Innovative Multistage Centrifugal Pumps as a Biggest Scope of Energy Saving
A Case Study

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Abstract **- Now a days people are becoming more conscious about Energy conservation & cost-effectiveness. In this report, a humble effort is made to explain the study on energy saving & cost effective factors on Multistage Centrifugal Pumps.**
Basic idea of this study on innovation on centrifugal multistage pumps is to lead the technical community to the awareness on various scopes of energy saving.

Keywords—Innovation, Energy Saving

I. INTRODUCTION

Efficiency of electricity use cannot be improved significantly by restricting the scope of the study to electrical equipment like air motors, furnaces, lighting etc. A detailed study of end-use equipments like air compressors, pumps, blowers, refrigeration machines etc. and system components like piping, ducting etc. is required This implies that efficiencies of important system components should be determined to identify opportunities for improving the system efficiency significantly.
Engineers, scientists, manufacturers, consultants & end-users are in continual process of getting the best. Out of all researches, studies on various equipments running by electricity, **"pumps"** projected as a case study, and concluded as a biggest scope of energy saving in this paper.

Factors affecting pump efficiency

1. Use of water
2. Efficiency of Pumps.
3. Head/flow requirements
4. Numbers of pumps in a system
5. Speed (Use of variable speed drives)
6. Optimizing pipeline sizes.
7. Maintenance.
8. Monitoring and control.
9. Electric Motor

II. WHY PUMPS?

A. Do you know that pumps are behind every product produced?

- Our fresh water supply.
- Radiators can't operate without pumps.
- In air-conditioning systems.
- Large airports usually use 2000-3000 pumps 24/7 to keep everything going.

10% of total energy consumption in world is done by pumps only. And fastest & cheapest way of reduce CO2 emission is to save Energy.

B. Some evidencial researches…

"In businesses, buildings, households and industries, pumps exist - in some form or another. They are key components in maintaining comfort levels in buildings. They deliver and distribute clean drinking water from water treatment plants throughout cities, while at the same time removing wastewater. And, they are highly present within a wide range of industries. The world depends on them, but many pumps are also serious energy wasters, leaving behind a significant carbon footprint. This is because today's pumps account for no less than10% of the world's electricity consumption and because the majority of electricity is still produced using fossil fuels."
Source : IEA report 2009 :

"Two third of all pumps use up to 60% too much energy."

Source : Almeida, Anibal T. et al; EuP Lot 11 Motors Final Report, University of Coimbra, December 2007, p: 68

Hidden Energy Users By using pumps only.

- Commercial & public buildings
- Hotel
- Hospital
- Campus
- Industrial Applications
- Water Utility

Pump efficiency is constantly improved by technology, so why should we remain behind?

III. INNOVATIONS IN MULTISTAGE CENTRIFUGAL PUMPS

We will discuss only some significant innovations before going to the results of our Case Study.

1. *Impeller*

An enhanced impeller design ensures a more streamlined flow in the impeller, reducing eddy flow and friction losses. Tiny margins determine the success of the final result, so manufacturer aimed for the very best. They developed a highly specialized laser-welding technology which facilitates unmatched accuracy. This technology literally makes dreams come true, allowing for a seamless transition from the sketchpad to real life. They use it to bring you impellers of truly superior design and construction, aiming for the point of theoretical perfection.

2. *Cartridge Seal*

The specially designed cartridge seal increases reliability, ensures safe handling and enables easy service and access.

Internal leakage caused by pressure differentials within the pump can be minimized. Tests on pumps have shown that an impeller seal clearance gap of just 0.1 mm between the impeller and the chamber causes a 5% drop in efficiency. The reason for this efficiency loss is quite simply that when liquid seeps out into the pump, precious energy is wasted on circulating that liquid. To reduce internal leakage to an absolute minimum, use of a floating seal ring between chambers can provides a close to perfect seal.

Unique cartridge seal design

The pump of course deserves an outstanding seal. So do you. The seal used in the pump line combines the best features of standard seals, wrapped up in an ingenious cartridge design that provides unique advantages. All of these ensure extra reliability. The durable seal is made from hardwearing materials which prevent downtime and prolong the lifetime of the seal. All axial movement has been eliminated, preventing wear of the shaft and rubber parts – a typical problem area for traditional seals. The cartridge seal is a balanced type seal, a fact which makes it less insensitive to pressure. We know, however, that even the best of materials are not necessarily enough to guarantee success in real life. That is why the innovative team of manufacturer set out to eliminate the small, yet crucial, factors that can have a negative impact on pump reliability. Many of these have to do with handling, assembly and service.

Safe and easy handling

The peerless cartridge design ensures that the seal components will never be assembled wrongly, the spring will never be incorrectly preloaded, and that sensitive surfaces will never be subjected to greasy fingers or dirt. All these factors are common causes of short seal lifetimes in other pumps. The cartridge design also enables rapid replacement when the seal ultimately does need changing after a long period of service. All in all, downtime is minimized. Naturally, this translates into significant savings for your business.

The cartridge design allows you to replace the seal in minutes – without special tools and without dismantling the pump.

3. *Dry-running sensor*

The patented manufacturer's system eliminates the risk of breakdowns due to dry running. If there is no liquid in the pump, the system will immediately stop it.

