GovEnergy
www.govenergy.gov

Charting a Course to Energy Independence

Providence, RI
August 9-12, 2009

UTILITY SYSTEMS SOLUTIONS®

A Service Disabled Veteran Owned Small Business (SDVOSB)

Energy Savings in Steam and Hot Water Systems at VA Facilities

Presentation to GovEnergy 2009

August 12, 2009

Utility Systems Solutions, Inc.

- Utility energy audits and turnkey solutions
- Certified/Verified as SDVOSB at VetBiz.gov
- On GSA Schedule:
  - Armstrong Steam components at GS 07F-0640M
  - Thermal Science Tech insulation at GS 07F-0121T
- Certified Energy Star Partner with EPA
- Certified Small Disadvantaged Business (SDB)

What hurts most?

- What is the toughest issue at your facility?
  - Aging infrastructure
  - Decreased manpower
  - Increased energy costs
  - Reduced funding for projects
  - Meeting federal energy reduction goals
- Why aren't we meeting the goals?

Why aren't we meeting the Federal Energy Goals?

- Government Goal: Total energy reduction goal of 30% by FY 2015, using FY 2003 as baseline.
- Requires: premium efficient products for electric motors, air conditioning and refrigeration equipment procurements.
- Source: The Federal Energy Policy Act of 2005 (EPAct 2005), and the Federal Energy Independence and Security Act of 2007 (EISA 2007)

