CHAPTER III

AN OVERVIEW OF CONCEPTS, REVIEW AND APPRAISAL OF LITERATURE

Introduction

The purpose of this chapter is to provide the researcher with background information on the contemporary studies on SMEs, impact on economic reforms, performance parameters, energy efficiency indicators, energy efficiency barriers and policy instruments along with the growth and development of tile industry in Kerala, wherein the present investigation starts. The intention of this chapter is not to furnish a detailed account of energy management in SMEs and development of tile industry, rather the purpose here is to familiarise the researcher with selected aspects of research on these areas undertaken by researchers of different kinds, which are very important to understand the nature, scope and significance of energy management in SMEs, with specific reference to the tile industry. In addition, descriptive and documentary materials are presented here to gain insights into the different studies related to energy management in SMEs.

Overview of concepts

The major concepts used for this study are:

- **Asset turn:** Ratio of annual sales to total assets
- **Burnt tiles:** Baked tiles that are ready for sale
- **Clay:** Sand having plasticity, porosity and flexibility that can be used for production of tiles
- **Contribution:** Difference between sales and variable cost
- **Energy cost:** Expenditure of the tile unit on items like firewood, sawdust and electricity used in the factory
- **Energy efficiency index (EEI):** Quantity produced (in grams of tile, g) per unit of energy (kJ), expressed as g/kJ; a more energy efficient factory having greater EEI; Inverse of specific energy consumption
- **Fixed capital:** Current market value of fixed assets, excluding land ft building is fixed capital
- **Fixed cost:** Cost which does not vary with the volume of production
<table>
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<tr>
<th>Green tiles:</th>
<th>Tiles formed into shape but not yet fired</th>
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<tr>
<td>Labour cost:</td>
<td>Wages paid to all labourers, both skilled and unskilled and those who are directly involved in different unit operations in the factory and in the divisions like administrative, marketing, transport, etc.</td>
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<td>Labour productivity:</td>
<td>Contribution per employee</td>
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<td>Profit margin:</td>
<td>Ratio of profit to sales</td>
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<td>Profit:</td>
<td>Difference between total revenue (annual sales) and total cost. Total cost consists of all direct and indirect expenses incurred for production and sale of tiles, including the sales promotional expenses</td>
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<td>Raw material cost:</td>
<td>The expenditure on clay, soil, sand and water</td>
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<td>Return on total assets:</td>
<td>Ratio of profit to total assets</td>
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<td>Sales:</td>
<td>Total value of tiles sold in the reference period</td>
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<td>Specific energy consumption (SEC):</td>
<td>Energy (in kilo joules, kJ) required to produce one unit of product (in kilogram of baked tile, kg), expressed as kJ/kg; lesser the SEC, better is the energy efficiency of the factory</td>
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<td>Variable cost:</td>
<td>Cost which varies almost in direct proportion to the volume of production or sales</td>
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**SMEs, Economic reforms and Performance parameters: Some Reviews**

Small and medium enterprises occupy a crucial position in the Indian economy because they not only contribute to GDP, income, exports and employment but also imply self/group initiative, self-employment and small livelihoods, and small business (Neela Mukherjee, 2002). And it is important to create and ensure space and more opportunities for such a sector given three things. One, the bogey of unemployment in India, two, the structural changes which are expected to come about in salaried and wage employment in the coming years due to disinvestment and privatization/liberalisation policies; and three, the uncertain environment faced by the SME's in today's world. Patrizio Bianchi (1997) while studying the Italian SMEs argues that the development of SMEs must be considered primarily as a spontaneous phenomenon - guided, but not determined by policy interventions. The formation of SMEs is largely due to free individual choices in social and economic contexts often dominated by uncertainty.
Till the opening up of Indian economy in 1991, through liberalization-privatization-globalisation (LPG), these SMEs, particularly those in the SSI sector and loosely classified under the rural/ traditional industry category were all enjoying the protectionist industrial regime of the Central and State governments. Though it was a known fact that without modernization and quality improvement coupled with cost reduction efforts, it would be difficult to survive in the globalised economic environment, there was complacency in preparedness by many industries and for a pro-active intervention in this direction by the good number of public institutions created for the upliftment of SSIs. With the arrival of better quality products at lesser price to the domestic market due to LPG and consumers preferring the same, the local industries started feeling the pressure to compete in the market. Indian economic reforms of 1991 represent a radical shift from the dysfunctional (Srinivasan, 2001) development strategy of the previous four decades. The pre-reform strategy pursued import substituting industrialization, with the state playing the dominant role in the economy. Its foundations were laid prior to independence and attracted wide support across the political spectrum. Though the two committees appointed by the government to study the issue on dereservation of products for production by SSI seem to have come to diametrically opposite conclusions, the progress has been glacial. The Abid Hussain Committee of 1997 recommended the abolition of reservation on all of the 800-odd products then reserved exclusively for SSI units. A new study group appointed by the Planning Commission in May 1999 is apparently in favour of retention of reservation for many products.

In order to help the sector integrate with the industry at large within the liberalized economic framework, the Government of India has announced new policy measures. In the present context, the following are of particular interest as announced in the year 1991:

- The investment ceiling for the purpose of definition of a small unit has been raised to Rs. 6 million (Rs. 7.5 million if the unit concerned undertakes to export 30 percent of its output or if it is an ancillary unit i.e. a firm supplying at least 50 percent of its output to large scale industries),
- Other investors (including large scale enterprises and foreign investors) are now allowed 24 percent equity participation in a small scale unit
The Act on Delayed Payments to Small and Ancillary Enterprises has been promulgated. Under this act, buying/mother units will be required to pay interest on delayed payments for supplies bought from SSI units if the payments are delayed beyond the negotiated and agreed upon time period.

The Reserve Bank of India has announced a package of measures to ensure a better flow of credit to the SSI through measures such as expansion of 'single window' loan scheme. Banks are encouraged to open specialized SSI branches and to give greater priority to the sector in their annual credit budgets.

Access to inputs has been improved by giving SSI priority to allocation of iron and steel from public sector undertakings and by removing obstacles to imports of a range of raw materials and intermediate products.

