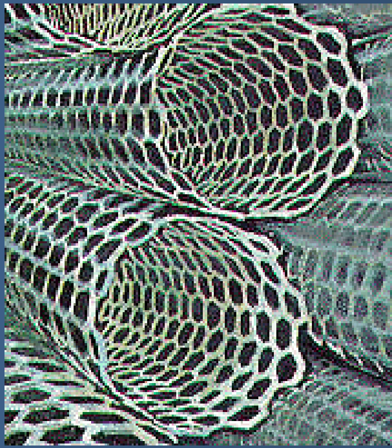
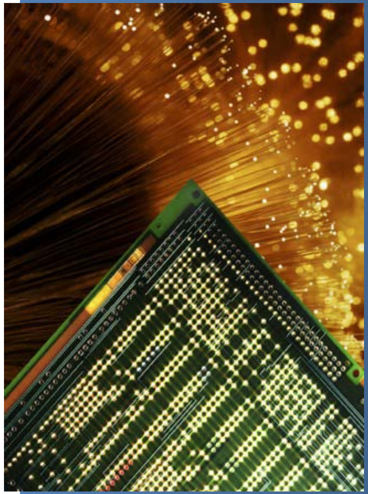
U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable



•Easy Ways to Save Energy Now - Take Care of those Steam Traps



Dr. Peter Fuhr

Wi-Fi Sensors, Inc.

Save ENERGY Now Webcast Series

Presented by

Department of Energy · United States of America

Wi-Fi Sensors, Inc.
trustworthy, period.

What Is the Industrial Technologies Program ?

The Industrial Technologies Program (ITP) is the lead federal agency responsible for improving energy efficiency in the largest energy-using sector of the country.

Together with our industry partners, we strive to:

- Accelerate adoption of the many energy-efficient technologies and practices available today
- Conduct vigorous technology innovation to radically improve future energy diversity, resource efficiency, and carbon mitigation
- Promote a corporate culture of energy efficiency and carbon management

Industrial Sector National Initiative

Goal:

Drive a 25% reduction in industrial energy intensity by 2017.

Save ENERGY Now

- Welcome/Intro/Logistics
  - Presenter: Dr. Peter Fuhr, CEO, Wi-Fi Sensors
- Seminar length (60 minutes)
  - Presentation (interspersed with…)
  - Two question and answer sessions

Quick Review: The White House Mandate

THE WHITE HOUSE

PRESIDENT GEORGE W. BUSH

For Immediate Release
Office of the Press Secretary
January 24, 2007

Executive Order: Strengthening Federal Environmental, Energy, and Transportation Management

By the authority vested in me as President by the Constitution and the laws of the United States of America, and to strengthen the environmental, energy, and transportation management of Federal agencies, it is hereby ordered as follows:

White House News

Section 1. Policy. It is the policy of the United States that Federal agencies conduct their environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner.

Sec. 2. Goals for Agencies. In implementing the policy set forth in section 1 of this order, the head of each agency shall:

(a) improve energy efficiency and reduce greenhouse gas emissions of the agency, through reduction of energy intensity by (i) 3 percent annually through the end of fiscal year 2015, or (ii) 30 percent by the end of fiscal year 2015, relative to the baseline of the agency's energy use in fiscal year 2003;

Remarks from govenergy 2007

News Media Contact(s):
Megan Barnett, (202) 586-4940

For Immediate Release
August 8, 2007

GovEnergy 2007 Conference

Prepared Remarks for Secretary Bodman

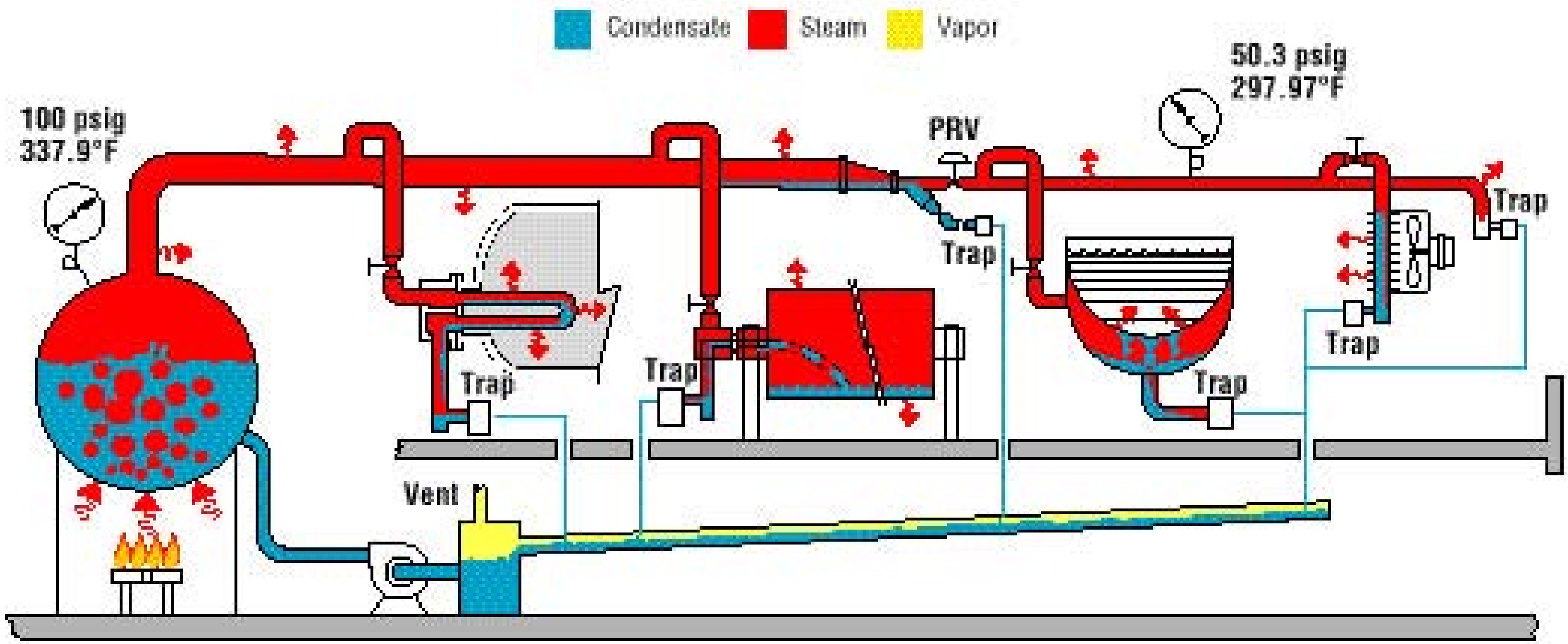
Thanks very much, Andy, and thank you all. I want to congratulate you --- both the organizers and the participants of GovEnergy 2007. In no small feat, we have drawn a record crowd of over 1,800 to this 10th GovEnergy conference. I am proud to be a part of this remarkable event.

● ● ●

Building upon the already ambitious goals laid out in the President's Executive Order, my specific requirements for the TEAM Initiative are as follows:

- Achieve no less than 30% energy intensity reduction across the agency. The path to achieving this goal will be outlined in a binding plan to be put in place for all DOE sites by 2008;
- Maximize installation of secure, on-site renewable energy projects at all DOE sites;
- Require that DOE's entire fleet operate their Alternative Fuel Vehicles exclusively on alternative fuels;
- Baseline, implement and monitor a Department-wide plan by FY 2008 to reduce water consumption at least 16%;
- Strive to achieve a LEED Gold standard for all new construction, and major renovations; and
- Ensure the implementation of an enhanced and widely applied Environmental Management System to manage the environmental energy and transportation components of all our activities.

