# ANALYSIS OF ENERGY CONSERVATION STUDIES IN SMALL TEXTILE INDUSTRY BOILERS AND FEASIBILITY OF REPLACEMENT FOR WOOD FUEL BY PRODUCER GAS

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**ABSTRACT**

*The steam is used for processing in textile industry, wherein wood is used as fuel for boilers resulting in scarcity of wood and possibility of deforesting. The deforesting will have an impact on environment and hence the effect of climate changes, as everybody experiencing as on date.*

*In view of energy conservation and possibility of deforesting there is need to find an alternative solution with least affordable capital investment and operating cost. An effort is made in this work for efficient combustion system of existing furnaces & boiler with an alternative fuel as producer gas. The work at department of energy technology surveyed the textile cluster near Kolhapur, Maharashtra state, India and collected the data of existing boilers in view of energy conservation & recommendation. In all 16 textile industries are surveyed for its energy efficiency and results are optimized for feasibility of alternative fuel, producer gas.*

*The paper further reveals that the combustion efficiency can be increased up to 83% instead of 60 to 65% for wood combustion. It is concluded that, there is saving in fuel especially the wood by converting the fuel firing system just for the payback period of less than two years.*

**Keywords:** ***Energy Conservation, Feasibility, Producer Gas, Saving Of Wood Fuel, Textile Industry.***

## I. INTRODUCTION

It is observed that in Small and Medium industrial (SME) of textile clusters of developing countries, wood is burned as a fuel for boilers. The industry uses primary non commercial energy source as well as bio mass and electricity for their final product i.e. cloth in terms of metres. The process of burning wood is robust and leads to inefficiencies in system. The steam is used for processing the cloth at various stages. A walk through audit results in potential for energy conservation opportunities .In all 16 SME units are surveyed for walk through energy audit.

The table 1 shows the production and wood, biomass and electrical energy consumptions as preliminary requirements of audit .It is physically noticed that the practice in using the wood are robust leading to losses. The overall system efficiency of the system falls below 50%.

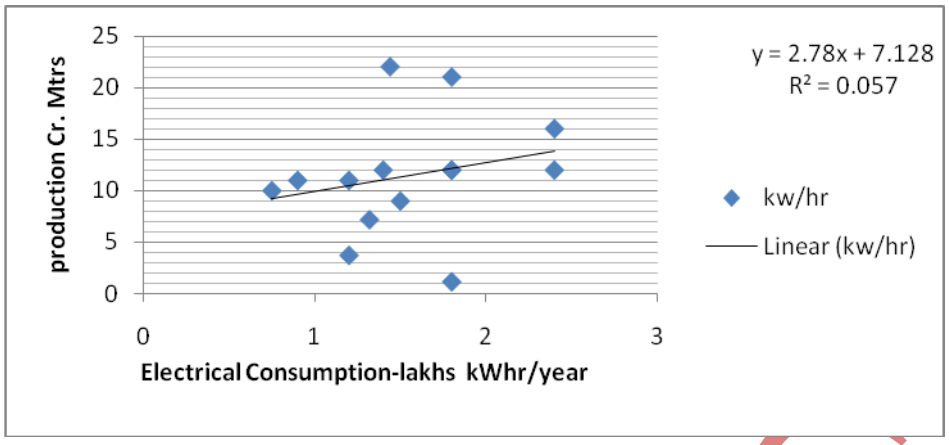
The analysis of data and its results are shown in graph1, 2 which can give thumb rule for forecasting the wood consumption. It becomes the self explanatory process alarming the serious note for deforesting the nature.