The Asian crisis taught many costly but valuable lessons (Manu Leopairote, 1999). The World Bank noted that debt-financed investments created excess assets, high fixed costs and low margins. For SMEs in particular, cost structure is indicated by high fixed costs, low asset utilization, wide product lines and declining demand. With the inevitability and even the realization of trade liberalization and globalization, SMEs must learn to face the challenge and be ready for competition. Pressures and lobbies from domestic industries to preserve sacred turf are expected. Despite five governments in the 1990s, India's average GDP growth was 6 per cent per annum, compared to 5.5 per cent in the 1980s. For three halcyon years (1994-95 through 1996-97) GDP growth exceeded 7 per cent and peaked at 7.8 per cent in 1996-97. Unfortunately, growth has slackened since then - to 4.8 per cent in 1997-98, 6.6 per cent in 1998-99, 6.4 per cent in 1999-00 and 5.2 per cent in 2000-01.

A consolatory feature of the post-reform employment scenario is that the pace of employment growth in the manufacturing sector did not witness a serious setback, both for rural male and female workers, as was widely feared to be happening when rural industry would start facing competition not only from urban industry at home but also from abroad, under the liberalised trade regime of the nineties (Chadha, 2002). On the whole, the process of structural shift of the rural workforce from agriculture to non-agriculture sectors has been operating highly unevenly among the states, both during the pre- and the post-reform periods, but has tended to widen in recent years. For example, the proportion of rural workers engaged in the non-farm sector varied sharply from 10.1 per cent in Madhya Pradesh
to 44.0 per cent in Kerala, during 1993-94, and from 12.8 per cent to 51.5 per cent, for the same two states, during 1999-2000.

In an interesting study by Deo Sharma, Hans Jansson and Saqib (2000) on the role of the Indian bureaucracy in Industrial Policy implementation, it is pointed out that in the bureaucracy is more or less an independent power and pursues its own ‘rules, regulations and procedures’. The purpose of the bureaucratic actions is to gain access to legitimacy and this is achieved through rule following. Behind the scene, however, Indian bureaucracy pursues a number of goals and aims of its own, only a few of which are overt and visible. This is made easy as the responsibility and the authority structures deviate. Those with the authority to make decisions are not responsible for the outcome. This allows the bureaucracy wide latitude in decision making and pursuing its aims. In this process decisions are delayed, if these are ever made. Moreover, ‘incorrect’ decisions are not uncommon.

An industry’s or an industrial sector’s performance can be seen in different ways depending upon the objectives in mind. Profitability has been recognised as the main indicator of financial performance in the case of private sector. On the other hand, economic performance can be studied in terms of productivity, efficiency, technology and technical progress. There can be other measures of performance from the national economic and socio-political viewpoint. For instance, even while a company makes handsome profits, if it is achieved by neglecting the interests of labour, consumer and the environment at large, the costs to the society can be enormous. From a specific region’s point of view, the location of a project in an area with poor infrastructure and providing employment to local population can be considered an achievement by itself. Similarly, contributing to a country’s exports and net earning of foreign exchange can be an important consideration for an economy suffering from huge external debt. Just as there is no single criterion for judging performance, performance in turn, in whatever manner it is measured, can be influenced by a number of factors. For instance, studies on profitability have used size, market share, capital-output ratios, foreign ownership, technology imports, age, advertisement intensity, other entry barriers, etc. as explanatory variables. In turn, profitability ratios were used as explanatory variables along with some of the above, to understand the differences in growth, investment, pattern of financing, etc., implying simultaneity in their
relationship. Following are the financial ratios used as a means of evaluating the profitability of a firm.

(i) Return on Assets (ROA)
(ii) Gross Margin on Sales (GMS) and
(iii) Sales to Assets Ratio (SAR)

ROA represents a measure of business performance which is not affected by accounting and financing modes. ROA takes the total firm concept and looks at how effectively a company has utilised its resources irrespective of the source of finance i.e., internal or external. The second measure namely GMS is an indirect measure of cost competitiveness. SAR calculates the total sales for each rupee of asset a company owns. It measures a company’s efficiency in using assets.

Many of the studies on productivity in Indian manufacturing are based on the data provided by Census of Indian Manufacturers and Annual Survey of Industries (ASI). Company level data is also used to study trends in productivity and related issues. Company level data offers some additional advantages as one can use certain firm-specific characteristics in explaining the trends. For instance, the relationship between technology acquisition and productivity growth in large manufacturing firms and the effects of technology transfer by examining the productivity trends were studied. ICICI brought out a study on productivity changes in the companies assisted by them by using aggregate data for the assisted companies.

Productivity is going to be a determinant of success. However, the changing nature of business and its organisation as well as the changing nature of the markets require new concepts of productivity, its improvement and management. Many considerations are possible in terms of defining and measuring productivity. Marc Vollenweider et al (2003) propose a conceptual framework that is quite different from existing approaches. It makes the case for looking at productivity along two very different dimensions: Efficiency and Effectiveness. While efficiency reflects the existing definition of ‘productivity’, i.e. an input/output relationship, ‘effectiveness’ widens the concept to reflect discontinuities such as new business models, disruptive products and technologies and the like. The importance of ‘effectiveness’ has increased strongly due to the increase in speed of innovation. Especially in the knowledge economy, the intangible factors such as knowledge, information, motivation, creativity and innovation play an important
role in managing ‘effectiveness’. Companies need to address efficiency and effectiveness concurrently, but a large part of managers may not have the necessary skills in such a dynamic environment.

Two types of efficiency have been highlighted and measured in economic literature. Allocative efficiency involves effective factor use in relation to factor prices which ensures that there is an optimal allocation of resources. The producer under such circumstances reaps maximum profits. The Cobb-Douglas production function has a built-in structure that ensures allocative efficiency provided that a sufficient condition is met. The requirement is that the factor shares of the two inputs are positive. Assumptions (i) and (ii), stated earlier, in the context of the C-D function, along with an empirical finding of positive factor shares ensures allocative efficiency.

Another concept of efficiency is called technical efficiency. There are two dimensions to this concept. In a static sense, the level of technical efficiency measures the amount of output that is not directly due to the existing level of inputs. It can be measured through a C-D function in terms of the intercept.

Theory of energy conservation

With the discovery, between 1845 and 1847, of the principle of conservation of energy during its transformations, the importance of energy in human life and progress was fully recognized, and scientists gave energy the romantic name of the “Queen of the World” (Alekseev, 1986). Theory of energy conservation or the First Law of thermodynamics states that energy can neither be created nor be destroyed but can be converted from one form to another. Having noticed that all forms of energy convert into heat which is shared with colder bodies and dissipates afterwards in the environment, where it then radiates into outer space, scholars discovered entropy, a measure of the degradation of energy, twenty years later. The more energy degrades the higher level of entropy.

