Power Plant Boiler System

Connecticut College

New London, CT

Increasing Boiler Efficiency

The Energy Systems Manager was tasked with identifying and implementing cost saving opportunities for the central power plant's equipment under his control. This report highlights just one portion of the energy saving programs put into practice to achieve better fuel efficiency for the power plant boilers. The winter months in the Northeast place a heavy burden on the steam boilers with higher operating loads on the power plant. This means the boilers have to work harder, burning more fuel and decreasing the efficiency due to scaling, which in turn, increases the stack temperature of a boiler.

Installing the Bon Aqua water treatment on the central power plant's three 90,000 #/hr Combustion Engineering water tube boilers proved that it was possible to achieve better fuel efficiency results.

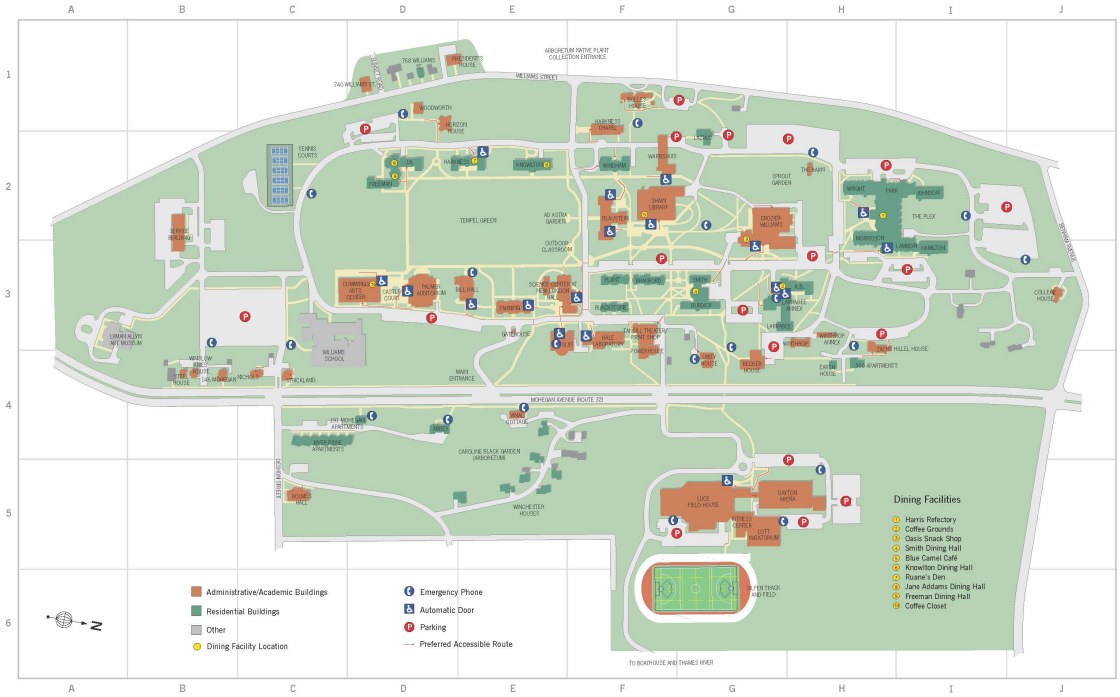
In order to improve the overall performance of the Central power plant, Bon Aqua treatment was also installed on three BAC/Trane tower systems totaling 1100 tons, and the cooling systems which service the campus' hockey/ice arena. Read on to see how those savings were achieved.

Boiler Systems:

- A comparison of actual steam output and stack temperatures proved more conclusive than the prior method of comparing steam to fuel ratios.
- Stack temperature is one of the primary indicators for determining boiler efficiency.
- There are several real benefits, in addition to the fuel savings that were obtained, and the better efficiency indicated by the lower stack temperatures.
- Any fuel savings indicated while running in the lower load ranges, would be proportionately larger at higher load ranges.
- The reduction in scale, which is indicated by the lower stack temperatures, gives significantly less risk of tube failure, due to the hot spots normally resulting from scale build-up.

