

# OPTIMIZING PROFIT THROUGH OPTIMAL STEAM PLANT PERFORMANCE

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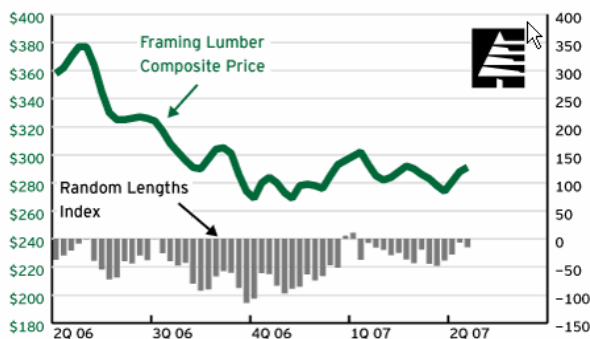
## The Good Old Days



Lots of wood, lots of water, little regulation, and less competition.

## Today

*Potlatch reports reduced earnings-* Potlatch Corporation reported earnings of 5.4 million, or 14 cents per diluted common share, for the first quarter of 2007. The company's earnings reached \$69.3 million, or \$2.33 per diluted common share, in the first quarter of 2006 (4/26/2007).



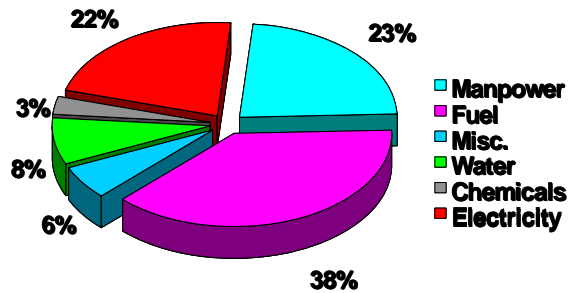
*Temple-Inland's first quarter earnings fall 52%* - Temple-Inland Inc., reported first quarter 2007 net income of \$38 million, or 35 cents per diluted share, a 52% reduction when compared with first-quarter 2006 net income of \$79 million, or 70 cents per diluted share (4/25/07).

*LP posts first-quarter loss, blames construction downturn* - Louisiana Pacific Corporation reported a first quarter net loss of \$37 million, or 36 cents per diluted share, on sales of 406 million. In the first quarter of 2006, LP's net income was \$84 million, or 79 cents per diluted share, on sales of \$678 million. Company officials cited the downturn in new residential construction as a key factor in the 2007 first-quarter results.

### What Factors are Leading to these Trends?

- Shrinking wood basket  
More competition = rising cost
- Less water
- Intense regulation  
Forest stewardship  
Environmental  
Water discharge  
Reuse
- Alternate markets and applications
- Truly is survival of the fittest
- In order to survive we must: know more, do more, make timely decisions, reduce the total cost of operations (TCO).

### Reducing Total Cost of Operation (TCO)



### Potential to Increase Steam System Efficiency

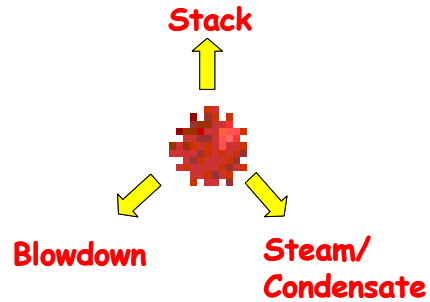
<b>Boilers</b>	<b>2%</b>
Boiler tune-ups	1-2%
Heat recovery equip	2-4%
Emissions monitoring	1-2%
<b>Operation and Maintenance</b>	<b>20%</b>
Water treatment	10-12%
Condensate return	5-10%
Load controls	3-5%
<b>Distribution System</b>	<b>10-15%</b>
Steam leaks	3-5%
Steam traps	10-15%
Insulation	5-10%
<b>Total</b>	<b>30-40%</b>

## What Do We Need to Do?




Johnny D always says: “you can’t control what you can’t or don’t measure.”

Do you know the following?

- Your water quality?
- Your cost to produce steam?
- The value of your condensate?
- Plant mass balance?



