Conserve to conquer

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Abstract. That the accelerated consumption resulting in exponential depletion of fossil fuels, it is imperative to conserve energy at every possible avenue not only to ensure availability of fuels for use in the days to come but also to ably tackle the climate change which is order of the day. While many initiatives for optimum energy use emanate in various manufacturing companies and also are put into practice, emphasis on reduction of specific energy consumption has become mandatory for high power intensive industrial units. Plethora of micro level energy saving activities at various spheres of life can yield phenomenal results to benefit the country to conserve reserves as well as consequent economic growth. Well buttressed by technical efforts, certain administrative measures too are vital to achieve the said goal. Hence the need for presentation of energy conservation in industry and beyond.

Keywords: Conservation, Energy, Fuels.

1. Introduction
Energy is the fulcrum of all activities across the Globe which is available in disproportionate quantity for most users in general and in the power-intensive industrial units in particular. While generation of power is on the rise at one end, its optimum use through efficient process is also exercised constantly at the other end so as to strike a workable balance between demand and supply. Thinkers and doers in any industry can and should explore all avenues to conserve energy for one simple verity that energy saved is energy generated without additional cost, time and efforts. Conservation of resources should be a bottom up activity for the lone reason that it is the workforce that operates plant and machinery day in and day out. Hence, they are the ones who should be aware of the ways and means of the frugal and effective use of energy at all levels. The momentum thus created by the bottom line should be well propped up by the middle management staff to perpetuate energy conservation activity. People at higher echelons are the ones to use eagle’s eye to monitor and encourage all the productive suggestions as well as motivate people to come up with more and more ideas for energy conservation in a synergized pattern.

This paper covers all needed points in a broader sense as to how there had been steady and steep reduction in specific energy consumptions of various products in one of India’s leading heavy chemicals manufacturers located at southern part of Tamil Nadu where the author served for over two decades. Based on the feedback on the recent lecture programs delivered by the author at few engineering colleges, the need to include energy management module in curriculum is also elaborated in this paper. Needless to mention, aligning to the title of the paper, certain administrative measures to encourage energy conservation too have been covered in the article.

2. About the industry
This chemical industrial complex has been in existence close to six decades. With modest commencement of its operation by manufacture of caustic soda way back in 1959, gradually the capacity was expanded over the years. Simultaneously, plant capacities of the byproducts viz. chlorine...
and its derivatives were also enhanced. The mercury cells installed during inception were replaced by latest membrane cell technology during 2007, much ahead of stipulated deadline laid by the Government for such conversion. The switch over to sophisticated and modified manufacturing process has not only eliminated use of mercury but reduction in energy consumption substantially. Doubling the capacity of Synthetic Rutile plant in the complex (which was installed during 1970 for utilization of hydrochloric acid generated in chloralkali plant) during 2004 by few mere modifications in the manufacturing process and adding balancing equipment did result in remarkable reduction in specific energy consumption of the said product. A stand-alone PVC manufacturing plant too is in operation in the premises. Synthetic Iron Oxide plant and CPVC plant are very recent additions making the unit totally unique. Now, the entire steam and power needs of the complex is met by coal based cogeneration plant. This paper vividly covers various energy conservation measures adopted in the chemical complex during the last few decades.

There are three major avenues for achieving energy conservation in process industry viz.

- Low investment – workplace related initiatives by workmen – bottom line
- Moderate investment activities – Supervisory related monitoring as well as improvements aimed propellants involving staff – middle line
- High investment major projects handled by the management – conceptual ideas involving top executives – top line

Even a wee bit of efforts taken by individuals at any of the above three levels would result in tangible improvements and savings.