Cooling Systems:

- Increase in the cycles of concentration, saving significant amounts of water
- Improved efficiency of chiller-condensers from scale-free tubes
- The attached graphs denote analysis and correlation of the TDS increase and water decrease on a 500-ton cooling tower at Connecticut College over a three-month period.
- It is noteworthy that the 1 to 4 increase in TDS is almost identical to the 4 to I decrease in water usage.



Number 1 Boiler Pounds Per Hour of Steam vs. Stack Temperature #6 Oil

Pd Per Hr Steam	Number of Samples		Stack Temperature	
	1995	1996	1995	1996
12,000	6	2	465	452
13,000	4	2	475	450
14,000	4	2	474	456
15,000	4	9	474	465
16,000	4	16	496	477
17,000	8	4	498	488
18,000	9	6	506	491
19,000	9	9	520	501
20,000	2	10	517	508
21,000	2	2	540	515
22,000	2	5	536	522
Total Samples	54	66	498	463

Number 3 Boiler Pounds Per Hour of Steam vs Stack Temperature #6 Oil

Steam Pd Per Hr	Number of Samples		Stack Temperature	
	1995	1996	1995	1996
8,000	1	8	418	408
9,000	0	4	---	418
10,000	0	0	---	---
11,000	3	3	428	426
12,000	0	5	---	422
13,000	2	3	431	429
14,000	1	6	457	439
15,000	4	3	456	441
16,000	1	1	468	450
17,000	0	3	---	448
18,000	0	1	---	458
Total Samples	12	37	442	427

