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Human Inefficiency and Fuel Switching!

What would happen if we converted all human beings to run on diesel oil? A large glass of diesel oil contains about 0.3 liter, and has about 0.3 liter x 37 MJ/liter = 11.1 MJ = 2653 Kcal of energy. This is enough to keep a human being going for a day. Furthermore, diesel is cheap energy, costing about Rs. 7 a day per person. Even the most modest Thali Costs Rs. 20 and gives less energy, plus you have to ask for a second, third and possibly even a fourth serving.

Human beings, as any internal combustion system, burn food energy together with air to sustain their motoric activities. Hard labour requires more than sleeping. "Thinking" I believe uses the least energy and is therefore a pretty energy efficient activity.

How efficient are we human beings? The bad news is that our system efficiency is very low, between 8% to 14%, depending on what we do and whether we run at full load or are idling.

Most combustion systems, which we have invented, such as diesel engines, power plants, and gas engines, have much higher system efficiencies of between 30% and 50%.

Consequently about 620 Crore human beings are roaming this earth consuming the most expensive energy, "food", and burning it most ineffectively. It is therefore no wonder the concept of energy efficiency or energy conservation is a little bit alien to most of us.

Energy inefficiency starts in your head. It is usually not technologies, which are inefficient, but the people who use them. Manufacturers of equipment such as boilers, fans, and pumps carefully talk about design efficiencies, and even design system efficiencies. They are fully aware that the design efficiency of a boiler of say 85% may quickly drop to 70% if an operator who is not well trained or doesn't care is in charge. Similarly, you may purchase the most efficient fan that has a design efficiency of 78% and then operate it at 40% efficiency because the fan was wrongly selected or the ducting does not match the design.

In other words, regardless of whether you buy and install efficient or inefficient equipment, the actual efficiency at which a piece of equipment operates depends on the operator. He may lose too much of the design efficiency by inappropriate operation.

A firm's management usually follows a carrot and stick approach to improve energy efficiency and reduce energy costs. Let us not talk about the stick approach, but more about carrots, i.e. incentives.

We would be interested to know what kind of incentives and staff recognition schemes are offered in industry to motivate those in charge of energy intensive equipment and processes to undertake extra efforts to reduce energy costs. Please let us know what your firm or others you are aware of are doing in this area.

Disclaimer

First of all I would like to mention that whatever points are being discussed or stated below are purely my own views and should not be correlated, whatsoever, with the decision of any management for the structure of incentive schemes or staff recognition schemes. The views expressed are purely one's own view.

In this era of fierce competition among the various industries and the pressure from the government, the industries are compelled to reduce the energy consumption, ultimately for the cost reduction.

Incentive programs are an excellent way to produce change in an organization, increase enthusiasm, and obtain buy-in concerning green ideas and practices. Rewarding with tangible benefits those who take the time and effort to put forward good ideas not only encourages the continuation of this behavior but also helps motivate others to perform in a similar fashion.

Power sector, of which I am aware of, offers quite a few incentive schemes for the O&M personnel, related directly to the energy conservation of the plant. Though other employees (other than O&M personnel) are also associated with the plant activities- directly and indirectly, they are deprived of some of these incentives, which lead to a sense of feeling that energy conservation is the duty of only O&M personnel and not ours. They sometimes frequently say "why should we bother for the lesser consumption, when the incentives are paid to them."

This creates a very bad repercussion. The employees other than O&M personnel also performs a lot of responsibilities, which keep the O&M personnel motivated and free from other responsibilities, so that O&M personnel can concentrate on their own limited responsibilities and do not take unnecessary headaches. That is why these departments are called "SERVICES". A simple example may purchase department. The personnel of this department takes a lot of pain (although you can say it is his duty) to get the good quality of materials requires by O&M personnel and get it delivered in time so that the work is not affected. Had this not been the situation, there would have been some production loss, energy loss, wastage of manpower, etc. But this philosophy has never and will never take a place in the mind of Management.

The personnel other than O&M personnel in the organisation/Industry can also contribute a lot towards energy conservation, no matter whatever the quantity is. Why are they not given incentives, whereas those in the O&M area are paid for that? We will see some of the case studies of foreign countries also.

Let us take the examples of Incentive / Recognition Schemes followed in some of the good Power Sector Generating Companies.

Schemes

- 1.Generation Incentive Schemes
- 2.Oil Incentive Schemes.
- 3.Incentive Schemes for Low Auxiliary Power Consumption
- 4.For any Good & Implementable Suggestions on Savings in Energy

1. Generation Incentive Scheme

This is the incentive scheme for maximizing production (power in our case). Some of the power stations runs far below the capacity utilization mark, whatever be the reason. To eliminate the possible practical reasons and to motivate the employee for maximum capacity utilization, this scheme has been designed. Example of our plant may be one of the best examples.

Ours is a **2x250 MW**, Coal based thermal Power plant. We try to operate the plant beyond the designated capacity, with proper margins for handling emergency situations and without bypassing any parameters above its maximum limiting value. With all the parameters within limit, and the demand is high, each unit of the plant produces 260-262 MW, almost 3-4 % higher than the designated rating.

