



**THERMOL TRIAL REPORT ON BOILER C – ASSIUT OIL REFINING COMPANY,  
ASSIUT, EGYPT – 22.06.2017**

A Trial using THERMOL has been conducted by Abhitech Energycon Ltd on Boiler C of 25 TPH in Assiut Oil Refining Company – ASORC, Assiut, Egypt. A protocol has been made governing the execution of the Trial. The details of the Trial results are mentioned below.

The Details of Boiler are as below:

Application	:	Boiler
Capacity	:	25 TPH
Fuel Used	:	Mazout
Fuel Consumption per day	:	30 Tons approx.

- The Trial was conducted in two phases – Pre Trial (Without THERMOL) and Post Trial (With THERMOL). Pre-Trial was conducted from 02<sup>nd</sup> June 2017 to 07<sup>th</sup> June 2017 to create a baseline for the comparison of the results; followed by Post Trial from 09<sup>th</sup> June 2017 to 21<sup>st</sup> June 2017.

**Gist of the Key Parameters**

The performance of THERMOL has been evaluated in similar load-bands during the Pre-Trial and Post-Trial; in order to avoid any ambiguity in the results on account of change in the steam load conditions. Complete data of Pre Trial and Post Trial is attached for record and reference to show overall performance and averages. Apparently, there is no data available either in Pre Trial or Post Trial in the Load Bands other than the following two sets of data.

<b>Steam Load 360-380</b>				
		<b>Pre-Trial Average</b>	<b>Post-Trial Average</b>	<b>Improvement %</b>
<b>No.of Days</b>	<b>Days</b>	<b>3</b>	<b>3</b>	
<b>Total Steam Production</b>	<b>TPD</b>	<b>367.98</b>	<b>369.88</b>	
<b>Mazout Flow</b>	<b>TPD</b>	<b>26.99</b>	<b>26.59</b>	
<b>Mazout GCV</b>	<b>Kcal/kg</b>	<b>10340</b>	<b>10327</b>	
<b>Steam Pressure</b>	<b>Deg C</b>	<b>12.92</b>	<b>12.96</b>	
<b>Steam Temperature</b>	<b>Deg C</b>	<b>234.93</b>	<b>234.26</b>	
<b>Feed Water Temperature</b>	<b>Deg C</b>	<b>97.63</b>	<b>97.50</b>	
<b>FD Fan Amps</b>	<b>Amps</b>	<b>110.08</b>	<b>109.95</b>	
<b>Flue gas Temp at ECO I/L</b>	<b>Deg C</b>	<b>359.42</b>	<b>366.26</b>	
<b>Flue gas Temp at ECO O/L</b>	<b>Deg C</b>	<b>188.78</b>	<b>187.39</b>	
<b>Reduction in Temperature between Eco I/L and O/L</b>	<b>Deg C</b>	<b>170.64</b>	<b>178.87</b>	
<b>Steam to Fuel Ratio</b>	<b>Ton/Ton</b>	<b>13.63</b>	<b>13.91</b>	<b>2.05%</b>
<b>Direct Efficiency</b>	<b>%</b>	<b>78.37</b>	<b>80.05</b>	<b>2.15%</b>
<b>Fuel Per ton of Steam</b>		<b>73.34</b>	<b>71.87</b>	
<b>Fuel Saving</b>				<b>2.01%</b>

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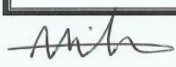

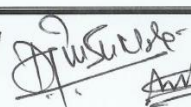
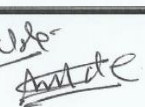
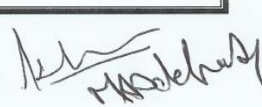
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Steam Load 380 – 400				
		Pre-Trial Average	Post-Trial Average	Improvement %
No.of Days	Days	1	3	
Total Steam Production	TPD	385.63	393.18	
Mazout Flow	TPD	28.14	28.07	
Mazout GCV	Kcal/kg	10327	10342	
Steam Pressure	Deg C	12.95	12.96	
Steam Temperature	Deg C	237.62	233.87	
Feed Water Temperature	Deg C	96.33	97.52	
FD Fan Amps	Amps	110.56	107.36	
Flue gas Temp at ECO I/L	Deg C	364.09	374.86	
Flue gas Temp at ECO O/L	Deg C	192.71	188.58	
Reduction in Temperature between Eco I/L and O/L	Deg C	171.38	186.29	
Steam to Fuel Ratio	Ton/Ton	13.70	14.01	2.23%
Direct Efficiency	%	79.24	80.44	1.51%
Fuel Per ton of Steam		72.97	71.38	
Fuel Saving				2.18%

- The overall average readings are mentioned below.

