Environmental Protection through Energy Conservation

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Introduction

All too often industries view environmental protection as an exercise in not allowing pollutants (that have been generated in a process) to reach the external environment. If this is successfully managed, the measure is said to be effective. However, preventing the generation of pollutants is an even more effective environmental protection method, which can be made economically attractive by combining it with resource recovery or energy conservation.

The Kyoto Protocol is now an international treaty, and has opened an opportunity for Indian industry to earn revenues through carbon trading. The following paragraphs describe certain actions on part of managements which are required to avail of carbon credits.

Clean up: An example

In mercerizing cotton fabrics in a textile mill the cloth is steeped in a strong solution of caustic soda and stretched. After the desired effect has been achieved, the operators use hot water to wash the caustic soda from the fabric. This produces a dilute solution which cannot be used to mercerize more fabric. Often this solution is drained to the effluent treatment plant where the alkali is neutralised with an acid: and after suitable treatment, we may say that the clean up has been successful.

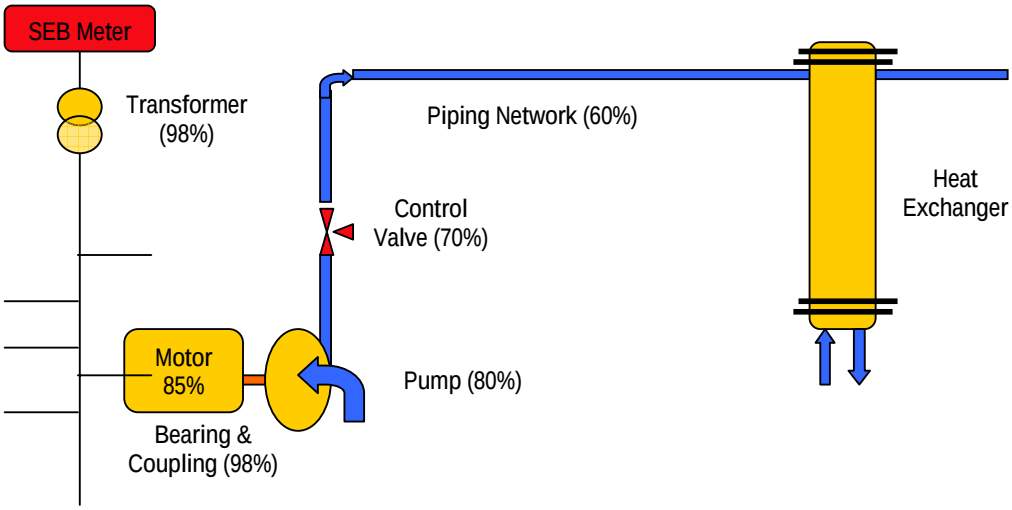
Much more effective measures can however, be taken:

- pressure rollers could squeeze out the caustic soda from the fabric to reduce the amount of alkali that is carried away by the fabric and thereby reduce the amount of water required to wash the fabric and also to reduce the amount of caustic soda and acid required by the plant.
- a caustic soda recovery system could be installed that would, at a very nominal cost, recover caustic soda and produce “free” “distilled” hot water, large quantities of which are required in the process. Another advantage of such a system is that no acid would be required to neutralise the caustic soda. Thus coupled with resource recovery, such a system would not only protect the environment, but also bring valuable cost savings to the plant and be an economically attractive proposition.