Since the generation incentive scheme is linked with the Plant Load factor, employees do all kinds of necessary action at the right time (for e.g- Preventive maintenance, Condition Monitoring, Predictive maintenance, etc) to keep the plant & equipments in healthy condition for maximum production without any disruption. This saves the downtime and consumers are provided with reliable, economical and uninterrupted quality power.

There is a cut off limit also, below which there is no generation incentive scheme applicable. Also there is a ceiling to the maximum incentive to be given over a period of time. Apart from monthly, there is Quarterly Incentive schemes also, depending on the quarterly production performance of the plant.

Generation incentive schemes are in this format:

PLF	% of Basic Salary
80-85	5
85-95	8
95-100	10

2. Oil Incentive Schemes:

This is the monetary reward given to the O&M personnel in the plant for not consuming or minimum consumption of oil, where a different fuel like coal is the main fuel. Since the burning of oil costs a lot to the

organisation, the management motivates the employees to use oil only in case of any unavoidable situations. Generally the amount is based on specific oil consumption in the plant.

In our power station, the concept of this incentive scheme was well in force when I joined my organisation. Rather it is a very well designed energy saving scheme. Whenever there is a trip, all the personnel gets involved to bring back the unit on coal within the shortest possible time; one of the reason behind this is not to lose oil incentives. The exceptional cases beyond one's control may not be considered. This incentive is generally not provided to other personnel like support services, who although work inside the plant area but are directly not involved in the savings in oil consumption.

Penalty for consuming more Oil: There is also a clause for penalty and the deduction from monthly salary, if the specific oil consumption equals to or exceeds 2.5 ml/kWh. A definite percentage of salary deduction has been defined in this case.

A Typical case:

Ours is a licensee power company, supplying power to only our customers in the Mumbai suburbs. So we are totally dependent on the demand of our consumers in Mumbai. The period (specially nights in winter) when our demand used to go down drastically, we had to back down the generation at our plant. As everyone may agree, it becomes very difficult for a coal based thermal power plant to survive at low loads, without the support of oil. I remember the days, when as an operator, we used to take maximum possible risk to control the parameters without taking the oil support, till the time it was possible to do. This is never a case as most of the other power stations supply their power to SEBs and do not have to back down power generation due to inadequate demand from the customers. But the days are not so far, when with the new electricity bill 2003, this will become the challenging task for all power stations operating in the country.

Case study : Oil incentive Scheme- by Mr. Manjeet Singh in his technical paper Issue#6 on www.energymanagertraining.com

Saving of 1 ml in specific oil consumption yield an overall saving of Rs.10 Cr in a year", "In firing of one oil gun for one hour, cost of oil required is equal to one month salary of a Junior Engineer" in a SEB. Sharing of saving was the next step and was found most effective too. Profit sharing scheme was offered to the employees in which a saving of 10 % of amount oil saved was to be distributed amongst the employees. Providing necessary measuring devices for oil, efforts to generate awareness to

save oil and motivation conveyed a positive message amongst the officers and employees. Lot many suggestions came from the user group, acceptable one were implemented and recognition was conveyed to respective person. The summary effect of these efforts generated a motion amongst the men to reach the Himalayan target. The result was more than expectations and to my satisfaction. Present level of specific oil consumption now is about 2 to 3 ml per unit. The idea of sharing the above experience is that if men in the organization are convinced they can do miracle

Incentive may be of two types; monetary and non-monetary. They need be carefully applied. Monetary schemes are capable of providing imaginary results in one sector of people whereas it may find other sector immune to. This sector gets motivation by non-monetary reward e.g. recognition. The satisfaction of achieving the target and recognition of being identified as best, most of the time does not cost anything to the management, but is the best incentive to the executive class. Thus appropriate scheme should be applied, depending upon the cadre and class of the work group.

3. Incentive Schemes for Low Auxiliary Power Consumption

Though this scheme is not in implementation at present, it has gone into the mind of management to provide a special incentive scheme for achieving a targeted value for Auxiliary Power Consumption. Non O&M staff may also contribute towards the savings in auxiliary power consumptions, with the optimum use of lighting, ACs, Computers and other office equipments. So these aspects should not be overlooked.

Auxiliary Power Consumption varies from plant to plant and depends on the type of plant, the auxiliaries installed and the capacity of the plant. Definitely there can be some percentage reduction in aux power consumption in a plant, by adopting different measures, such as

1. Optimisation of Coal Mills
2. Controlling the HT Auxiliaries Operation
3. Monitoring the losses at various points and applying correction
4. Optimising the Ash Handling operation.
5. Controlling the Lighting Operation, Office equipment, etc.

But to achieve this, a strict measurement and monitoring is required, but it should not be done at the cost of reliability of the plant. An incentive scheme will be definitely welcomed in this aspect. It is not very far, when other power stations too will look into the depth of this aspect and implement this incentive scheme.