# Energy Tips

Steam
Motors
Compressed Air

**Monitor Flue Gas Temperature**

An indirect indicator of scale or deposit formation is flue gas temperature. If the flue gas temperature rises (with boiler load and excess air held constant), the effect is possibly due to the presence of scale.

**Perform Visual Inspections**

Visually inspect boiler tubes when the unit is shut down for maintenance. Scale removal can be achieved by mechanical means, or acid cleaning. If scale is present, consult with your local water treatment specialist and consider modifying your feedwater treatment or chemical additives schedule.

**Clean Boiler Water-side Heat Transfer Surfaces**

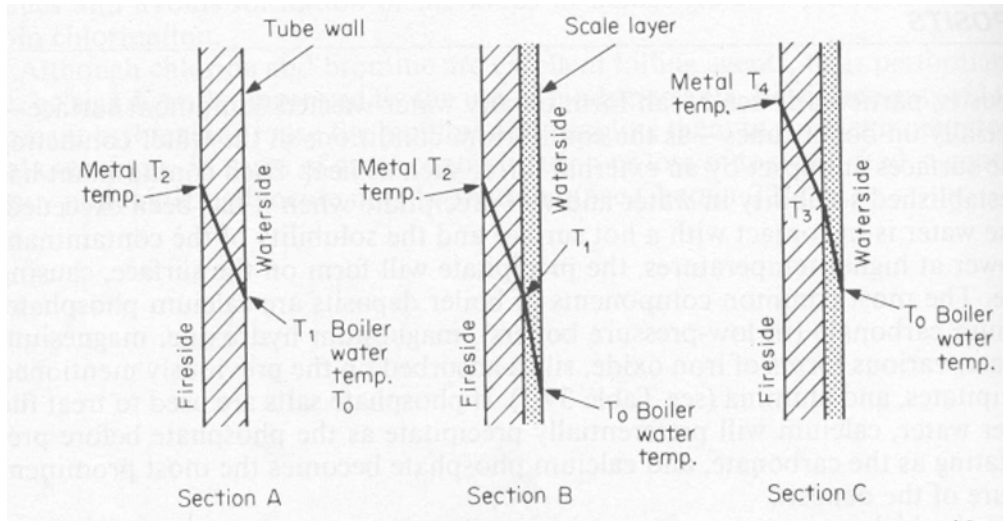
Even on small boilers, the prevention of scale formation can produce substantial energy savings. Scale deposits occur when calcium, magnesium, and silica, commonly found in most water supplies, react to form a continuous layer of material on the waterside of the boiler heat exchange tubes.

Scale creates a problem because it typically possesses a thermal conductivity an order of magnitude less than the corresponding value for bare steel. Even thin layers of scale serve as an effective insulator and retard heat transfer. The result is overheating of boiler tube metal, tube failures, and loss of energy efficiency. Fuel wastage due to boiler scale may be 2% for water-tube boilers and up to 5% in fire-tube boilers. Energy losses as a function of scale thickness and composition are given in the table below.

Energy Loss Due to Scale Deposits*			
Scale Thickness, inches	Fuel Loss, % of Total Use		
	Scale Type		
	"Normal"	High Iron	Iron plus Silica
1/64	1.0	1.6	3.5
1/32	2.0	3.1	7.0
3/64	3.0	4.7	-
1/16	3.9	6.2	-

Note: "Normal" scale is usually encountered in low-pressure applications. The high iron and iron plus silica scale composition results from high-pressure service conditions.  
\*Extracted from National Institute of Standards and Technology, Handbook 115, Supplement 1.

A scale layer reduces your heat transfer efficiency.

