Environment Conservation by Energy Conservation

By
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Introduction

The impact of Energy Conservation has direct impact on Environment Conservation and is applicable to Large Industrial Complexes as well as to small household dwellings. The use of Electricity is thought to be an environmentally clean means of power, heating and as a fuel, but it is not to be true when this electricity comes from a fossil fuel (coal and oil) fired Thermal Power Station (TPS). When electricity is generated at fossil fuel TPS, there are emissions of pollutants such as Carbon Dioxide (CO_2), Carbon Monoxide (CO), Nitrogen Oxides (NO_X), Sulphur Oxides (SO_X), Particulates, Hydrocarbons, Aldehydes and the like pollutant, which are emitted through flue gases. These flue gas emissions could be reduced by gas clean up, which is an expensive option. Energy conservation is a better and cost effective way of pollutant emission reduction option. For ***every*** unit of electricity saved or conserved, by attention to good lighting practices and the uses for industrial power, there is a saving of ***three*** units of primary fossil fuel [(1)]. There are unlimited ways to save energy, however this article enlightens the norms to quantify these energy savings into reduction of pollutant emissions and thereby conserve your environment. Some of the case study results are given, quantifying the impact of energy savings on environment conservation.

Summary

The release of toxic chemicals into the atmosphere as a direct result of human activity has now reached levels sufficient to create global environmental problems, with a clear link established between environmental damage and high levels of energy consumption [(2)]. Recent studies have made it clear that the burning of coal, oil and gas are major and growing causes of carbon dioxide emissions, with most coal burning being for electricity generation. Of all the available remedial measures energy efficiency alone could account for 40 per cent of the action needed to stabilise emissions over the next 15 years. Failure to act is likely to have a disastrous impact on the global climatic balances, leading to droughts, floods, migrations, an increase in urban pollution, cancer caused by solar radiation and so on [(2)].

To quantify your energy savings in terms of reduction in pollutants emitted to atmosphere, the table-1 and table-2, shown below, will be your useful guide.

Table-1: **CO2 emissions per TJ delivered energy [(2)]**

Electricity	231	tonnes CO_2
Coal	92	tonnes CO_2
Oil	84	tonnes CO_2
Natural gas	55	tonnes CO_2

Table-2: Pollutant (*tons) V/s Annual emissions (per 1000 tons of **fuel) [3]

Pollutant	****Coal (*tons)**	****Oil (*tons)**
Aldehydes	.052	.012
Carbon monoxide	.052	.0084
Hydrocarbons	0.21	0.67
Nitrogen oxides	21	22
Sulphur oxides	139	53
Particulates	4.5	0.7

Case study-1 [4]:
Pollution Reduction Potential in Steam Tracing Systems Today
Although the efficient production of steam is always important, the efficient consumption of steam is clearly as important in reducing these emissions.

The approximate amount of pollutants generated by the excess fuel being generated by the excess fuel being burned when using the bare convection tracing method of yesterday versus the new isolated tracing [SafeTrace™][9] method can be determined from information provided by the U.S. Environmental Protection Agency (EPA) [5].

In most plants, the steam consumption efficiency, defined as the ratio of the energy used in the steam supplied to the energy in the steam produced, is much less than the steam production efficiency because of considerable energy losses in the system [6]. In order to determine the amount of fuel required to generate the quantity of steam needed for the winterisation steam-tracing model of a petrochemical facility, and for assessing the amount of pollutants generated, a 60% steam system efficiency rate is assumed for the model. The Fuel Consumption savings worked out for the model is 128,715 gal/year. Accordingly the following analysis demonstrates the typical pollution reduction potential. Note that the bracket [xxx] term in the calculations represent the emission factors from the EPA document previously referenced.

SO_X = 128,715 gal/yr / 1000 gal x [159(2)] **= 40,931 lb/yr**

NO_X = 128,715 gal/yr / 1000 gal x [55] **= 7,7091 lb/yr**

CO = 128,715 gal/yr / 1000 gal x [5] **= 644 lb/yr**

The fuel consumption for the typical Refinery is four (4) times that of a typical Petrochemical plant. Thus for a Refinery, the potential **SO_X, NO_X** and **CO** pollution reduction will be:
SO_X = 163,725 lb/yr; NO_X = 28,317 lb/yr; **CO = 2,574 lb/yr**

Case study-2 [7]
Thermal Insulation for Crude Oil Storage Tank

Background
For Storage Tank holding light crude oils, the importance of heating is not to raise or maintain temperature, but simply to provide convection currents that prevent the various fractions from settling out. As an alternative to heating, various forms of mechanical stirrers powered by electric motors are sometime used. It would be uneconomic to fit agitators if there were abundant supply of low cost steam near at hand. Conversely, agitators are very useful on tanks remote from a steam service or where steam is in short supply [8]. It could also be uneconomic to use agitators when the tank is thermally insulated and its tank wall surface heated with Electric or Steam Surface heating system.