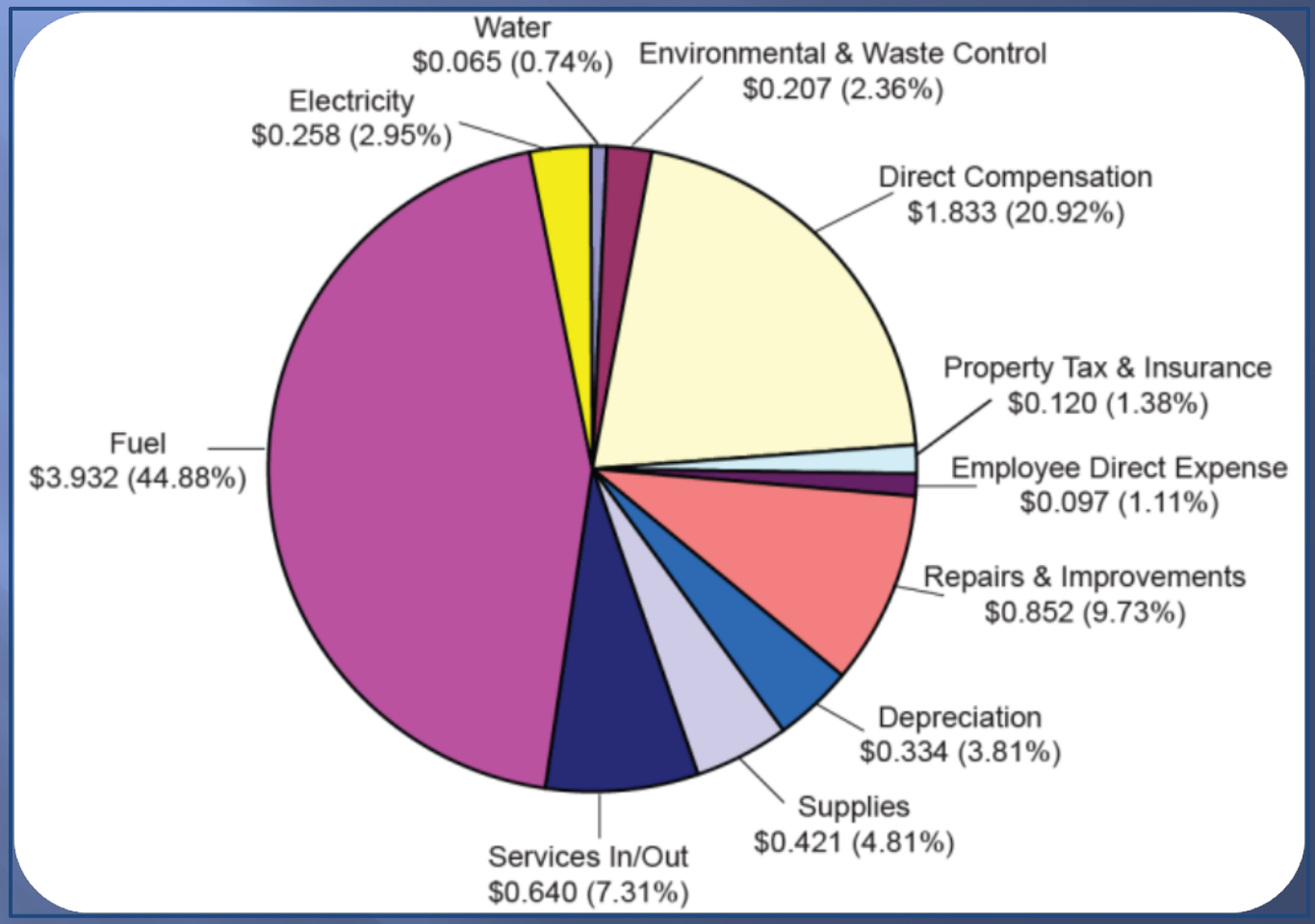
Sustained Energy Savings

- Section 431 of EISA 2007 increased the energy reduction goal to 3% per year:
- FY 2007 .....4%
  FY 2008 .....9%
  FY 2009 .....12%
  FY 2010 .....15%
  FY 2011 .....18%
  FY 2012 .....21%
  FY 2013 .....24%
  FY 2014 .....27%
  FY 2015 .....30%

What does steam cost to produce?

2003 Steam Rate
($8.76/1,000 lb)

2009 Steam Rate
($12.50/1,000 lb)



Annual Usage = 1,493,800,000 lb

Total Annual Cost = $13,087,843

Annual Usage = 1,493,800,000 lb

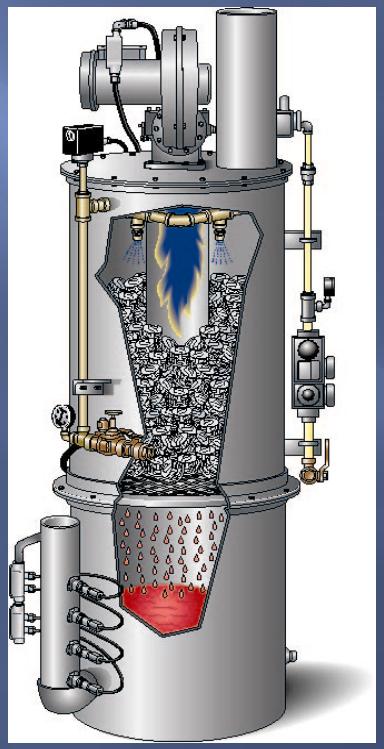
Total Annual Cost = $18,672,500

Dollar Loss for a Single Trap

- **Annualized dollar loss at $12.50/1,000 pounds thru an 1/8th inch orifice (.125") at pressures:**

Pressure	Lost Steam	Annual loss	Cost
15 PSI	12 lb/hr	105,120/yr	$1,314
30 PSI	19 lb/hr	166,440/yr	$2,080
60 PSI	31 lb/hr	271,560/yr	$3,394
125 PSI	58 lb/hr	508,080/yr	$6,351

Energy Saving in Steam and Hot Water Utilities



STEAM DISTRIBUTION SYSTEM :

STEAM TRAP MONITORING

How Wireless Trap Monitoring Functions in a Trap Field

- Tracks 2,000 traps real-time
- Senses temp, sound, conductivity
- Alarms on trap failure
- Shows when, where, how failed
- Signal does not disrupt RF
- Talks to BAS and DCS systems

SteamEye Screen:
What, when, where and how it failed

Armstrong SteamEye - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://steameye.armintl.com/LoginHandler

Armstrong Intelligent System Solutions™ STEAM • AIR • HOT WATER

SteamEye®

Critical Equipment | Failed Equipment | **All Equipment** | Configuration | Logout | SteamEye_In-House_WER