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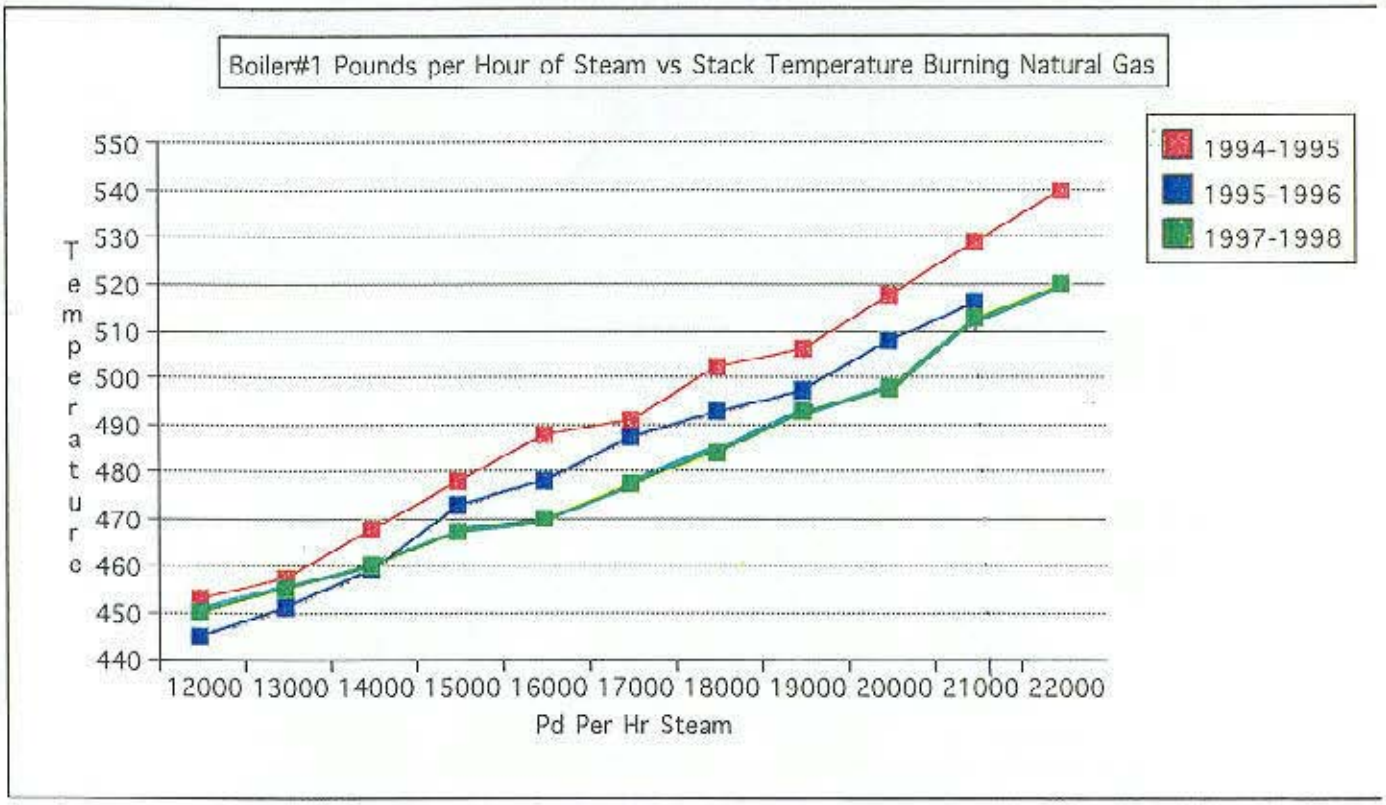
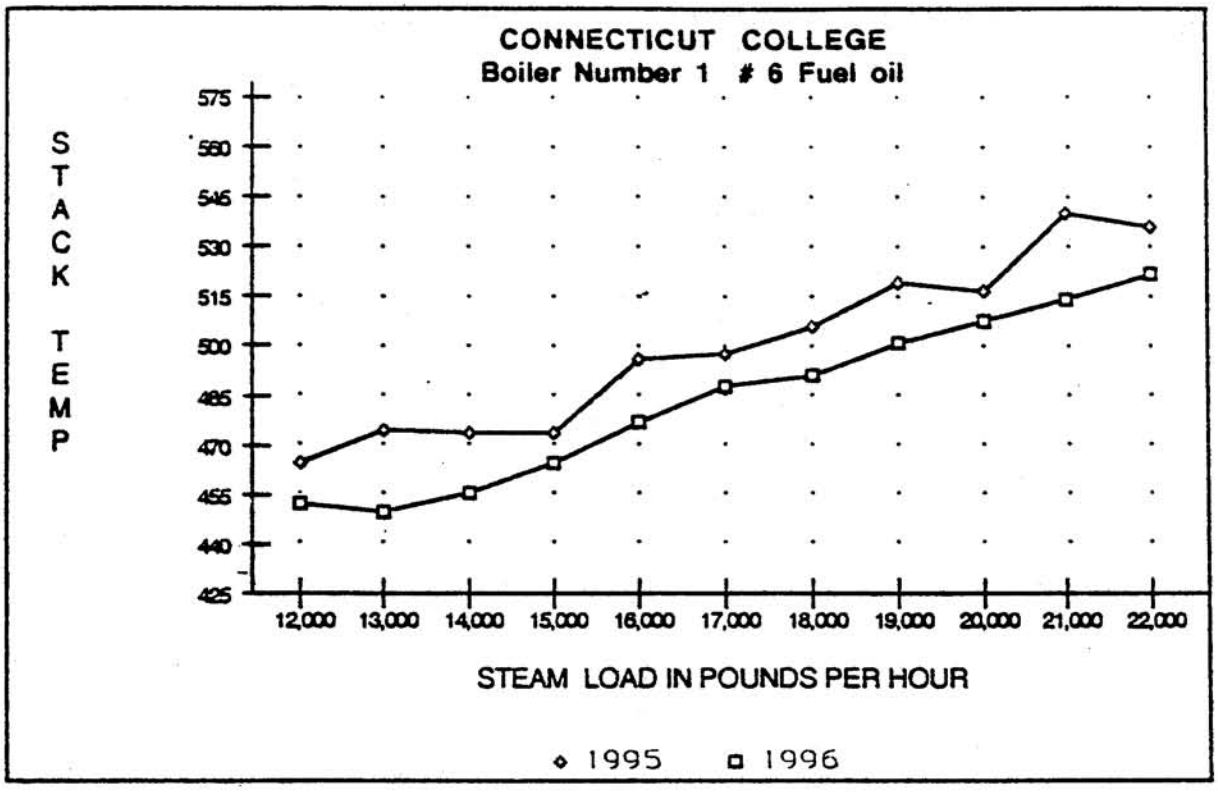