A change in energy \( \Delta E = E_1 - E_2 \) in an isolated system indicates the maximum amount of work \( A_{\text{max}} \) that the system can theoretically produce in transition from state 1 to state 2. A change in entropy \( \Delta S = S_2 - S_1 \) represents the store of energy \( \Delta E \) converted into heat and dissipating, i.e., \( Q_0 = T_0 \Delta S \). Under real
conditions of transition and at $T_0$ ambient temperature, this store diminishes the amount of the actual work $A_a$ to $A_{max} - T_0 \Delta S$. Thus the change in entropy characterizes the amount of energy degradation in the process of transformation. The total amount of heat $Q = \int T \, d\Sigma$ that expresses the ‘loss’ of energy depends upon the process in progress. Both the amount of heat that (a) dissipates as a result of direct heat exchange between the system and the environment; and (b) released and dissipates as a result of friction, depend equally on that factor, i.e., the process in progress. Thus the actual value of work also depends on the process and is always less than the maximum value, i.e., the change in energy in the system. Since all real processes are accompanied by friction and heat exchange, entropy continuously increases.

Attempts to reduce this heat loss to the surrounding by reducing the frictional force (for example by proper lubrication on the rotating shaft) and heat exchange to the surrounding (for example, by proper insulation on the kiln walls or technological change from the incandescent lamps producing good amount of heat along with light to the fluorescent ones with less of heat generation) is informally or casually termed as energy conservation measures or energy efficiency enhancement options or energy loss mitigation actions. In fact, a natural process of energy concentration and entropy decrease is currently occurring on the Earth. In the process of photosynthesis the dissipated energy of solar radiation is transformed into the concentrated chemical energy in green plants. A further decrease in entropy occurs in animal and human organisms, the most sophisticated systems on Earth, during food digestion and assimilation.

**Energy efficiency indicators**

Energy intensity indicators measure the quantity of energy required to perform a particular activity, such as the production of output. Energy efficiency is effectively the inverse of this ratio, but aims to measure ‘how well’ the energy is used to produce output. The calculation of indicators, either in physical or monetary units, varies according to the nature of the analysis to be undertaken. Generally, indicators calculated in monetary units are applied to the analysis of energy efficiency at a macro economic level, while energy efficiency indicators denominated in physical units are more suited to detailed sub-sectoral analysis. Energy efficiency indicators perform a variety of functions, ranging from the
monitoring of energy efficiency, through to policy analysis and evaluation, and the appraisal of new technologies (Alastair Stevenson, 2000). However the usefulness and effectiveness with which energy efficiency indicators can be used is subject to a number of stipulations, particularly in relation to the availability and quality of data.

Energy efficiency indicators can be generated according to many different formulations, each of which can be used to answer specific or general questions related to energy efficiency. Determining the appropriate level of detail for the construction of energy efficiency indicators needs to reflect the goals of the specific analysis. Indicators can be denominated in either physical units, where energy is directly related to the physical quantity of output, or alternatively in economic terms, where energy consumption is linked to the monetary value of production.

Physical indicators calculate specific energy consumption relative to a physical measurement of production, such as tonne of product. The advantage of physical indicators is that there is a direct relationship between the indicator and the energy efficiency technology. For example, improvements in technologies will be indicated as savings in the specific energy consumption, and result in an indicator that assesses a lower specific energy requirement per tonne of output. Since physical energy efficiency indicators are necessarily applied to the analysis of energy efficiency at less aggregated levels, problems associated with the structural effects lessen. However, to the extent that the product mix and energy source vary, some structural inconsistencies may still exist.

Value based indicators measure the quantity of energy consumed relative to the economic/monetary value of the activity generated, denominated in a currency related unit, for example the quantity of energy consumed relative to the value added of steel sector production. Rather than expressing the output as a measured quantity, such as tonnes of steel, the value associated with production is measured generally in a monetary unit. The key advantage of using economic value based energy efficiency indicators is that indicators can be compared across industries since the denominator (monetary value) is similar even though dissimilar products are produced. As energy efficiency indicators are constructed at more aggregated levels, economic energy efficiency indicators become increasingly common.
Measurement problems are also prevalent in many developing and centrally planned economies where some activities, such as barter, are significant and not included in GDP measures of value added. The methodology for examining techno-economic effects focuses on an assessment of the technical and behavioural energy savings achieved, and their contribution to the changes in energy consumption. These energy savings are aggregated from individual energy savings calculated at a detailed (disaggregated) level. Energy savings are calculated on the basis of variations in energy performances compared to a base year, with the level of activity and structures of the current year.

ADEME (1999) suggests the following three complementary alternatives for comprehensively reviewing trends in energy efficiency at a sectoral or sub-sectoral level.

Energy Intensity: Energy intensities consider whether energy, as an input to production, is used efficiently. Energy intensities analysis is generally based on relative comparisons with established benchmarks, historical trends, or other comparable energy intensities.

Techno-economic ratios: These ratios calculate, from an engineering perspective, the economic production associated with the unit or specific consumption of energy.

Energy savings indicators: These indicators endeavour to measure energy savings achieved by consumers over a period. These ‘techno-economic effects’ essentially analyse changes in the techno-economic ratios.

Emphasis on energy efficiency as a component of energy policy increased substantially following the oil crises in 1973-74 and 1979-80. At the same time, the use of energy efficiency indicators by policy makers for the analysis of energy efficiency also increased. Energy efficiency indicators allow policy makers to:
- define and monitor energy efficiency targets;
- evaluate the effectiveness of programmes designed to enhance energy efficiency;
- develop energy policies that respond effectively to changes in energy efficiency;
supplement energy demand and supply forecasts with energy efficiency information;

develop intra and inter economy comparisons.

Changes in energy efficiency indicators can also be attributed to improvements in energy technologies. By monitoring energy efficiency indicators, policy-makers can determine the overall influence of the new production technologies on levels of energy consumption. As the emphasis on energy efficiency has increased, the desire to compare indicators of energy efficiency within and between economies has also increased. Comparisons of energy efficiency indicators can be used as a basis for evaluating the relative strengths and weaknesses of respective energy efficiency policies, identifying improvement potentials, and developing reasonable policy objectives.