All Equipment

Device Type Select Device to Filter

Tx#	Tag#	Location	Type	Model No.	Status	Battery	Radio	# State Changes	Last Report	Previous Report - State	Cycle Count
20006	20006	Plant 1 Tests-R-Us North-West Bay Pump Trap #1	Pump Trap w/ Cycle Count	ARM / PUMP TRAP	OK	OK	2	809	Tue Apr 03 10:51:26 EST 2007	Wed Mar 14 09:58:54 EST 2007 - LOS	9925
20007	20007	Lab	Sump Ejector	ARM / Sump Ejector	OK	OK	4	5627	Tue Apr 03 11:26:54 EST 2007	Mon Apr 02 11:30:41 EST 2007 - FL	N/A
20008	20008	Plant 1 Tests-R-Us North-West Bay Pump Trap #2	Pump Trap w/ Cycle Count	ARM / PUMP TRAP	OK	OK	6	1191	Tue Apr 03 11:46:58 EST 2007	Wed Feb 14 09:45:40 EST 2007 - LOS	14325
22222	22222	Lab Test Station	Steam Trap	ARM / 800	LOS	OK	4	30	Fri Dec 22 09:58:31 EST 2006	Thu Dec 21 08:57:30 EST 2006 - CC	275
986720	30	Lab CB-4 Drip Trap Tag # 13-2	Steam Trap	ARM / 2011	CD	OK	0	48	Tue Apr 03 11:47:45 EST 2007	Tue Mar 27 16:15:46 EST 2007 - UNK	N/A
986727	986727	Lab	Steam Trap	ARM / FT4000	OK	OK	8	42	Tue Apr 03 11:38:15 EST 2007	Wed Mar 14 09:19:14 EST 2007 - LOS	N/A
986786	986786	Lab Test Station URFC4300 Prototype	Steam Trap	ARM / 800	OK	OK	10	230	Tue Apr 03 11:43:32 EST 2007	Thu Mar 15 07:35:03 EST 2007 - CD	N/A
986791	25	Tool Room Unit Heater Tag # 6-2	Steam Trap	ARM / TVS812	OK	OK	13	25	Tue Apr 03 11:37:45 EST 2007	Sun Apr 01 01:39:45 EST 2007 - UNK	N/A
986792	27	Plant 3 Boiler Room Tag # 8-2	Steam Trap	ARM / 2011	OK	OK	1	114	Tue Apr 03 11:48:06 EST 2007	Wed Mar 28 07:40:01 EST 2007 - CD	N/A

Done

start | Inbox - Microsoft Out... | 5 Reminders | Presentations | Microsoft PowerPoint ... | Armstrong SteamEye ... | 11:46 AM

ALERT

STEAM TRAP MONITORING SYSTEMS

ISSUE:

Steam traps can fail to operate properly. The results can be energy losses when a trap fails open, or back-up of condensate in the steam piping when a trap fails closed. The back-up of condensate is dangerous if water-hammer occurs. Water-hammer has the potential for rupture of valves, pipes, and fittings. The process of manually identifying failed traps is very time-consuming and typically requires hand-testing at each trap. Now, wireless and hard-wired electronic technologies with sensors mounted on the steam traps can allow facility managers to monitor trap failures more easily.

DISCUSSION:

Standard steam traps have no mechanisms to report when, where, and how they have failed. However, wireless and hard-wired technologies now permit trap testing using systems that test for cold plugged and blow-through conditions with conductivity and acoustic sensors. **These monitors can be cost effective because they save energy, reduce consequential damage to the steam lines, eliminate the need for annual trap surveys, and cut troubleshooting and diagnostic time in the field.**

Monitoring systems can be provided which automatically send individual trap failure signals to a receiver. In some systems the receiver can communicate to a computer work station. That information can be utilized to create a work order identifying when, where, and how a trap has failed in order to assign repair priority. Because the conductivity sensor is integral to the trap, it must be mounted on a trap with an entry port. However, the acoustic sensor can be clamped on to virtually any trap's inlet pipe and avoid the necessity for proprietary equipment.

The desired outcome is for a steam trap to operate effectively for its entire useful life, and upon failure to alarm and announce the need for replacement. Trap monitoring systems provide this by allowing the trap to complete its useful life, then be promptly replaced or repaired upon failure.

RECOMMENDATIONS:

Steam trap monitoring systems should be considered for high pressure steam main drips, medium pressure traps, and for any usage where the trap is hard to reach. Facilities should contract with vendors to perform baseline trap audits prior to installation, and vendors should perform follow-up services. Wireless systems are offered by Armstrong International, and hardwired systems are offered by Spirax-Sarco.

LINKS TO FM TECHNICAL INFORMATION LIBRARY (TIL):

See "HVAC Design Manual" at http://www.va.gov/facmgt/standard/manuals_hvac.asp

See "Outside Steam Distribution Design Manual" at http://www.va.gov/facmgt/standard/manuals_steam.asp

FOR ADDITIONAL INFORMATION: Contact Jim Shoemaker at 202-565-5176, Consulting Support Office (183A).

