# SOME NON-TECHNICAL FACTORS AFFECTING ENERGY CONSERVATION IN SRI LANKAN INDUSTRY

*M W Leelerathne*
*Head, Energy Management Center,*
*NERD Center, Ekala, Ja-Ela*

## 1. Introduction

Sri Lankan industrial sector consumes nearly 1340 Tones of Oil Equivalent (TOE) of commercial energy per day, of which approximately 25% or 335 TOE is wasted. In monetary terms, this represents approximately Rs. 14 million (electricity Rs. 10 million[1] and fuel oil Rs. 4 million[2]) and Rs. 3.5 million, respectively.

After the oil crisis in 1970s, like any other country, Sri Lanka also embarked upon various programs to improve energy utilisation efficiency. Consequently, the efficiency of energy utilisation improved considerably during the past decade, as indicated by Figure 1. As a result, energy productivity increased five fold from 1984 to 1993. More importantly, it shows that there is a great potential for increasing energy productivity further as manifested by the sharp inclination of the graph during the latter part. Despite such opportunities and the potential economics and financial benefits, industrial energy consumers are slow to invest in energy conservation measures. This trend has been observed by the Energy Management Center (EMC) during the past decade of their activities in promoting industrial energy conservation in the country. Since 1986, the EMC has carried out over 100 energy audits and the identified energy conservation potential in these industries exceeds 10 TOE per day. However, of this only less than one TOE has been realised as savings up to now, because the number of industries which actually implemented the energy conservation measures remain less than ten percent. Others are very slow to participate meaningfully.

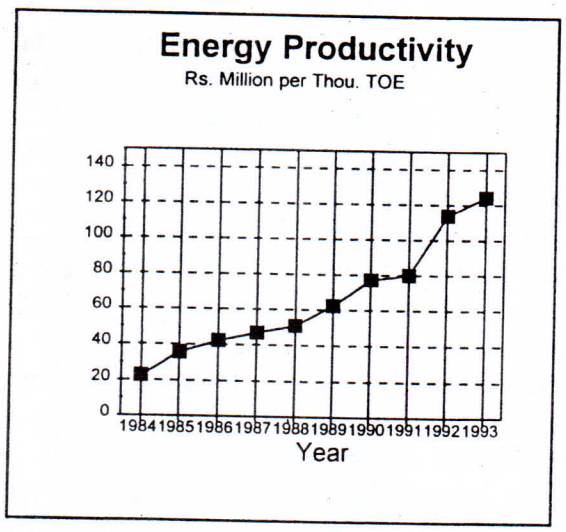


Figure 1

The problem is not one of technology. Technologies of increasing energy efficiency already exist and are readily available and more and more are being developed and introduced to the market regularly. It is up to

1 Based on CEB's supply cost taken as Rs. 3.00 per kWh

2 Based on 1993 market prices

the energy consumer to acquire the correct technology for his requirement and enjoy the benefits. Like any other programme, implementation of energy efficiency programmes are also influenced by many factors. This paper examines some of the less obvious factors effecting the implementation of energy conservation programs in the industry. Much of the contents of this paper are drawn from the field experience the author has had while promoting energy conservation in industry.

## 2. Misconceptions

According to observation made by EMC, it is a wide spread belief in the industrial sector of Sri Lanka, that the technological factors alone determine the success (or failure) of any energy conservation programs. This is not only incorrect but misleading too. Beliefs of this nature has, insidiously, carved out a notion - more or less a psychological fear - in the minds of many industrialists that energy conservation is too complicated and too technical an issue to be treated as any other business matter. The situation is aggravated as majority of the key decision makers in industry have only a limited knowledge on the utilisation of energy in general and on the efficient use of energy in particular. Such wrong perceptions and ill feeling on the utilisation of energy have turned investment on energy conservation more risky. This fact, together with other complementary issues (which are to be discussed in the following chapters), have effectively lowered the motivational strength of energy conservation amidst other competing business issues. Accordingly, many energy conservation projects are unable to command a high degree of priority in the business environment and consequently do not receive sufficient commitment from the management for the successful implementation of the project.

