Steam System Workshop: Going Beyond the Low Hanging Fruit

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New Zealand
Workshop Overview

1. Who Are We
2. Workshop Objectives
3. Definitions
   a. Defining Efficiency
   b. Your Energy Efficiency Tree
   c. Defining Your Steam System
4. Steam System Applications - Ultrasound
   a. Steam Traps
   b. Valves
   c. Other Unit Operations
   d. Higher Level Opportunities
Workshop Overview

5. Demand Side Opportunities
6. Supply Side Opportunities
7. Implementation Back Home
   a. Getting Started
   b. Justifying Projects
   c. Where to get Help
Waikato Energy Research Centre

Industrial Energy Efficiency Division

- Compressed Air
- Steam
- Utility Loop Optimisation
- Heat Recovery and Heat Integration
- Pinch Analysis
- Industrial Fluid Flow Optimisation – Liquid & Gas Transport
- Renewable Energy Solutions & Distributed Generation
- Energy Audit Methodology Development
- CO₂ Emission Reduction Programmes
- Specialised Industry Training

www.energyefficiencynz.com
Workshop Objectives

- Leave Empowered to Take Your Energy Efficiency Program to The Next Level
- Map Out Your Energy Efficiency Tree
- Have Some Fun!
Definitions

- **Energy Usage**
  - Per unit of production (Specific)
  - Total production
  - Net production

- **Plant Down Time – or OPT**
  - Minimum stoppage times
  - What is the cost of unplanned plant shut downs?
  - Impacts specific energy usage

- **Product Quality and Yield**
  - Impact of product quality
  - Impact of variable production rates
Definitions - Efficiency

- **Equipment Efficiency**
  - Individual unit efficiency
  - Pump, Fan, Boiler, Trap, Heat Exchanger etc

- **Process Efficiency**
  - Minimise Product Waste
  - Maximise Product Yields

- **Total (Site) Energy Efficiency**
  - Minimum Energy Use per unit of net production
This Waste can be broken down into:

a) How we look after the plant – Maintenance & House Keeping
b) How we run the plant - Process Operation & Control Decisions
c) Plant Design – Built Into Plant
Efficiency Opportunities

- Reactive Efficiency
  - Run to failure

- Preventive Efficiency
  - Scheduled Intervention

- Predictive Efficiency
  - Monitor Performance & Intervene Based on KPI’s
Efficiency Opportunities

- Proactive Efficiency
  - System Design/Redesign
  - Equipment Selection
  - Installation Excellence
    - Staff Training
    - Preferred Suppliers
    - Equipment Specifications
- System Integration
  - Process level
  - Plant Level
  - Site Level
Your Energy Efficiency Tree

- Energy Efficiency Tree – What does your tree look like?
Your Energy Efficiency Tree
How do you get to the higher fruit?

- “Low Hanging Fruit” Mindset
  - Let’s make a list?

- What does the higher fruit represent?
  - Let’s make a list?
The 4 Levels of Energy Efficiency

- **Level 0: Basic House Keeping**
  - Reactive Fire Fighting

- **Level 1: Predictive Programmes**
  - Monitor & Target Performance
  - Standardise Procedures

- **Level 2: System Optimisation**
  - Process Optimisation

- **Level 3: Site Wide System Integration**
  - Plant/Site Optimisation
What is our Game Plan?

- Who are the Players?
  - Let’s make a list?

- What they currently do?
  - Let’s make a list?

- What do we need to change?
  - Let’s make a list?
Steam System Definition

- Where do we draw the Boundary?
- What is the Function?
Steam System Definition

➢ Take a Step Back…..

Electricity
Steam
Compressed Air
Chilled Water
Hot Water
Water
Gas
Coal

Waste Energy

Heat Recovery & Integration
Compressed Air Analogy

- Demand Side of the System
  - End Users
  - Distribution network
  - Steam Distribution & Condensate Return
- Supply Side of the System
  - Boiler House

Pop Quiz:
Where do you start first?
Applications for Ultrasound

- Leaks
- Traps
- Valves
- Pipe Work
- Heat Exchangers
Steam Traps

Programme Options

1. No programme!

2. No Steam Pressure – better get someone in?

3. Regular Trap Surveys – Check & Replace

4. Condition Monitoring of Traps

5. Data Management
Discussion

1. In House or Out Source?

2. Survey Timing – When?

3. Criticality – Are all traps equal?

4. Condition Monitoring & Data Collection
   - What, When, Why…..?
Steam Leak Cost

What factors determine the cost of a steam leak?

- Pressure
- (Pressure Differential)
- Orifice Size
- Steam Cost

Anything else?
## Steam Leak Costs

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Steam Trap Examples

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Valves, Pipe Work & Heat Exchangers

- What are we looking for?
  - Internal Leaks
  - External Leaks

- Other Problems?
  - Water Hammer
  - Condensate Lines
  - Flash Steam
  - Orifice plates v traps?
Demand Side Opportunities

- Basic Leaks & Waste
- Condensate
  - To Drain
  - Return
  - Flash Steam – can it be used?
- Pressure Minimisation
  - Lower P = Greater Heat Transfer
- Substitutes?
  - Do you need to use steam?
  - Heat recovery opportunities?
Supply Side Opportunities

- **Fuel Conversions**
  - Coal
  - Gas
  - Biomass
  - Waste
  - Nuclear?

- **Boiler Tuning**
  - How often?
  - Fuel Dependent?
  - Cleaning?
Supply Side Opportunities

- Condensate Return System
- Insulation
- Collection
- Flash Steam Management
- Site Safety *
- Pre-Heaters
- Make Up Water & Chemicals
- Co-Generation
- Tri-Generation
Higher level Opportunities

- Comprehensive Thermal utility Integration
  - Waste Heat Recovery
  - Thermal Storage (hot & cold)
  - Heat Integration
    - Eliminates excess heating and cooling
    - Multiple Savings
      - Steam
      - Cooling Towers
      - Refrigeration Load

- Process & Plant Re-Engineering
Thought for the Future

- If you have the same plant design that is used by your competitors, what is going to keep you ahead of them?
Review

Steam Systems have unique characteristics that require extra special attention:

- Limited down time
- High Temperatures
- Risk to people & equipment
- Always remember – Safety first.
Implementation Back Home

Getting Started
1. Where do we begin?
2. What resources do I need?
3. How do I develop my business case?
4. Where can I go for help?

Software Data Logging Tools Available
- Leak Logger
- Steam Trap Manager
- Mobile Apps – Windows & Android platforms
Thank You & Good Luck!

Further information:

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