18 January 2007

Typical Facility Prospects

- Trap failure rate at federal facilities: 17.75%*
- Average steam cost per 1,000 pounds: $12.50
- Typical trap population at fed facility: 400
- Representative Potential Savings: $225K
- Typical Monitoring Project cost: $300K
- Typical Trap Monitoring payback: 3-4 years

*Based on analysis of industry survey results by Armstrong International

Transmitters for low, medium and high pressure applications

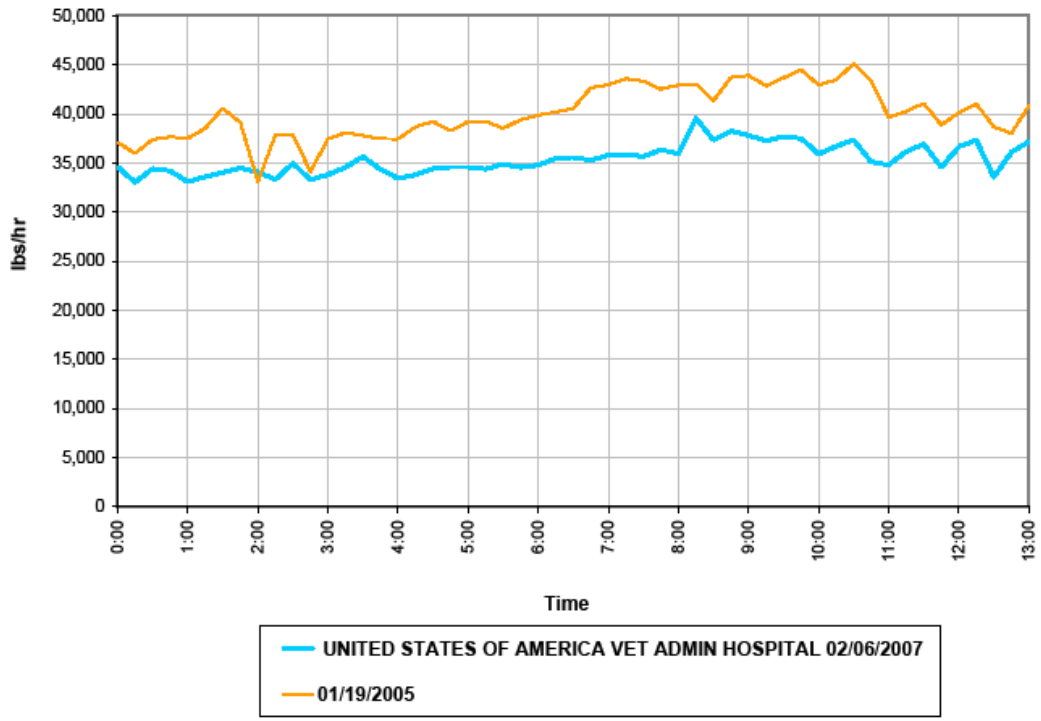
Designed for easy installation

CASE STUDIES OF STEAM MONITORING PROJECTS

Federal SteamEye Sites

- National Institutes of Health, Bethesda, MD
  - Monitoring 254 units
- Naval Base San Diego, San Diego, CA
  - Monitoring 987 units
- Bureau of Engraving & Printing, Wash, DC
  - Monitoring 695 units
- Sub Base Bangor, Bangor, WA
  - Monitoring 645 units
- Whidbey Island Naval Air Station, WA
  - Monitoring 824 units
- McChord AFB, Tacoma, WA
  - Monitoring 643 units

STEAMEYE Saved 4,000 Lbs/Hr (Source: Con Ed Tracking Log)



VA Manhattan Actual Steam Savings

- SteamEye system installed Sep 2006
- Con Ed tracked savings of 4,000 lbs/hr
- Cost of steam is $20 to $33 per 1000 lbs
- At $20/1000, annual savings of $700,000 and payback under 6 months

Bureau of Engraving & Printing: Payback under 2 years

Bureau of Engraving & Printing, Washington, DC; Energy Optimization System - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://bepsteameye/stations/BEP_Server/Web/main.htm Go Links Web assistant

THE BUREAU OF ENGRAVING AND PRINTING

- BEP
  - Annex Building
    - Floor Plans
    - Trap Summaries
      - Basement
      - **1st - 4th Floors**
      - 5th - 9th Floors
    - Status Reports (Annex)
    - Alarming (Annex)
  - Main Building
  - Status Reports (BEP)
  - Alarming (BEP)
  - Record Keeping
  - Security
  - Documentation

