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Assessment and Planning of Improvement of Energy Efficiency of Indian Industries

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ABSTRACT

This study investigates the broad topic of energy efficiency within the context of the industrial sector by means of a thorough review of existing energy reduction strategies and a demonstration of their successful implementation by obtaining data directly from companies. The study begins by discussing current industrial energy consumption trends around the globe and within the Indian manufacturing sector. This is followed by a literature review which outlines 3 prominent energy efficiency improvement strategies currently available to companies:

I. INTRODUCTION

This should come as no surprise, as it takes an enormous amount of energy to operate the machinery, tools, and processing systems which create most of the goods used in today's society. Most of the energy consumed by the industrial sector is used to power the motors of auxiliary equipment, produce heat to generate steam, and provide space heating/cooling. From melting iron in furnaces to pumping coolant to maintain key production equipment, many of today's industrial processes utilize enormous quantities of energy, often inefficiently. Recent pressure on industries to be more environmentally conscious and the development of more stringent energy regulations has created a growing emphasis on energy efficiency (within both academia and industry) and the importance it will play in successfully achieving global GHG reduction target. In recent years, governments across the globe – from Europe and Asia, to North and South America – have identified improved efficiency as a fundamental component of their energy and environmental strategies. Unfortunately, very little has actually been done over the last several decades to curb global energy consumption. Energy efficiency project deployment has been minimal despite extensive research on the topic and a boost of technological developments in the field .

II. LITERATURE REVIEW

To begin, there are numerous techniques available for companies to implement to improve the energy efficiency of their equipment, processes, and overall production. Companies can work on eliminating wasted energy by altering production schedules to make better use of resources, they can implement various maintenance protocols to catch areas of concern before they become major problems, and they can use alternative energy sources to supply power to plants and facilities in order to offset some of the carbon footprint of their activities. Many of today's organizations may argue that there is even *too much* information available on the subject and that deciding where to best target their energy efficiency projects can be, at times, overwhelming.

Waste Heat Recovery

Currently, one of the best ways for companies to reduce their energy consumption, without the need for vast equipment, system, and facility overhauls, is through the implementation of waste heat recovery technologies, which offer the industrial sector an incredible opportunity to save energy and improve efficiency. In fact, the United States Department of Energy (DOE) estimates that somewhere between 20 to 50% of industrial energy input is presently lost as waste heat in the form of hot exhaust gases, cooling water, or from equipment surfaces and heated products.

Recuperators

Recuperators recover exhaust gas waste heat in medium to high-temperature applications such as soaking or annealing ovens, melting furnaces, afterburners, gas incinerators, radiant tube burners, and re-heat furnaces . Recuperators can be based on radiation, convection, conduction, or a combination of the 3. A simple radiation recuperator consists of 2 concentric lengths of ductwork, as shown in Figure 5 below . Hot waste gases pass through the inner duct and heat transfer is primarily radiated to the wall and to the cold incoming air in the outer shell. The pre-heated shell air then travels to the furnace burners.

The convective, or tube-type recuperator, on the other hand, passes the hot gases through relatively small diameter tubes contained in a larger shell . The incoming combustion air enters the shell and is baffled around the tubes, picking up heat from the waste gas. Another The system includes a radiation section followed by a convection section in order to maximize heat transfer effectiveness .

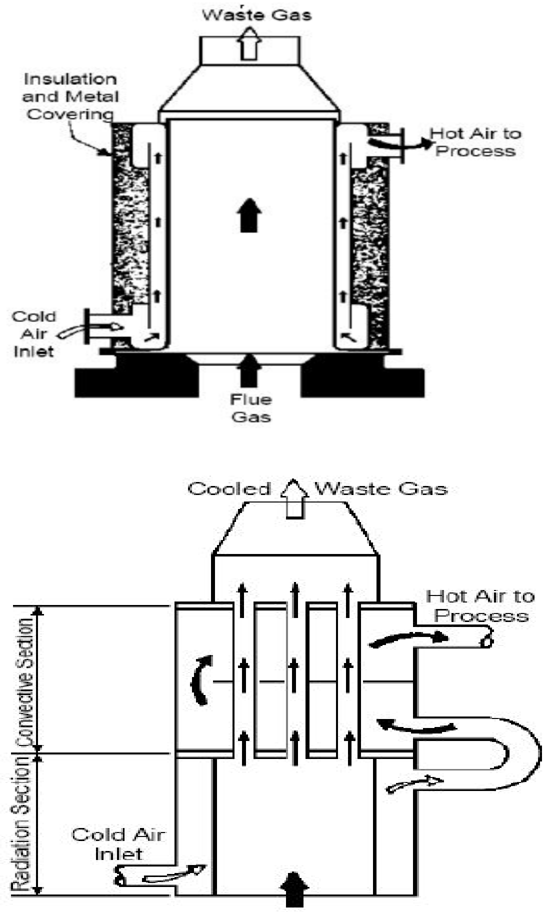

Figure 1: Metallic radiation recuperator (left); Combination radiation/convection recuperator (right)

