

## **Case study on Energy Cost Reduction by Conversion of Electrical Heating System to Solid Fuel (Briquettes) or FO Fired Thermic Fluid Heater of low temp application (<150°C) in an Automobile factory**

In the automobile factory under study the heat treatment is done to improve the metallurgical properties of the component. Heat treatment is done in batch or continuous furnaces based on Industry's requirements. The heat treatment is carried out at 830°C or at 930°C depending upon the process requirements.

The low temperature applications in the automobile factory under study are :

Washing & Rinsing @ 70°C  
Tempering @ 150°C  
Drying @ 115°C  
Phosphating @ 70°C  
Paint ovens @ 120°C  
7 tank process @ 70°C

**The sum of connected load of electrical heaters for low temp application (<150°C) in the automobile factory Under study is 936 kW**

### **Present Electrical Cost**

Power Cost /Unit = Rs 4.40  
Power Consumption/Hour = 936  
Working Hours/Year = 24 X 350 = 8400  
Total Units Consumed / Year = 78,62,400 units

On 100% of Connected load Power Cost/Year = Rs 3,45,94,560  
On 75% of Connected load Power Cost/Year= Rs 2,59,45,920  
On 60% of Connected load Power Cost/Year= Rs 2,07,56,736  
On 50% of Connected load Power Cost/Year= Rs 1,72,97,280

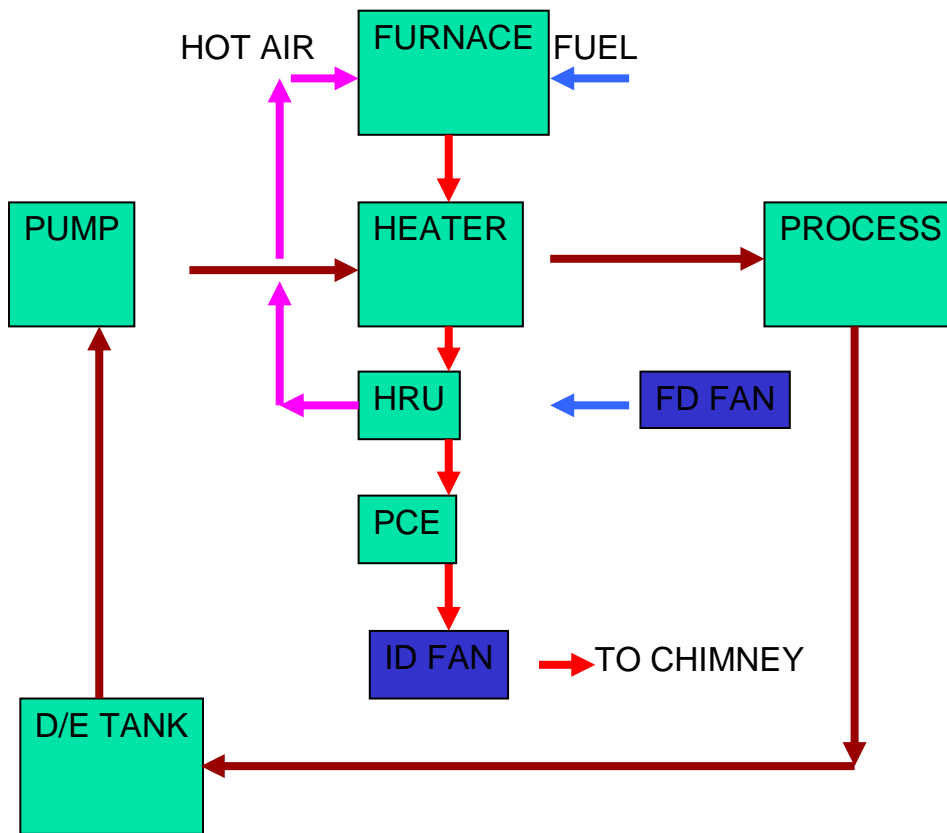
### **Thermic Fluid System as a Cheaper & Greener Substitute to Costlier Electrical Heating System**