Armstrong SteamEye™

Annex Building, Steam Trap Summary, Floors 1 -4

Tag #	Location	Model Number	Status	Low Battery	Last Update Date	Last Update Time
106	ANNEX - 4TH FLOOR ROOM 402-4	3/4" 811PC 30#	OK		8-Feb-2005	10:45 AM
245	ANNEX - 2ND FLR NEW CAFETERIA AHU A2-12	1.5" 815PCLV 15#	OK		8-Feb-2005	10:29 AM
314	ANNEX - 1ST FLOOR LOAD DOCK UH @ ROOM 132	3/4" 811PCLV 15#	OK		8-Feb-2005	10:46 AM
499	ANNEX - 1ST FLR GARAGE ENTRANCE	3/4" 811PCLV 30#	COLD		8-Feb-2005	10:41 AM
513	ANNEX - PIPE FITTERS WORK SHOP 115-9A	3/4" 800PC 20#	OK		8-Feb-2005	10:48 AM
514	ANNEX - GARAGE N WALL OUTSIDE OF 115-23A	3/4" 811PCLV 30#	OK		8-Feb-2005	10:43 AM
515	ANNEX - GARAGE N WALL OUTSIDE OF 115-23A	3/4" 811PCLV 30#	OK		8-Feb-2005	10:48 AM
517	ANNEX - 1ST FLOOR LOAD DOCK UH @ ROOM 125-2	3/4" 811PCLV 15#	OK		8-Feb-2005	10:47 AM
519	ANNEX - OFFICE 109-1	1/2" 811PCLV 30#	LOST		21-Oct-1996	-
525	ANNEX - 1ST FLR MAIL RM 132-A	1/2" 811PC 30#	OK		8-Feb-2005	10:42 AM
534	ANNEX - 2ND FLOOR RM 202 CONVERTER RM	3/4" 811PC 125#	OK		8-Feb-2005	10:44 AM
535	ANNEX - 2ND FLOOR RM 202 CONVERTER RM	3/4" 811PC 125#	OK		8-Feb-2005	10:47 AM
538	ANNEX - 1ST FLR RM 125-12A	1/2" 800PC 20#	OK		8-Feb-2005	10:47 AM
548	ANNEX - 2ND FLR N WALL MACHINE SHOP 218A	3/4" 811PC 30#	OK		8-Feb-2005	10:43 AM
549	ANNEX - 2ND FLR N WALL MACHINE SHOP 218A	3/4" 811PC 30#	OK		8-Feb-2005	10:46 AM
550	ANNEX - 2ND FLR N WALL MACHINE SHOP 218A	/2" TVS811SPC 30	OK		8-Feb-2005	10:45 AM
551	ANNEX - 2ND FLR N WALL MACHINE SHOP 218A	3/4" 811PC 30#	OK		8-Feb-2005	10:47 AM
552	ANNEX - 2ND FLR N WALL MACHINE SHOP 218A	1/2" 811PC 30#	OK		8-Feb-2005	10:47 AM
561	ANNEX - ND FLR ABOVE CEILING 218A	1/2" 800PC 20#	OK		8-Feb-2005	10:46 AM
562	ANNEX - 2ND FLR ABOVE CEILING 218A	2" TVS811PCLV 1	OK		8-Feb-2005	10:46 AM
563	ANNEX - 2ND FLR ABOVE CEILING 218A	4" TVS811PCLV 1	OK		8-Feb-2005	10:45 AM
564	ANNEX - 2ND FLR TAPS & DYE RM 218A	4" TVS811PCLV 3	OK		8-Feb-2005	10:42 AM
575	ANNEX - 2ND FLR W WALL BY WINDOW 218A	3/4" 800PCLV 20#	COLD		8-Feb-2005	10:48 AM
577	ANNEX - 2ND FLR MACHINE SHOP 218-6-2AA	/4" TVS811SPC 30	OK		8-Feb-2005	10:48 AM
578	ANNEX - AHU ABOVE EASE END OF MACHINE SHOP	/2" TVS811SPC 30	COLD		8-Feb-2005	10:47 AM
579	ANNEX - AHU ABOVE EASE END OF MACHINE SHOP	/2" TVS811SPC 30	OK		8-Feb-2005	10:48 AM
580	ANNEX - AHU ABOVE EASE END OF MACHINE SHOP	/4" TVS811SPC 15	COLD		8-Feb-2005	10:44 AM