Steam Traps…



Steam traps are like loyal servants. They are usually tucked in the corner doing their job day in and day out. However, nothing lasts forever.

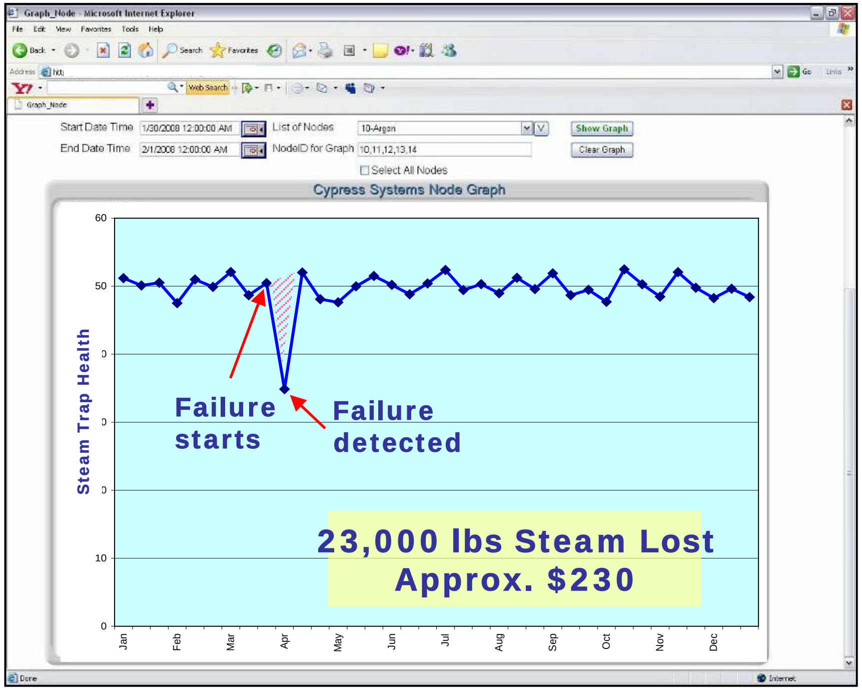
Challenge: Steam Trap Failures

- Steam Traps separate condensate from dry steam, essential for proper operation
- Old technology: 15% - 20% fail each year (source: US Dept of Energy)
- Typically manually inspected once per year.
- Most fail open and leak dry steam which cost $15/1,000 lbs
- $8,000 per year waste, even for smallest steam trap

How Steam Trap Monitoring Saves Energy

Without Steam Trap Monitoring

With Steam Trap Monitoring



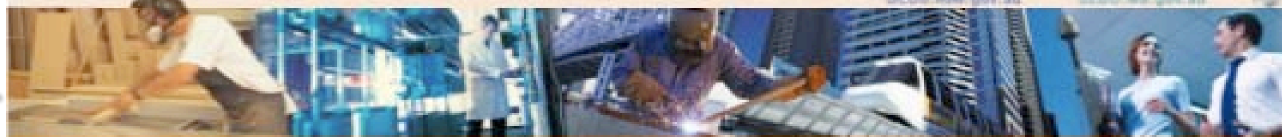
Typical savings for 1/8” orifice steam trap

•Steam/Money Loss Calculator (pt1)

DEPARTMENT OF ENERGY, UTILITIES AND SUSTAINABILITY
NEW SOUTH WALES GOVERNMENT

Sustainable Energy Development Office
Government of Western Australia

DEUS.nsw.gov.au SEDO.wa.gov.au

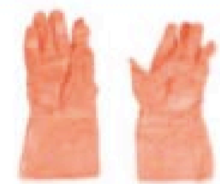


Introduction | Greenhouse Tutorial | Energy Saving Manual | Energy Management Guide | Calculators | Other Resources

Section 13: Steam Distribution Systems

Steam is used in many industrial processes and is often a source of large amounts of wasted energy and money. Making energy savings is easy. It is crucial to establish a regular maintenance program to inspect and repair steam traps, steam leaks and insulation. By insulating steam distribution and condensate return lines, savings are made because less heat is lost to the surrounding air, thus minimising costly steam production. It is also important to consider the use of steam and whether it is necessary for all applications, or whether other energy sources, such as gas, could be used. Improving your boiler efficiency is another way to make savings on your steam system, but is not addressed in this section.

Why?



Industrial facilities can reduce steam energy consumption by 20% through simple improvements in their steam system.

Taking Action

1.Are there steam losses in your system?

> Info

Steam leaks

- Actively identifying and repairing steam leaks can achieve steam system efficiency improvements of 3-5%.
- As well as wasting energy, leaks cause a drop in system pressure that can cause equipment to operate less efficiently by reducing the amount of heat that can be delivered to a process.
- Fixing leaks may involve anything from simply tightening a connection to replacing faulty fittings.

Steam trap leaks

Steam traps allow the condensed steam to be removed from the steam distribution system.

- It is common to find that steam distribution systems go without maintenance for three to five years.
- Without adequate maintenance, 15-30 % of a plant's steam traps are often inoperable.
- Steam traps fail in the open position, which means steam passes through the condensate system and is wasted.
- Energy efficiency gains of 10-15 % are common when steam traps are actively maintained, so establishing a regular maintenance program, including complete systematic inspection, testing and repairing of steam traps is imperative.

>Action

Finding Leaks

- Steam leaks are easily identified visually and should be tagged when located.
- Use an ultrasonic detector to locate leaks. They cost about $1300, but the cost of a detector will be repaid by the savings from fixing just one leak as an average steam leak costs around $3500 per year.
- A monitoring system consisting of small control attachments to individual steam traps can be connected to a hand held computer or linked to an Energy Management System so the user can check the effectiveness of the steam traps themselves.

Steps to calculate how much steam leaks are costing:

http://www.energysmart.com.au/sedatoolbox/esm13.asp

•Steam/Money Loss Calculator (pt2)

1. Locate steam leaks.
2. Identify the diameter of the leaks.
3. Determine the mass of steam lost per hour from the table below. Do this by counting the number of leaks of each size then, knowing the pressure of the steam, the steam loss can be calculated.

Hole diameter (mm)	Steam Loss (kg/hr) Steam Pressure (kPa)			
	104	690	1035	2070
0.8	0.4	1	2	–
1.5	2	6	9	16
3.0	6	24	34	65
4.5	14	54	77	147
6.5	25	95	136	261
9.5	55	214	307	586

Adapted from US EPA Steam Challenge

4. Multiply this mass by the yearly operating hours.
5. Multiply this by the value of steam per tonne. This value is dependent on many variables and it is important to get advice on this. As a general rule, steam can cost $18/tonne, which includes the cost of gas to heat boiler water, chemical treatment of the water and other costs.
   For example: a trap of 4.5mm is found to be stuck open on a 1035kPa steam line.
   By repairing the failed trap, the savings can be calculated:

Loss per hour	77 kg
Yearly operating hours	6000 hrs
Steam value/tonne	$18
Total Savings = (77kg x 6000hrs x $18/1000)	$8300/yr

2.Can heat losses be reduced?