Unless misconceptions are removed and the path is cleared of such obstacles, the real benefits of energy conservation efforts would be difficult to realise. Confidence in undertaking energy conservation projects need to be established in the minds of industrialists by reducing the investment risks, increasing the awareness and knowledge, etc. Also steps must be taken to increase the motivational strength of energy conservation, at least on par (if not above) with other business issues, so that it could be identified as another business problem.

## 3. Management Commitment

Like any other area of management, success in energy management too comes through commitment. Management commitment is an essential pre-requisite for implementing energy conservation programmes. According to field experience of EMC, many medium and small industries in Sri Lanka show serious lack of commitment towards energy conservation. This has been demonstrated by lack of knowledge, accountability, action and involvement, on the part of industrialists, in conserving energy, although the Sri Lankan industrial sector faces a growing energy supply and utilisation problems. They do not perceive energy conservation as a strategic option for the industry to increase profitability and competitiveness. Judging from the intensity of advice sought from and the number of energy efficiency improvement assignments, including energy auditing, undertaken by EMC during the past decade, it is very clear that there is a growing need for conserving energy in the industrial sector (also in the commercial sector for that matter) of this country. Poor management commitment to

pursue the matter, however, slowed down the implementation process and, therefore, only a little has been realised of the achievable energy conservation potential. For instance, during the past decade more than 250 small and medium industries sought advice on energy efficiency and related matters from EMC, but those who actually committed to proceed with energy conservation programs amounted to less than 30%. Moreover, of those industries which got the energy audits done, only about 10% actually implemented the energy conservation measures. This shows that there is growing interest and potential need of conserving energy in the industrial sector, but poor motivational strength of energy conservation has failed to generate sufficient commitment required to pursue the matter. Figure 2 shows the results of a survey conducted by the author in an attempt to ascertain the degree of management commitment towards energy conservation in the industrial sector. The relative strengths of attributes which measure the degree of commitment towards energy conservation argue well for the slow progress of the industrial energy conservation process.