| Industry No. | Annual production Cloth (Cr Mtrs) | Annual fuel consumption | | |
|---|---|---|---|---|
| | | Wood (MT) | Bagasse/ Coal(MT) | Electricity (lakh Kwh) |
| 1 | 1.80 | 6750 | 3000 | 12 |
| 2 | 1.2 | 5400 | | 11 |
| 3 | 1.80 | 2700 | | 12 |
| 4 | 1.40 | 7800 | | 12 |
| 5 | 1.2 | 4060 | | 3.75 |
| 6 | 0.75 | 6000 | | 10 |
| 7 | 1.44 | 8400 | | 22 |
| 8 | 1.80 | 700 | | 1.2 |
| 9 | 0.90 | 6000 | | 11 |
| 10 | 1.5 to 1.8 | 3000 | 3000(coal) | 21 |
| 11 | 2.40 | 4500 | 1800(coal) | 16 |
| 12 | 2.40 | 4200 | | 12 |
| 13 | 1.32 | 3300 | | 7.2 |
| 14 | 1.50 | 3000 | | 9 |
| 15 | 4.50 | 5000 | 500(coal) | |
| 16 | 2.40 | 5250 | 750 | |
| **Outcome** | 28.51 | 76060 | 3750/5300 | 160.15 |

**Table No. 1:- Survey of Textile Industry**

**Fig-1 shows the wood burning practices**

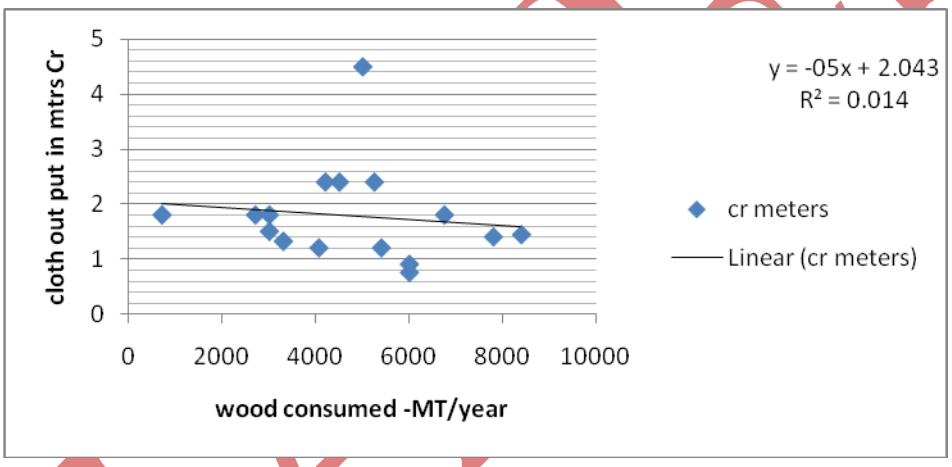
The environmental concerns from government agencies in the areas of survey region are reported. In view of restriction in using wood and the inefficiencies involved an effort is made to reduce the wood consumption by efficient wood gas having more burning efficiency with less environmental effect.




**Graph 1:- Electrical Consumption Vs Production**

**y=2.78x+7.128**

**$R^2$ = 0.057**




**Graph 2:- Wood consumed Vs cloth output**

**y = -05x + 2.043**

**$R^2$ = 0.014**

## II. METHODOLOGY

The survey of textile industries is averaged for energy conservation as under

1. The average capacity of boiler is @ 1 TPH
2. Steam Pressure
3. Feed water temperature
4. Steam Temperature
5. Heat Generated = Ƞ×Q× enthalpy @ required pressure

   Where,

   Q – Quantity of steam generated per hour (Q) in kg/hr.

   Ƞ - Efficiency of boiler

For analysis purpose the factual efficiencies, quantity of wood fuel and producer gas are numerically evaluated for respective Gcv of 4443.14 & 3500 kg kcal/hr by efficiency equation as above.

6. The results are then tabulated and graphically presented in graph no 3, 4&5.
7. Saving are calculated based on actual respective efficiency at a given industry for wood fuel and producer gas as fuel
8. Energy conservation and saving per year can be estimated for any industry. The pay backs can be easily worked out
9. The results are formulated for 1TPH boiler and the data as under

Steam Pressure = 100 psi (6.9 bar)

Feed water temperature = 80 degree Celsius

Steam Temperature = 180 degree Celsius

Theoretical wood boiler efficiency = 79 %

Producer gas boiler efficiency = 83%

Enthalpy @ 6.9 bar = 668.10 kcal/kg

Heat Generated = 830×661.80

= 549297.72 Kg Kcal/Hr

Required producer gas = 549297.72/4443.14

=123.62 Kg/Hr

Wood Biomass required =154.53×1.5

= 103.02 kg/hr

10. Saving are calculated as under,

During the survey it is found that average wood consumption for 1 TPH boiler is 3500 kg/day.

