9.1 INTRODUCTION

Energy is an indispensable input in every sector of an economy; however it is crucial for the industrial sector, which accounts for almost half of the total energy used around the globe. This is true even in the case of Indian industrial sector, which has a large number of small scale industry units apart from medium and large-scale industries. MSME is a major sub-sector of Indian economy in view of its size in terms of number of units, number of employment, value of output and value of exports, absolutely as well as relatively. According to estimates, in terms of value, the sector accounts for about 45% of the manufacturing output and 40% of the total exports of India. The MSME sector employs about 42 million persons in over 13 million units throughout the country. There are more than 6000 products, ranging from traditional to high-tech items, which are being manufactured by the Indian MSMEs. Thus, MSME has a diversified and prominent presence in Indian economy. Considering the size of MSMEs, its demand for energy is likely to be substantial and will increase in the future, looking at its prospects for growth and the current policy emphasis on small industry modernization. Energy being an essential input to economic growth, its efficient use in any sector of the economy will have multiple benefits in India, which is a 'net importer' of energy.

Energy efficiency improvement is crucial in any economy due to:

- Demand for energy will grow at a lesser rate and thereby reduce the need for energy imports and additional energy supply capacity.
- Saved energy can be made available for other economic activities.
- Reduction in per unit cost and thereby making the concerned sector more competitive.
- Reduction in negative environmental impacts.

Another significant feature of MSMEs in India is that they have clustered naturally and spontaneously in different regions of the country. It has been found out that there are over 400 small industry clusters and approximately 2000 rural and artisan-based clusters in India (SIDO, 2004). Many of these small industry clusters are found to be energy intensive. Though individual units may not consume large amount of energy, collectively,
their energy needs in such clusters cannot be ignored. Improving energy efficiency is necessary for survival and growth of these clusters, because, higher energy efficiency not only improves their competitiveness through cost reduction but also minimizes the adverse environmental implications associated with the energy consumption.

Energy represents an important and expensive factor of production in MSMEs, particularly in energy-intensive sectors such as mineral processing (ceramics, tiles, pottery, brick, glass etc.), metallurgical and metal industries (foundries, forging, alloys, heat treatment, steel re-rolling, etc.) and agro and food processing (bakeries, dairies, rice mills, etc.). However, many of them operating in MSME sector cause both global and local pollution due to their inefficient energy use. Studies have shown that MSME firms not only produce more waste per unit of output but also, at an aggregate level, account for at least equal if not more pollution than their large-scale counterparts (Visvanathan and Kumar, 2002). There could be many reasons for this, such as lack of awareness and information, financial and economic issues, structural and institutional aspects, policy and regulatory features, behavioural and personal attitudes concerning the sector. MSMEs, on their own, may do very little about energy efficiency due to these factors and moreover energy related issues might not be their priority while running the business. The MSMEs in these sectors largely depend on inefficient equipment and technology. This leads to wastage of fuel; it also results in release of substantial CO₂ and particulate emissions.

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. Leaving alone, the efforts to promote energy efficiency in MSME units, even the industry-wise energy consumption pattern of small industry is still not known to the desired extent. 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 as well as reduction in negative environmental impacts. Especially, in the recent times the MSMEs have been experiencing unprecedented pressure for their survival and growth in the liberalized and globalized market arena. Enhancement of competitiveness, among others, is the key for MSMEs to successfully come out of this grave situation. Improving energy efficiency, particularly in energy-intensive brick industry, helps not only in cost
reduction but also in mitigating the environmental pollution associated with energy use, thus contributing towards sustainability of the units.

9.2 ENERGY AND ENVIRONMENTAL RELATED STUDIES IN MSMEs

The Energy and Resources Institute (TERI) study conducted at Noida identified plastic & rubber, fabrication & machining, and textile as three most energy-intensive sub-sectors. By conducting energy audits, scope for energy saving was found in motors, boilers, compressors, cooling towers, lighting etc. The study felt that MSMEs may not consider energy saving options purely on economic benefits but it must be promoted along with other concerned issues (TERI, 1998). TERI also conducted a detailed ‘Action Research’ on foundry clusters at Agra and Howrah. The energy audits conducted at Agra revealed a very low operating efficiency of cupola characterized by very high coke feed ratio. The study estimated an energy saving possibility of about 40% via better working procedures and improved furnace designs. In the Howrah cluster, cupola design was improved for further energy saving and reduced pollution levels (TERI, 1999). Further, TERI also conducted studies in MSME sector to improve the efficacy of its various initiatives related to energy-efficiency (TERI, 2010).