Although such comparisons are desirable and justified, in practice the difficulty of constructing truly comparable indicators will, in most cases, limit the analysis. These difficulties arise from inconsistencies in a range of factors that influence the measurement of the energy efficiency indicators. For example, differences in the economic structure, resource base, prevalent technologies, data measurement techniques, as well as geographical and climatic considerations. Various data and indicator adjustments can be used to overcome these difficulties, such as the denomination of a common currency unit or standardisation of annual heating days.

Energy efficiency indicators can be very useful tools in evaluating the success of energy efficiency policies and programs. When the oil crisis hit in the 1970s, energy conservation and energy efficiency were topics of significant interest to the public, industry and policymakers. During the period from the mid 1970s until the mid 1980s, energy efficiency policy programs and technological advances contributed to a substantial decline in energy intensity in almost all sectors of the economy in the developed world, as well as fundamentally influencing energy consumption patterns in developing economies.

More recently, concerns about greenhouse gas emissions have largely replaced concern for energy efficiency improvements. Today, sustainable development is becoming an important public concern, and improvements in energy
efficiency may become an important goal within that context. There are, however, a number of barriers to the implementation of energy efficiency programs, and a number of possible policy options.

Technical/ Energy efficiency of SMEs: Some Reviews

Energy efficiency refers to activities or programmes that are aimed at reducing the energy used by specific end-use devices (technologies) without affecting the services provided. They reduce overall energy consumption without any adverse effects to the services rendered. Examples would include high efficiency appliances, efficient lighting programmes, high-efficient heating, ventilating and air conditioning systems or control modifications, efficient building design, advanced electric motor drives, heat recovery systems, etc. The World over, people and institutions are known to generally waste energy in their daily activities. This makes them end up paying large utility bills that may be avoided. In small-scale enterprises, cost reduction has become the most critical factor in generating profits or even for the very survival of a business when one considers the stiff competition in the market. Often SMEs, in this liberalized era, find themselves pre-occupied with looking for various new avenues of cutting down costs. An area where significant cost reduction is possible, though often overlooked, is in the field of Energy Efficiency. In many developing countries, including India, this attractive cost saving opportunity has not received the kind of attention it deserves. This is partly because in the majority of the Small-Scale Enterprises, energy costs are not itemised on their own in the accounting records but are hidden under various budget heads and sections. This makes the impact of energy costs and its cost-saving potential not to be realised. While supply-side activities have attracted the most attention in the planning of the Energy Systems, both energy supply and energy end-use technologies are required to obtain an energy service. The provision of energy services can be costly. Hence the need to utilise available options for improving the efficiency of service delivery to small-scale enterprises.

For the customers, EE helps to:

- Satisfy needs by availing energy which would otherwise be wasted;
- Reduce costs since the same or even more work is done with less energy;
o Maintain or even improve lifestyle and productivity because energy is made available when required and less money is now spent on energy whilst savings made are used for acquiring more wealth;

- Reduce the negative environmental impacts of energy consumption when the usage is rationalised

For the society, EE assists in:

- Creating jobs by eliminating energy shortages which keep industries and commercial activities running at or near full capacity;
- Reducing pollution due to less greenhouse gas emission into the atmosphere;
- Conserving resources because less energy is required to do a given job;
- Protecting global environment because less wood or charcoal is used in accomplishing required tasks;
- Maximising customer welfare by alleviating poverty because savings from reduced expenditure on energy is used to improve the standard of living; and
- Increasing competitiveness of local industries

For the utilities, EE:

- Lowers cost and improves value of service
- Improves operating efficiency and flexibility by reducing the peak load
- Reduces capital needs because it is a low cost alternative to construction of power plants

Some of the constraints on Energy Efficiency in Small and Medium Enterprises, as evidenced in the discussions in many energy forums are summarized below.

- The perception of small-scale enterprises management that favours increased production and sales instead of cost reduction through energy conservation and process improvement activities;
- Lack of awareness about energy efficiency benefits, potential, practices, and end-use technologies is common among SMEs, industrial energy users and the general public;
- Lack of skilled manpower with adequate technical, financial, economic, managerial, and energy planning skills to identify and implement specific energy efficiency policies and measures; Manpower problem is one of the main constraints to efficient energy planning and management in small-scale enterprises;
• Lack of financing manifested in terms of shortage of capital available in the local market to finance energy efficiency projects at the national and individual levels;

• Lack of efficient energy end-use technologies in the country encourages small-scale enterprises to import used (second-hand) machinery and equipment, which are normally energy-inefficient;

• Lack of adequate institutional frameworks is an overriding barrier to efficient energy service delivery; and

• Inefficient pricing policies such as in the electricity tariffs that are subsidized for the residential and small-scale enterprises to the extent that they do not reflect real economic costs of service delivery; Invariably, this has sent the wrong pricing signals to these categories of consumers and is likely encouraging inefficient usage of energy.

There is a general hypothesis that the economic reforms launched by the Government of India in 1991 ultimately aiming at enhanced foreign direct investment has resulted in improved technical efficiency of Indian enterprises. However, the evidence from six studies (Siddhartha, 2004) using different methodologies and different data sets do not support the hypothesis relating to an increase in productivity/efficiency in Indian industries consequent upon economic liberalisation. The main gainers of these reforms have been the Multi-National Companies (MNCs) and their affiliates which have better access to technology and other intangible assets. But firms that are stuck with an earlier technological paradigm with large productivity gaps have lost out.

Various semi-industrialized countries found that the efficiency levels of their firms and their ability to adjust rapidly to altered framework conditions and heightened competition were low (Jorg Meyer-Stamer, 2001). When they opened their economies to the international market, business collapses, sometimes even culminating in the demise of entire industries, were not rare. Competitiveness is thus a difficult challenge even for industrially advanced developing countries - the existence of an industry offering random-quality products at high prices in a sheltered domestic market is one thing, the existence of an efficient and competitive industry up to the levels of efficiency and quality customary in the world market is quite a different matter.
Lall and Rodrigo (2000) examine technical efficiency variation across four industrial sectors in India, using a stochastic production frontier technique. The results are comparable to technical efficiency distribution patterns obtained in other countries. The results suggest that managerial effectiveness significantly influences efficiency and that considerable benefits derive from location within established industrial clusters for particular industries. There is considerable room for efficiency gains through better organization and management of production processes and improved supply chain management, even in the highly organized corporate sector. These gains could be achieved by purely internal learning processes with no extra investment in physical plant or equipment, or with the help of outside consultants, or through business alliances with partners from industrial countries (a rising trend). The results also show that greater technical efficiency correlates with better energy use and higher investments in plant management. The major problems identified in the affected (due to economic reforms) traditional industry sectors were the lack of modernisation and development efforts vis-a-vis the rise in operating costs mainly connected with labour, raw material and energy.