> Info

Insulation

Insulation around pipes and valves dramatically reduces heat loss and makes the work environment much safer by reducing the likelihood of severe scalding. It can typically reduce energy losses by 90% and help ensure proper steam pressure at plant equipment. The higher the temperature of the boiler skin or pipes, the greater the radiant heat loss to the surroundings.

Minimise pipe lengths

Often a sequence of plant upgrades leads to unnecessarily long lengths of steam pipe, which increases the heat loss. Reducing pipe length makes good financial sense. Also, where a small steam load is located at the end of a long branch of steam pipe, it might be cost-effective to install a stand-alone piece of equipment, and to decommission that section of the steam system.

>Action

Install insulation

- To measure the temperature of your pipes, use an infrared thermal sensor meter. They cost $600-$800 but this outlay can be repaid by the savings from insulating your system. It is also advisable to consult a supplier of steam system monitoring equipment and they will often test your steam distribution system for free as part of a quote for work.
- Any surface about 10ºC above ambient temperature should be insulated, including boiler surfaces, steam and condensate piping and fittings. Removable insulating jackets are available for valves, pressure-reducing valves, steam traps and other fittings.
- Damaged, missing or wet insulation should be repaired or replaced regularly. It is important to consult an expert on steam system insulation because the thickness and type of insulation material varies according to pipe size and application.

The following example will give you an idea of the money that can be saved by insulating pipes. For example: If a 75mm bare pipe transported steam at a temperature of 150ºC above ambient temperature, 640 Watts of power would be lost per metre of pipe. By insulating this pipe, the loss could be reduced to 64 Watts, a 90% saving.

Energy cost (natural gas)	= $ 0.06 kWh
Energy savings per metre	= (640 – 64) = 576W
Hours of operation/year	= 6000 hrs
Dollar savings/year	**= $207/metre of pipe**

= energy savings x energy cost x operating hours
= $0.06 x (576/1000) x 6000

Insulation can typically cost about $150/m, so in one year, you would have paid back the initial capital cost and saved $57.

QUESTION AND ANSWER SESSION

Enter your questions using the GoToWebinar questions function.

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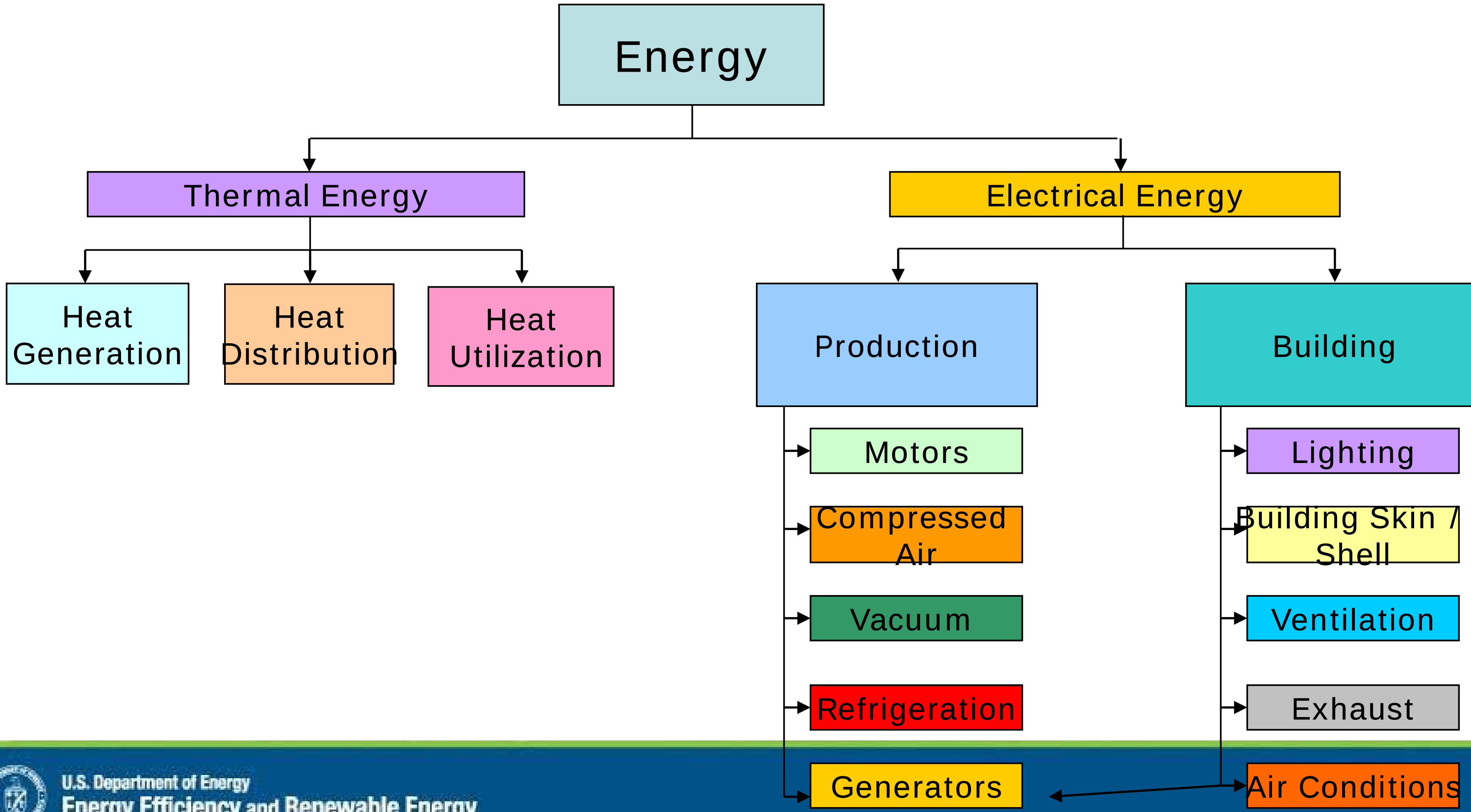
ENERGY MANAGEMENT IN TEXTILE PROCESSING INDUSTRY

THE FOCUS...



USER GROUP

- The project the team focused on available energy conservation opportunities from,

I. Maintenance of **steam traps** etc.

II. Improving boiler efficiency & evaluation of the energy losses,

III. Insulation of feed water tank, Pipe lines,

IV. Condensate recovery,

V. Maintenance of **heat exchanger**,

VI. Recovering heat from Flue gas

USER GROUP –

ENERGY MANAGEMENT IN TEXTILE PROCESSING INDUSTRY

Ground Zero !

Supported by Intelligent Energy Europe

AUSTRIAN ENERGY AGENCY

BESS = Benchmarking and Energy Management Schemes in SME's

www.bess-project.info/

"Horizontal Measure List"

More on ROI – steam traps

Benchmarking demonstration is underway at ORNL. Multiple vendors, standards based.

Tangible Results:

- Economics and operability
- Ease of Use
- ROI analysis

Energy Efficiency Improvement Program News

Vol. 1, Issue 4 • December 2007

ENERGY CASE STUDY

Steam Trap Maintenance Yields Savings

Steam traps are a type of automatic valve that open, close or modulate automatically to discharge condensate and non-condensate gases without permitting the escape of steam. Failing steam traps are commonplace; a 15 percent to 30 percent failure rate is typical in a steam trap system that hasn't been maintained for three to five years. Even well-maintained systems can experience a failure rate of 10 percent. (1)

Failed open steam traps allow steam to escape into the condensate return system; consequently, malfunctioning steam traps can cost hospitals more than $1,400 per trap annually or tens of thousands of dollars each year, depending on the size of the steam system.(2) The U.S. Department of Energy recommends an annual steam trap survey for low-pressure steam systems (less than 30 psig) to identify failing steam traps within a steam trap networ

FAQs. Frequently Asked Questions

#10. What does a deployed system look like?

