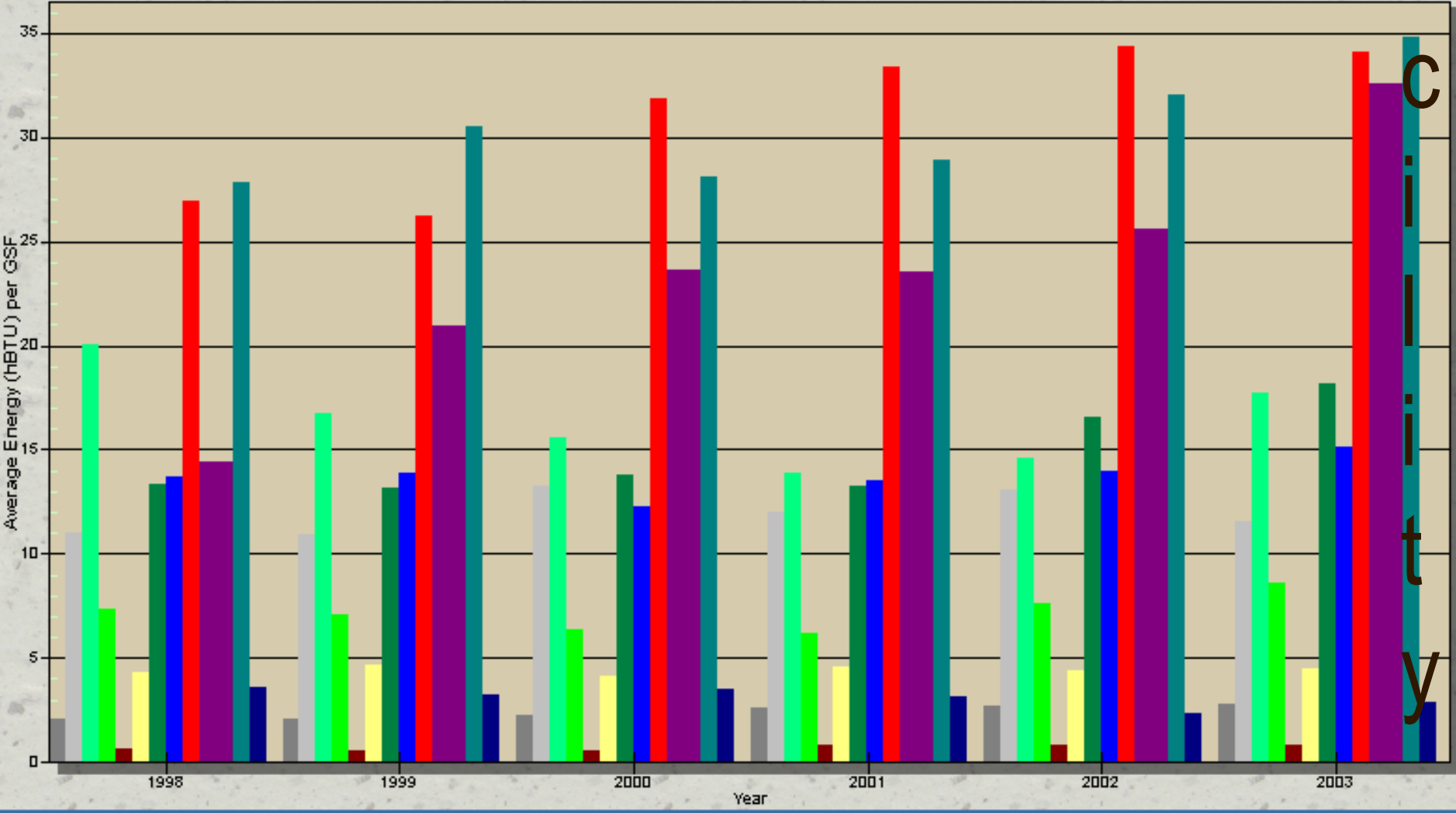
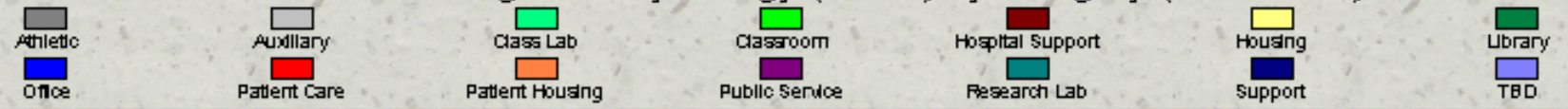
UtilityPro Explorer - 2444 Items