1 KWh of Electricity = 860 Kcal @ Rs. 4.40, means Rs. 5.11 per 1000 Kcal of heat even at 100 % system efficiency

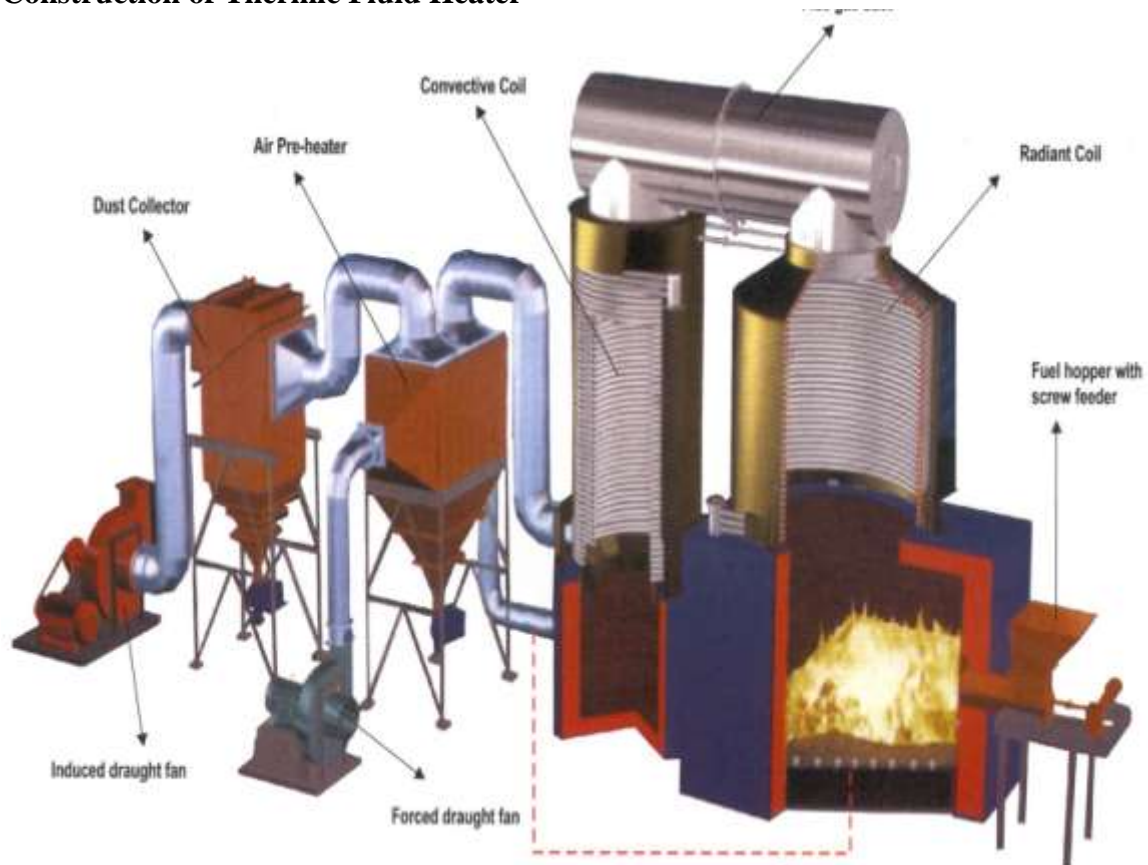
1 liter of FO = 9650 Kcal/Kg @ Rs. 20 per Kg, means Rs. 2.6 per 1000 Kcal of heat at 80 % system efficiency

1 kg of Briquette = 4000 Kcal/Kg @ Rs. 3.0 per Kg, means Rs. 1.07 per 1000 Kcal of heat at 70 % system efficiency

# Working of Thermic Fluid System



## Construction of Thermic Fluid Heater



## Operational Cost Comparison of FO Fired Thermic Fluid Heater With Electrical Heating System

Equipment Name TPC-10  
 Fuel = FO  
 Heat Capacity = 10,00,000 Kcal/Hr  
 Fuel Calorific Value = 9650 Kcal/Kg  
 Efficiency of Thermic Fluid Heater = 87%  
 Fuel Consumption = 119.11 Kg/Hr  
 Fuel Cost/Kg = Rs 20  
 Electrical Power Consumed/Hr = 26.63  
 Power Cost/Unit = Rs 4.40  
 No of Operator Required = 3  
 Operator Salary Per Day = Rs 150  
 Working Hours/Day = 24