Wi-Fi Sensors used for steam trap monitoring (temp+acoustics)

…at my own plant…

Steam Trap Monitoring at ORNL

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Industrial Technologies Program

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BestPractices

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Printable Version

EERE Information Center
Programs and Offices

Steam

Over 45% of all the fuel burned by U.S. manufacturers is consumed to raise steam. Steam is used to heat raw materials and treat semi-finished products. It is also a power source for equipment, as well as for building heat and electricity generation. Many manufacturing facilities can recapture energy through the installation of more efficient steam equipment and processes. The whole system must be considered to optimize energy and cost savings. Such as: (Download Adobe Reader)

- Steam Generation through cogeneration applications, boiler controls, and water treatment
- Steam Distribution through checking steam leaks, installing insulation and proper steam trap maintenance
- Steam End Use through heat exchanger maintenance
- Steam Recovery through condensate return

Steam Case Studies

- J.R. Simplot: Burner Upgrade Project Improves Performance and Saves Energy at a Large Food Processing Plant (PDF 638 KB)

Steam Tip Sheets

- Click here for a complete list of steam system tip sheets.

Technical Publications

- Achieve Steam System Excellence: Industrial Technologies Program BestPractices Steam

http://www1.eere.energy.gov/industry/bestpractices/steam.html

BESS – MANUAL ...

3.6 Horizontal measure list

PRODUCTION PROCESSES

Thermal energy

Heat generation

Low-cost / short term opportunities	
Energy Saving Opportunity	**Action to Check**
1. Reduce excess combustion air to minimum	1. CO_2/O_2 measurement
2. Maximise completeness of combustion 3. Maintain boiler cleanliness (soot/scale)	2. Soot/CO measurement 3. Monitor for rise in flue gas temperature
4. Repair (replace) boiler insulation	4. Periodic inspection of boiler insulation condition.
5. Insulate feedwater tank – cover tank	5. Check possible feedwater temperature losses
6. Insulate condensate return lines	6. Check possible heat loss from condensate return lines.
7. Optimise quality of make-up water and feedwater	7. Monitor quality of make-up water and feedwater: hardness, acidity, O_2.
8. Minimise blowdown 9. Maintain nozzles, grates, fuel supply pressure/temperature at manufacturers' specifications	8a. Monitor concentration of dissolved solids in boiler water. 8b. Improve blowdown controls 9a. Ensure specifications are available and in use. 9b. Regular check and resetting/maintenance.
10. Maximise combustion air temperature	10. Draw air from highest point in boilerhouse.
11. Reduce steam pressure where it exceed system/process requirements.	11. Check system/process needs; adjust controls.
12. Use duct for intake of warmer combustion air	12. Install duct from combustion air intake to higher parts of room.
13. Install an automated gas leakage detector.	-
14. Repair leaks in steam pipework.	-
Higher cost / longer term opportunities	
Energy Saving Opportunity	**Action to Check**
1. For rapidly varying demand, convert one or more boilers to live accumulator (buffer tank).	1. Monitor/evaluate demand change patterns.
2. Alter controls to "High-Low-Off" or "modulating-Low-Off"	2. Monitor/evaluate demand change patterns.
3. Install flash steam heat recovery 4. Improve combustion controls.	3. Consider in large capacity situations with high (continuous/frequent) blowdown. 4a. Provide adequate heat input to meet demand. 4b. Minimise fuel/pollution. 4c. Protect personnel/equipment.
5. Waste heat recovery	5a. Economiser 5b. Air heater (recuperator)?
6. Install boiler blowdown heat recovery.	6. Consider in large capacity situations with high (continuous/frequent) blowdown.
7. Use process integration	7. Couple process units that have significantly different heat requirements (i.e. low-pressure steam leaving a high-pressure steam consuming production process can be used for a process requiring low-pressure steam).

USER GROUP – 2008

ENERGY MANAGEMENT IN TEXTILE PROCESSING INDUSTRY

BESS – MANUAL ...

Heat Distribution

Low-cost / short term opportunities	
Energy Saving Opportunity	**Action to Check**
1. Repair/replace faulty insulation 2. Repair inefficient steam traps/drains. valve spindles etc.	1. Pipework insulation – especially around valves. 2. Regular checks for leaks throughout the system.
3. Insert valves to isolate "periodic-use" items in system. 4. Remove/isolate "dead-legs" and redundant Pipework	3. Check system for periodic (e.g. seasonal, nightly) items (e.g. space heaters). 4. Check for dead-legs and redundant piping.
Higher cost / longer term opportunities	
Energy Saving Opportunity	**Action to Check**
1. Replace steam traps/drains with more efficient designs.	1. Monitor efficiency of, and heat losses from existing traps.
2. Replace or increase insulation	2. Check existing insulation; estimate heat losses in system.
3. Maximise condensate returns.	3. Measure "discarded" heat from condensate.
4. Redesign system to minimise pipe runs. 5. Generation pressure reduction.	- -

Heat Utilisation a) process

Energy Saving Opportunity	Action to Check
1. Plant insulation	-
2. Local burner efficiency	
3. Maximise heat transfer rate	-
4. Improve controls (e.g. thermostats)	
5. Consider alternative energy source 6. Ensure plant at high load factor	- -
7. Eliminate uneconomic "hot standby" periods 8. Recycle waste heat to process	- -
9. Recover heat, for use elsewhere	-
10. Train all staff to operate manual controls and to watch for energy saving opportunities.	-

ENERGY MANAGEMENT IN TEXTILE PROCESSING INDUSTRY

BESS – MANUAL ...

Heat Utilisation b) space heating

Low-cost / short term opportunities	
Energy Saving Opportunity	**Action to Check**
1. Use heat only when area is occupied	-
2. Set thermostats to minimum for comfort	-
3. Minimise loss of hot air	-
4. Clean and effective heaters	-
5. Maintain pipe insulation in unheated areas	-
6. Check condensate traps	-
7. Vent air from hot water systems	-
8. Time switches	-
9. Manual controls where appropriate	-
Higher cost / longer term opportunities	
Energy Saving Opportunity	**Action to Check**
1. Install more/more efficient thermostats	-
2. Use motorised valves to divide building into different zones	-
3. Air curtains	-
4. Change energy source	-
5. Change heating system – where: Insulation / Ventilation / Use Good / High / Radiant Heat Poor / Low / Convective Heat	
6. Improve building insulation	-

Electrical Energy

Motors

Energy Saving Opportunity	Action to Check
1. Try to ensure that motor capacity is not more than 25% in excess of full load.	-
2. Install motor controllers (voltage, power factor and fixed speed controllers).	-
3. Build in "soft-start" facilities.	-
4. Install variable speed drives	-
5. Install high efficiency motors	-

USER GROUP -

ENERGY MANAGEMENT IN TEXTILE PROCESSING INDUSTRY

THE OPTIONS... LEARNED FROM BESS....

