Executive Summary:

Based on our burn laboratory testing as outlined in the document below, we have achieved a range of 11-16% BTU Efficiency improvement relating to 13-22% actual fuel use reduction in a more typical "heavy load" running systems. The Burner Booster achieves these results by using an Ultra-high pressure injection method that breaks the fuel into much smaller droplets and creates a better ionization/ atomization that chemically allows for better thermo-oxidation of these finer "fuel Drops/ Mist". This better improved "Ionic Bond", thereby attracts; and uses the oxygen better. Heating the oil helps the atomization so that the smaller droplet and the better ionized/atomized fuel oil (with its many compounds) facilitates a cleaner and more complete ignition of the fuel oil resulting in greater heat output per measure and dramatically reduced emissions. Using stack temperature for evaluation is not accurate of performance.

Conclusion Section:-Testing from: April 14th to June 5th.

Equipment Used:

Boiler used

1.80 - 3.20gph	Weil McLain 80 series-480 model	max. 3.4gph
5.0 -6.1gph	Kewanee HTB ---3 pass	max. 14.5gph
8.5-12.5	Kewanee HTB----3 pass	max. 14.5gph

Burners used

STD. Burner	Nozzle@Psi.	Actual fire/GPH
Wayne HS.	2.75@105psi	2.817
Wayne EH	5.50@120psi	6.050
Wayne FH	5.50, 5.00@110psi	12.340
Beckett AFG	2.50@140psi	2.820
Beckett CF-500 W	2.75@140psi	3.210
Burner Booster:		
BB-HS-(Z11)	@1,250	1.957
BB-EH-Pro(Z-12)	@1,100	2.053
BB-EH-Pro(Z-13)	@1,350	5.107
BB-FH-Pro(Z-14)	@1,250	8.090

Instrumentation

E-Instrument model-8500-9 gas analyzer, factory calibrated 4-4-2013
Bacharach PCA-3 and Bacharach PCA-2, factory calibrated 4-11-2013

GPI water flow meter, (range .5-9.0gpm +- .5%)- calibrated and new.
GPI water flow meter, (range 1.5-20gpm +-1%)

OMEGA Fuel oil flow meter with totalizer. (.25-22.0gph, accurate up to .001 gallons)
Calibrated and new.
Digital time clocks and stop watches with controls.

Notes:
On Weil McLain boiler, 1.9-3.2; shows Number of cycles /120 min:
{3.00gpm water in @ 52.^{oF} with aquastat limit @185 F. .. }
6 cycles with std. burners on/ off VS. 4 with BB. = ~40% less start stops/ day.

Comments: (as we see it**);**
Start/ stops of Std. System had CO levels 35-120ppm for 1 minute..(before clearing up)
Start/ stops of BB. System had CO levels 3-11ppm for 30 seconds…….(before clearing up)
This coincides with facts that 70%-80% of soot is from start and stops.

Burner Booster system improves the AFUE system value to be over 86%.
<u>*.% Efficiency Improvement</u> and fuel saved is not expected to be linear-which these tests show.
Run-Up improvement; shows larger nozzles reduce efficiency of atomization of fuel oil.

Actual fuel savings in the real world of tests before and after, of our accounts, EES has over 92% of our installation sites shows between 16-28%- fuel savings.(factoring heating degree days, and production process volume demand at those locations). We believe this is due to added combustion air to run the burner system more cleanly, resulting in some performance loss. Tune-ups are made by human judgment.

Conclusion Review- Fuel savings:

A series of tests methodologies were run, many repeated with slight variation for accuracy and repeatability.

Test ***A*** ”STEADY-STATE” max load, no shut off, constant run.
Test ***B*** ”Cold Start-Run Up” with norm heavy load- 40-60 minute test
Test ***C*** ”Load Cycle test”, normal load, cycle on off @ 185F 120 minutes.

% Fuel Improvement

TEST	1.8-3.2gph	5.0-6.0gph	8.5-12.5gph
A	5.6 - 7.1%	7.2- 8.5%	9.5-11.7*%
B	15.8-19.5%	17.5-21.0%	22.0-28.0%
C	13.1-15.5 %	16.0-20.0%	18.0-24.0%

Many of the tests were repeated for consistency of the truest of values. They are some of the tests recognized by the Heating Industry: Dept. of Energy, National Evaluation Labs, Boiler and Burner Companies. Independent testing was also done by Worchester Poly-Technic Combustion Lab.