3. Initiatives with less investment

Quality Circles, which are small groups comprising workmen / shop floor supervisors surcharged with skilled awareness on energy saving must be formed. The teams with great amount of synergy do identify the areas where energy-saving can be implemented at their respective work place. The team takes cognizant of various spheres of day-to-day functioning such as safety, energy, housekeeping and maintenance issues. Even a minuscule effort on right direction can result in substantial benefit sooner or later and hence the teams are to be constantly motivated to sustain their functioning. The Quality Circles in the said industry have done about 150 minor projects over the last 10 years. It is germane to cite an interesting case study undertaken by one of the teams. Salt is the raw material for manufacture of caustic soda and it is harvested from company owned salt pans spread over 1000 acres of land. The conventional solar evaporation is the process adopted and over the years various improvements like laying of LDPE films in the salt pans to avoid percolation of brine into the ground, replacement of old pumps by energy efficient pumps to pump sea brine were carried out.

The pumps are installed at various locations in the above said 1000 acres to handle / feed the brine at different concentrations from condensers to crystallizers. The sea brine whose temperature increases during day time will evaporate during night when there will be heavy wind across the salt fields and hence salt production will be at its peak during night hours as well. When such high wind is available, if there be any pump failure at any stage in the brine flow, salt production will be directly affected.

Few years ago, frequent tripping of pumps was experienced and when such problem occurs at night, not only there would be loss of salt production, it will be extremely difficult to locate / identify the exact pump station in the vast land area and even if located, analyzing further causes of tripping during night hours was a concern since power supply will be available only for the pump house and nearby surroundings will be dark.

On such occasions, whenever inspection was made during next day morning, it was observed tripping was mostly due to “bird hit”. Migrated large birds accidentally get caught in between the power lines when they take off from the electric poles during night thus tripping the electric motor.
The aforesaid problem was taken up by a Quality Circle team. While birds’ movement cannot be prevented, the team members worked out possibilities of avoiding tripping as well as saving birds getting electrocuted. They came up with an idea of fixing a cross like structure atop all the electric poles where birds can land and take off safely above the live wires. The condemned wooden materials salvaged from the packing boxes at the stores were used and hence NIL cost for the project. Initially, as trial, the wooden cross were fixed at few poles (which were more prone to tripping caused by birds based on the past data) and the effort yielded fruits. Absolutely there were no tripping thereafter, but some days later when similar problem was observed, the team decided to install the wooden cross at all the electric poles in the salt to eliminate the issue once for all. The salt production simply got spiraled.

Through simple provision of a wooden structure at no cost, nuisance of tripping was totally eliminated benefiting with reduction in specific power consumption in respect of salt production. Those involved in the above project had a sigh of relief and elation in saving the migrated birds in addition to enhanced salt production. The team was encouraged to participate in State and National level Quality Circle Conventions which motivated them to go for more such innovative yet simple no-cost projects to save energy besides making other teams venture into critical analysis at their respective workplaces on various issues on the same modality.

Few other noteworthy conservation activities by Quality Circles are

- In-house invented Auto Sampler for mineral processing plant which resulted in dramatic reduction in energy use by process optimization.
- Recycling of expensive Demineralized water back into process.
- Product recovery in mineral processing plant from channels / pits.
- Use of gravity flow to avoid pumping system.

Kaizen Scheme encourages shop floor staff and workmen to come out with various suggestions to improve safety and productivity. Every month, employees who had contributed in this realms are rewarded and recognized. This system, apart from improved productivity and minimized breakdowns, enhances the morale of the workforce, as, human asset with unassuaged encouragement, energy and enthusiasm is the precious asset.

Energy conservation fortnight celebrations are yet another opportunity thrown open to employees through which even non technical personnel too are encouraged to contribute their mite. The suggestions are studied and critically evaluated prior to implementation at shop floor. During valedictory function of such celebrations, vendors are also provided opportunity to display their energy saving products and also explain the features, so that various options for usage would be studied and implementation taken up wherever feasible.

4. Moderate investment activities

Cost improvement programs are organized twice a year. Proposals from various teams (Civil, Mechanical, Electrical, Process, Safety etc.,) are presented highlighting present conditions, suggestions for modifications, improvements etc. A healthy rapport and subsequent interactions between the presenting teams and audience pave way for better understanding of the subject / issue in depth through collective mental cogitation and cognitive brain storming. With staff from all departments taking part in the meeting, pros and cons could easily be deliberated with absolute open mindedness.