- UtilityPro Data
  - Buildings
  - Contacts
  - Systems Control Center (SCC)
  - Metering
    - Meters
    - Accounts
    - Plants
    - Suppliers
    - Products
    - Maximo
    - Heating Plants
    - Outages
    - Excavation Permits
    - Organizations

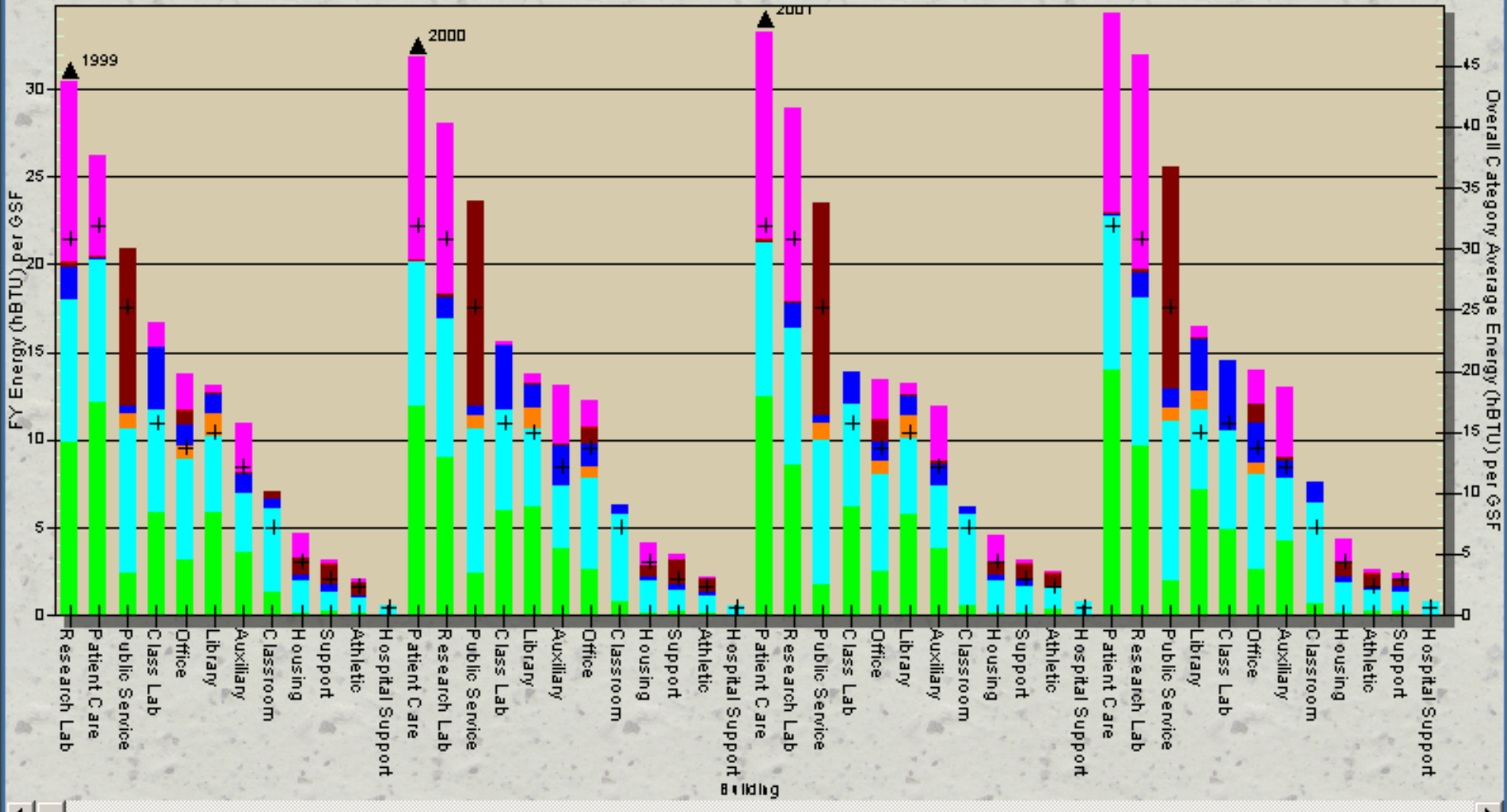
Explorer Meters Meter Readings Graph Form