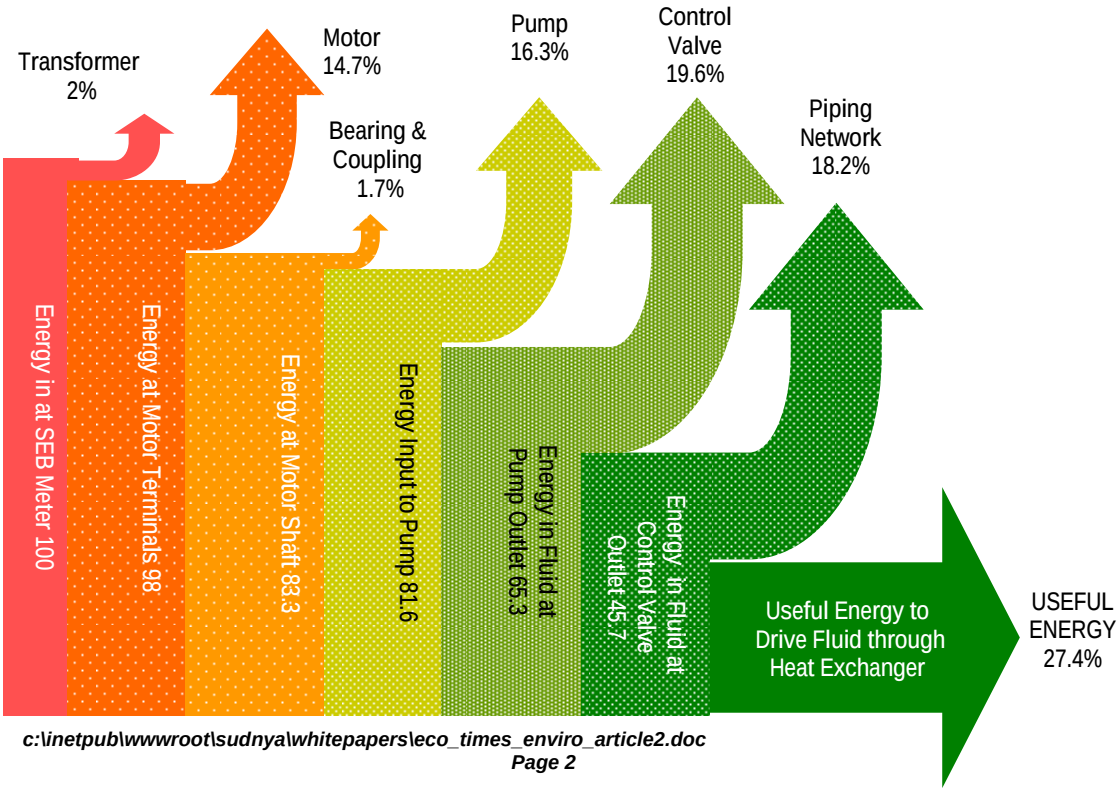
The Energy - Environment Link

The above example demonstrated the "end-of-the-pipe" method of managing pollution, which was economically very attractive because of resource recovery and recycle.

Not always does pollution occur at the point at which resources are used. For example, when electrical energy is used, pollution occurs where electricity is generated, but the point of use is quite "clean". We often overlook the cascading effect of energy losses in our system on pollution. Consider the following simple pumping system, a common installation in a factory.



The numbers in the braces are the assumed efficiencies of the various items of equipment. It seems to be a reasonably efficient system. But



how efficient is it really? The above Sankey diagram demonstrates that it is not particularly efficient.

The upward arrows indicate the amount of energy that is lost in each piece of equipment, and the horizontal arrows show the amount of energy that is actually transferred to the next piece of equipment. We can see that the useful energy in this "efficient" system is only about one-fourth the amount of energy that is fed to it! If we assume that the transmission and distribution losses are about 20%, and that the power plant that produces electricity has a "bus-bar" efficiency of 35%, then the primary energy in the fuel charged to the power plant is about 350 units resulting in an **overall efficiency** of a **mere 7.5%!!!** For this reason, energy efficiency at the point of use brings the greatest benefit to the economy, and the customer.

Carbon Trading

Energy efficiency improvement can therefore substantially reduce pollution in general and the emission of greenhouse gases in particular. This latter effect can be converted into an attractive cash flow through carbon trading facility of the Clean Development Mechanism.