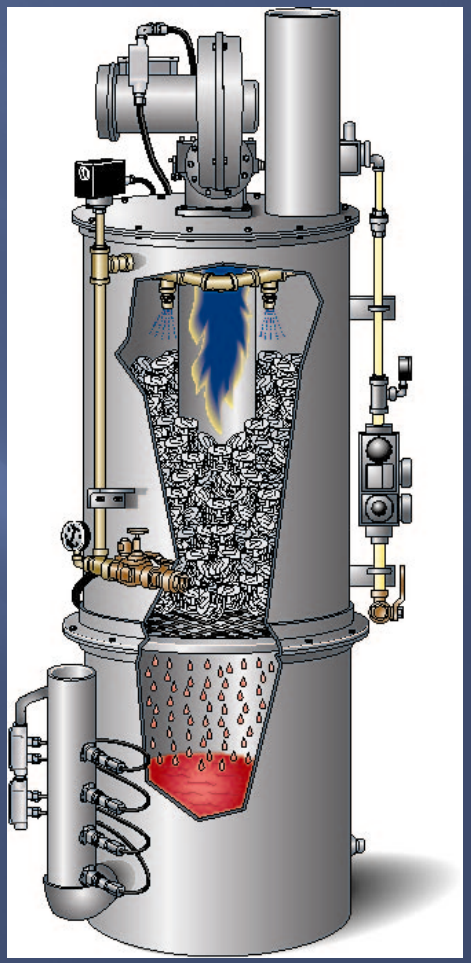
http://bepsteameye/db/BEP_Server/Graphics/Trap_Summaries/Annex_Summary_1_4 Local intranet

ALTERNATIVE TO BOILERS:

DIRECT FIRED NSTANTANIOUS HOT WATER HEATERS

Direct Fired Application

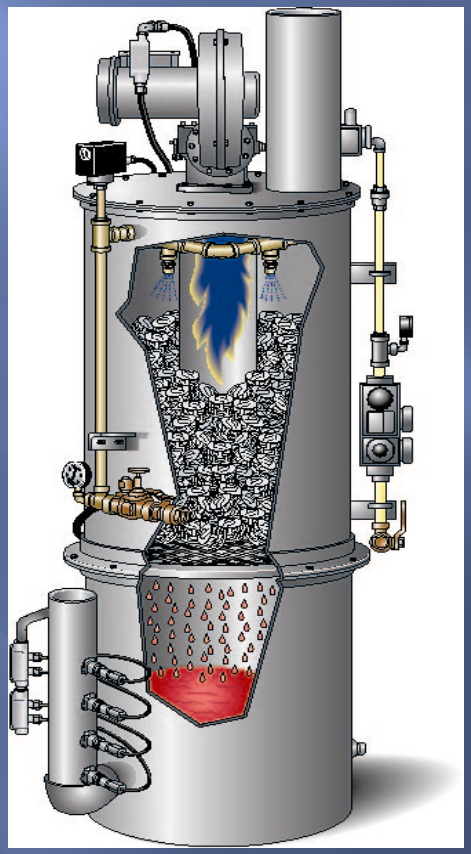
- Highly efficient
  - 99.7% vs 70% boiler
- One time water use
  - Not for recirculation
- Laundries, dorms, kitchens
  - Saves energy and
  - Mechanical room space
- Sized for load
- Typical use 20,000 gal/day



What makes it so efficient?

100% Energy In

Fuel In



- No Loss Out The Stack
- No Lost Condensate
- No Idle Run Time
- No Lost Radiant Heat
- Hot Water On Demand

99.7%+ Energy Out

Hot Water Out

Case Study: Direct Fired vs. Boiler Energy Savings

- Facility heats 67,200 gallons a day
  - From 40 to 150 degrees and
  - Pays $8.50 per 1000 cubic feet for natural gas
- A Boiler at 70% efficiency would cost
  $746 per day
- A Flo-Direct at 99.7% efficiency would cost
  $524 per day
- A daily savings of $222.47 x 260 days =
  $57,842 savings per year

ENERGY SAVING LO-COST SOLUTION:

REMOVABLE INSULATION COVERS

Capture Wasted Heat in Manholes, Tunnels & Vaults

Field engineers can measure, manufacture and install custom-made Removable Insulation Covers for piping within your manholes