High Cost Long Term

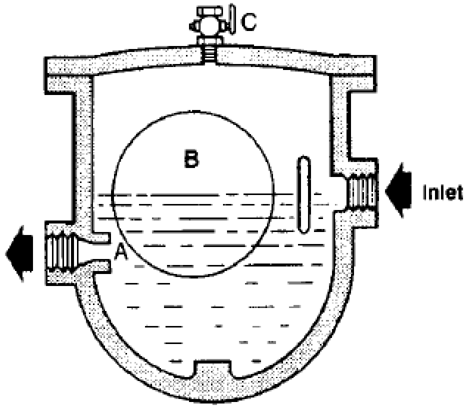
Low Cost Short Term

STEAM TRAP

"Lack of Steam Trap Knowledge Is the Weakest Link", By Thomas K. Lago, PM Engineer Magazine, July 1, 2002.

"The weakest link when it comes to steam systems may not be an individual component, but a fundamental lack of knowledge. For example, a steam trap, when properly installed, may be the most beneficial but least understood piece of equipment in the system. However, the lack of knowledge about steam traps and how they function can result in excessive energy loss, compounded environmental costs, productivity problems, and yes, safety concerns for personnel and property".

STEAM TRAP



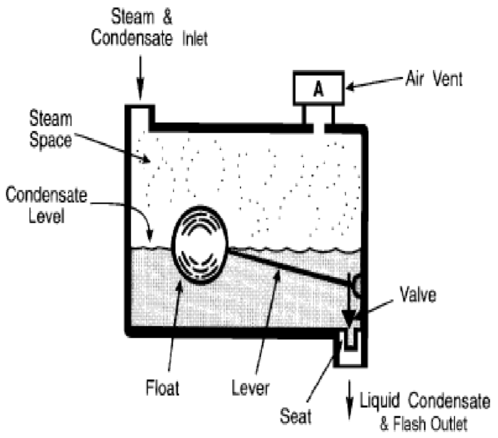
- **S**team is used as a heating medium through its latent heat. That means that the vapor is condensed as it gives up its heat content.
- In order to have continuous steam heat, one must continuously remove the condensate formed.
- A steam trap is nothing but a separation device; steam trap continuously removes the condensate formed inside the system.
- Proper condensate removal is essential for efficient plant and process operation.
- There are various types of steam traps are available, No single type of trap is suitable for all applications.

Steam Trap Classification

Steam Traps

Mechanical	Thermostatic	Thermodynamic
Mechanical traps are based on buoyancy principle, it sense the density difference between steam and condensate through the use of a float or bucket as a measuring device. Mechanical traps are preferred where immediate removal of the condensate is required	Thermostatic traps are intended for relatively low condensate removal capacities and typically used in low-pressure steam heating equipment. Thermostatic Traps includes Bellows Trap, Bimetallic Trap and liquid Expansion Trap etc	Thermodynamic Trap includes Piston Trap, Impulse Trap and Labyrinth Trap. Basically all steam traps have the same functions. They allow condensate and non-condensable gases to escape while holding steam in a system

STEAM TRAP



The required action of steam traps are given below;

- Steam trap must vent air and other gases from piping and equipment.
- It should prevent the flow of steam into the condensate piping system.
- Steam trap must allow only condensate into the condensate piping system.

Common Trap Failures

BT	Blow Thru	Trap has failed in an open mode with maximum steam loss. Trap should be repaired or replaced.
LK	Leaking	Trap has failed in a partially open mode with a steam loss of approximately 25% of maximum. Trap should be repaired or replaced.
RC	Rapid Cycling	Disc trap going into failure mode.
PL	Plugged	Trap has failed in a closed position and is backing up condensate. Trap should be repaired or replaced.
FL	Flooded	Trap is assumed to be undersized and unable to handle the condensate load. Trap should be replaced with proper size.
OS	Out of Service	The steam supply line is off and the trap is not in service.

What could happen if Trap fails?

- If condensate is allowed to collect in the pipe line, it reduces the flow capacity of steam lines and can lead to **“water hammer,”** with potentially destructive and dangerous results.
- Change in the heating cycle timings.
- Losses of energy

The Fact!

- The fact to understand is that all ***new steam devices leak a certain percentage of steam even when newly installed into a steam system.*** The most important factor is identifying the percentage or quantity of steam leakage.

They perform worse when they're installed incorrectly

Steam Trap leaking test standard

- Steam trap leak testing standards formed in the early 1980's by ANSI/ASME. The ***ASME Code PTC 39.1*** is described by ASME as follows:

- *This Code covers devices used in removing condensate and non-condensable gases from steam systems. It covers devices used for intermittent or continuous removal of fluids such as steam traps, orifices and valves. The purpose of this Code is to specify and define the practice of conducting tests of condensate removal devices to determine:*
  - *(a) Condensate discharge capacity, for specified conditions of saturated and sub cooled condensate and back pressure.*
  - *(b) Steam loss, under specified conditions.*

"Any steam management system should include steam trap monitoring as a basic tool to reduce waste, costs, and environmental liability. Whether this is conducted manually or automatically will depend on the size of the site, the number of traps, the number of personnel, and the urgency of repair."

Results from DOE/ITP/EERE TEAM Meeting (ORNL 2008-2009)

OAK RIDGE National Laboratory

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

"In steam systems that have not been maintained for 3-5 years, between 15 to 30% the installed steam traps may have failed-results steam leaks. Experts claim that leakage in a steam trap may results in increasing in the operational costs. Further experts estimate that in a plant with no active steam trap testing and repair program, 50% of the traps are blowing steam. With monthly inspection and prompt repair, this figure can be reduced to fewer than 3%".

The equation used to calculate the stipulated savings from loss through a trap that has failed: (Masoneilan Formula) ***Ref: UNFCCC - AM0017/Version 02***

$$L_{t,y} = FT_{t,y} X\ FS_{t,y} X\ CV_{t,y} X\ h_{t,y} X\ \{(P_{in,t} - P_{out,t})\ X\ (P_{in,t} + P_{out,t})\}^{1/2}$$

where; **$L_{t,y}$** = Is the loss of steam due to the steam trap t during the period y in Kg of steam.

$FT_{t,y}$ = Is the failure type factor of steam trap t during the period y.

$FS_{t,y}$ = Is the service factor of steam trap t during the period y.

$h_{t,y}$ = Are the hours of steam trap t is operating during the period in y in hours.

$P_{in,t}$ = Is the pressure of the steam at the inlet of steam trap t in psia.

$P_{out,t}$ = Is the pressure of the condensate at the outlet of steam trap t in psia.

Condition: The equation is only valid for outlet pressures Pout,t≥ (Pin,t/2); Hence if this condition is not satisfied; use {Pin,t/2} in the formula.).

Factors Used for the Calculation

Based on type of failure & type of trap

Type of Failure	FT
Blow thru ------------	1
Leaking -------------	0.25
Rapid cycling ---------	0.2

Application	Capacity Safety factor S	Service Factor FS
Process steam traps	1.75	0.9
Drip & tracer steam traps	3	1.4
Steam flow (No condensate)	Very large	2.1

$CV = 22.1 \times D^2$

Where,

CV = Is the Flow Co-efficient.

D = Is the diameter of the Orifice of the steam trap in Inches.

QUESTION AND ANSWER SESSION

Enter your questions using the GoToWebinar questions function.