Among others, government policy has a major role to play in the promotion of energy efficiency. This is particularly true in the context of small industry because small industry units individually may not take any initiative for enhancing energy efficiency due to either lack of awareness or prohibitive costs or lack of competence. Though Government of India has evolved a comprehensive policy since independence for small industry promotion, the policy emphasis on the promotion of energy conservation and efficiency is not substantial and is largely confined to energy intensive sectors of small industry such as foundry, re-rolling mills, glass and ceramics, etc. To promote awareness among the concerned entrepreneurs, Small Industries Development Organisation (SIDO) has conducted seminars on ‘energy conservation’ and sponsored studies to identify energy efficiency gaps and potential for energy conservation with reference to the energy intensive sub-sectors of small industry.

Leaving alone the efforts to promote energy efficiency in SSI units, even the industry-wise energy consumption pattern of small industry is still not known as no comprehensive study has been undertaken so far. But the few studies that have been carried out with reference to some specific industries did bring out that there is scope for improvement of energy efficiency, which, in turn, would lead to cost
reduction. Manufacturing strategy of most Indian firms is still not addressing certain fundamental issues of competition: need to change product mix rapidly, need to introduce new products based on indigenous R&D, need to use process innovation and quality improvement process to reduce cost of operations and consequently price of product (Pankaj Chandra and Trilochan Sastry, 2002). Absence of serious innovation from the agenda of most firms exhibits an incomplete assessment of the drivers of competitiveness. Investment in tools for the use of new technology, conducting basic research internally and rate of acquisition of technology from external sources is very low.

Analyses by Tan Hong and Batra Geeta (1995) show that mean efficiency levels rise with firm size. However, there is substantial overlap in the distribution of efficiency across firm sizes, with some small firms operating at higher levels of efficiency than some large firms. Thus, small firms are not inherently inefficient. A common set of factors appear to distinguish more-efficient firms from less-efficient firms in all five economies: education and training of workers, low labor turnover, certain investments in technology, exporting, automation, and quality control. As reasons for not providing training, many SMEs cite the low-skill requirements of mature technology and the adequacy of existing skills supply; many others see it as a concern and they rank poor information, limited financial resources, and high turnover of trained workers as significant constraints on training. There are pockets of low-efficiency firms where selective policy interventions to improve firm efficiency may have high payoffs.

While ranking the top three operating costs - materials, labour and energy - in terms of the potential for cost savings, some of the industries have realised that energy often moves to the first priority position. Energy cost could become a major detriment in profitability. However, there are gaps in knowledge of energy management options and its economic impact among the entrepreneurs, planners and policy makers related particularly to the traditional industry sector. Nagesha and Bala Subrahmanya (2006) argues that while the need for technology upgradation to enhance energy efficiency and hence sustainability of SSI clusters is undisputable, this alone cannot succeed in meeting the goal either. But, human resource, economic, organizational and behaviour issues of SSIs also need to be properly addressed for fruitful results. The company culture serves as the general, historically developed background that strongly influences the chances to start
energy efficiency activities (Peter Hennicke, 1998). The all-important topic of quality control is still an issue. For example, drying is one of the areas which still have not got its required attention in spite of much technological advancements in related areas. Proper drying operations still depend on operator expertise (Francois Leger, 2003). Unfortunately problems in modelling the drying process and measuring moisture content still remain to be totally solved. Keeping in mind that most of the producers are SMEs who have invested their own money and who are operating according to the very basic rules of supply-demand, it is difficult to enforce and implement an efficient quality control system (Swiss Centre for Development Cooperation in Technology and Management, 2001).

As regards technology, UNCTAD (1999a) writes that policy makers must “focus on technological capability building as an essential element for sustained competitiveness and productivity of SME’s in an increasingly technology-intensive global economy”. It adds that foreign direct investment can accelerate the process of technological upgrading but it cannot be a substitute for local technological capabilities. UNCTAD (1999b) identifies five core business services representing key strategic element for increasing firm-level competitiveness of SME’s. Such core business services include computer software and information processing services, research and development and technical services, marketing services, business services and human development services. Through common availability of business services, SME’s located close to each other can avail administrative, marketing, purchasing and information services and common computer and technical facilities tailored to meet local needs (UNCTAD 1999b).

Technology should not be seen in isolation from the environment in which it emerges or from the organizational structures in which it is used (Jorg Meyer Stamer, 2001). Technology does not come about in a vacuum; it always develops in concrete social contexts. It is therefore never neutral, and is always developed on the basis of given (economic, social, political) interests. Technological and economic development are linked inseparably - sustained economic growth results in particular from increasing the efficiency of inputs, i.e. from the introduction of new, better machines, through organization improvements, successful learning processes, and enhanced qualifications - in short: through technological progress. There is no doubt today that more than technology and capital are required for dynamic development. Political and economic framework conditions, socio-cultural factors, and an eye for
specific ecological conditions are what decide on the success or failure of
development strategies. That is not to say that technology is a secondary element.
Quite on the contrary, technology is more than ever a central factor of economic
development. Technology is the link between the inputs capital and labor and the
output, the product. Technology can be the lubricant that makes for efficient
production; but it can also be the sand that clogs up the process, causing that, in the
end, what comes out will be less than what went in.

The analysis by Sonali Deraniyagala (2000) reveals that technological
capabilities, as proxied by the formal technical qualifications of the workforce and
of senior managers, also had a positive and significant effect on efficiency. The
analysis of Balasubramanya and Balachandra (2001) revealed that labour skill
levels and owner’s qualification and technology levels are the most important
factors, which determined the level of energy consumption and thereby pollution
levels. Therefore, the pollution abatement measures through efficient use of energy
and materials have to focus on the human resource factor, particularly labour skill
levels, along with the technology factor. The study by Sonali Deraniyagala (2000)
provides strong support for the argument that productivity enhancement in
developing country firms is not merely a straightforward process of purchasing new
technologies and that considerable in-house effort to operationalise these
technologies is required.