Suggestion Scheme:

Recognition is one of the most important necessities of personnel, after his basic needs are fulfilled. Our organisation follows a "Suggestion Scheme" in which the employees putting up a good and implementable suggestion gets the recognition as well as reward from the organisation. The names of such personnel are also published in the internal magazine published by the company.

Let us Go Global now.

Case Study #1

General Incentive Scheme in Federal Republic

Flip off a light, close a window or shut down the office's ancient copy machine before you go home and, if you're a state employee, Gov. Jeanne Shaheen might pay you a cash reward. Implementing a long-ignored state law, Shaheen's office is now offering up to \$10,000 to state employees who dream up innovative, effective ways to cut the state's annual \$18.5 million energy bill. The 1983 measure permits the governor's office to give cash incentives to workers who go beyond their normal duties to save the state money.

Started June 1, the Kill-A-Watt contest will present awards to the top three "E-Teams" who produce the most impressive energy savings in their buildings by Nov. 1. The program is unique in New England states, but a similar effort during last summer's "rolling blackouts" out West **reduced the state of California's energy consumption by 25 percent.**

"There are a lot of simple things we can all do, and when you add them up, they can make a real difference," said Bill Burtis of the Governor's Office of Energy and Community Services.

The program is **the brainchild** of the state's first energy czar, Hamilton McLean, hired last year to reduce the state's rising power bills for heat, lights, office equipment and transportation.

McLean hopes the reward program will help his office look at energy consumption rates statewide and pinpoint ways to save the most energy at the lowest cost. Ultimately, the program aims to gain more in energy savings than it pays out in incentives.

The contest is open to all state employees, even if they work in privately owned office space rented by the state. Workers are encouraged to form teams that will identify potential savings and encourage coworkers to conserve.

In one of the cases workers were able to cut electricity use by simply turning down the temperature in an electric water heater. Before the change, water coming out of the heater was too hot to touch and needed to be mixed with cooler water from a tap - a needless waste of electricity, McLean said.

"We don't want people to live with less. We just want them to live more aware of how they use energy," said McLean, adding that the savings will help the environment by reducing the power demand on utilities.

The contest is structured so that even employees in small offices can win. The rules offer simple energy savings tips, such as making sure idled computers, printers and copiers are set either on "sleep" mode or turned off when not in use. Computers (the state has 10,000) can be programmed so that they automatically reduce power use when idle. Even eliminating unused coffee pots, hotplates and other appliances can make a difference.

Incentive Schemes by Federal Government

The Federal government has a long and successful history of incentive programs aimed to motivate its workforce to save money. More recent versions provide financial incentives for suggestions that could lead to **cost savings due to reductions in water, energy, and resource consumption**. A sophisticated incentive program can dramatically help reduce the environmental impact

A Few Incentive Schemes are:

Utility incentive programs include rebates, customized services, bidding programs, and other offerings. In utility incentive bidding programs, tenants, owners, utilities, and energy service companies work together as a team to create energy-efficient systems. Group incentive programs can be just as important as individual incentive programs. For example, in DOD, groups can use up to 40% of the savings from their energy conservation efforts for quality-of-life improvements at military bases and other facilities. The Energy Policy Act of 1992 offers Federal agencies the opportunity to participate in any and all electric and gas utility incentive programs that the utilities offer to their non-Federal customers.

Contract incentives: To encourage environmental initiatives in such areas as environmentally preferable purchasing, contract language can be written that provides financial incentives to contractors for improved environmental material selection and product procurement, as the Pentagon parking lot project demonstrates.

Green building rating system incentives: Rating systems such as LEEDTM recognize high-performance buildings by awarding points and “levels” (certified, silver, gold, and platinum) for green design initiatives. Used as an incentive program, the rating system assists the design team in setting green priorities in order to receive recognition and added value.

Annual awards programs that recognize outstanding achievements in sustainable design have been established by DOE FEMP, DOD, AIA, and others. These awards can act as incentives to the integrated design team, inspiring and motivating their actions and choices.

The annual Federal Energy and Water Management Awards are presented by DOE in conjunction with the Federal Interagency Energy Policy Committee (the “656” Committee). The program recognizes outstanding achievements in the efficient use of water and energy, the use of renewable energy sources, and cost beneficial landscaping practices by the Federal government. Renewable measures include, but are not limited to, photovoltaics, solar thermal systems, passive solar design, biomass energy, wind systems, geothermal heat pumps, and low-head hydro dams. FEMP coordinates this program for the Federal government.

The American Institute of Architects recognizes the “Top Ten” sustainable design projects in the United States, annually on Earth Day, while DOD has an Energy and Environment Awards Program for military bases.

Employee suggestions: The standard Federal suggestion program is an excellent vehicle for garnering input from employees regarding the greening of facility operations.

Case Study # 2

In some of the foreign countries, Companies are increasingly concerned about climate emissions and **energy use**. Many employers offer **incentives** to employees who carpool, bike to work, or use public transportation. There's also growing acceptance of environmental factors in corporate procurement policies, for everything from office paper to materials used in manufacturing.

Actually this is a good incentive scheme, which may be followed in our developing countries also, a step towards conserve energy.