Overall Data Average				
		Pre-Trial Average	Post-Trial Average	Improvement %
No.of Days	Days	6	11	
Total Steam Production	TPD	375.53	393.53	
Mazout Flow	TPD	27.36	28.31	
Mazout GCV	Kcal/kg	10341	10333	
Steam Pressure	Deg C	12.94	12.95	
Steam Temperature	Deg C	235.22	233.95	
Feed Water Temperature	Deg C	97.41	98.11	
FD Fan Amps	Amps	110.22	109.08	
Flue gas Temp at ECO I/L	Deg C	362.54	371.61	
Flue gas Temp at ECO O/L	Deg C	189.62	189.79	
Reduction in Temperature between Eco I/L and O/L	Deg C	172.92	181.82	
Steam to Fuel Ratio	Ton/Ton	13.72	13.90	1.34%
Direct Efficiency	%	78.91	79.83	1.17%
Fuel Per ton of Steam		72.88	71.92	
Fuel Saving				1.32%



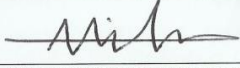
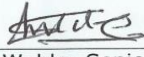
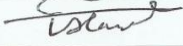
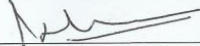
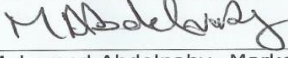
### Flue Gas Analysis :

Parameters	Source		Pre-Trial Average	Post-Trial Average	Improvement %
O <sub>2</sub>	Gas Analyzer	%	5.74	4.79	16.63%
O <sub>2</sub>	Lab	%	4.97	4.68	5.84%
CO	Gas Analyzer	PPM	0.00	0.00	
CO	Lab	PPM	0.00	0.00	
CO <sub>2</sub>	Gas Analyzer	%	11.41	12.13	6.33%
CO <sub>2</sub>	Lab	%	11.48	12.30	7.14%
NO	Gas Analyzer	PPM	125.56	117.56	6.37%
SO <sub>2</sub>	Gas Analyzer	PPM	628.67	613.80	2.36%
Excess Air %	Gas Analyzer	%	39.22	31.63	19.37%
Combustion Efficiency	Gas Analyzer	%	72.00	74.89	4.01%

- The following benefits have been observed as a result of THERMOL usage :-
  - Improvement in Steam to Fuel Ratio
  - Improvement in Boiler Efficiency.
  - Reduction in excess air.
  - Reduction in SOX and NOx emissions.
  - Improvement in Combustion Efficiency.
  - Improved heat transfer efficiency across Economiser.
  - Improved Flame Quality.
  - Cleaning of fuel line injection system observed.
- The following factors adversely affected the assessment of savings :-
  - On account of lower capacity of the Boiler and short Trial period, even a small variation in parameters had a significant effect on the averages.
  - Frequent variation in the steam production throughout the Trial affected the stability in operation as well as the results.
  - The Air-to-Fuel ratio is governed by the software having very low sensitivity; which did not allow us to take the full advantage of improvement in the combustion parameters as a result of THERMOL usage.
- Thus, in view of the improvements noticed in various combustion parameters, it can be stated that these results are indicative and the full benefits could not be captured due to above limitations.

<b>For, Assiut Oil Refining Company</b>	<b>For, Abhitech Energycon Limited</b>
<i>Badr Farghaly</i>	<i>Dinesh Mote</i>
Badr Farghaly-Management Director EGPC	Dinesh Mote- Senior Vice President



For, Assiut Oil Refining Company	For, Abhitech Energycon Limited
	
Ali Ibrahim-Management Director ASORC	Sanjeev Walde- Senior Manager
	
Islam Maher - Operations Engineer ASORC	Md. Imran Khan- Manager
	
	Mohamed Abdelnaby- Marketing Manager