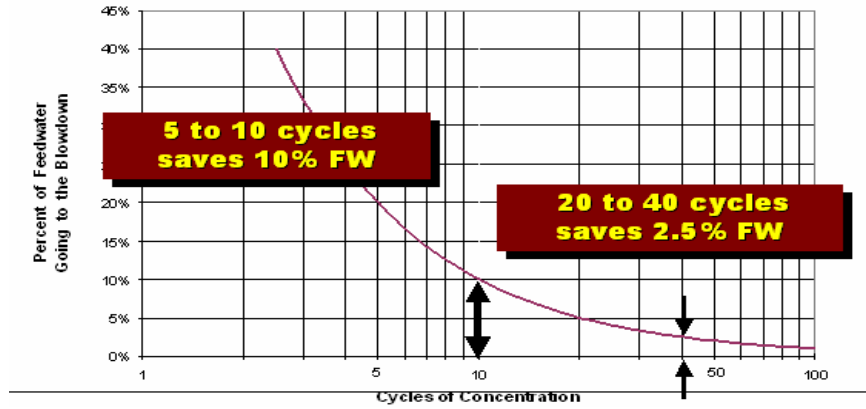


Deposit thickness	Efficiency reduction
0.0199 cm	2 - 4%
0.0397 cm	4 - 6%
0.0794 cm	6 - 9%
0.159 cm	9 - 12%
0.3175 cm	12- 16%
0.476 cm	16 - 20%
0.636 cm	20 - 25%
0.794 cm	25 - 30%
0.953 cm	30 - 35%
1.11 cm	35 - 40%
1.27 cm	40 - 50%

## Reduce Boiler Blowdown

$$\% \text{ BD} = 1/\text{cycles} \times 100$$

Percent of Feedwater for Blowdown



### Condensate Recovery Produces Savings

A large specialty paper plant reduced its boiler makeup water rate from about 35% of steam production to between 14% and 20% by returning additional condensate. Annual savings added up to more than \$300,000.

### Suggested Actions

Reduce operating costs through maximizing the return of hot condensate to the boiler.

Consider the following actions:

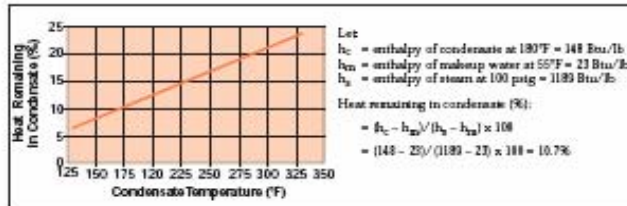
- If the condensate return system is absent, estimate the cost of a condensate return system and install one if economically justified.
- Repair steam distribution and condensate return system leaks.
- Insulate condensate return system piping to conserve heat and protect personnel against

### Return Condensate to the Boiler

When steam transfers its heat in a manufacturing process, heat exchanger, or heating coil, it reverts to a liquid phase called condensate. An attractive method of improving your powerplant's energy efficiency is to increase the condensate return to the boiler.

Returning hot condensate to the boiler makes sense for several reasons. As more condensate is returned, less makeup water is required, saving fuel, makeup water, and chemicals and treatment costs. Less condensate discharged into a sewer system reduces disposal costs. Return of high purity condensate also reduces energy losses due to boiler blowdown. Significant fuel savings occur as most returned condensate is relatively hot (130°F to 225°F), reducing the amount of cold makeup water (50°F to 60°F) that must be heated.

A simple calculation indicates that energy in the condensate can be more than 10% of the total steam energy content of a typical system. The graph shows the heat remaining in the condensate at various condensate temperatures, for a steam system operating at 100 psig with makeup water at 55°F.



## Typical Condensate Return

Industry	Typical % Return
Sugar	100 +
Independent Power	95-99
Institutional	80 +
Wood Processing	75-90
Corrugated Box Plant	70-80
Tire	60-70
Textiles	50-60
Canning	50
Grain Processing	30

## How Do I Maximize Condensate Return

- Good understanding of system
- Good maintenance (mechanically and chemically)
- Insulate as much as you can
- Good communication

## Where Do I Start?

- Know your make up water quality
- Cost of water (make up and sewer)
- Cost of pumping
- Cost of pretreatment (salt chemical, etc.)
- Cost of fuel
- Boiler efficiency (75%)
- Blowdown rate
- Cost per mmlbs steam
- Define your goals, maximize boiler cleanliness
- Maximize boiler cycles of concentration: 50 cycles or 2%
- Maximize condensate return: > 80% return
- Define your opportunities in terms the mill owner will understand

## Take-Aways

- A clean boiler is an efficient boiler.
- Blowdown is big dollars—go get it!
- Use the pretreatment equipment that meets your needs.
- Survey and upgrade your condensate system.