Gcv of wood = 3500 kcal/kg

Gcv of use per Kg of Wood = 3500 X 0.79

= 2765 Kcal / Kg

Gcv of use per day = 3500 X 2765

= 9677500 Kcal.

Gcv of producer gas = 4443.14 X 0.83

= 3687.80 Kcal / Kg.

Gcv of use per day of producer gas

= 3500 X 3687.80

= 12907322 Kcal.

Gain in Gcv per day = 12907322 – 9677500

= 3229822 Kcal.

Wood saved per day = 3229822 / 3500 = 923Kg.

Wood saved per annum = 923 X 300 days = 276990Kg.

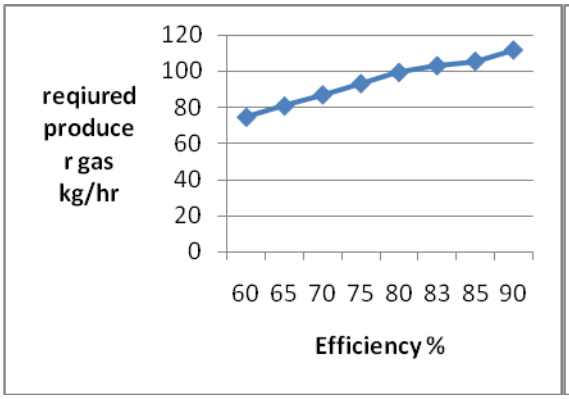
Cost of Wood saved = 276990X Rs. 3.2/ Kg

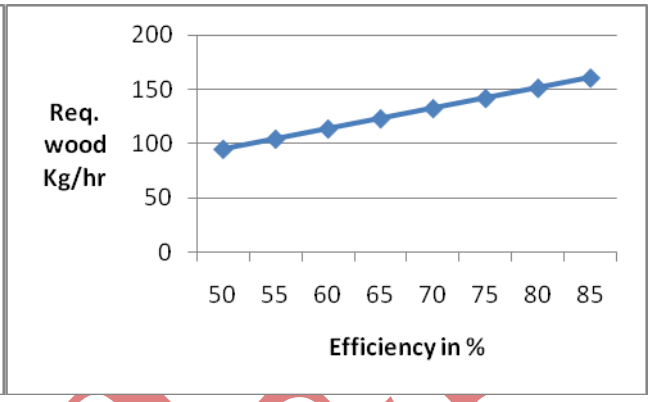
= Rs 886080/-.

Investment in Gasifier = 16 Lacks.

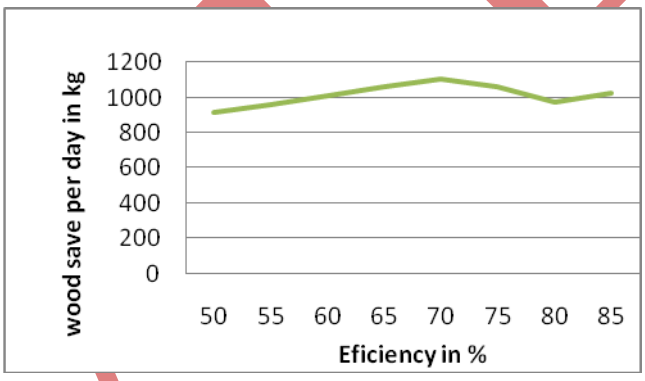
Pay Back Period = 22 months

The graphs are plotted for efficiency against requirement of producer gas .quantity required for wood and hence the saving as compared to wood consumption earlier for regular boiler.




**Graph No. 3:- Efficiency Vs required producer gas** **Graph No.4:- Efficiency Vs required wood**




**Graph No. 5:- Efficiency Vs Wood per day**

## III. RESULTS & RECOMMENDATION

From the above analysis it is found that we can save nearly 26% of wood by installing the gasifier system. There is potential for conservation of energy and new firing system with wood gasifier will be required to be installed. The results of study and analysis are positive. The design of modified or new boiler should have best possible efficiency.

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