

IUPUI Reducing Energy Consumption: Magnetic Treatment of Fluids

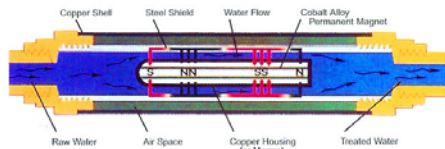
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What is Multi-Pole Magnetic Technology?

- Green technology that treats fluids with a magnetic field and reduces energy requirements, chemicals for treatment, and emissions
- Water and other fluids pass through a series of alternating reversing polarity fields that are orthogonal to the fluid flow, which redirects the orientation of the charged species and produces physicochemical changes in fluids

Cutaway of a multi-pole unit for scale treatment



Applications of Magnetic Fluid Treatment

- ✓ **Scale removal**
 - Replaces most water-softening equipment (U.S. DOE, 1998)
 - Commercial boilers, cooling towers
 - Ice-makers, steamers, dishwashers, coffee makers, misting nozzles, irrigation systems, car washes, commercial laundries, dental spray units, residential water systems and hot water heaters
 - Zebra mussel control
- ✓ **Natural gas combustion**
- ✓ **Potentially unlimited applications for energy reduction and scale control**

The Problem of Natural Gas Combustion

Depletes fossil fuel resource; Produces CO, CO₂, and many other pollutants; Degrades health; Contributes to global warming

LTV Pilot Project Summary

Facility: LTV Steel Company's #2 Tin Mill

- produced 384,000 tons of finished product during year of study

Magnetic Unit: Magnatech Kinetic Energizer

- installed on #5 portable anneal furnace

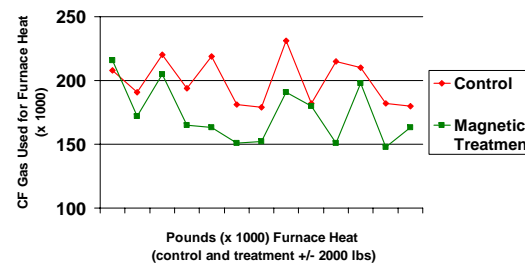
Period of Study

- control, 9 months; treatment, 1 year
- 3,373 cf/hr average flow rate of natural gas during control and treatment periods

Energy Savings

- 33 cycles of fuel use data analyzed
- statistically significant difference between magnetic treatment and control period
 - overall 7% reduction in natural gas usage
 - $t = 2.92$; $p < 0.00024$
- **annual savings: \$252,000 (2006 prices) for continuous anneal line and 5 portable anneal furnaces**
 - payback time of 0.44 years (2006 prices)

LTV Pilot Project Natural Gas Usage Comparison, Magnet Treatment vs Control



The Problem of Scale

Hard scale is a major problem worldwide! Scaling reduces the heat transfer performance of equipment. Scaling decreases the flow rate of water through tubes and pipes. Scaling leads to increased energy usage and costs. Energy consumption on heat exchange surfaces can increase by:

- 8.5% for 1/32 inch (0.8 mm) of scale
- 25% for 1/8 inch (3.2 mm) of scale

DOE Boiler Project Summary

Traditional Lime Softening vs Magnetic Technology using NIST BLCC (ver.4.4-97 model)

Assumptions:

- Recirculating boiler with 1,000 gpm flow (1.4 MGD)
- Hard water (350 mg/L as CaCO₃)
- Makeup and blowdown = 10% of flow
- Lime softening required semi-annual inspections and annual cleaning of heat exchanger.
- \$10/ton for delivered lime; \$5.80/1,000 ft³ natural gas; \$2/gallon for acetic acid

Energy Savings

Item	Cost \$/unit	Baseline Lime Softening		Alternative Magnetic Treatment		Annual Cost Savings \$
		Annual Use	Annual Cost \$/yr	Annual Use	Annual Cost \$/yr	
Electricity	0.05 per kWh	3,100	155	0	0	155
Natural Gas	5.80 per Mbtu	400,000	2,320,000	360,000	2,088,000	232,000
Chemicals	10 per ton	48	480	0	0	480
Total			2,320,635		2,088,000	232,635

Summary

- Magnetic technology is a green technology that can be used to reduce energy consumption, regardless of the source, in a variety of applications
- It provides significant potential health, safety, and environmental benefits because it is a non-chemical treatment