Clean Development Mechanism (CDM):

Under CDM, a company from the Developed Countries (commonly called Annexe 1 countries) who are obliged to reduce their emission of Greenhouse Gases (GHG) to be able to meet their GHG emission quotas may do on of two things:

- Take suitable action in their facilities so that their emission of GHGs measurably reduces;
- Purchase emissions reductions from organisations in Annexe 2 countries (i.e. developing countries) who are under no obligation to reduce their emissions at present.

The "Proof of Additionality"

In order to purchase emissions from Annexe 2 countries, the purchaser of GHG Emissions reductions may provide funds, or technology, or both to the seller so that the latter is able to implement a project to reduce GHG emissions.

The project sponsors have to prove that the project is "additional" i.e. the project would not have been possible without the technical or financial support provided by the buyer.

Measurement & Verification

Another important requirement under the CDM mechanism is the need for continuous project monitoring to ensure that GHG emission reductions are actually occurring. Energy Services Companies

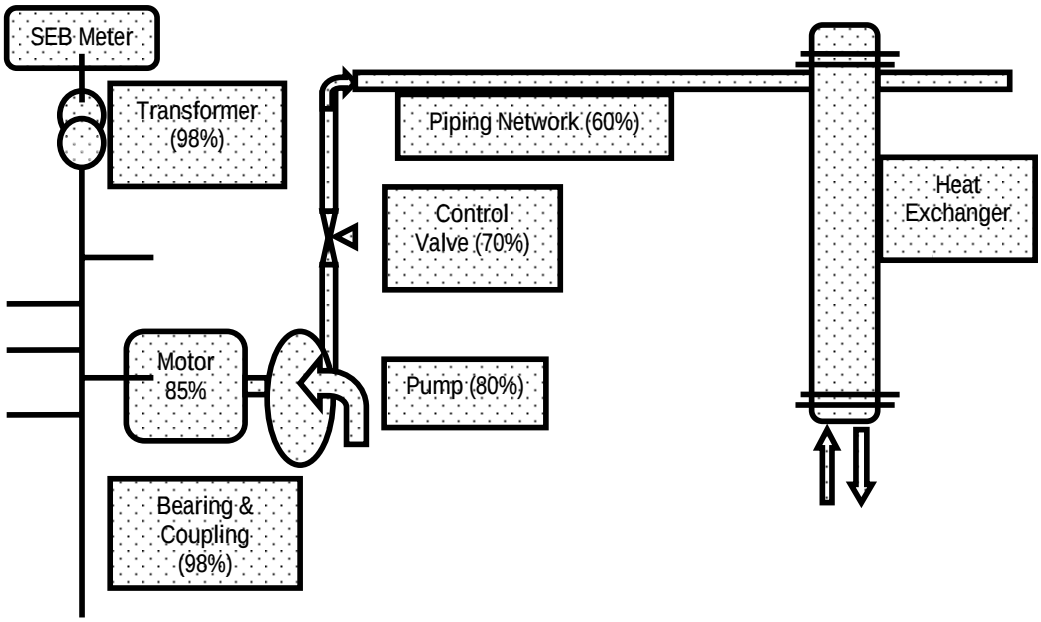
implement projects on a performance basis, i.e. payments to them are contingent upon actual savings that occur. They are therefore, obliged to install a good measurement and verification system along with their energy efficiency improvement measure. Oftentimes this M&V system could, with a little modification, be made suitable for measuring reduction of CO_2 emissions.

