Western Cape Government
Environmental Affairs & Development Planning

BETTER TOGETHER.

Allowing Condensate to the Boiler - Fact Sheet

Department of Environmental Affairs and Development Planning

ALLOWING CONDENSATE RETURN TO THE BOILER

FACT SHEET

Steam generated from boilers used for various applications, eventually converts back to liquid phase, condensate, due to excessive heat losses (radiation) during a production process. The condensate formed is a direct result of used steam, which is rich in energy and has great potential for reuse. The condensate is most often disposed of in ways that does not make use of the quality of the condensate (treated water) and the expensive energy that it holds, which makes reusing condensate very attractive.

WHY implement?

Condensate within a typical steam system contains more than 10% of steam energy. Allowing steam condensate return to the boiler would render:

- A Reduction in feed-makeup water required to the boiler, thus making a saving in water supply.
- A 1% fuel saving for every 6 degrees feed water temperature increase. The quantity of fuel used by the boiler is reduced as the feed water will enter at higher temperature, requiring less fuel for heating.
- A return of high quality condensate reduces energy loss, as this would reduce boiler blow down required (visit the energy solution center web page for more information on boiler blow down).
- A reduction in feed water treatment cost, as the condensate return will reduce the amount of feed-makeup water required (visit the energy solution center web page for more information water treatment).

HOW to implement?

Allowing for condensate return to the boiler can be done as follows:

- Estimate the cost of installing a condensate return system and the savings that will result in fuel, water and water treatment costs.
- If currently partially recovering condensate, determine whether this can be increased, by evaluating the cost versus savings that will be incurred.

WHAT is required to implement?

Capital cost associated with acquisition and installation of condensate return valves, piping and pumps.

Example

A steam system returns 4539kg/hr of condensate at 82.°C, assuming the system operates at 8000hours annually with an average boiler efficiency of 82% and make up water temperature at 13°C. The fuel cost is R51.25 per Gj and the specific enthalpy values are 54.7754kJ/kg (at 13°C) and 343.473kj/kg (at 82°C). Assuming a 12% flash steam loss, calculate the overall annual savings.

Determining annual fuel savings = (1- Flash Steam Fraction)×(Condensate load in kg/hr) × (annual operating hours) × [B](make up water specific enthalpy difference) × (Fuel cost in R/kJ)[A] ÷ Boiler efficiency

$$\frac{(1-0.12)\times(4539kg/hr)\times(8000hours)\times(343.473kJ/kg-54.7754kJ/kg)\times(R51.25/kJ)}{0.82\times10^{6}} = \text{Savings}$$

= R546, 506

- **Insulating condensate return lines** allows for higher temperature condensate recovery to the hot well, which renders savings in fuel as well as a reduction in radiation that contributes to a drop in the surrounding temperature in the work place.
- For more information on condensate recovery and calculating your payback times, fuel and water savings, visit the Spirax Sarco web page.
- The Steam System Assessment Tool (SSAT) allows steam analysts to develop approximate models of real steam systems. Using these models, you can apply SSAT to quantify the magnitude—energy, cost, and emissions-savings—of key potential steam improvement opportunities. To view visit the EERE web page and scroll down to see SSAT tools.

Sources and Useful Links:

- Energy Star: http://wwww.energystar.gov/gasstar/workshops/dall
- Armstrong: http://armstrong.be/prod/pumps/pumpsmain.html
- US department of energy: http://www.oit.doe.gov/bestpractices/steam/operate.shtml
- Spirax Sarco: http://www.spiraxsarco.com/learn/pdf/block14module1.pdf
- Energy solution centre: http://www.energysolutionscenter.org/BoilerBurner/Eff_Improve/Primer/Boiler_Efficiency.asp
- EER: http://www.eere.energy.gov/industry/bestpractices/software.html

Department of Environmental Affairs and Development Planning Directorate: Pollution and Waste Management.
Telephone: +27 21 483 2705

Fax : +27 21 483 44 25

The entire range of fact sheets can be found by visiting the www.capegateway.gov.za web page.

[B] To retrieve enthalpy values for your process temperatures (hf for sub saturated water) visit http://www.spiraxsarco.com/esc/default.asp?redirect=SSW_Properties.aspx

[A] R/kJ = R/lt * 1/(kJ/lt) or R/kJ = R/lt *kJ/kg *its density (lt = litre; kJ= kilo joules; R= rands; kg=kilo grams; density= mass/volume which is kg/lt of the fuel). The information above can be retrieved from your supplier).