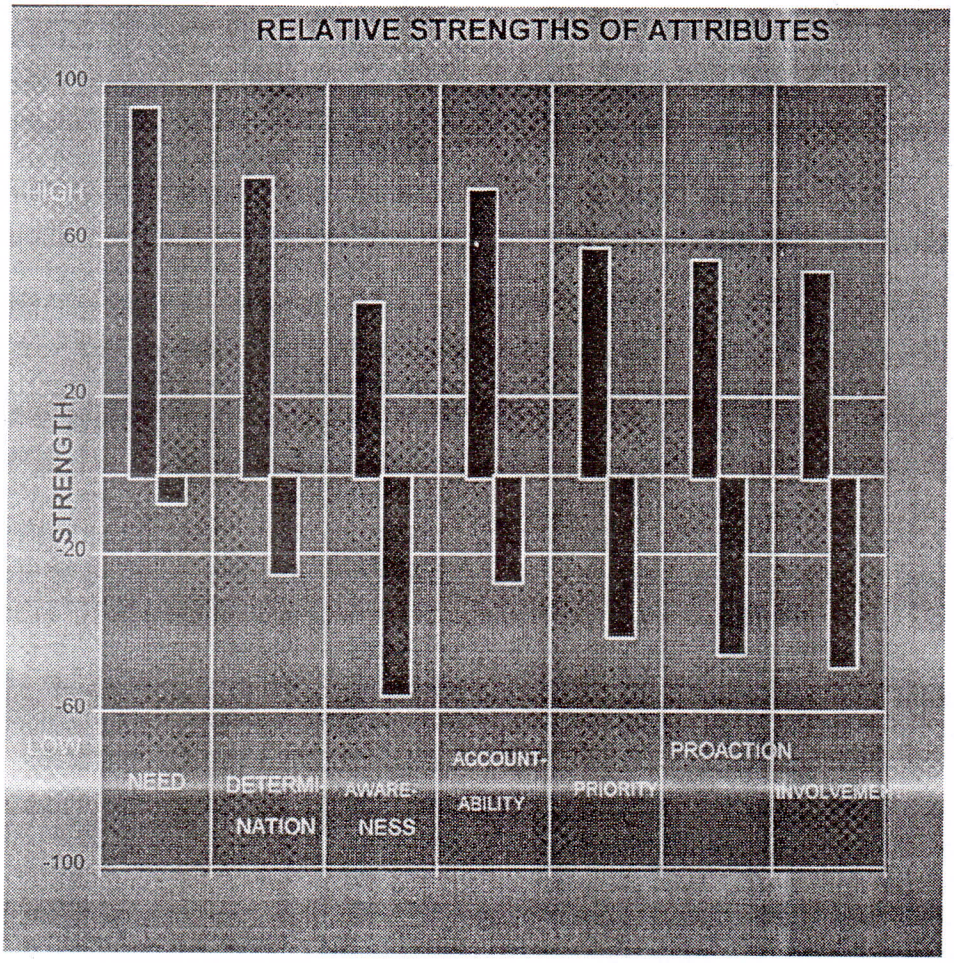


Figure 2

## 4. Poor Or Complete Absence Of Preventive Maintenance

Efficient maintenance of plant and equipment is a pre-requisite not only for meeting production targets but also for utilising scarce resources efficiently. Poor or improper maintenance of plant and equipment result in wastage of resources and energy is perhaps the most scarce and dynamic resource that is affected due to this. In an industrial environment, flaws or inefficiencies in energy usage caused due to poor maintenance are hardly recognisable and the problem could persist for a long time incurring substantial energy losses. Only regular preventive maintenance can prevent this and save the precious energy.

According to observations made by EMC during energy auditing work, at least 80% of the industries audited did not have proper maintenance programs for their plant and equipment. Majority of them relied on break down repairs and actually did only adhoc maintenance work, which situation invariably created ample opportunities for precious energy to go down the drain. Such situations are characterised by frequent break down of machinery, unduly long waiting time for replacement parts and for attending repairs, quick and low quality work, low operating efficiency, etc. The result is drop in energy utilisation efficiency of industrial plant and equipment and of the factory as a whole. Wastage of this nature become quite obvious and considerable in thermal energy applications. Live steam leaks, damaged insulations, malfunctioning of control valves and units, broken and choked equipment, etc. are a common sight in many industrial installations. Damaged or incorrect metering devices, defective control systems and malfunctioning of energy conservation systems (for example out of tuned burners) are also abound even in so called better managed and maintained industries. According to EMC's estimates more than 50% of the thermal energy wasted in the industrial sector is due to lack of a proper maintenance program. There are no technical barriers to correct this situation and to minimize energy wastage. Technologies for maintaining plant and equipment and designing preventive maintenance programs are well developed and skilled people are available to implement them. What is lacking is organizational commitment to design and execute a proper preventive maintenance programme.

Prevalence of this situation in the industrial sector leads to other conclusions as well, viz. It might be that the industries could still survive and remain competitive in the present economic climate without recourse to any structural changes in their engineering function (which include maintenance). It might be that industrialists are not truly convinced of the real economic benefits that are accruable through good preventive maintenance program. It might be that the cost of energy is a small portion of the total operational cost, so that cutting energy cost is not an attractive option to reduce total operational cost. Incidentally, in majority of medium and small scale industries the share of energy cost vary from about 3% to 10%. But, in some medium scale industries where energy cost is about 15% to 25%, for example in spinning, the situation is no better.

## 5. Energy Pricing

In economics, pricing is an effective tool for controlling the demand of a commodity and

the degree of control depends on the elasticity of the demand with respect to price changes. Industrial energy demand exhibits somewhat an inelastic behaviour to price escalations. To price increases in energy, the consumers may respond initially by reducing the consumption, but will soon comes to normal as the reduction in energy usage tend to effect the day to day operations. Increased energy costs, in the absence of the proper energy saving programme, are usually passed down to the consumer by way of increasing the price of consumer goods. Hence, profitability is not seriously affected by energy price hikes. Therefore, energy pricing itself may not be an affective tool in reducing the demand for industrial energy without affecting the industrial production.

Nevertheless, energy pricing could be very effective in switching among alternative energy sources, so that an economical energy mix could be reached with increased (or decreased) utilisation efficiency. In addition, energy pricing, if coupled with energy conservation, could be used very effectively to improve industrial energy productivity - it is more sensible to talk about energy productivity than energy saving in the industrial sector. This is, perhaps, the only meaningful way the industry could adjust themselves to the increasing energy costs. To realise this, energy price structure must be such that it should encourage industrialist and highlight opportunities to conserve energy and control energy costs. Investment opportunities are appraised on the relative strength of the accruable economic benefits and the choosing of a suitable investment opportunity is based on opportunity costs. Energy conservation projects, therefore, must have attractive returns, which are often a function of energy cost, at least on par with other investments options (if not above), if they are to command priority.