Superior dry-running protection

Dry running is the most common cause of pump failure. In most pumps, the shaft seal and bearings will burn out almost immediately if liquid stops flowing in the pump. The manufacturer's innovative pump is different. As part of manufacturer's constant dedication to innovation, they have tested new and alternative materials to bring you the best possible solution. This means that they can equip pumps with a shaft seal and bearing system that can withstand extreme heat and friction for longer periods of time. This makes them less unforgiving if the pump does run dry.

The system for protection of dry running: checking for liquid 24 hours a day

For those who need to avoid dry-running altogether, the this system is the answer. Available with all pumps, the system is plug-and-play technology at its very best. Ever vigilant, the system constantly checks that there is liquid in the pump. If there isn't, it stops the pump immediately. With this system, you always have someone watching your pump.

IV. CASE STUDY

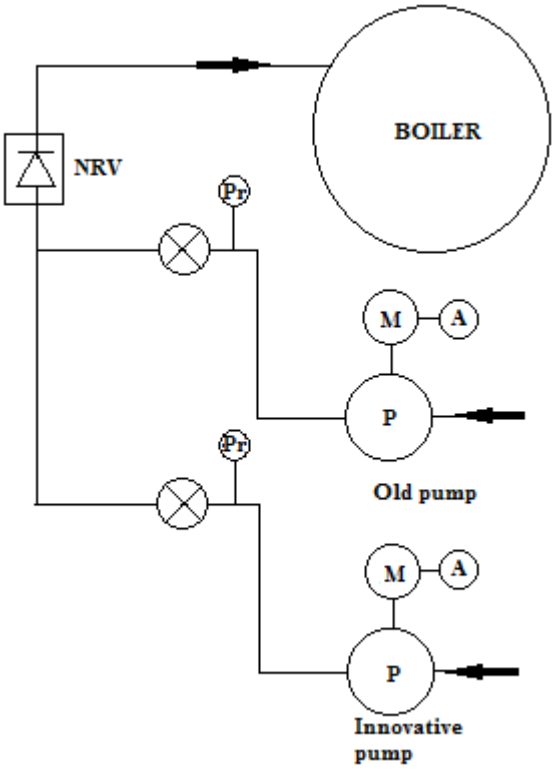
A common application of multistage centrifugal pump is boiler water feed pump. As an energy saver representing here some numbers, based on purely observations, previous data & study.

Energy Saving by replacing

1. Energy efficient pump of Boiler Feed water Pump: (Pump Model: CR-CM-10-18, Make M/S Grundfos)
2. Energy efficient pump of Raw water Pump: (Pump Model: 64-3-2, Make M/S Grundfos)

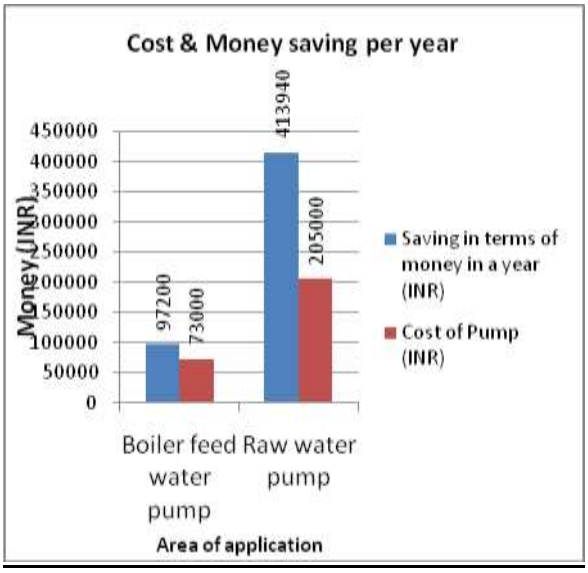
(Place of study & observations – GSFC (Fiber Unit) – Kosamba)

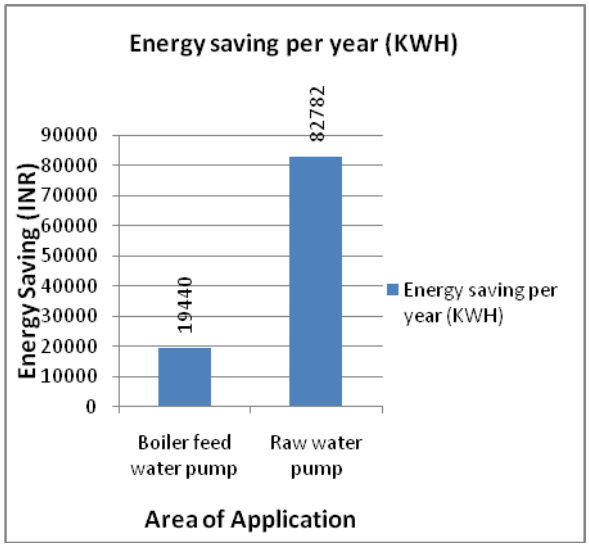
Line diagram of the set up where this case study have been carried out is given hereunder,



some analytical data of both places are given in the table.

	Boiler feed water pump	Raw water pump
Energy saving per year (KWH)	19440	82782
Saving in terms of money (INR)	97200	413940
Cost of Pump (INR)	73000	205000
Pay back period (Months)	9	6





V. CONCLUSION

As discussed in the beginning & with results of case study, each and every end user of pumps can easily come to know the fact, "among all machineries & equipments run by an electricity, pumps are almost have been proved as biggest scope of Energy Saving."

And of course we as a technical community have to take responsibility to make users understand the fact.

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