MnTAP Minnesota Technical Assistance Program

Energy Savings Seminar: Assessments that Save Energy and Money

University of MN – CEE Center

St. Paul, Minnesota

September 30, 2009

Helping Minnesota businesses maximize resource efficiency, increase energy efficiency, reduce costs, and prevent pollution

UNIVERSITY OF MINNESOTA

Today's Agenda

- Introductions
- Meeting purpose
- Identify and Scope
- Review of past work
  - Compressed air assessments
  - Steam trap assessments
- Comments and discussion
- Wrap up and next steps

MnTAP

- Minnesota Technical Assistance Program
  - University of Minnesota
  - Free to Minnesota businesses
  - Focused on waste reduction & energy efficiency
  - http://www.mntap.umn.edu

- Jeff Becker, engineer
  - office: (612) 624-4633, mobile: (612) 240-8765
  - e-mail: beck0254@umn.edu

MnTAP Services

- Customized technical assistance
  - Technology demos & pilots
  - Energy assessments
    - Compressed air
    - Steam traps
- Summer intern program
  - Applications for 2010
  - Sarah Haas, 612.624.5119
- Materials Exchange
  - http://mnexchange.org/

MnTAP Client Response Efforts

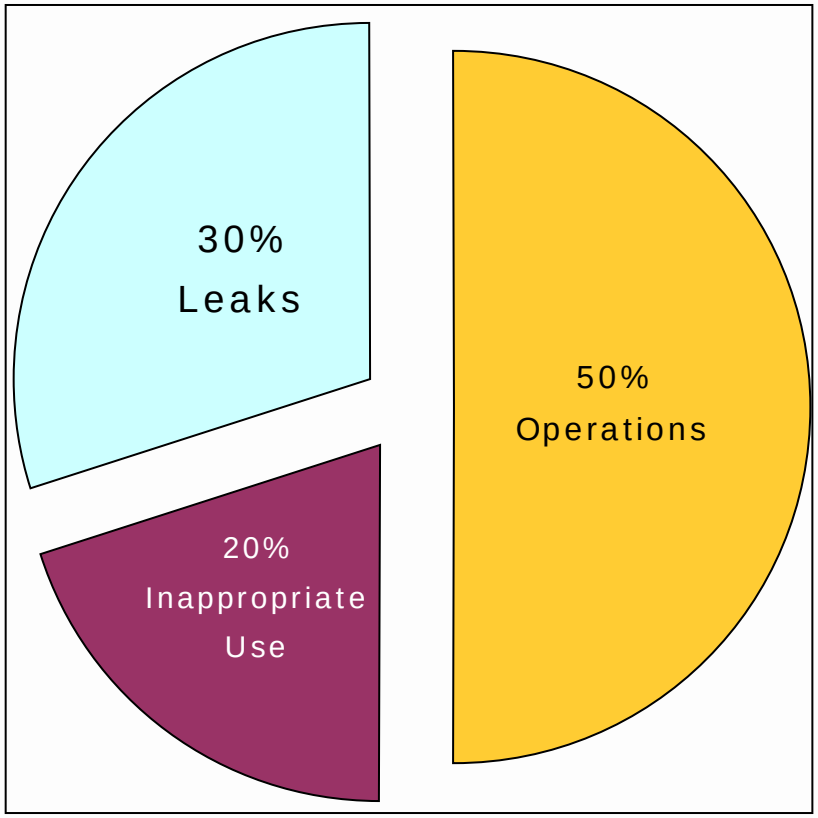
- 2008 Impact
  - 1.25 million lbs waste and emissions reduced
  - 75.6 million gal water conserved
  - 13.4 million kWh and 684,000 therms energy conserved
  - $3 million saved

E2 Savings and State Goals

- Association of Energy Engineers
  - No Cost Actions and Maintenance produce 5 to 15% savings
  - Low Cost or Short Payback Actions 15 to 30% savings
  - Higher Cost or Longer Payback Actions 30 to 50% savings
- American Council for an Energy Efficient Economy (ACEEE)
  - 2004 report stated a median achievable electric savings of 1.2% per year and a median achievable gas savings of 0.5% per year
- Minnesota's Next Generation Energy Act
  - New law calls for increasing the amount of energy saved in the use of electricity and natural gas by 1.5% a year in order to reach 25% savings by 2025
  - Notable renewable energy initiatives

Why Compressed Air?