Energy pricing structure in Sri Lanka lacks the power to motivate the industrial energy consumer to take into energy conservation, seriously. Inadequacy of motivational strength of tariffs towards energy saving is prominent with respect to electrical energy. Although there are deferent tariff systems designed and made available for the industrial customer many of them are not persuasive enough in energy conservation point of view. For example, the "Time of Day Tariff", designed specifically to encourage the industry to minimise the usage of electrical power during the national peak hours (6 pm to 9 pm) has a basic structural deficiency, because of which the tariff fails to motivate majority of industrialists to invest on minimising the peak hour power consumption. The main attraction of this tariff is the reduction of the kVA charge by almost 50%. What is expected in return is the reduction in peak hour demand which is normally achieved by improving the power factor of the installation. On the other hand, the implementation of this tariff allows industrialists to opt for it without any obligation to reduce the peak hour demand. What goes wrong with this tariff is that once in this tariff the investment on the power factor correction become non-viable because then the return on investment, which is calculated at reduced rate of kVA, becomes so small and the payback period extends beyond acceptable limits. In such a situation industrialists do not go for power factor improvement and as a result kVA does not reduce. It is rather ironical that this tariff offers a windfall to those industrialists who operate only the day shift because they can obtain the highest direct financial saving by simply converting into it without any

investment to reduce the demand. What happens here is that the direct financial gains from converting to "Time of Day" tariff cannot be considered as a return from power factor correction. According to EMC, those industries having less than 12% electrical energy consumption during peak hours can benefit by this tariff without reducing the demand.

One method of alleviating this problem with the "Time of Day Tariff" is to tie it up with power factor. If, for example, the scheme is such that any one who maintain the power factor $\geq 0.9$ would become eligible for this tariff, then this would encourage industrialists to go for the power factor correction and thereby reduce the maximum demand. In this case the return on investment for power factor correction includes the direct financial gains obtain by converting to "Time of Day" tariff and then the investment become attractive. This will give benefit to both of the supplier and the consumer of electricity.

## 6. Lack Of Awareness

When people know better of something they tend to take control of it. Likewise, when people know little about energy and its utilisation they tend to lose control of it and result in wastage. A situation similar to this prevails in the Sri Lankan industry, where awareness on energy and its efficient utilisation is incredibly low. This is what EMC has experienced mostly when assisting industrialists to conserve energy.

The problem is not confined to one category of employees, but prevails at various levels of the organisation from top to bottom. The situation is more serious than one would imagine. For instance, in many instances the management is often unaware of the energy prices at which they purchase them. For example, in one company, which the EMC audited, had been paying for electricity at a higher rate than they had been contracted to pay. As a result, the company had paid over the years, several millions of rupees over and above what should have been actually paid. No one recognised the error which was there from the inception of the factory. In another incident, a live steam line was kept open constantly by the boiler operator just to maintain the service steam pressure to suit an end user. The overall thermal efficiency of the plant was estimated to be less than 5%. The strange thing was that everybody was happy as the boiler operator was able to provide the steam requirement without interruption, but no one recognised the utter wastage of precious energy and money.

According to observations made by EMC, the operators of all plant and equipment are trained only on the operational aspects of the machines. No training whatsoever has been given to them on the utilisation of energy with respect to those machines. A common operational blunder made with respect to the running of a boiler plant is the adjustment of the combustion air by looking at the smoke in the chimney. Smoke is a problem generally caused due to incomplete combustion of fuel. But, without investigating into the causes of this problem the smoke is diluted by adding more combustion air so that the smoke problem is camouflaged. The result is drop in combustion efficiency and loss of large amount of energy. Also, EMC has come across cases where steam traps are bypassed and opened to atmosphere when the equipment failed to build up temperature. Also, sending condensate to drain is a common sight in many industries. All these are problems due to lack of awareness and

inability to recognise the value of energy wastage.