Load on Units in %	100	75	60	50
<b>Total Operation Cost Per Day</b>	60435	46141	37565	31848
<b>Total Operation Cost Per Year</b>	21756630	1,66,11,017	13523648	1,14,65,403
<b>Thermic Fluid Heater maintenance cost /year</b>	1,50,000	1,50,000	1,50,000	1,50,000
<b>Total Operation Cost Per Year</b>	2,19,06,630	1,67,61,017	1,36,73,648	1,16,15,403
<b>Power Cost</b>	3,45,94,560	2,59,45,920	2,07,56,736	1,72,97,280
<b>Savings Pre Year</b>	1,26,87,929	91,84,902	70,83,087	56,81,876

### Pay Back Calculations for FO Fired Thermic Fluid Heater

Capital Expenditure = Rs 86,50,380  
 Interest on Capital @ 15% = 12,97,557  
 Total Investment = Rs 99,47,937

#### Pay Back Period

On 100% of Connected load Power = 9 Months  
 On 75% of Connected load Power = 13 Months  
 On 60% of Connected load Power = 18 Months  
 On 50% of Connected load Power = 23 Months

# Operational Cost Comparison of Solid Fuel Fired Thermic Fluid Heater With Electrical Heating System

Equipment Name: Solid Fuel Fired Thermic Fluid Heater

Fuel = Briquette

Heat Capacity = 10,00,000 Kcal/Hr

Fuel Calorific Value = 4000 Kcal/Kg

Efficiency of Thermic Fluid Heater = 70%

Fuel Consumption = 357.14 Kg/Hr

Fuel Cost /Kg = Rs 3

Electrical Power Consumed (max) = 23.85 KW

Power Cost /Unit = Rs 4.40

No of Operator Required = 4

Operator Salary Per Day = Rs 150

Working Hours/Day = 24

Load on Units in %	100	75	60	50
<b>Total Operation Cost Per Day</b>	28,832	22,404	18,547	15,975
<b>Total Operation Cost Per Year</b>	1,03,79,824	80,65,538	66,76,967	57,51,253
<b>Thermic Fluid Heater maintenance cost /year</b>	1,50,000	1,50,000	1,50,000	1,50,000
<b>Total Operation Cost Per Year</b>	1,05,29,824	82,15,538	68,26,967	59,01,253
<b>Power Cost</b>	3,45,94,560	2,59,45,920	20,756,736	1,72,97,280
<b>Savings Pre Year</b>	2,40,64,735	1,77,30,381	1,39,29,768	1,13,96,026

## Pay Back Calculations for Solid Fuel Fired Thermic Fluid Heater

Capital Expenditure = Rs 1,00,00,000

Interest on Capital @ 15% = 15,00,000

Total Investment = Rs 1,15,00,000

Pay Back Period

On 100% of Connected load Power = 7 Months

On 75% of Connected load Power = 10 Months

On 60% of Connected load Power = 14 Months

On 50% of Connected load Power = 18 Months

**Pay Back Period will Further reduce due to CDM Benefit**

**Approximate CER Generated Per Year = 3000 TCO<sub>2</sub>**

**In monetary terms CER benefits, Rs. per year = 3000 x 40 x 12 = 14,40,000**

### Summary

<b>Energy Source</b>	<b>Capital Cost</b>	<b>Operating Cost per Yr.</b>	<b>Savings in Rs. per year as compared to Electricity @ 60% LF</b>	<b>Payback Period, Months</b>	<b>Additional Benefits per Yr.</b>
<b>Electricity</b>	-	<b>208 Lakhs</b>	-	-	-
<b>FO</b>	<b>86.5 Lakhs</b>	<b>137 Lakhs</b>	<b>71 Lakhs</b>	<b>18</b>	-
<b>Briquettes</b>	<b>100 Lakhs</b>	<b>68 Lakhs</b>	<b>140 Lakhs</b>	<b>14</b>	<b>14.4 Lakhs CDM benefits</b>

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