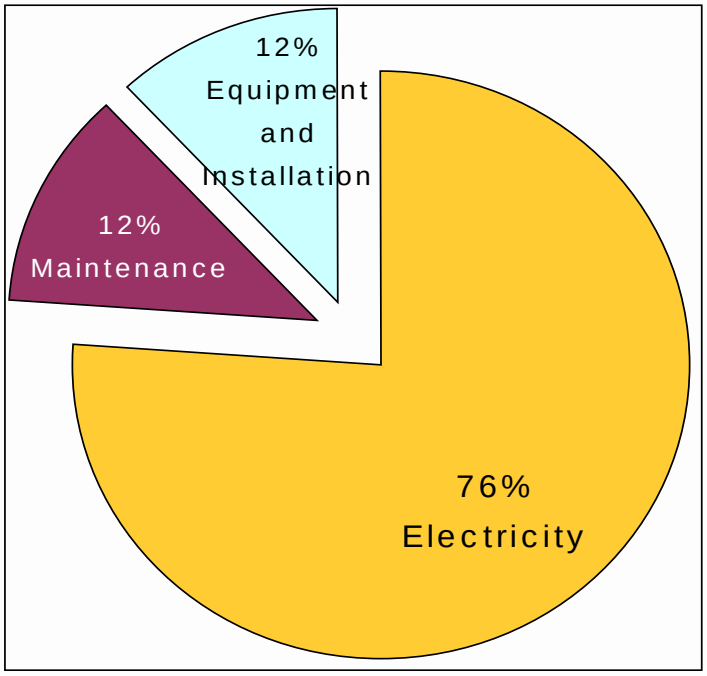
- Affects your bottom-line $$$
  - Most, if not all, facilities have compressors
  - 50% of compressed air gets used in production
  - Costs ~$13,000/yr to operate 50hp motor @ $0.05/kWh rated at 90% efficiency
    - Assumes ideal production utilization (and 75% loaded)



Source: US DOE, Energy Efficiency and Renewable Energy

Why Compressed Air?

- Efficiency Rules of Thumb
  - Takes 8hp of electricity to generate 1hp of compressed air
  - An audible leak costs on average $700 a year
  - Properly designed systems should have less than a 10% pressure drop from the discharge to end-use
  - Life cycle costs



Source: US DOE, Energy Efficiency and Renewable Energy

Compressed Air System Support

- Data collection
  - Pressure differential
  - System decay
- Ultrasonic leak detection
- Evaluation of operation and use
- Report and recommendations
- Link to rebate assistance

Compressed Air Opportunities

- Reduce inappropriate use of compressed air
  - Invest in a high volume blower
  - Achievable savings of 243,000 kWh ($17,000 annually)

- Equipment storage/coordination/sequencing
  - Add storage and eliminate compressor
  - An 80% reduction in compressed air electric utility

Case Study: Ford Motor

Ford Motor Company Sterling Heights, MI

- Compressed air management program
  - Energy savings of over 1 million kWh since 2000
  - Maintenance and energy costs decreased $165,000
- Quality magazine's 2008 plant of the year

Compressed Air Assessment

- Is compressed air necessary?
- Air treatment
- Controls and pressure levels
- Load profile
  - measures changes in demand over work hours
  - heavy demand during short periods calls for storage
- Audiometric leak testing
- Airmaster + air system assessment and analysis software
  - downloadable and free from the EERE
  - http://www.compressedairchallenge.org/

Compressed Air 'Fast Break'

- Estimate Leaks
  - Turn off all plant equipment
  - Leave compressors and dryers running
  - Time On/Off or Load/Unload time

- Estimate Expenses
  - Approximate % Leak = $\frac{\text{Load time}}{\text{(Load time + Unload/Off Time)}}$
  - Total Annual Use
    - $Annual = hp * 0.746 kW/hp * hours * rate * load %/efficiency
    - More precise – add an unloaded factor @ 0.25 energy duty
  - Leak Cost
    - % Leak Rate * $Annual

Compressed Air Auditing

- Utility, e.g. Xcel Energy, protocol
  - Requires documentation, often pre-approval
  - Two steps to energy savings
    - Diagnosis
      - Assessment of supply and demand
      - Airflow and electric metering
      - Written report of leaks/waste and costs
      - List of system recommendations and equipment rebates and savings
    - Implementation
      - Earn rebates for equipment upgrades or system improvements
      - Potential to receive up to $400 rebate per kW saved

Compressed Air Results

- Fiberglass Fabricators
  - Use compressed air primary for spraying and lay-up applications and mold/piece cleaning

Annual Savings	Est. Leak Rate, %	Leak kWh	Leak $	Peripheral $	***Total $***
Firm A	4	20,543	$1,438	$816	***$2,254***
Firm B	5	15,450	$927	$387	***$1,314***

Compressed Air Results

- Plastic Injection Molding
  - Use compressed air primary for mold release and pneumatic actuators

Annual Savings	Est. Leak Rate, %	kWh Wasted	Leak $	Peripheral $	***Total $***
Firm C	< 10 %	1,287	NC	$73	***$73***

Compressed Air Results

- Primary Metals and Metal Fabrication
  - Use compressed air primary for air tables, air cylinders, and mold release.