Maintenance Schedule for Steam Traps

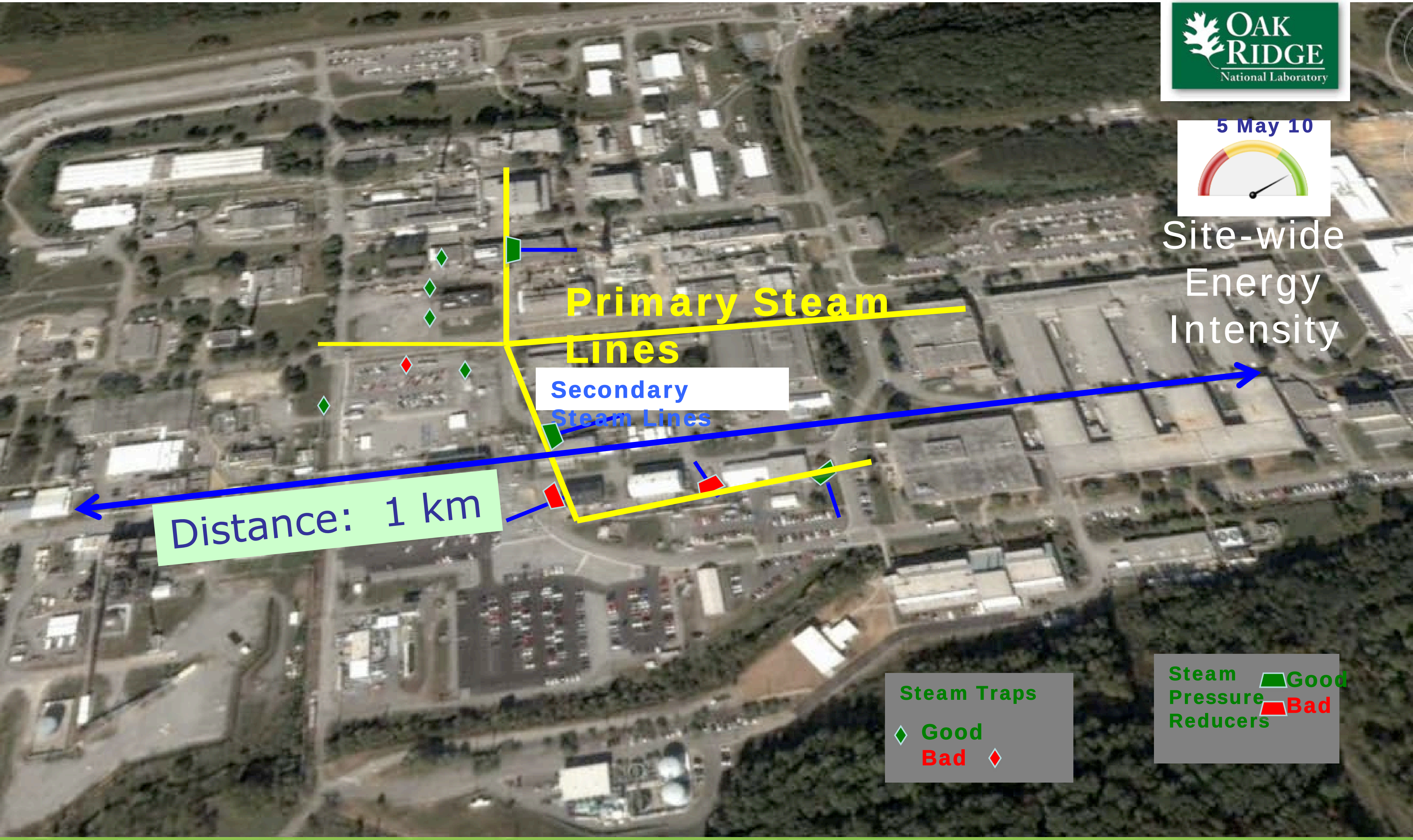
Recommended time schedule for testing steam traps

- Process steam traps **Every 3 months**
- High pressure (150 psig) steam traps **Every 6 months**
- Low to medium pressure (30-150 psig) steam traps **Every 6 months**
- Building heating steam traps **Twice a heating season.**

Testing Steam Trap Functionality

- ***Visual Inspection***
- ***Temperature Measurement –*** Sense upstream and downstream temperatures with contact pyrometers or infrared detectors.
- ***Ultrasonic Detection –*** Ultra sonic sound devices.

The size of many DOE facilities makes running wires too expensive (let alone difficult to install)



Enter the Dept of Energy ITP Wireless Program

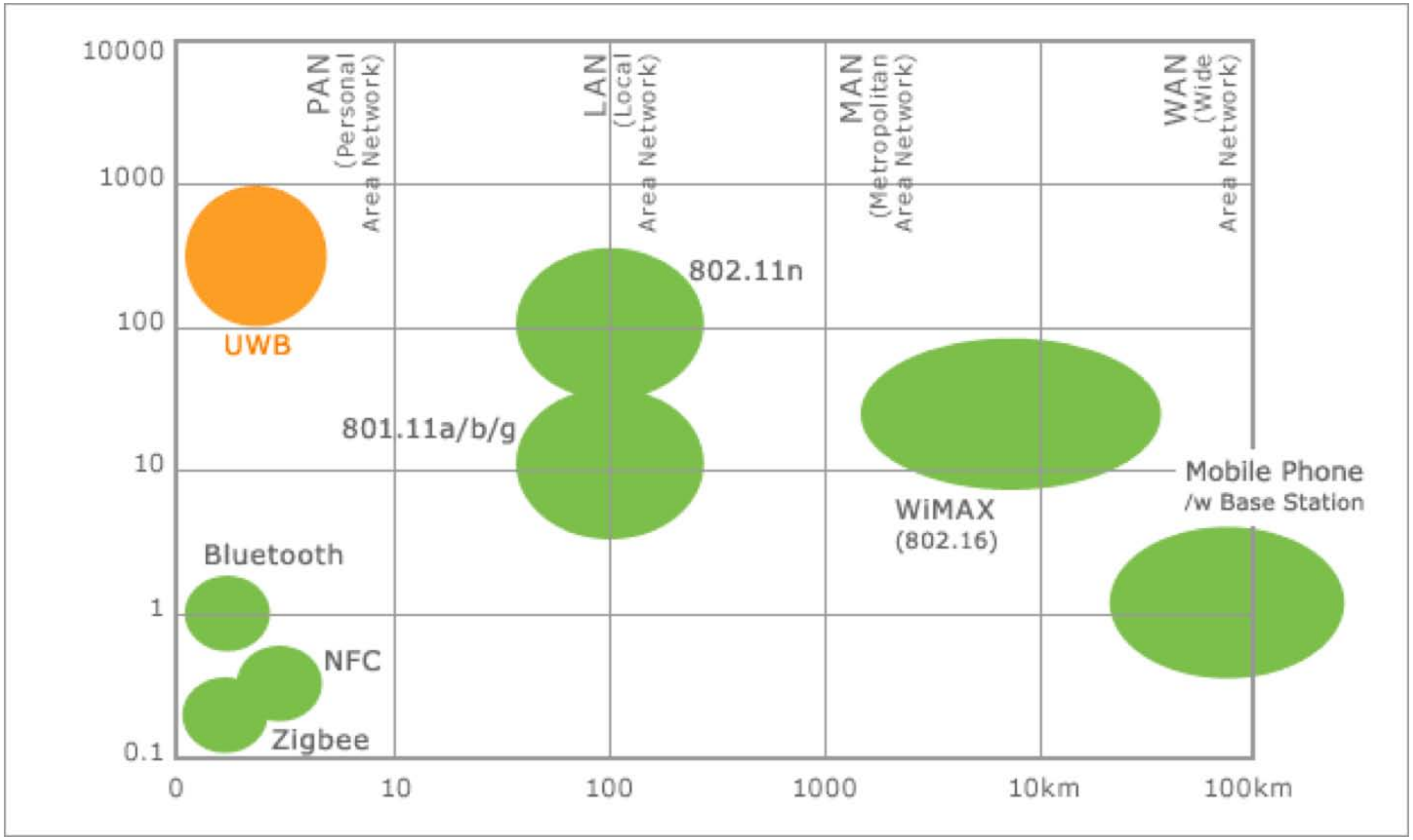
Secure
Reliable
Standards-Based
Wireless Sensor Networks

