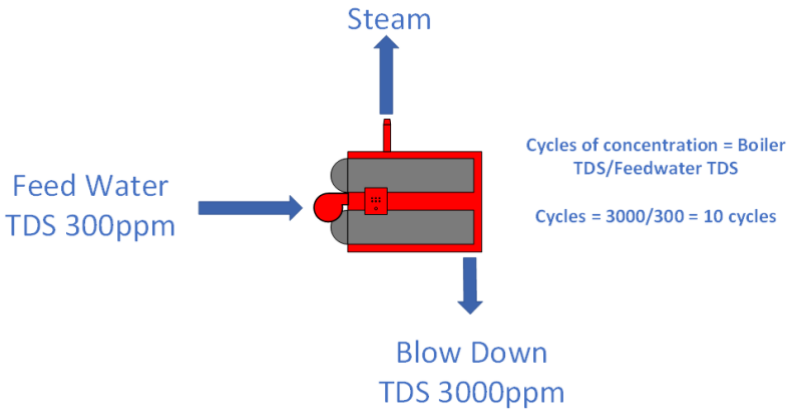
Reducing Energy & Water Costs - Boilers

Steam boilers present a range of opportunities for process heating enhancements, but perhaps the easiest way to impact **fuel consumption** and **expenditures** is through maximising the **cycles of concentration**. Cycles of concentration is the ratio of Boiler Water Total Dissolved Solids (TDS) divided by the Feedwater Total Dissolved Solids (TDS) as represented below.



Produce Higher Quality Feedwater

Feedwater is generally made up of towns water and a condensate return. Condensate is condensed steam and will generally have high thermal energy and low TDS. The more condensate return you have in your feedwater the lower your feedwater TDS will be and hence your potential for maximising cycles of concentration will be high.

If condensate return is limited or can't be returned, then your feedwater will predominantly be made up of towns water. Towns water TDS varies in water quality depending on your location but can range in TDS from 60-500 across Australia. In terms of cycles of concentration for a maximum boiler water TDS of 3000, this could relate to cycle range of 6-50 based on geographic location. Obviously, boilers operating 6 cycles of concentration are significantly less efficient than operating at 50 cycles.

NB: 50 cycles is the maximum cycles of concentration recommended in boilers.

In the case of higher TDS feedwater significant energy and water savings could be made by improving the feedwater quality. The most effective means of improving feedwater quality is to reduce the TDS by removing the dissolved salts present in the towns water.

Reverse osmosis (RO) is a well proven and reliable method for reducing Feedwater TDS (conductivity) from the makeup, leading to a more substantial increase in cycles of concentration. Obviously, cost differences between RO specific to the size and type of operation must be carefully weighed against the potential of each option for increasing cycles. In comparing options, a thorough evaluation of goals and methods must be conducted as the engineering, operation and maintenance associated with each respective technology differs.

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Using the iH2OM modelling tool, we identified in this example *(below)*, that by increasing to 50 cycles of concentration from what is a rather low 5.2 there is the benefit to save more than $180,000 per annum. iH2OM can do this through the application of its pre-treatment program taking into consideration the Mechanical, Operational and Chemical (MOC) elements of the Boiler Water Program, as well as a Boiler Modelling Tool.

Inputs & Values			
Input	SI Units	Value	
Sewer Cost	$/m³	$ 3.10	18hrs per day, 5 days per week
Make Up Water Cost	$/m³	1.78	
Makeup Water Temp.	°C	22	
Return Condensate Temp.	°C	93.33	
Fuel Cost	$/GJ	$ 20.10	
Boiler Efficiency	%	80%	
Operating Days per Year	Days	172	

Operational Information				
		As is	Desired	Savings
% Condensate Return	%	17.70%	21.50%	
Boiler Cycles	Cycles	5.2	50	
Steam Rate	kg/hr	6,000	6,000	
Steam Pressure	kPa	1,000	1,000	
Steam Temperature	deg C	184	184	
Steam Enthalpy	kJ/kg	2,781	2,781	
Blowdown Enthalpy	kJ/kg	781	781	
Makeup Flow	kg/hr	6,166	5,082	1,084
Return Condensate Flow	kg/hr	1,263	1,041	222
Feedwater Flow	kg/hr	7,429	6,122	1,306
Blowdown Flow	kg/hr	1,429	122	1,306

Energy & Water Costs				
Blowdown Energy Cost	$/year	$ 102,122	$ 8,753	$ 93,368
Blowdown Sewer Cost	$/year	$ 18,293	$ 1,568	$ 16,725
Makeup Water Cost	$/year	$ 44,952	$ 35,348	$ 9,604
Total Costs	**$/year**	**$ 165,366**	**$ 45,669**	**$ 119,697**

CO_2 EMISSION SAVINGS - Metric Tonne CO2 per year	**232**
WATER SAVINGS - Megalitres per year	**5.4**
ENERGY SAVING - Gigajoules per year	**4,645**

With regards to financing these energy saving opportunities, we can provide the following options:

- Straight up capital purchase
- Amortisation (lease to own) over a term
- Amortisation linked to your production i.e., $ per hectolitre
- Rental options

	JAN	FEB	MAR	APR	MAY	JUN		
GAS USAGE	1586981	1871489	1572936	1857985	2113547	2027541	11030479	
GAS COST	$ 32,926.84	$ 38,672.83	$ 32,466.55	$ 38,345.43	$ 43,072.57	$ 41,459.51	226943.73	
$/GJ	$ 0.021	$ 0.021	$ 0.021	$ 0.021	$ 0.020	$ 0.020	$ 0.02	GJ

KG / Month	31565052.09	37223916.21	31285697.04	36955321.65	42038449.83	40327790.49	219396227.3	Kg/Yr
							438792.4546	M3 GAS/YR

NOTES

GJ	Propane (L)	Conversion	Propane (KG)
1	39	0.51	19.89

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