Annual Savings	Est. Leak Rate, %	Leak kWh	Leak $	Peripheral $	***Total $***
Firm D	30	690,714	$24,175	$4,079	***$28,254***
Firm E	40	123,177	$10,370	$2,330	***$12,700***

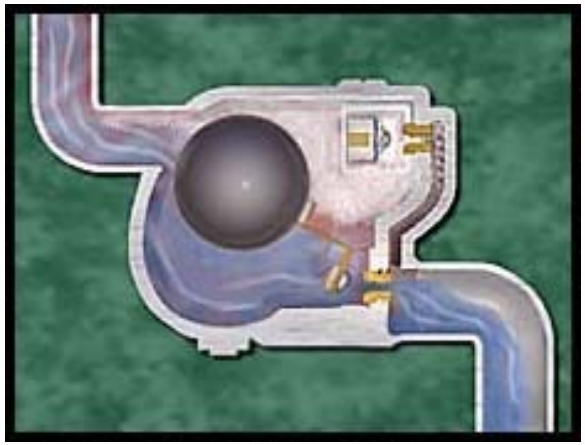
Steam Trap Audits

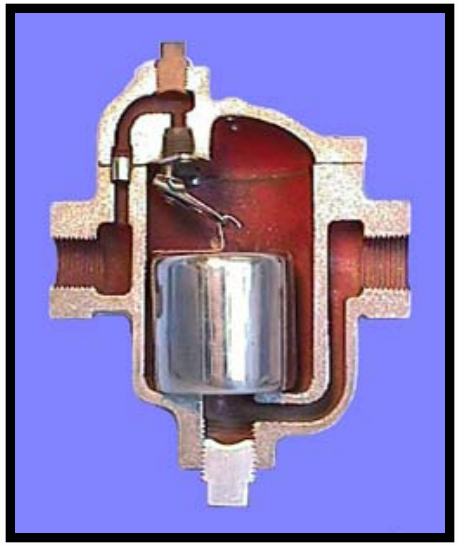
- Vision and Goals
  - Identify Steam Losses in Various Market Sectors
  - Provide Training on Trap Testing
  - Promote Rebate Program
  - Promote On-Going Inspections

- Tools of the assessment
  - Eyes: visually see failures
  - IR Temperature Gun: detect cold lines and traps
  - Ultrasonic hearing: detect cycling (hiss-discharge-hiss) or steady modulation

Steam Trap Inspection Basics

- Identify and record each trap and style
  - Tag or number trap
  - Number of failed traps
  - Time spent inspecting
  - Value of steam ($/1000 lbs)
  - Inspection payback





Steam Trap Inspection Basics

Steam Trap	Operation	Normal Sound	Fail Open	Fail Close
Disc	Intermittent	H-D-H	Rapid or no cycle	Cool
Inverted Bucket	Intermittent	H-D-H	Rapid or no cycle (jack-hammer)	Cool
Thermostatic	Intermittent	H-D-H	Blow-by	Cool
	Continuous	Steady mod.	Blow-by	Cool
Float and Thermostatic	Continuous	Steady mod.	Large venting sounds	Cool, no sound
Orifice	Continuous	Steady mod.	Blow-by	No sound