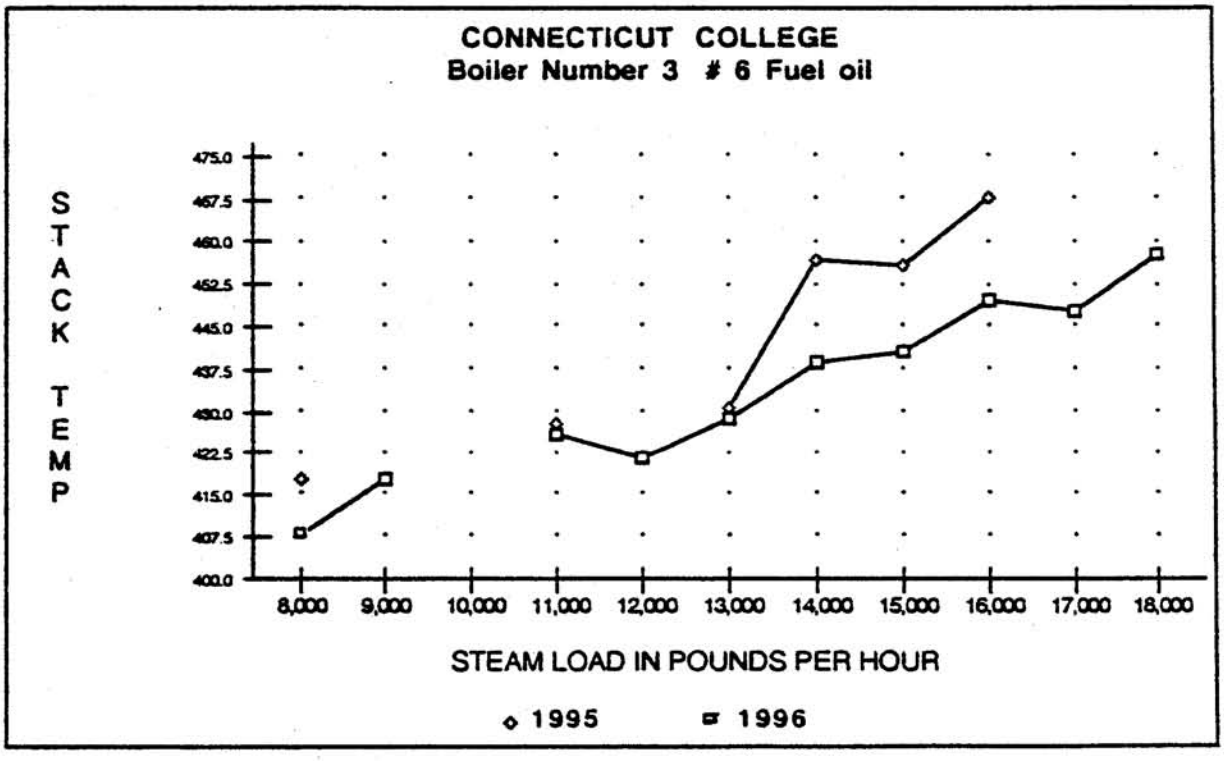
Boiler#1 Pounds per Hour of Steam vs Stack Temperature Burning Natural Gas