Final Analysis & ROI Projection

				DESIGN			FACTORED						
NODE	LGTH. FT.	DIA. IN.	DEPTH FT.	INSUL. THK IN.	AIR GAP IN.	PRE-FOAM LOSSES BTU/HR-FT	PRE-FOAM LOSSES BTU/HR-FT	POST-FOAM LOSSES BTU/HR-FT	SAVINGS BTU/HR-FT	SAVINGS MMBTU/YR.	SAVINGS $/YR	PAY BACK YRS	ROI
0													
1	180	8	4	2	10	202.53	648.11	35.24	612.87	966.37	13529	2.3	43.0%
2	85	8	4	2	10	202.36	647.56	35.19	612.37	455.97	6384	2.3	43.0%
3	85	8	4	2	10	202.24	647.17	35.16	612.01	455.70	6380	2.3	42.9%
4	70	8	4	2	10	202.13	646.83	35.13	611.70	375.09	5251	2.3	42.9%
5	110	8	4	2	10	202.00	646.39	35.09	611.29	589.04	8247	2.3	42.9%
6	165	8	4	2	10	201.79	645.72	35.04	610.68	882.68	12358	2.3	42.8%
7	70	8	4	2	10	201.64	645.23	34.99	610.24	374.20	5239	2.3	42.8%
8	200	8	4	2	10	201.42	644.53	34.94	609.59	1068.01	14952	2.3	42.8%
9	120	8	4	2	10	201.20	643.83	34.87	608.96	640.14	8962	2.3	42.7%
10	63	8	4	2	10	201.08	643.44	34.84	608.61	335.88	4702	2.3	42.7%
11	182	8	4	2	10	200.87	642.80	34.78	608.01	969.37	13571	2.3	42.7%
12	120	8	4	2	10	199.70	639.03	33.76	605.27	636.26	8908	2.4	42.5%
13	213	10	4	2	9.5	237.62	760.39	42.98	717.41	1338.59	18740	2.0	50.3%
14	80	10	4	2	9.5	237.56	760.19	42.97	717.22	502.63	7037	2.0	50.3%
15	87	10	4	2	9.5	237.52	760.06	42.96	717.10	546.52	7651	2.0	50.3%
									TOTAL	10136.45	141910	2.3	44.2%

Annual Savings = $141,910

ROI Payback = 2.3 years

Designed for Durability

- Light weight construction
- Teflon® laminated outer jacket
- Interior thermal insulation
- Withstands flooded conditions
- Temperatures up to 550°F
- Easy removal/ replacement

Removable Insulation Covers

TRIGEN Philadelphia Energy
Philadelphia, PA

DISTRIBUTION LINE ALTERNATIVE:

INJECTED POLYISOCYANURATE INSULATION

ConduFill®

HTHW Piping in Concrete Trench

Paris, France

Thermal Science Technologies

ConduFill®

Technical Data

Density
3.0 pcf

Service Temperature
400°F / 204°C

K Factor
0.18 Btu-inch/hr-ft^2-degree F

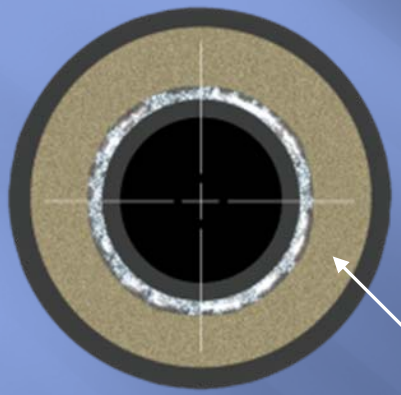
Compressive Strength
16-17.5 psi

Closed-cell Content
>95%

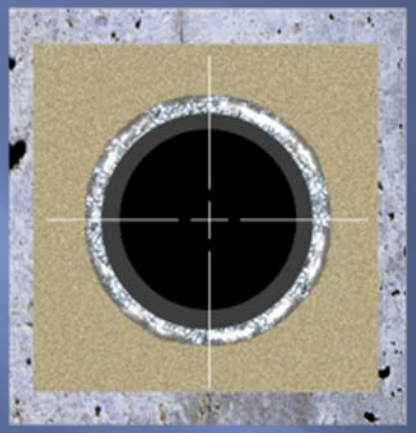
Dimensional Stability
-0.20% (by volume)

Water Absorption
<2% (by volume)