A study of energy consumption in MSME clusters in Karnataka has identified labour skill levels, owner qualifications, and technology levels as the important factors in explaining the energy consumption and environmental impact. (Bala Subrahmanya and Balachandra, 2002). As energy makes a substantial contribution to output in many MSME clusters, there is a need for firms in the clusters to adopt energy efficiency as a ‘cost cutting’ or ‘profit maximizing’ strategy. The government intervention for achieving higher energy efficiency is advisable in the national interest and may be achieved through awareness campaign, upgradation of technology, improvement in skill level of human resource, etc. (Bala Subrahmanya and Balachandra, 2003).

There are a few studies regarding energy and environmental issues pertaining to brick manufacturing units. The bureau of energy efficiency (BEE, 2010) carried out studies in the brick cluster of Varanasi. Based on the energy audits, their recommendations made in the cluster include: i) Process change from straight line to zigzag firing,
ii) Adoption of best practices in coal charging/feeding,
iii) Adoption of induced draft fan, and
iv) Shifting to VSBK and Hoffman Kiln.
The Greentech Solutions (Greentech Knowledge Solutions, 2012) aimed at developing strategies for the introduction and promotion of cleaner walling materials in India, thereby recommending that the efforts to propagate cleaner brick kiln technologies over the next decade should focus on three specific technical measures:

a) Adoption of cleaner kiln technologies,
b) Promotion of internal fuel in brick making by mechanizing the process,
c) Diversifying products (e.g. production of hollow and perforated bricks) and promotion of modern renewable energy technologies in brick making.

Nagesha (2010), has identified labour skill level, owner qualification and technology level as the important factors in explaining energy use and environmental pollution in the Indian context. However, (Blackman and Geoffrey, 1998) found that small-scale brick makers in Ciudad Juarez, Mexico have responded significantly to informal community pressure for improved environmental performance. Further, Blackman (2000) has developed a list of feasible environmental management policies and examined how these policies have fared to control emissions from informal kilns in northern Mexico. Till recently, there was hardly any reference made either in government reports and documents or in research literature, to the environmental implications and impact of small scale brick industries with reference to south Indian clusters.

But, it can be noted that most of the initiatives to improve energy efficiency and environmental performance in MSMEs have adopted a technocratic approach. Observing that such initiatives have achieved little in India, in terms of efficiency improvements or environmental improvements, Dasgupta (1999) argues that these initiatives suffer from narrow perspectives and inappropriate methodology. Combustion related pollution is closely related to several factors such as inefficient resource use, absence of waste management, poor work practices and house-keeping. Such factors must be addressed first, to prepare the ground for technological change and any energy-led initiative must consider them necessarily.

Although some energy and environmental related studies of MSMEs are reported in literature from certain regions and sub-sectors of the country, there is still scope for further study. In India, the energy consumption by the MSME sector as a whole is likely to be
substantial. However, small industry sectors have not succeeded in attracting researchers and policy makers in the past to the desired extent to study this vital issue. There is a need for increased industrial energy efficiency and better environmental performance of energy intensive small-scale industries. From the available literature pertaining to brick industries in southern India, the states of Karnataka, Andhrapradesh, and Tamilnadu appears not to have attracted the desired attention from researchers and policy makers in the past. Further, a detailed review of available literature on energy related studies in the context of Indian small scale industries has revealed the following:

1) Though it is appropriate to analyze energy consumption within its social context, most of the energy studies in the past have ignored the influence of some of the factors influencing energy and environmental aspects in MSMEs.

2) There is hardly any comparative study of different geographical small-scale brick production clusters substantially dealing with energy and environmental performance.

3) Most of the studies are either single cluster based or single industry focused and there is hardly any study of clusters comprising different regions of the country or involving drivers sub sectors of the country.

4) There is hardly any cluster based study substantially dealing with barriers and drivers to energy efficient improvement.

