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Experimental Analysis of Kitchen Waste Heat Recovery Unit

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ABSTRACT: Heat is a form of `Energy` and energy conservation is one of the prime requirement in the present scenario, therefore consuming energy in any form is important so as to protect the global environment. This paper will actually propose a design for recovery of Waste Heat from a common Gas stove used in homes and large scale cooking purposes, by actually entrapping large amount of heat emitted while cooking in form of (Radiation and Convection) . The experimental setup transfer that heat to the water passing inside the pipes , thus the outlet water temperature is 80 degree Celsius in an optimum condition.

KEYWORDS: waste heat, WHRU, Gas stove, heat exchanger.

I. INTRODUCTION

Energy saving is one of the key issues not only from the view of energy conservation but also for the aegis of global environment. Waste heat is the heat generated all along most of the operations of systems and then it is dumped into the surroundings even though it could be still utilized for some other beneficial and remunerative purposes. Waste heat is usually correlated with waste streams of air or water and it put in to environment Recovery of waste heat is a hefty research area among majority of scientists. Waste heat which is repudiated from a process at a temperature higher than atmospheric temperature can be dexterously and efficaciously procured and bestowed for from other profitable work. The technique of culling the waste heat relies upon the temperature of waste heat and the purpose for which the heat is extracted. In our day to day life we come across to see various processes that involve the emission of heat, and we term this emitted heat as Waste heat.

Waste Heat Recovery is actually a mechanism which involves the method of transferring or exchanging the amount of heat of a certain emitted stream with a certain component. Since most of the waste heat is being transferred or released to the environment, so using the amount of energy of that waste heat is practically an economical idea.

II. RELATED WORK

[1] Jabinesh.n.v, ameer.a, arun kumar.d, arun thanga sujith.m investigated on generation of power from house hold waste heat. The Experimental Setup is placed surrounding the burner of gas stove so that the waste heat from the kitchen . [2] bashir a. leghari, abdullah. mengal, ayaz. hussain investigated on optimization and analysis of heat recovery from domestic cooking system. This work introduced the problem of wastage energy from domestic cooking system and analyse the financial impact and recovered the waste energy to improve the efficiency of the system. This work also introduced the energy conservation process and suggested to enhance the domestic system in a better way to save energy. [3] manshu Kapoor investigated on design for recovery of waste heat from a common gas stove used in homes and large scale cooking purposes. the primary gas stove will emit a huge amount hot gases which are a result of combustion of the l.p.g gas and of course due to cooking, weather it may be boiling or frying of any food component [4] mohammad arizam bin Abdul Wahap, mohammad haidir bin Maslan, sharimienizam bin harun, a shamsul rahimi bin subki, sharizal bin saat investigated on renewable energy from cooking stove waste heat energy using thermoelectric generator for night market application. the electrical energy source is one of the major concern for the night market hawkers in Malaysia. [5] mohammad s*, salahuddin h, al-far a and al-khatib investigated on waste heat recovery: a



special case.the main aim is to lift the energy efficiency in lafarge factory by recovering the waste heat. energy bills have major effect upon cement production.

III. METHODOLOGY

Waste heat recovery methods include capturing and transferring the waste heat from a process with a gas or liquid back to the system as an extra energy source. The energy source can be used to create additional heat or to generate electrical and mechanical power.Waste heat can be rejected at any temperature; conventionally, the higher the temperature, the higher the quality of the waste heat and the easier optimisation of the waste heat recovery process. It is therefore important to discover the maximum amount of recoverable heat of the highest potential from a process and to ensure the achievement of the maximum efficiency from a waste heat recovery system. The quantity or the amount of available waste heat can be calculated using the equation shown below.

$$Q=V \times \rho \times C_p \times \Delta T$$

where, Q (J) is the heat content, V is the flowrate of the substance (m^3/s), ρ is density of the flue gas (kg/m^3), C_p is the specific heat of the substance ($J/kg.K$) and ΔT is the difference in substance temperature (K) between the final highest temperature in the outlet (T_{out}) and the initial temperature in the inlet (T_{in}) of system. Depending on the type and source of waste heat and in order to justify which waste heat recovery system can be used, it is essential to investigate the amount and grade of heat recoverable from the process.

IV. EXPERIMENTAL RESULTS

The aim of this work is to utilize the heat energy wasted in conventional LPG gas stove used in the house hold kitchen. A kitchen waste heat recovery unit is Installed on the gas stove which consist of copper tubes on three sides (top, left and right) and having two inlets and two outlets respectively. The experimental setup was designed , fabricated and installed on the top of the conventional gas stove used in kitchen which act as a heat exchanger which transfer the heat from the direct ration from fire and pan as well as heat from the steam of food to the water travel inside the copper tubes.

- The water from the copper tubes has maximum temperature of 80 degree Celsius
- Similarly the minimum temperature of water from the waste heat recovery unit is 45 degree Celsius



(a)

(b)

(c)



(d)

(e)



VI. CONCLUSION

The effectiveness of the waste recovery unit is 73 % as per the calculation. in order to consume the heat energy completely we designed the setup (WHRU). which act as a heat exchanger which transfer the waste heat by means of direct radiation from the burners and the pan which was kept inside the stove and the heat from the steam which is produced by boiling of food stuffs

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