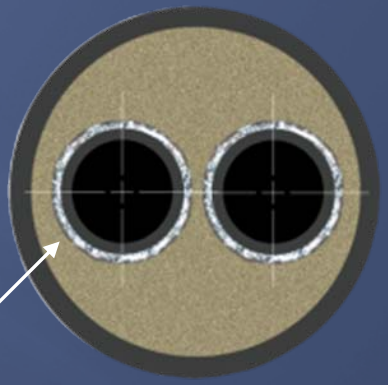
Common Buried Piping System Profiles



PRE-INSULATED (CLASS A)

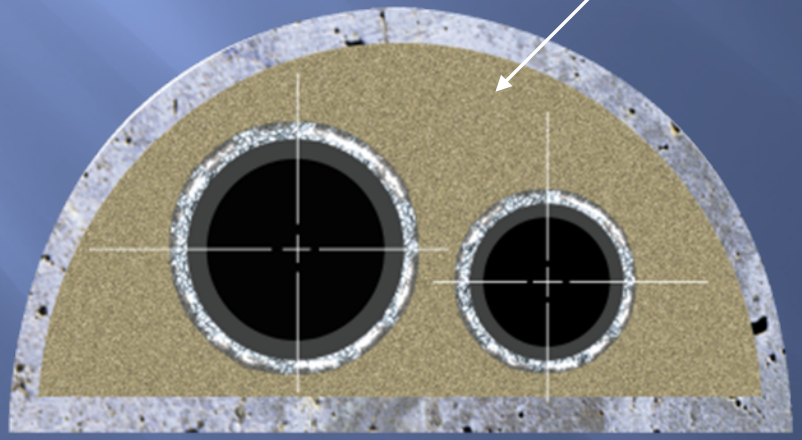


CONCRETE BOX

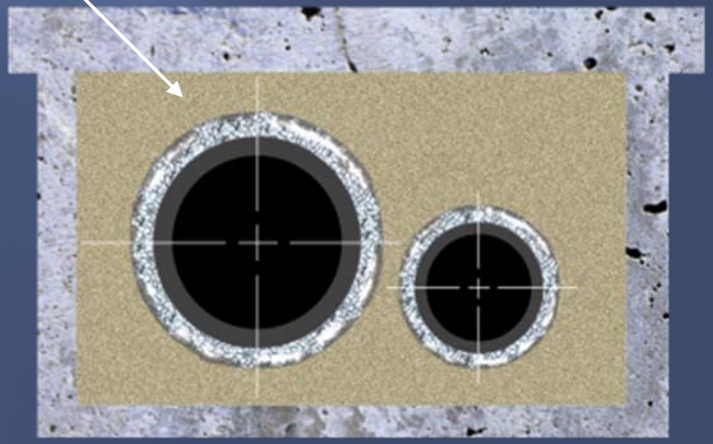


DUAL PIPE PRE-INSULATED

ConduFill®



ROUND-TOP TERRA COTTA/CONCRETE



CONCRETE TRENCH

Typical Cost and Payback

- Installation cost considerations
  - Depth of piping
  - Piping configuration
  - Excavation of road or field
- Typical installation is $250 per linear foot
- This is about 20% of the replacement cost

- Paybacks generally are 2 to 3 years

General Services Administration

Washington D.C.

GSA Building
Nov 2007

White House
February 2003

Next Step: Steam Assessment / Insulation Assessment

- An on-site walk thru is the next step
  - Inexpensive ($5,000)
- Produces a useful 10 page report
  - Gives budget estimate and available savings
- Collects baseline data for a Survey proposal
  - Shows basic issues to address and payback

Trap Surveys

- Steam Trap Survey of 400 traps
  - Budget estimate $14,000
- Radio Frequency (RF) Survey of 400 traps
  - Budget estimate $2,000
- Location Mapping of 400 traps
  - Budget estimate $2,000 (using furnished map)
- System Design for turnkey solution
  - Budget estimate $4,000

- General range is $15,000 to $25,000

Insulation Survey

- Insulation survey analyzes energy loss
- Assesses damaged and missing insulation
- Measures flanges, elbows, valves, PRV's
- Detailed assessment and report on savings
- Report helps to rank your top problems
- Budget estimate $15,000 - $25,000 per study

UTILITY SYSTEMS SOLUTIONS

A Service Disabled Veteran Owned Small Business (SDVOSB)

Utility Systems Solutions, Inc

Dave Shutler, President

3030 LBJ Freeway, Suite 700

Dallas, TX 75234-7781

214.722.7508 Phone

214.722.7676 Fax

info@us2inc.com Email