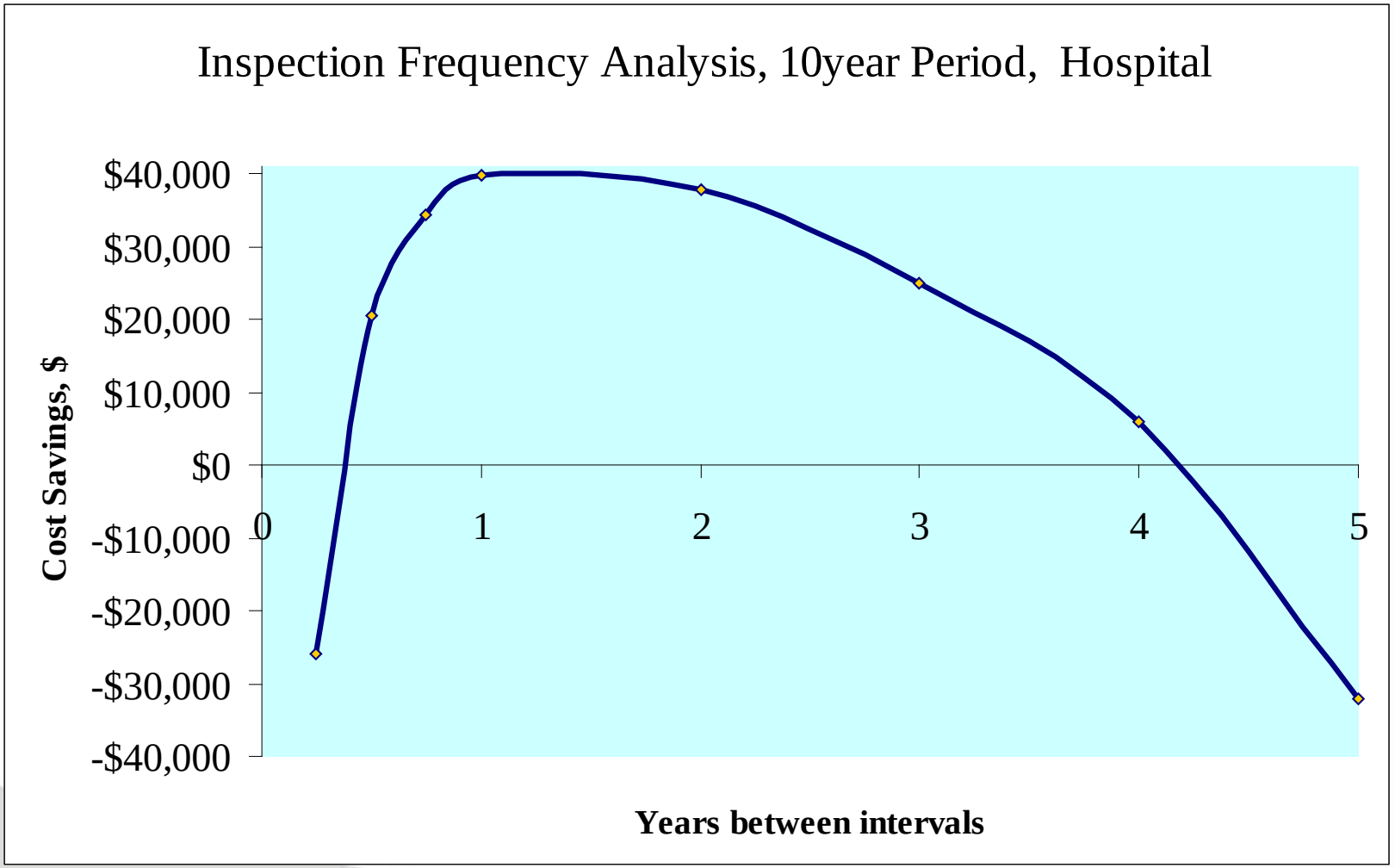
Steam Trap Inspection and Failure Rates

pressure	Facility Inspection Program type: Reactive	Simple	Proactive
low	13%	12%	2%
med	14%	7%	0%
high	25%	8%	3%

steam loss per failed trap

	ave fail rate	$/yr
low	12%	$600
med	9%	$2,900
high	15%	$7,500

Steam Trap Inspection and Failure Rates



Steam Trap Failures by Industry Type

- Minnesota Market Analysis Highlights
  - Colleges and institutions, 5-19%
  - Hospitals and laboratories, 6% average
  - Manufacturing facilities, 9% average
  - Schools, churches, and office buildings
    - Highest failure rate of market analysis
    - One facility had a 71% FAILURE RATE

Additional Steam Savings

- Public water treatment facilities, universities, and industrial facilities.

Annual Savings	# Traps	# Leaks	Hours	Trap Failure, %/year	Leak $
Industrial, High Pressure	76	13	40	2 %	$20,000
Industrial, Low Pressure	159	10	40	1 %	$5,200
Manufacturer	78	3	16	2 %	$500

Steam Trap Inspection Recommendations

- Assuming a uniform 2% trap failure rate, inspection guidelines were established based on
  - Overall trap operation AND inspection costs
  - Periodic usage at some facilities

Annual Savings	# Facilities	Range of inspection *f*	Average recomm. inspection frequency
H.Pressure Traps	2	0.5 – 1 yr	9 months
L.Pressure Traps	12	0.1 – 1 yr	11 months
L.Pressure Distribution Traps	1	1 yr	1 yr
Radiator Traps	4	2 – 4 yr	3 yr

Thank you for your Participation!

Jeff Becker, engineer

MnTAP, U of MN

Office: 612.624.4633

Mobile: 612.240.8765

e-mail: beck0254@umn.edu