Pd Per Hr Steam	Stack Temperature			Number of Samples		
	1994-1995	1995-1996	1997-1998	1994-1995	1995-1996	1997-1998
12000	453	445	450	12	7	3
13000	457	451	455	5	6	5
14000	468	459	460	5	6	5
15000	478	473	467	9	10	8
16000	488	478	470	8	4	6
17000	491	487	477	10	7	11
18000	502	493	484	9	4	7
19000	506	497	493	6	5	7
20000	518	508	498	7	2	10
21000	529	516	513	2	4	10
22000	540	- -	520	3	0	8
Total Samples				76	55	80




CONNECTICUT COLLEGE
Boiler Number 1 # 6 Fuel oil
STACK TEMP
575
560
545
530
515
500
485
470
455
440
425
12,000
13,000
14,000
15,000
16,000
17,000
18,000
19,000
20,000
21,000
22,000
STEAM LOAD IN POUNDS PER HOUR
1995
1996


CONNECTICUT COLLEGE
Boiler Number 3 # 6 Fuel oil
STACK TEMP
475.0
467.5
460.0
452.5
445.0
437.5
430.0
422.5
415.0
407.5
400.0
8,000
9,000
10,000
11,000
12,000
13,000
14,000
15,000
16,000
17,000
18,000
STEAM LOAD IN POUNDS PER HOUR
1995
1996

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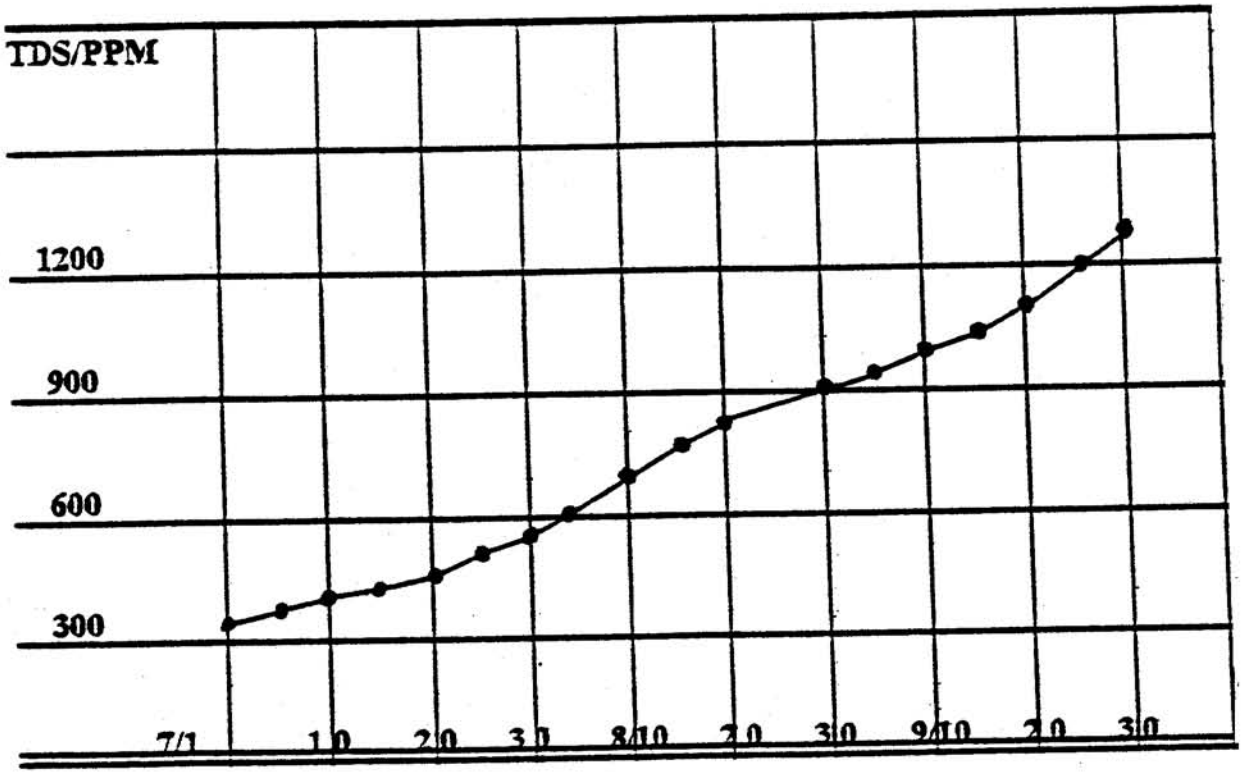
These graphs denote analysis and correlation of the TDS increase and water decrease on a 500 ton cooling tower at Connecticut College over a three month period. Bon Aquas were installed June 15, 1994. It is noteworthy that the 1 to 4 increase in TDS is almost identical to the 4 to 1 decrease in water usage.

TOTAL DISSOLVED SOLIDS INCREASE



WATER USAGE DECREASE