### 7. Poor Financial Incentives

Fiscal incentives (or dis-incentives) are provided when government wanted to motivate people to do what is desirable in an economic point of view. Import duties, subsidies, bank lending rates, tax holidays, etc. are suitably manipulated to encourage (or discourage) investments in some branches of the economy. Although, such incentives are abound for many economic activities, there is hardly any available for promoting energy conservation. Many medium and long term energy conservation measures require some capital investment, but inadequate financial incentives keep industrialists away from undertaking these projects. Moreover, since energy conservation investments are, inadvertently, put into the high risk category, industrialists are reluctant to borrow money at prevailing high interest rates for the implementation of such projects. To make energy conservation projects attractive and less risky, tangible financial incentives must be provided for procuring necessary material, equipment, etc., required for implementing such projects. Failure to provide financial incentives for such materials as efficient energy conservation equipment, insulations, energy efficient lamps, energy metering and monitoring equipment, power factor correction equipment etc. can retard the energy conservation process. More recently, Ceylon Electricity Board has been able to sell energy efficient Compact Fluorescent Lamps at a reduced price due to the granting of such financial incentives.

Also, energy efficiency could be a criteria for evaluating tenders for procuring equipment and machinery which consumes energy. This pro-active measure will help address the energy problem at the beginning of an investment and eliminate meddling with unforeseen energy consumption issues at a later stage.

### 8. Non-Availability Of Standards For Monitoring Energy Performance

Standard norms are widely used in industry for monitoring performance. They are also used as indicators of efficiency of utilisation of input factors of production. Presently, it forms a powerful management tool for controlling costs, reducing wastage, optimising resources, obtaining quality product, etc.

Standard energy consumption figures and industrial norms for energy efficient operations are not available for Sri Lankan small and medium scale industries. When it comes to monitoring of performance, energy is normally a neglected area. In the absence of comparative performance figures of energy consumptions, industrialists are not encouraged even to measure their own performance levels. As such industrialists have no basic data or information with respect energy consumptions, except those maintained and provided by the energy suppliers for billing purposes. Without knowing the own performance level and the industry standards in respect of energy consumption (or any determinant of energy consumption; for example equilibrium moisture content in drying materials), industrialists are unable, in the first place to see any energy conservation potential and secondly to set an realistic energy conservation targets. When there are no achievable targets it would be difficult to organise and implement an energy conservation programme.

Industry norms are also indicative of the development of technology and, therefore, norms are revised upward regularly with the development of the technology, especially energy efficient processes, equipment, etc. Since Sri Lankan industrialists are not conscious about energy standards they are slow to acquire new technologies, processes, equipment etc. which are energy efficient. In the international scene, norms for energy consumption and for other parameters related to energy efficiency are widely available and are often used to improve energy performance on regular basis.

## 9. Conclusion

Sri Lankan industrial sector is yet to show firm commitment towards energy conservation. Although there is a greater need for reducing energy costs, lack of management commitment has slowed down the realisation of potential energy savings. Therefore, energy problem must be presented in a more convincing manner and issues should be forceful and attractive enough to draw the attention of industrialists and enable them to look at the problem more meaningfully.

To generate management commitment towards energy conservation, the motivational strength of energy conservation options must be increased and return on such investments must compete with other business investments. To do this, it is important to identify all factors inhibiting the progress of energy conservation projects and suitable remedial action taken to reduce their effect. Fundamental issues such as misconceptions, lack of awareness, poor maintenance of plant and equipment, purposeful energy pricing, non availability of industry standards, etc. must be accorded high priority and steps must be taken to minimise or eliminate their ill effects.

## References


1. Gamba, Julio; A Caplin, David; J Mulckhuyse, Jhon; "Industrial Energy Rationalisation in Developing Countries", World Bank Publication, Jhon Hopkins Univercity Press, Baltimore, Maryland, USA, 1986.

2. Heslop, Peter, "Training Staff to Cut Energy Costs", St. Edmundsbury Press, Suffolk, 1986.

3. E James William (Edited by), " Energy Conservation in the Asian Region", APO, 1986.

4. Harris Peter, "Preparing the Company Energy Plan", St Edmundsbury Press, Suffolk, 1986.

5. Annual Report, Centrel Bank of Sri Lanka, 1983.

6. Review of Economy, Central Bank of Sri Lanka, 1983.

7. Energy Audit Reports, Energy Management Centre, NERD Centre, 1986-1994.