Joy Clancy (2003), while, studying the innovation process in small and
medium scale industries in developing countries, taking the briquetting
(densification of biomass) as a case study, finds that the technical efficiency was
found to vary significantly between firms, which can be attributed to the lack of
technological capabilities within firms and weaknesses in the external environment.
Management skills were found to be weak, which has been identified as the major
factor inhibiting innovation within briquetting firms. Entrepreneurs tended to
concentrate on technical solutions, whereas many organisational solutions could
have been implemented at lower cost. In order for a firm to function as an
organisation it has to successfully integrate the various components of its
technological capabilities; technical skills, knowledge and management/
organisational skills.
While analysing for the low productivity for workers in Indian industries compared to workers in other developed countries, a few literature argued that it is the low effort level of the Indian worker, reflecting worker’s relative preferences for low work intensity versus income; also suggest that union resistance to increased work norms was a factor. But Bishnupriya Gupta (2003) argues that nutrition levels and living conditions were such that Indian workers may have been physically incapable of higher work intensities. His study in the Indian textile industry shows that labour use per machine was no greater in the unionised Bombay mills, as compared to nonunionised regions, implying that organized worker resistance was not important in explaining low productivity.

Technology upgradation efforts including cleaner production technologies are not only desirable from the environmental point of view as a preemptive strategy, but also make good economic sense. As has been seen in many cases (Hegde, et al., 2001), such exercises have added to the bottomline by conserving resources like energy, raw materials and manpower, improving yield and reducing treatment/disposal costs. Rauzah Bt. Zainal Abidin (2002) after comparing the relative levels of efficiency achieved by different industry sectors explains the characteristic of the relatively efficient firms: there is a high correlation between technical efficiency, capital intensity and value added per employee (labour productivity). The scale of production has a positive correlation with the technical efficiency (Jinghai Zheng, 1998).

Bhavani (2002), in her study on the Impact of Technology on the Competitiveness of the Indian Small Automotive Component Industry, conclude that the usage of advanced technology embodied in sophisticated machinery such as NC machines substantially improves the competitiveness of the units in relation to both organization and communication technology on the one hand and the conventional inputs on the other hand. Lack of dissemination of information on energy efficient technologies as well as specific information on savings and benefits of energy savings contribute to the hesitation to improve energy efficiency (Katja Schumacher and Jayant Sathaye, 1999). Also lack of financing capabilities particularly for small and medium sized units, as well as lack of incentives and investment programs impedes the implementation of such measures.
It has been reiterated in many policy documents and declarations that technological advances should be promoted through research and development, economic diversification and strengthening of relevant regional, national and local institutions for sustainable development (The Delhi Declaration COP 8). Upgradation of technology and modernisation are vital for the existing industries to survive in an environment, which is becoming increasingly competitive (Kerala Industrial Policy, 1998). There are very many challenges in the field, as follows, to overcome to reach the ultimate goal of enhancing technical efficiency and therefore the recommendations of this study would be framed up accordingly. For most small St medium enterprises, short-term profits are usually preferred over long-term gains (SMI Newsletter, 2001). This makes it difficult to sell the argument that greater efficiency and higher material recovery leads to improved profits in the long run. Energy efficiency and environmental protection are a low priority (compared to expansion), even though the project may be sound. Pollution abatement receives little or no attention, as there is no market opportunity to compensate for the costs. Though incentives such as interest free loans, low interest loans, subsidies, tax holidays and duty exemption are available, in many cases these financial incentives are insufficient to motivate SMEs to take the risk.

SMEs do not operate in a vacuum. They operate in business environments determined by government policies, public and private sector institutions, physical infrastructure and other factors (World Bank, 2001). The technical upgradation facilities exist in large number in the country, but somehow these facilities remain closer to the academic world and at laboratory scale rather than being application oriented and closer to the industry (Jacob Levitsky, 1996). The commercial approach in their working is yet to be set in. Council for Scientific & Industrial Research (CSIR), a Government owned laboratory network is currently gearing towards increased commercial approach which further alienates the small sector through high costs and long gestation periods.

Newer technologies are capital- rather than labour-intensive and, importantly, knowledge-intensive. The importance of education policy as a fundamental condition for technological competitiveness and industrial development should by now be seen to be axiomatic. The most significant lesson provided in the study by Rajneesh Narula (2004) is that the governments cannot and should not view their employment and technological agendas individually. Governments face
the challenge of reaching ambitious goals within environmental and energy policy. Many governments have begun focusing on voluntary approaches to meet this challenge. Reaching the goals within the environmental and the energy areas requires an efficient policy towards all sectors in society, including the industrial sector (Kirsten Hansen, 1999). Governments often lack instruments towards industry that fulfill the environmental goals without harming the competitiveness. This need for new policy instruments has contributed to the widespread use of voluntary agreements. In recent years, an increasing number of agreements have been adopted in the environmental and energy areas.

Since 1993 a complex mix of instruments like energy agreements, energy taxes and investment subsidies has been used in order to reduce energy consumption in many countries. The energy agreements in the Danish Industry (Thomas Bue Björner, 2000) have only been offered to the most energy-intensive companies in the industrial sector. These companies have been given the option to pay a reduced CO₂ tax if they enter an agreement that commits them to carry out certain actions to increase energy efficiency. It is found that the energy agreements have had a significant impact on the energy consumption in the affected companies (after controlling for the effect of the reduced energy tax). The estimated reduction in energy consumption associated with an agreement is around 9%. This suggests that companies with an agreement would have used more energy if they had not been offered the agreement, but just had paid the full tax. The Zhenjiang and Hohhot experiences (Hua Wang, et al 2002) also have shown that performance disclosure can significantly reduce pollution, even in settings where environmental NGO's play little role and there is no formal channel for public participation in environmental regulation.