Transformational Energy Action Management (TEAM) Wireless Energy Efficiency Keys Initiative Workshop

Ways of Using Wireless Technology to Help You Reduce Energy Usage at your Facility

Wayne Manges, Teja Kuruganti, Elliott Levine, Brian Kaldenbach, Peter F

Wireless for Federal Facilities



Wireless for Federal Facilities

September 4, 2009 article:

RFID JOURNAL
THE WORLD'S RFID AUTHORITY

Automakers, National Lab Prepare Specs for Wireless Sensors

Topics/Verticals: Sensors, RFID Standards, IT/Infrastructure, More...

The DOE tested hardware compliant with the 802.15.4 standard (known as a low-rate wireless personal area network, commonly used in ZigBee-based systems) but found that the system was not only insufficiently secure, it was also not fast enough to transmit data 24 hours a day at the rate the agency needed the information sent. "For us, none of the commercial hardware meets our security needs," Cordaro says. "We are looking for very high-security, high-speed communication, and so far, it just hasn't been there for us."

Fed facilities require 802.11-based wireless (due to security and performance requirements)

Are there any examples of wireless already being used for energy savings?

- Show me some examples.....

Wired vs Wireless costs: in-building

- **In-Building Systems: temperature sensors, in-plenum wiring. The cumulative wiring distance for all temperature sensors is about 3000 feet with the majority loose in-plenum wiring. Eighteen AWG cable is assumed for sensor connections at an approximate cost of $0.07/ft. and a labor cost of $1.53 per linear foot of wiring (RS Means 2001). The cost for the wireless system includes an assumed installer mark-up of 50%. For the radio frequency (RF) surveying and RF installation we estimated the labor rate of $100 per hour for an engineer. For simplicity, the labor cost for battery change-out, expected to occur every 5 years, is not included. This activity can be estimated at about $300, assuming a battery cost of $3 per battery and 2 hours of labor for replacing 30 batteries.**

Cost Component	Cost	Cost
	Wired Design	**Wireless Design**
Sensors	$1800	$2152 [1]
Wiring	$4800 [2]	-
Communication and Signal Conditioning Hardware	-	$1475
Labor	--- [3]	$800
Total Cost	$6600	$4427
Average Cost per Sensor	$220	$148

- [1] Temperature sensors each with an integrated transmitter. [2] Including labor for installation.
- [3] Included in cost of wiring

Wired vs Wireless costs: retrofit

- Constant length of 3000 ft for the wiring. For the retrofit example, we establish a wiring cost of $6,600, assuming a cost per linear foot of $2.20 including wires. For new construction, we assume a reduced wiring cost (because of easier access) in the amount of $2,010 for a cost of $0.67 per linear foot. In each case we assumed that wiring conduits already exist and thus, the wiring cost excludes the cost associated with installing conduits.

- In the situations examined, the wireless systems are ~25% cheaper than wired.

- In cases where retrofit conduit would have to be installed, the cost of the wireless systems are ~90% cheaper than wired.

- In certain historic buildings instances, building codes and restrictions will simply make it prohibitively expensive to use a wired solution; wireless is the only option.

Wired vs Wireless costs & Time

Cost Component	Cost	Cost
	Wired Design	**Wireless Design**
Sensors	$636	$752
Wiring	$168 [1]	-
Communication and Signal Conditioning Hardware	$1903	$805
Labor	$2179 [2]	$450
Total Cost	$4886	$2007
Average Cost per Sensor	$407	$167

Cost Component	Cost	Cost
	Wired Design	**Wireless Design**
Sensors	$1800	$2152 [1]
Wiring	$4800 [2]	-
Communication and Signal Conditioning Hardware	-	$1475
Labor	--- [3]	$800
Total Cost	$6600	$4427
Average Cost per Sensor	$220	$148

- Time/Disruption of Installation:
  - Conclusion: "Installing wireless systems is considerably faster than wired systems and caused significantly less disruption to the occupants."

Wired vs Wireless deployment time

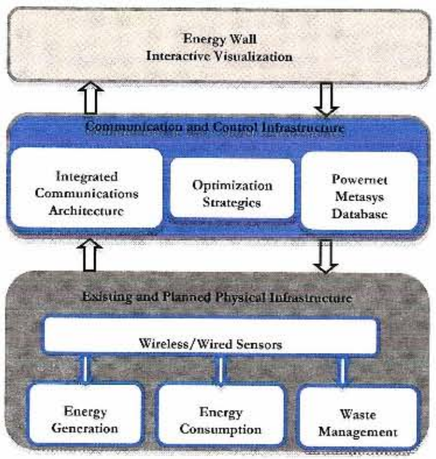
- Study by Ingersoll-Rand:
- “Installation time for a wireless versus wired system was 5-10 times less. Restated, it took, on average, 7.2 times longer to install the wireless system than the comparable wired system. Connection to the control system for each was approximately the same.”
- “As the number of sensors and the complexity of the installation location (refinery, office building, historic structure) increased the time savings associated with the wireless system increased to, on average, 13 times quicker when a 50+ sensor/transmitter system was installed across multiple floors of a downtown Chicago office building.”

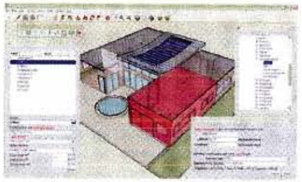
- Conclusion: “Installing wireless systems is considerably faster than wired systems and caused significantly less disruption to the occupants.”

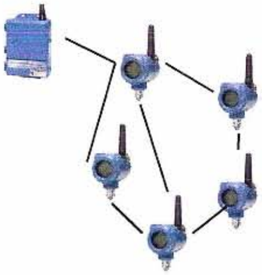
Lot’s of talk…is there anything underway?

ORNL Energy Wall

OAK RIDGE NATIONAL LABORATORY







Operational Capability

The Energy Wall will lead to requirements determination, including an embedded control center consisting of the right tools and connections to the ORNL physical plant to ensure a class of energy use control, acquisition, and efficiency improvement that will serve as a model for DOE and other federal agencies.

Using the site and facility information of metering, models, simulations, projections, flow, and efficiency data will be presented on the wide-area display.

Wireless sensor networks provide a low-cost path to deliver voltage, current, power, load, and other key process information to facility/enterprise systems or applications to save energy, provide diagnostics and prognostics, and improve uptime across the *entire* plant.