NOTES:

A **Test:** is not typical of an actual operating boiler/burner system. It reflects the thermodynamics of the system at max performance.

B **Test:** This evaluates the BTU in and out, the efficiency from a cold start over time to reach a set max temputure of about 185 degrees. (0-50 mints test with heavy load).

C **Test:** is more typical of an actual operation of a boiler/burner system. Starts at a cold start of about 50^{o}F, with medium cold water input of about 50 degrees for 2 hour test.

*** This was an estimated value from other inputs also.**

Conclusion Review- BTU Input /Output

A series of many test to evaluate the efficiency of the total system and that of the heat exchanger showing traditional Std. well "tuned up" VS. The Burner Booster on the same boiler. The results from several tests and test method C resulted to the following conclusions. The cold starts where about 50^{o} F with same water temp. input.

		GPH-Range	
Values	**1.80-3.20**	**5.0-6.0**	**8.5-12.5**
BTU- Input per gal	136,700	136,700	136.700
BTU Output-Std. /gal.	108,900	109,400	110,600
BTU Output-BB. /gal.	123,700	125,400	128,200
% BTU Improvement	**10.84%**	**14.63%**	**15.91%**
Run-Up Improve.~	15.20%	19.0%	27.0%

Total system efficiency "AFUE-Like" (0-120minits, w/ cycling and heavy load)

System Eff. Value-Std.	80.17%	77.8%	69.0%
System Eff. Value- BB.	92.76%	91.1%	87.0%
Delta EFF. Incress.-PTS.*	12.59	13.30	18.0
Fuel saved. (Test C)	**13.40%**	**18.50%**	**22.20%**

This validates many claims that "Efficiency improvement "and fuel savings is not 1:1 and not linier. There are many other variables of how the thermodynamics of the system has improved as well as the much improved cleaner starts and stops.

***Delta EFF.** Increes.-PTS = change of efficiency of points increase in value.

Conclusion Review- Emissions Report,

A series of tests; that monitor the emissions that coincide with the fuel usage performance tests of many dozens of runs, and recording of the values listed below are more of averages based on the fire rate table. **Vs** ~ % of Lbs. /BTU output reduction.

	1.80-3.20gph		5.0-6.0gph		8.5-12.5gph		% reduction
Gasses	**STD,**	**BB**	**STD,**	**BB**	**STD,**	**BB**	**/Same BTU output**
O_2.....(%)	5.8	3.6	5.3	2.3	4.7	1.8	
CO_2...(%)	11.2	13.1	11.5	13.3	12.3	13.6	14-19%
CO....(ppm)	3-8	2-4	4-7	0-2	5-6	0-1	45-58%
NO....(ppm)	78	98	65	90	79	107	28-34%
NO_2..(ppm)	0	0	0	0	0	0	
H_2S...(ppm)	0	0	1	0	2	0	20-50%
SO_2...(ppm)	59	61	55	67	57	77	20-28%
SO*...(ppm)	45	12	53	21	49	5	75-85%
SO_3*.(ppm)	5	9	12	27	19	37	(+ 2-7%)
SOx .(total)	109	82	120	115	125	119	~28%
H_xC_y..(%)	.08	.01	.10	.06	.23	.07	~24%
STK. $^{o}F.$	440	365	370	265	380	278	
SMK.(0-3)	0-T	0-T	0	0	0	0	
Velocity(FPS/")	29/9	21/9	21/12	13/12	28/12	17/12	

The formal emissions were tested w/ E-Instruments 8500 series (9 gas analyzer), and checked against The Bacharach PCA-2 and PCA-3 flue gas analyzers.

These values coincide extremely well with over 20 sites EES and 3rd party documents have done over the last 3 years and at ours and other labs.

- *Calculated values.
- These are snap shot values, so using Velocity of gasses = lbs. per moment. X run time/day
- The claim we make of using 20-35% less air/gal. is shown when using the same volume of fuel.
  - Like CO going to CO_2, Sulfur Monoxide (SO) going to SO_2 or SO_3 which appears to produce a better thermal state in the combustion chamber in our lab test.
- **The greatly reduced oxygen flue gas values and less combustion air input, and reduced emissions; (we believe) validates a new shift with Burner Booster combustion compared to the 25 year old combustion science.**