III. METHODOLOGY

As noted in the literature review above, there are numerous energy efficiency strategies available for companies to implement. It is important to keep in mind that those solutions focus on only 3 sources of inefficiency, when, in reality, there could be dozens of other sources of energy loss within a plant or facility. With so many individual processes, pieces of equipment, or production stages to monitor it is easy to understand why so many companies feel overwhelmed by the thought of pursuing energy efficiency initiatives? It takes a considerable amount of time and resources to initially identify the primary sources of inefficiency within a facility, as each has its own unique requirements. It is the unique nature of energy consumption that makes a blanket solution for energy efficiency practically impossible. Varying production schedules, production levels, and equipment types all play a significant role in determining the overall energy requirements of a facility and can also affect the feasibility of certain energy efficiency projects. It is important that energy efficiency projects target the major areas of concern within a facility in order to achieve maximum economic and environmental impacts. But with so many factors influencing a facility's specific energy requirements, how can a company begin to pinpoint the best area to focus their efficiency efforts?

Case Studies

Purpose of the Performance Test

To find out the efficiency of the boiler .To find out the Evaporation ratio the purpose of the performance test is to determine actual performance and efficiency of the boiler and compare it with design values or norms. It is an indicator for tracking day-to-day and season-to-season variations in boiler efficiency and energy efficiency improvements.

Performance Terms and Definitions

$$1.\ \textbf{Boiler Efficiency}, \eta = \frac{\textbf{Heat output}}{\textbf{Heat Input}} \times 100$$

$$= \frac{\textbf{Heat in steam output(kCals)}}{\textbf{Heat in Fule Input (kCals)}} \times 100$$

$$2.\ \text{Evaporation ratio} = \frac{\text{Quantity of heat Generation}}{\text{Quantity of fule consumption}} \times 100$$

The Direct Method Testing

Description

This is also known as 'input-output method' due to the fact that it needs only the useful output (steam) and the heat input (i.e. fuel) for evaluating the efficiency. This efficiency can be evaluated using the formula:

The various heat losses occurring in the boiler are:

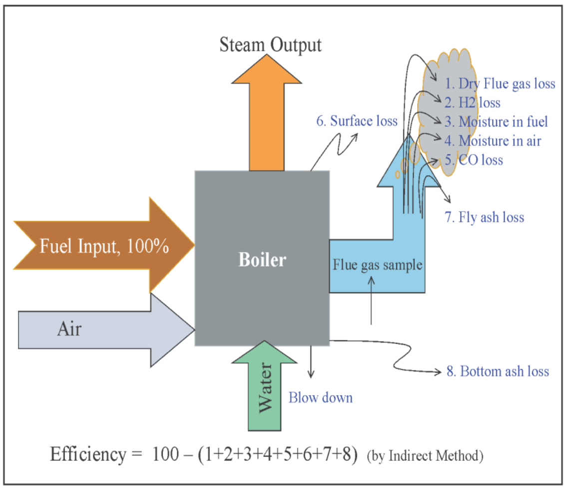

Figure 2: The various heat losses occurring in the boiler

TABLE 1.1 TYPICAL INSTRUMENTS USED

Instrument	Type	Measurements
Flue gas analyzer	Portable or fixed	% CO2 , O2 and CO
Temperature indicator	Thermocouple, liquid in glass	Fuel temperature, flue gas temperature, combustion air temperature, boiler surface temperature, steam temperature
Draft gauge	Manometer, differential pressure	Amount of draft used or available
TDS meter	Conductivity	Boiler water TDS, feed water TDS, make-up water TDS.
Flow meter	As applicable	Steam flow, water flow, fuel flow, air flow

Table 2: Summary of Heat Balance for the Boliler Using Furnace Oil

Sr no	Input/Output Parameter	kCal / kg of coal	% loss
1	Heat Input	10000	100
2	Losses in boiler		
3	Dry flue gas, L1	786	7.86
4	Loss due to hydrogen in fuel, L2	708	7.08
5	Loss due to moisture in fuel, L3	3.3	0.033
6	Loss due to moisture in air, L4	38	0.38
7	Partial combustion of C to CO, L5	0	0
8	Surface heat losses, L6	38	0.38
Boiler Efficiency= 100 - (L1 + L2 + L3 + L4 + L5 + L6) =84.27 %			

IV. Conclusions and Recommendations

As a result of the research undertaken for this study, it can be concluded that energy efficiency improvement strategies present multiple opportunities for Canadian industry – saving money, stimulating economic growth, increasing productivity, and offering a significant reduction in environmental impact. The case studies presented within this thesis highlight some of the major energy consumption and GHG emission reduction opportunities that are available to industry through the implementation of various efficiency projects.