This study analysis the current prevailing standards where the Tank surface is kept Bare (i.e. Not thermally insulated) and it is provided with heating arrangement using internal immersed steam coils, as well as the provision of mechanical stirrer operated by electric motor. In the first phase of analysis, the effort is to establish the importance of thermally insulating the tanks so that the crude contents can be efficiently kept heated and prevent various fractions in the crude from settling out. Which would also minimize the use of mechanical stirrer and thereby conserve electrical Energy and also thereby conserve the Environment.

Once the Designers and the Owners understand and foresee the benefits of thermally insulating the tanks to be kept heated, then the second phase of the study can be taken up to determine cost effective external surface heating system with Steam and that with Electrical. Simultaneously, a study of Electrical Power load from stirrer could be compared with the Heating Energy used to prevent settling out of various fractions from crude.

The current study also considers certain crude, which would have a Pour Point at 30^oC and is to be maintained at 40^oC. Therefore, the storage tank would be required to kept heated at 40^oC at all times, round the year.

Study Conclusion
For Ten numbers of Crude oil Storage tanks of 92 m diameter x 20 m height, thermal insulation offers annual Savings of over: 19,000 MW of Energy, i.e. Savings equivalent of over 5000 tons of Oil. And, in terms of Environmental Emission Reduction, thermal insulation offers annual Reduction of over 2000 tons of CO_2; of over 28 tons of SO_X; of over 12 tons of NO_X; of over 365 kg of Hydrocarbons; of over 65 kg of Aldehydes and of over 5 kg of CO. These levels of Energy Savings and Emission Reduction requires serious thinking of thermally insulating Crude Oil Storage Tanks by the Owners, however insignificant 40^oC may seem.

Case Study-3 [2]
Energy Policy outlook in the United Kingdom

It now seems clear that the UK's future energy policy will be dictated by the international demands made upon the country to meet its obligations to improve the efficiency of energy generation and energy use, as a prime mechanism for reducing greenhouse gas emissions.

A model energy policy for a green Britain has been proposed by Friends of the Earth. Elements of this policy include:

- The introduction of forms of environmental taxation, e.g. a carbon tax, to encourage moves away from environmentally damaging options.
- The setting of minimum energy efficiency standards for appliances
- Extensions to energy efficiency grants
- The banning of electric heating where suitable alternatives exist
- The encouragement of combined heat and power (CHP) schemes.

Case study-4 [2]
Adopt a holistic view

Resource managers have to be concerned with a holistic, systematic view. Becoming fixed on one objective, or on one resource such as energy, may give results, which are not as good as they could, or should be. To achieve a holistic view requires good data and good training. An effective project will save energy and other resources, including maintenance, and regulate environmental impact.

Project example

An industrial example of this is given by the investment in an infrared paint-curing oven by a major UK automotive manufacturer. As well as reducing energy costs for the process by 80 per cent from Pound 1.30 / car to 36 pence pence/car, the investment reduced environmental emissions and maintenance costs, improved quality by eliminating the need for rework, reduced materials costs, eliminated production bottleneck, freed a large area of floor space and reduced the average float of unfinished cars in the factory by 500 vehicles.

Conclusion

Recognition of the greenhouse effect and of its potentially catastrophic impact upon world climate has totally changed the nature and direction of the energy debate and global warming now sits firmly at the top of the environmental agenda [2]. The emission of CO2 from the combustion of fossil fuels will eventually cease when the world's resources are depleted [1]. Environment audits cannot simply look away from energy audits, and all Environmental Impact Assessments (EIA) now needs to assess energy consumption norms of the industry, and accordingly an industry could be given environment credit or environment debit in their assessment by weighing the energy consumption.

Future investments should also consider the cost towards environmental cleaning of wastes and discharges from the manufacturing process and/or its activities.

As the saying goes for Charity, we could adopt it to say that 'Environmental control begins at home'. For people who are energy conservation conscious, let it be known to them that the great parallel role-played by them in environment protection at no extra cost or efforts. It is now the time that Environment managers also looked at Energy conservation measures seriously in achieving their environment conservation goals.

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