### Benchmarks - Average Facility Energy (hBTU) by Category (Since 1998)

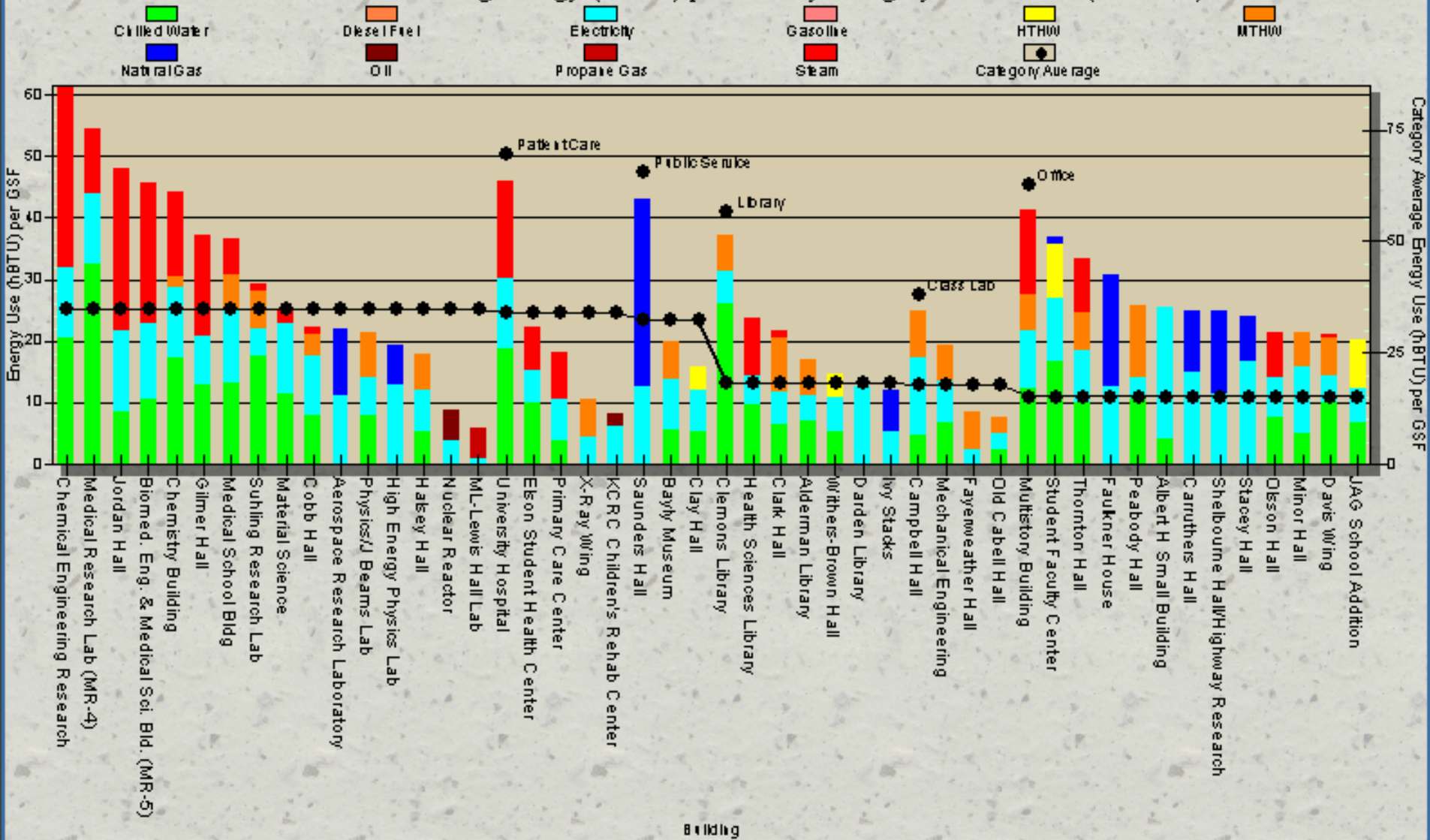


### Benchmarks - Facility Category Energy (hBTU) per GSF w/ Products (Since FY 1999)





### Benchmarks - Building Energy (hBTU) per GSF by Category w/ Products (FY 2003)



# Questions?

- Thanks and feel free to ask questions!



# ENERGY METERING AND BENCHMARKING

**08/20/2003**

**Melinda DeLuca**

**Manager Utilities and Energy  
Corporate Engineering**



# Miller Brewing Company

- Owned by SABMiller plc
- SABMiller plc is one of the world's largest brewers, with 2002/03 lager volumes in excess of 115 million hectolitres. It has a brewing presence in over 40 countries across four continents and a portfolio of strong brands and leading market shares in many of the countries in which it has brewing operations. Outside the USA, SABMiller plc is one of the largest bottlers of Coca-Cola products in the world.
- MBC has 6 major breweries in the US - Headquarters located in Milwaukee, WI
- The process of making beer is very energy intensive.