Though research into new energy-saving technologies should continue, it is also clear that many of the techniques and strategies needed to begin to significantly lower global GHG emissions already exist. Unfortunately, many companies – especially SMEs – still shy away from the opportunities that are available to them from energy conservation due to a lack of in -house expertise, inadequate resources, or positive reinforcement through industrial feedback on the use of such techniques. Additionally, energy efficiency is still largely viewed as a problem rather than an opportunity. A number of broad recommendations have been created from the results of this study. They are summarized below.

(1) Despite all the potential benefits, a single barrier still exists to wide-scale industrial energy efficiency progress: confidentiality. Until organizations and government become more transparent about consumption practices within the industrial sector, very little will change. Companies must be more willing to share their energy consumption data and an open dialogue regarding best practices must begin. Governments should encourage more organizations to share their conservation success stories in order to begin to remove the taboo industry has placed on the discussion surrounding energy consumption.

(2) Organizations must begin to avail of the resources and tools (from government agencies, technological societies, and universities) that have been created to better equip industrial users to improve the efficiency of their systems, equipment, and tools. These resources have been specifically created to aid industrial users with their energy efficiency projects and many of them are free of charge. The notion that not enough information or expertise exists will soon no longer be an acceptable excuse for why energy efficiency is not promoted within an organization.

(3) Individuals who are chosen as energy managers within their respective organizations should come from a strong sustainability background. They must be open to the notion that all three (3) spheres of sustainability

are equally important and they must understand the importance that open dialogue plays in energy consumption and creating the necessary changes within industry to curb emissions. By placing the appropriate personnel in energy management roles, energy efficiency projects will likely be implemented more frequently and with less opposition within organizations.

(4) Lastly, it is important that energy reduction strategies remain effective and focused on the most promising solutions. Determining what these efficiency "*best practices*" are can only be achieved through effective consumption sub-monitoring, both pre and post-project implementation. Without appropriate monitoring of energy consumption it is practically impossible to know where the greatest sources of inefficiency are stemming from and how they can be remedied. Even if organizations begin to overhaul their existing systems with new equipment, design layouts, or maintenance regimes, if consumption is not adequately monitored before an alteration, it is quite difficult to pin-point specific savings and whether or not the new system is performing effectively. Accurate and sufficient energy monitoring is a key component to energy reduction success.

REFERENCES:

[1] 2013. International Energy Agency. Key world energy statistics 2013. [Online]. Available: http://www.iea.org/publications/freepublications/publication/KeyWorld2013.pdf

[2] 2015. Wikipedia. Tonne of oil equivalent. [Online]. Available: http://en.wikipedia.org/wiki/Tonne_of_oil_equivalent

[3] November, 2012. United Nations Environment Programme, Nairobi, Kenya. The emissions gap report 2012. [Online]. Available: http://www.unep.org/pdf/2012gapreport.pdf

[4] 2004. United Nations Department of Economic and Social Affairs – Population Division. World population to 2300. [Online]. Available: http://www.un.org/esa/population/publications/longrange2/WorldPop2300final.pdf

[5] 2014. U.S. Energy Information Administration. Short-term energy outlook. [Online]. Available: http://www.eia.gov/forecasts/steo/pdf/steo_full.pdf

[6] A. Thompson. Climate Central. April becomes 1st month with CO2 levels above 400 ppm. April 29, 2014. [Online]. Available: http://www.climatecentral.org/news/april-becomes-first-month-with-co2-levels-above-400-ppm-17367

[7] 2013. Natural Resources Canada. Improving energy performance in Canada report to parliament under the Energy Efficiency Act for the fical year 2011-2012. [Online]. Available: http://oee.nrcan.gc.ca/publications/statistics/parliament11-12/parliament11-12.pdf

[8] September, 2013. CBC News. Canadian population surpasses 35 million. [Online]. Available: http://www.cbc.ca/news/canadian-population-surpasses-35-million-1.1869011

[9] 2015. Wkipedia. Canada. [Online].

Available: http://en.wikipedia.org/wiki/Canada

[10] 2015. Wikipedia. Norway. [Online]. Available: http://en.wikipedia.org/wiki/Norway

[11] 2015. Statistics Denmark. Decoupling of environmental pressures from economic development by indicator, reporting country and unit. [Online]. Available: http://norden.statbank.dk/INDIC401

[12] 2015. Wikipedia. Sweden. [Online]. Available: http://en.wikipedia.org/wiki/Sweden

[13] 2013. The World Bank – Data. Population, total. [Online]. Available: http://data.worldbank.org/indicator/SP.POP.TOTL/countries?display=graph

[14] 2011. U.S. Energy Information Administration. How much energy is consumed in the world by each sector? [Online]. Available: http://www.eia.gov/tools/faqs/faq.cfm?id=447&t=1

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