All studies of SMEs confirm that the provision of suitable technical assistance is among one of the most critical requirements (Amitav Rath, 2000). Technological inputs are harder because the system of supply of machinery and equipment and technical services tend to be less organized. SIDBI provides assistance for small enterprises in the acquisition of ISO - 9000 certification (Volker Schmidt, 1999). This is part of the Technology and Modernization Fund. Another institution, The Exim Bank (Central State Export/Import Bank), provides grants up to 50% of the costs by export-companies obtaining ISO - 14000 certification. Khalid Nadvi (1995) suggests that instead of pursuing the current fashion of credit extension as the main
strand of SME support programmes, greater effort has to be placed on improving collective resources, such as infrastructure, and in developing targeted sectoral support programmes in conjunction with local institutions and trade bodies. The Business and Innovation Centre Leipzig (Germany) is hosted by the municipality as a publicly owned traditional business incubator (Michael Wilhelm Hoeppel, 2002). In addition to the typical range of services, facilities and tools, it organises networking through various avenues. Henry Sandee (1997) in the study on small industry cluster in Indonesia finds that producer-driven innovation processes are the driving force behind technological change in the cluster. Adoption took place without support from local government agencies or NGOs. There was no provision of training, credit, marketing assistance, and so on, to stimulate the introduction of new technology. An important initiative in which the local government participated was the organization of ‘study tours’ to clusters where new technology was introduced and successful. The tours were important, because they improved access to information, both for producers and also, importantly, for suppliers of capital goods, who saw possibilities for penetrating the market.

**Energy Efficiency Barriers and Policy Instruments: Some Reviews**

As energy efficiency activities involve millions of end-use consumers, it is quite difficult to detail every implementation barrier. The major barriers are summarised below:

**Payback period:** Energy is typically a relatively small percentage of total operating costs in industrial processes, accounting for around 5-10 per cent of operating costs. As a result, energy savings may not rank highly on the investment decision-making scale of most industrial companies. In many cases, the introduction of energy efficient technologies will involve replacing existing equipment, incurring costs which may exceed the potential benefits if the old equipment has not been fully depreciated. Consequently, energy efficient equipment is usually installed incrementally, as existing equipment reaches the end of its useful life. However, even then any extra costs in installing energy efficient technology must be weighed against the potential benefits. Often the payback period is sufficiently long to make the investment doubtful, or unattractive.
Limited capital: Even firms in developed economies operate with scarce capital, this being more so for firms in developing economies. With scarce capital, and many urgent demands on it, especially the need to increase production capacity, energy efficient equipment and programs are likely to have relatively low priority. This situation is exacerbated by relatively low energy prices.

Limited technological capability: Energy efficiency programs and associated technologies require skills that can be in poor supply in developing economies. Even where new, energy efficient technologies have been installed, there may be a lack of skilled experts to keep the equipment operating at maximum efficiency, negating many of the potential benefits. More commonly, firms continue to utilise old equipment they are familiar with until maintenance costs make replacement an attractive alternative. In areas with low levels of industrialisation in developing economies, old obsolete equipment will continue to be used because replacement may not be a feasible option financially.

Lack of information: Even in developed economies, people may lack information about energy efficient equipment and practices. Recent studies show that consumers tend to repeat prior decisions when faced with unfamiliar choices and to avoid cost minimising choices that have higher upfront costs (Channele, 2000). Information gathering and analysing consume time and human resources. The public often has insufficient information to measure energy efficiency profitability, particularly in developing economies. Two kinds of information problems generally exist. One is that energy efficiency information is not readily available; the other is that the information is not satisfactorily transferred to the public. Efficiency advocates have historically promoted energy efficiency to industrial audiences that, for the most part, neither seek it nor fully understand its significance (Christopher Russell, 2003). Accordingly, the full potential of industrial energy efficiency has yet to be realized. Efforts to promote industrial energy efficiency will certainly be more successful if the outreach presents meaningful solutions to current business priorities. The promotion and adoption of energy efficiency may involve communication more than technology, mostly in developed world.

Economic measures (energy price, financial incentives and tax credits), Mandatory regulations, Voluntary agreements and information and technical assistance are the four policy instruments that can be considered.
Energy price: As input costs are very important factors with respect to firm profitability, the price of energy can influence demand for it. A recent study undertaken by the 1EA (1999) looked at energy prices in a sample of economies. On average, energy end-use prices were found to be approximately 20% below opportunity-costs or a market-based reference level. Often energy prices do not reflect full costs because of subsidies or lack of inclusion of environmental costs. Almost all industrial activities involve electricity use, so the price of electricity is an insensitive factor with respect to the performance of industrial firms. Many factors, such as industrial structure, the macro-economic environment, organisation management, technology level, etc influence industrial output per unit of electricity consumed, and it is not simple to separate these influences.

Financial incentives and tax credits: Financial incentives and tax credits are the traditional ways of promoting particular activities. However, the risk exists that the costs exceed the social benefits. For energy efficiency projects that may be small or have uncertainty with respect to payback, financial incentives can promote markets to engage in energy efficiency projects.

Mandatory regulation: Although the market plays a crucial role in energy efficiency activities, there are situations where markets can be perceived by policymakers to fail to deliver desired social outcomes. For example, energy efficiency programs may not always bring direct and immediate economic benefits to consumers, particularly if the goal is environmental or has a long-term goal. In these cases mandatory regulations may be necessary. While implementing The Energy Conservation Act 2001, the Government of India has envisaged making some of its provisions mandatory. However, till date, no provisions of the Act have been made mandatory.

Voluntary agreements: Voluntary agreements are generally contracts between governments and firms. Companies promise to attain certain energy efficiency objectives within a defined period (Kim, 1998). Stokey (1997) defined four major types of voluntary agreements: target-based; performance-based; cooperative R&D; and monitoring and reporting. The recent agreements between BEE, Government of India with the manufacturers for energy star rating the fast moving consumer goods like the Air-conditioners, Refrigerators, Fluorescent lamps, Pumps, etc., are examples of voluntary agreements.
Information and technical assistance: Information programs aim to demonstrate to energy consumers the importance of energy efficiency and how to achieve it. Information programs by themselves have been shown to result in energy saving of 0-2 per cent (Collins et al., 1985). For the industrial sector, many economies provide information and related technical assistance to improve energy efficiency.