# Brewery Utility Systems

- Steam Boilers
  - steam produced at 125, 600 and 850 psig
  - co-generation for electric production
- Compressed Air - control systems
- Refrigeration - process and beer aging cellar cooling
- Carbon Dioxide - collection from brewing, purification and used in packaging
- Electricity - purchased, self-generated with gas fired turbines and steam turbine generators
- Water Treatment - ensures product taste and mouth feel of beer are consistent for MBC brands
- Waste water - aerobic and anaerobic with methane gas production used in boilers



# Metering & Benchmarking - Energy Strategy

- MBC's 3 year energy strategy will establish criteria for energy efficiency and low cost operation by benchmarking, and then auditing against the plan while ensuring reliable supply for both purchased and self-generated energy
- Some Components of Strategy
  - 1) Benchmark Usage
  - 2) Energy user departments held accountable for benchmark goals



# Existing Meters

- MBC has not standardized on meters or totalizers
- Data collection from meters includes:
  - monthly operator “rounds” to manually read meters
  - monthly operator “rounds” to electronically download meters
  - Ethernet network system of meters - electrical switchgear for departments
    - PowerLogic - Schneider Electric
- Most report generation is into spreadsheets which gets rolled up into Corporate reporting and tracking
- System of metering method not as important as what is done with the data for existing MBC systems



# Metering In the Future for MBC

- Add additional sub-meters to complete metering for all the plants and departments
- Further evaluate web based systems for metering and reporting
- Wireless
- Reduce report generation times





# Electricity Metering

- Incoming lines - purchase from local Utility
- Departments within Brewery - some overlapping depending on physical location
  - Meters located at substations
  - Utilities (air compressors, CO2 purification system, refrigeration)
  - Brewing
  - Packaging
  - Wastewater
- Co-Generation from turbine generators
- Reported as Kwh/ bbl of packaged beer



# Water Metering

- Incoming water lines into the plant
- Raw material for the process- metered in the brewing process for product quality
- Reported as bbl of water/ bbl packaged beer
- Wastewater also tracked to complete water balance in the brewery



# Fuels Metering

- Coal
  - reported based upon delivery
  - coal pile inventory 1-3 days so slight variation month to month
- Fuel Oil
  - flow meter at boilers
- Natural Gas
  - based upon Utility bill
- Fuels reported on therm / bbl of packaged beer (1 therm = 100,000 Btu)



# Benefits of Metering

- Provides basis for reducing operating costs
- Establishes a baseline for usage
  - When the plant is down what is the usage rate
    - » - helps to determine losses in the system ie cost savings opportunities
    - » compressed air leaks, lights on, water and steam leaks
- Metering by department and plant provides
  - departmental operating budgeting - cost / bbl of beer
  - accountability for troubleshooting system losses
  - usage rate trends by processing areas



# Spending \$'s to Meter Will Not Provide Savings If:

- Metering of utilities without a clear reason why to meter - example high cost
- Metering sub-headers with low usage - better to install in lines with biggest opportunity, highest cost utility
- Metering without plans to generate meaningful reports are wasted \$'s
- Too much data is not necessarily a “good thing” - tracking 15 minutes intervals may help if on Real time pricing and plant is load shedding.
- Purchase the least cost meter to provide wanted results - measurement of disturbance monitoring, harmonic analysis may not be needed in areas of reliable electric supply.
- Meters measuring and reporting power factor may only be helpful if plant can effect the power factor with synchronous motors, capacitors or generation



# Savings Due To Metering More Likely When:

- Results are reported and reviewed at Management level responsible for operating costs.
  - MBC reports and reviews monthly with VP of Operations
  - Brewery and departments are held accountable
- Attainable usage goals for the breweries are established which are based upon past usage rates and industry benchmarking
- Meters are kept calibrated otherwise may lose confidence in the usage rates
- Difficult to justify spending large capital dollars for installing meters without support from management to reduce operating costs



Questions?



ENERGY STAR

# Upcoming Web Conferences

**September 17, 2003**    **Identifying Projects  
& Creating  
Effective Action  
Plans**

**October 22, 2003**    **Increasing Energy  
Performance  
Across the  
Organization**





Thank you for participating!