Energy Wall Program Benefits:

- Contribute towards the TEAM initiative by developing an enabling framework to achieve 30% energy efficiency within DOE complex
- A comprehensive situational awareness and situational understanding of site-wide energy generation, energy consumption, and waste management
- Site wide- energy profiling
- Investigate site-wide parameters for site-wide energy efficiency improvements
- Wide-area energy usage visualization

Milestones, Deliverables, & Contact:

Key Milestones: Development of a framework for wireless steam trap monitoring. Concept development for site-wide energy usage visualization

Deliverables: Site-wide energy generation, transmission, and consumption visualization. Identify energy efficiency opportunities.

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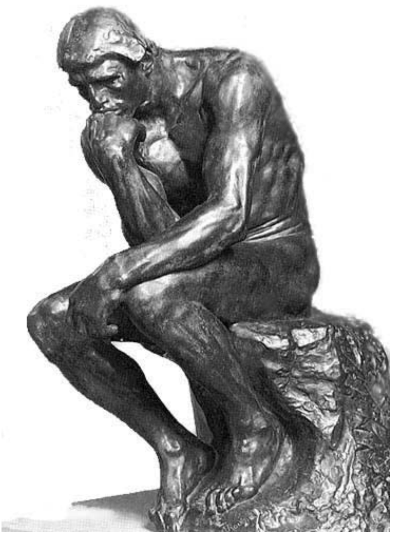
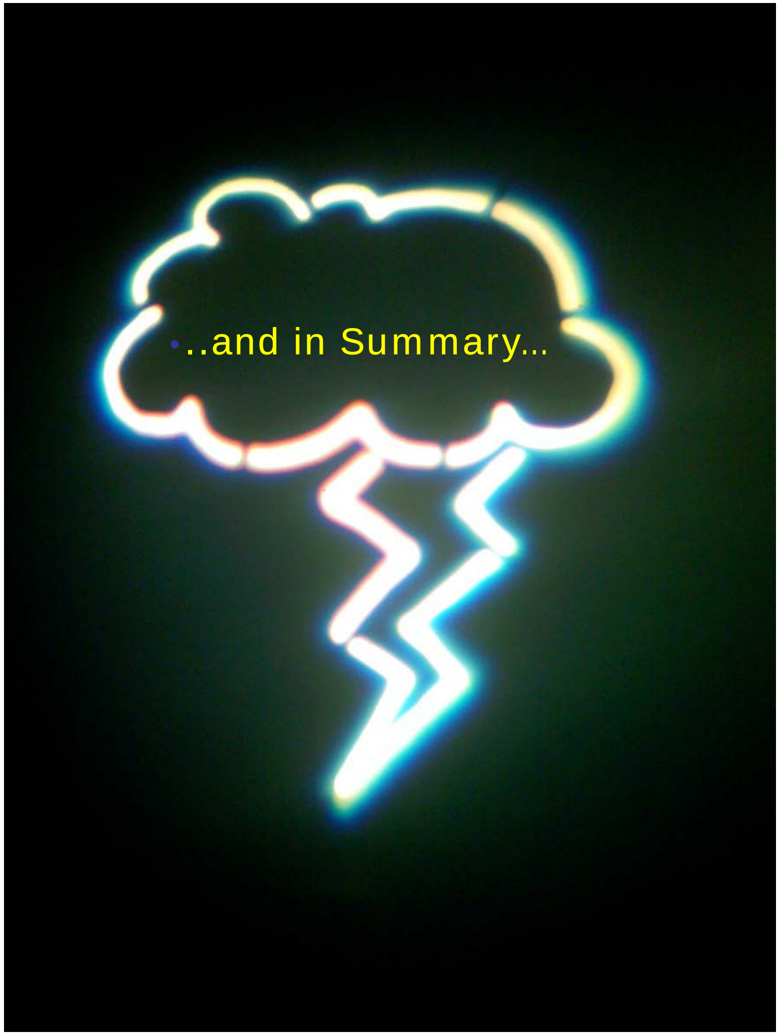
EMC2 Extreme Measurement Communications Center

Summary





The impetus

- DOE

United States Department of Energy

Office of Public Affairs

Washington, D.C. 20585

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For Immediate Release
August 8, 2007

Department of Energy Launches Major Initiative to Increase Energy Savings Across the Nationwide DOE Complex by 30 Percent

NEW ORLEANS, LA – U.S. Department of Energy (DOE) Secretary Samuel W. Bodman today launched the Transformational Energy Action Management (TEAM) Initiative, a Department-wide effort aimed at reducing energy intensity across the nationwide DOE complex by 30 percent. The TEAM Initiative aims to meet or exceed the aggressive goals for increasing energy efficiency throughout the federal government already laid out by President Bush. Reducing energy intensity by 30 percent across the DOE complex will save approximately $90 million in taxpayer dollars per year, after projects are paid for.

Links and Resources

ITP webcasts by clicking the links below:

October 30, 2008: Quick PEP Tool Demonstration and Results

November 6, 2008: Energy Assessments: What are the Benefits to Small and Medium Facilities?

November 13, 2008: Assessing Data Center Energy Use

November 20, 2008: Super Boiler Technology

Learn More

To learn more about the Save Energy Now program, including information about no-cost energy assessments, software tools, and additional

resources, training, tip-sheets, and sourcebooks, please visit ITP's Save Energy Now Web site: http://www1.eere.energy.gov/industry/saveenergynow/.

Stay Informed

Sign up to receive ITP's free monthly e-newsletter, *E-Bulletin*, BestPractices quarterly journal e-magazine, *Energy Matters*, and partner with ITP to Save Energy Now:

http://apps1.eere.energy.gov/industry/saveenergynow/partners/

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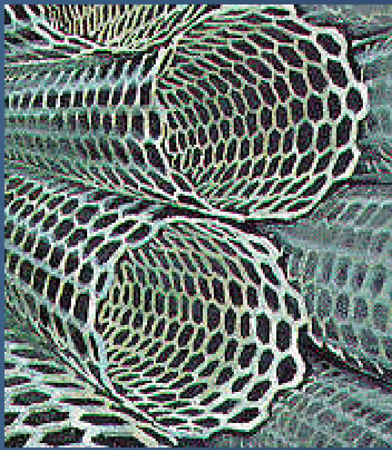
- Joe Lake, lakeje@ornl.gov

Steam Trap Leak Info:

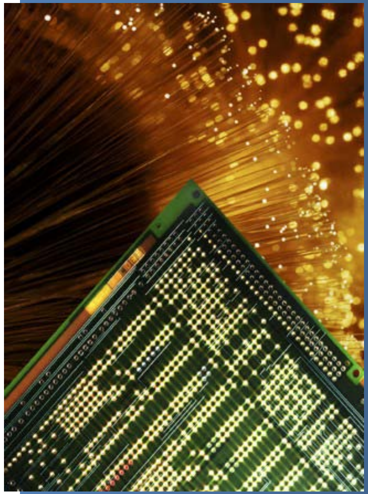
http://www.energysolutionscenter.org/boilerburner/Eff_Improve/Steam_Distribution/Steam_Trap_Leaks.asp

http://www1.eere.energy.gov/industry/bestpractices/steam.html

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable



Easy Ways to Save Energy Now - Take Care of those Steam Traps



- **Presenter:**

Dr. Peter Fuhr

Wi-Fi Sensors, Inc.

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