Use of renewable energy sources for various applications is also debated in this program. One such outcome was “Solatube” use of sunlight for office lighting – installed in one section and studied for performance and energy savings. The Lux levels met the requirements even during cloudy weathers and implementation at few more buildings was taken up.
Few of activities undertaken in cost improvement programs which resulted in considerable energy reduction are;

- Enhanced batch size in reactors
- Flash steam recovery system
- Re engineering of pumps
- Harnessing of solar energy for certain process applications is also on the anvil.

Buyer – Seller meet is yet another event organized every year wherein issues related to product quality that in turn affects process and ultimately increases energy use are discussed with vendors. Best practices are exchanged for mutual benefit in the meet. Plant visit by vendors to discuss in detail about the requirements and observe the functioning of the materials being supplied by them at site is the key objective of the meet. Such visits by product suppliers facilitate the end user on the right application under right parameters, operation & maintenance – including preventive maintenance and throw more light on the technical knowledge which would result in optimum usage of products for sure.

Energy audits at regular intervals as also when felt needed by techies, experts and doyens in the domain of energy are organized and quick wins are addressed on priority.

Condition monitoring of critical equipment by competent technical personnel optimizes energy use apart from minimizing breakdowns.

5. High investment efforts

In the aforesaid energy conservation initiatives, wherever large investments are estimated, suitable erudite and experienced consultants from outside are engaged for detailed study to ensure precise suggestion with perfect time frame and cost implications along with exact ROI (Return On Investment).

Plant scale trials are undertaken wherever possible to generate surfeit of data which can help us implement after establishing energy savings as envisaged. One such implemented system is introduction of suitable equipment in the process flow to avoid mismatches between the upstream batch operation and downstream continuous operation. Installation of the said equipment (known as “table feeder”) in addition to prodigious fuel oil reduction in the downstream rotary kiln, has also avoided requirement of additional kilns at huge capital cost. Though certain standard table feeders are available in the market, this application is very unique to handle acidic, wet, beneficiated, mineral sand and hence necessitated visit of vendor to site to understand the need and to design & incorporate suitable MOC (Material of Construction) to withstand severe duty conditions as well as adverse environ, if any.

Modernization of plants with latest energy efficient equipment, automation of process to banish human errors, retrofitting to minimize capital cost, investment on metering equipment, identifying alternate fuels for process etc., are few of the initiatives were taken up with considerable investments and successfully implemented. Conversion from mercury cell to membrane cells for caustic soda manufacture was one of the very high investments that the management took up during 2008. This conversion, as one could understand, especially those in the sphere of manufacture of caustic soda, required new plant altogether with necessary modern state of art control systems, brine purification system along with other accessories & auxiliaries.

The author, during his visit to Mozambique to source raw materials for the Synthetic Rutile plant, on return, could implement few modern techniques in mineral sampling systems and ore purification methods prevailing at the vendor’s facilities which resulted in minimizing loss of products in waste stream, means enhanced production and hence reduction in specific energy consumption of the product.
6. Energy management in the curriculum
The author, who is now a freelancer, visits few technical educational institutions to deliver lecture programs to the students in various engineering disciplines on desired technical captions. Mostly the topics covered are either on the need for industry – institution interactions or applicability of theoretical knowledge and the ways to put into practice at workplace or energy conservation & use of renewable energy.

It is the strong opinion of the author, that, discrimination of branches in engineering like Civil, Mechanical, Electrical, Electronics, Chemical and Instrumentation etc. is valid until a student completes the bachelor course. The transition from college campus to industry demands conversion of knowledge into skill as a “full-fledged engineer” in his/her core area and his lectures pin point this important transformation on the part of the students.