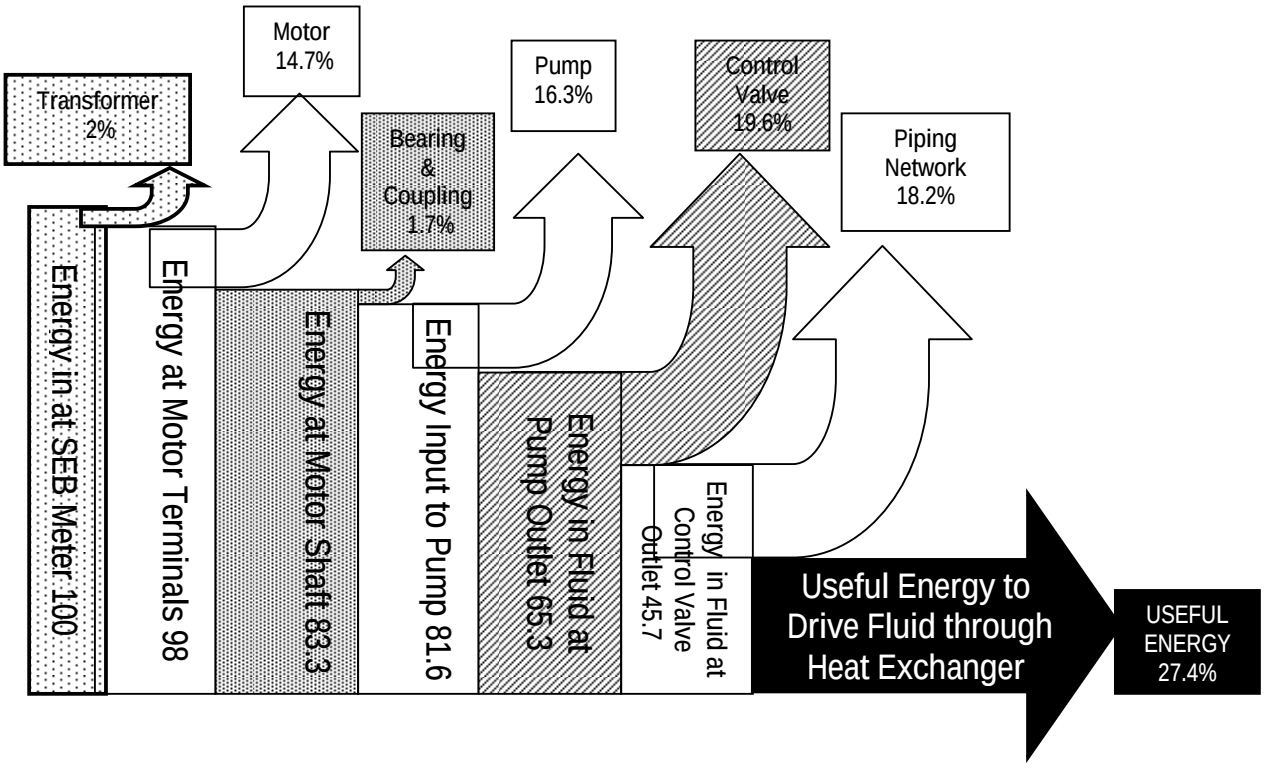
Carbon Trading vis-à-vis CDM

After 2010 when some of the Annexe 2 countries like India would also be obliged to reduce GHG emissions, having such an M&V system installed could enable the facility owner to obtain certification of emissions reductions and be able to trade them, perhaps even without CDM requirements of "additionality" having to be proven. This then becomes a "free" cash flow stream that did not exist, and could add considerably to the returns from investments in energy efficiency.

Conclusion

Investments in energy efficiency at the point of use result in very large reductions in primary energy consumption and can lead to substantial environmental benefits. What is more, such measures can have additional cash streams through carbon trading which can make the projects very attractive. Energy Services Companies can install measurement and verification systems that can enable the facility owner to avail of benefits of carbon emissions reductions.


SEB Meter
Transformer (98%)
Piping Network (60%)
Heat Exchanger
Control Valve (70%)
Motor 85%
Pump (80%)
Bearing & Coupling (98%)


Transformer 2%
Motor 14.7%
Bearing & Coupling 1.7%
Pump 16.3%
Control Valve 19.6%
Piping Network 18.2%
Energy in at SEB Meter 100
Energy at Motor Terminals 98
Energy at Motor Shaft 83.3
Energy Input to Pump 81.6
Energy in Fluid at Pump Outlet 65.3
Energy in Fluid at Control Valve Outlet 45.7
Useful Energy to Drive Fluid through Heat Exchanger
USEFUL ENERGY 27.4%