Tile Industry in Kerala: Some Reviews

   Ceramic products have been manufactured and used for centuries. The first information about ceramics is available in the Vedas, the Atherva Veda, the Rig Veda and the Yajur Veda and the most popular ceramic materials talked about are tiles and bricks. The study which is claimed to be the first one on this subject produced in the English language is “A Rudimentary Treatise on the Manufacture of Bricks and Tiles” by Edward Robson (1889). He gives a detailed account of the designs that existed in olden days and were used in monuments in different parts of the world. The efforts of Basel Mission in establishing tile industry in north Kerala are well explained by Hoffman (1913). The main reason for selecting that region was the availability of good quality clay, labour and cheap transportation facilities using the rivers ft backwaters. Further information on development of tile industry is available in the works of Appaswamy et al. (1948), Bose (1948), Chandler (1949), Chaudhuri (1949) and Duby (1950). The first academic research work on tile industry in India came from Karat (1955). He critically examined the factors which enabled the concentration of tile factories in Mangalore. Comparing the new trends in the housing sector, he suggested that unless the industry diversified by 1980s, the future could be gloomy.

   A call for modernisation of tile industry came from Poornam (1962) and he detailed the need for diversification. Bhaskaran (1963), after critical examination of the structural ratios, suggested the dire necessity of modernisation of this traditional industry sector. Menon (1963) suggested that the industry should think of producing glazed tiles along with its efforts at modernisation for better growth and profitability. John et al. (1966) observed that one of the drawbacks of the roofing tile industry in Kerala was the absence of technological innovation. The paper by Syndicate Bank (1968) reveals that one of the factors which hinder
technological modernisation in tile industry is the lack of working capital. Ayyappan Nair (1973) cautioned that the clay deposits are fast depleting and availability of good quality clay could be a problem in the immediate future. Karunakaran (1975) advised that the products from the industry should be changed to suit the new trends in house construction. Kiln, the heart of any tile factory has been discussed in detail by Sreedharan Nair (1975). Radha (1979) discussed the economics of tile industry in Thrissur district in terms of distribution of units, capital invested, output and demand. Aravindakshan (1983) reports the technological stagnation in this sector in Kerala and finds that more units are getting sicker due to high production cost and diminishing demand. Balan (1986) also joins in this view and finds that the industry is more dependant on traditional technology. Ananthasubramanian (1986) attributes the delayed efforts in modernisation to lack of availability of finance. Thomas (1986) argues for the urgent need of modernisation and provides examples of the efforts being planned by his factory, in co-operation with the Regional Research Laboratory, Trivandrum. The study team deputed by the Western India Tile Manufacturers Association (1986) suggested liberalised lending of finance to tile industry. Hajela (1988) highlighted the labour intensiveness and lack of R&D facilities as the two major problems the industry is facing.

A detailed prescription for modernisation in different sections of the tile industry is available from the paper prepared by Balachandran (1988). Mani (1990) compared the economics of tile industry in different regions namely, Thrissur, Calicut, Alwaye and Kollam. Probably because the post 1990 period saw a drastic downfall of the tile industry, there were not many studies also on this industry sub-sector. Table 3.1 gives the growth performance of tile industry in Kerala.

### Table 3.1

Growth performance of tile industry in Kerala

<table>
<thead>
<tr>
<th>Particulars</th>
<th>1961¹</th>
<th>1971¹</th>
<th>1981¹</th>
<th>2001²</th>
<th>2008³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registered Units</td>
<td>266</td>
<td>345</td>
<td>509</td>
<td>132</td>
<td>53⁴</td>
</tr>
<tr>
<td>Gross Output (Rs crores)</td>
<td>4.99</td>
<td>12.91</td>
<td>28.16</td>
<td>25.87</td>
<td>55.00</td>
</tr>
<tr>
<td>Employment (numbers)</td>
<td>19,976</td>
<td>22,470</td>
<td>23,686</td>
<td>4,150</td>
<td>2,900</td>
</tr>
</tbody>
</table>

Source: ¹ Mani, K P (1990) ² Government of India (2002): Third All India Census of SSI 2001-02 ³ Compiled from primary data ⁴ Number of units in operation
Existing Gaps in Research

Research attempts are not found made to explore the relative economic value to firms of the various energy efficiency improvements made in their facilities/operations nor to identify the impact of energy management initiatives on profitability indices of an energy efficient and not-so-efficient firm, with micro-level evidences. Nearly all national and international studies on energy consumption in industry have been based on aggregated data. Information about individual companies can be very rich and helpful in convincing the results of the study to the target group of similar industries and/or to the policy makers. Such information is often lost when aggregating data, leading to less pragmatic recommendations.

It is also important to understand the motivation for certain units to improve their energy efficiency and the impediments for others not to innovate or modernize. Though many research studies has identified the non-technical aspects for bettering energy management in an industry, the industry perspective of this issue is not seen captured. This would certainly help to identify the existing weaknesses in the system, which has a fairly good network of public institutions with the mandate to enhance the technological capabilities of Small and Medium Enterprises, and then reveal opportunities for strengthening them.

Summary

Small and medium enterprises occupy a crucial position in the Indian economy not only because they contribute to GDP, income, exports and employment but they also imply self/group initiative, self-employment and small livelihoods, and small business. An industry’s or an industrial sector’s performance can be seen in different ways depending upon the objectives in mind. Profitability has been recognised as the main indicator of financial performance in the case of private sector. The major problems identified in the affected (due to economic reforms) traditional industry sectors were the lack of modernisation and development efforts vis-a-vis the rise in operating costs mainly connected with labour, raw material and energy. Among others, government policy has a major role to play in the promotion of energy efficiency. This is particularly true in the context of small industry because small industry units individually may not take any initiative for enhancing
energy efficiency due to either lack of awareness or prohibitive costs or lack of competence.

While ranking the top three operating costs - materials, labour and energy - in terms of the potential for cost savings, some of the industries have realised that energy often moves to the first priority position. However, there are gaps in knowledge of energy management options and its economic impact among the entrepreneurs, planners and policy makers related particularly to the traditional industry sector. Research attempts are not found made to explore the relative economic value to firms of the various energy efficiency improvements made in their facilities/operations nor to identify the impact of energy management initiatives on profitability indices of an energy efficient and not-so-efficient firm, with micro-level evidences. It is also important to understand the motivation for certain units to improve their energy efficiency and the impediments for others not to innovate or modernize. Though many research studies has identified the non-technical aspects for bettering energy management in an industry, the industry perspective of this issue is not seen captured. This would certainly help to identify the existing weaknesses in the system, which has a fairly good network of public institutions with the mandate to enhance the technological capabilities of Small and Medium Enterprises, and then reveal opportunities for strengthening them.

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