- For instance, in a process industry radiation losses largely depend on the healthiness of coatings and insulations. Generally heat resistant painting, refractory linings, hot & cold insulations are dealt by Civil department.
- Selection and maintenance of pumps, reactors, utilities etc., lie largely with Mechanical department. Needless to mention steam, compressed air and efficiencies of equipment account for significant energy use which are monitored by utility department.
- Supply of power to the equipment is handled by Electrical department. Power factor corrections and limiting harmonics in supply lines are major steps for energy conservation. Where electrolysis is involved (like manufacture of caustic soda), every millivolt drop in the bus bars at cell house contributes for increased power consumption.
- Plant operation is managed by Chemical department. Optimization of batch size and enhancing throughput is the key function to achieve energy reduction. For caustic soda manufacture , achieving ultra purified brine for electrolysis (impurities in the order of ppb) is the main factor that directly impacts power consumption.
- For measuring of critical process parameters, the role by Instrumentation department is vital. Control room operation and installation of accurate meters to measure power and steam are the prerequisites which were rare phenomenon 30 years back is now a regular feature in any plant. The accuracy level of such meters decide the exact energy reduction.

Thus, every aspect of the above said engineering activity has strong influence in energy use. Hence, it would be advantageous if certain basic course / subject on energy management for all engineering disciplines is included in the curriculum, it will be of help to better contribute when a student joins the industry after graduation.

It is reiterated that engineering departments can’t function effectively in isolation in any industry and when such inputs are provided in the bachelor’s degree course, will naturally accelerate the improvements at workplace. The policy makers who frame the syllabus for technical courses are requested to kindly consider this aspect and explore possible implementation in the days to come. India has immense potential to harness solar energy and if such course / subject is covered along with basic aspects of solar power, benefits in the long run can be expected.

As an approved competent Energy Auditor, the author always eyes on energy saving and highlight this factor among students as to how they should unanimously and collectively interact with all concerned to benefit the organization they belong to in respect of energy saving!

7. Suggested administrative measures
It had been the practice to provide conveyance allowance / reimbursement at the offices to those who use their cars / two wheelers based on their positions. Now a totally upside down approach is required!!!. Yes, those who possess vehicle but still use public transport are to be encouraged with
suitable “allowance for not using the car” While doing so, two main aspects to be taken care of. Firstly, it is to be ensured that the right person gets the benefit with suitable system by recording declared non usage of own vehicle. Secondly, the tax implications on payment of such incentives are to be suitably addressed. Otherwise, by getting a benefit for no usage of own vehicle, a person may lose the benefit by way of additional income tax for such extra earnings. Since, this conservation measure ultimately will reduce import of fuel benefitting the country, there should not be tax burden on the individual. To be precise, compared to loss of plausible revenue by way of income tax to the Government exchequer on account of exemption of IT for the above extra income, import duties on account of fuel would absorb the loss.

Most of the people deem it prestigious to own a vehicle either two-wheeler or four-wheeler (of course they are proclaimed to be fuel efficient) and avoid public transport system. A few others discard public transport facilities for more than one reason as Government transport facility deny their comfort. Therefore, when the Government focuses its attention on the reformation and rejuvenation of its entire transport network, the public would slowly drift towards using public transport provided sufficient awareness is also created on fuel conservation. Of course, the role of Indian Railways in the recent past in making Indian public to use its services by improving the train commuting facility across the country is commendable.

8. Conclusion
As described in this paper, the three-tier system in any industry viz. Initiatives with less or no investment, moderate investment activities and high investment efforts with specific time frame and ROI will ensure energy savings on a consistent basis. ISO 5001 system can further streamline energy management and will help us bench mark energy consumption and efforts towards continual improvements.

Energy saving efforts are perennial, perpetual, eternal and everlasting considering the depleting natural resources at one end and increasing cost of fuel at the other end. I now prefer to take it on to the student community who are going to serve various industries. Let us adopt at once the Switch Off Something (SOS) concept before the entire country sounds SOS (Save Our Souls) for want of natural energy resources.

That is the main reason of my suggesting the people at the helm of affairs in the realms of education to add conservation of energy in their syllabi so that young India would get energy conservation imbied so strongly to implement the same at their respective work spots.

To conclude I energetically fuel the urge in the minds of the readers of this paper to go all out to conserve energy with unassuaged enthusiasm.

9. References
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