It is with these research gaps in mind that this empirical research study of three energy-intensive small scale brick industry clusters in south India is undertaken. The identified research gaps and subsequent discussion with the experts helped in formulating the objectives, scope and methodology of the present study. Overall objective of the study was to ascertain the importance of energy as an input in the energy intensive three south Indian brick industry clusters, and to demonstrate the linkage of energy use with environmental performance. Further; it aimed at analyzing the energy consumption by probing causes, consequences and constraints for energy efficiency improvements in the energy intensive brick industry. The specific objectives of the current research were as follows:

1. To study the energy consumption pattern and associated environmental pollution.
2. To find out the current level of energy efficiency and estimate the potential for energy efficiency improvement.
3. To categorize and analyze the factors influencing energy efficiency.
4. To identify and probe the barriers and drivers to energy efficiency improvement.
To analyze the differences amongst the three clusters in terms of energy and environmental performance.

The current study looked at establishing the current levels of efficiency, estimating the energy conservation potential and environmental pollution. Apart from establishing the current levels of efficiency, it also found the factors influencing the same. Further, the relevant drivers and barriers were identified in order to fine-tune the policy initiatives for enhancing energy efficiency. The study covered three energy intensive small scale brick industry clusters located in different states of south India: Malur brick cluster, Kolar District, Karnataka (50 units), Tiruvallur brick cluster, Tiruvallur District, Tamilnadu (50 units), Krishna brick cluster, Krishna District, United Andhra Pradesh (50 units). Thus, a total of 150 units were covered in the three clusters of this research study.

9.3 SUMMARY OF RESEARCH FINDINGS

This thesis analyzed energy use in the three brick industry clusters involving study of energy consumption pattern, prevailing energy efficiency level and conservation potential. Apart from this, it also probed the factors, barriers and drivers for energy efficiency, eventually to help energy improvement initiatives in this sector.

The study of energy consumption pattern revealed that biomass, electricity and diesel were the energy carriers used in the Malur brick cluster and their percentage shares in total energy utilization were respectively 98.74, 0.66, and 0.60. Whereas in the Tiruvallur cluster, coal instead of biomass is used as the main source of fuel along with electricity and diesel and their percentage shares in total energy utilization were respectively 98.90, 0.73 and 0.37. While the Krishna cluster uses coal, rice husk, electricity and diesel as a source of fuel with respective shares being 51.44, 48.10, 0.23 and 0.23. From an end-use perspective, it was observed that in all the three clusters the thermal needs dictated the energy consumption. The biomass mainly in the form of eucalyptus leaves and small amount of firewood provided the thermal energy needs of brick firing in the Malur brick kilns. Coal dominated the energy needs in the Tiruvallur cluster. Whereas coal and rice husk dominated the energy needs in the Krishna Cluster.

As far as environmental pollution due to energy use was concerned, the study estimated the air pollution in terms of GHG and other pollutants based on Intergovernmental Panel
on Climate Change (IPCC) guidelines. It was found that the Malur cluster caused highest air pollution followed by Tiruvallur and Krishna clusters respectively (based mainly on CO₂ emission). In the brick enterprises the air pollution intensities were comparable as biomass and coal dominated the energy scene of the three clusters. In these clusters, CO₂ was the largest pollutant and can only be ignored if the biomass is obtained on a sustainable basis, which is hardly seen. The other significant pollutants in these clusters include CO, SO₂, NOₓ and TSP.

Apart from this air pollution, the environmental impacts caused by brick industries are diverse which include deforestation, land degradation accompanied by soil erosion, localized pollution, and loss of floral and faunal diversity. This indicates that the contribution of individual small scale brick clusters to global pollution may not be substantial, but their effect on local pollution merits attention. Further, in view of the existence of a large number of such small scale brick clusters in the developing countries including India, the total effect of all such clusters on global pollution is likely to be significant.

The second objective of the study was to assess the prevailing energy efficiency levels and subsequently to arrive at the energy conservation potential in the clusters. The average energy efficiency in terms of Specific Energy Consumption (SEC - MJ/kg of product) in the brick clusters of Malur, Tiruvallur, and Krishna were found to be 11.41, 2.41 and 4.57 respectively. However, the efficiency expressed in terms of Energy Intensity (EI - MJ/Value added Rupees) for the same clusters were at 3.31, 0.56 and 1.06 respectively. This shows that Tiruvallur cluster uses less energy of high quality for creating same value. When efficiency was expressed in pure economic units in terms of Economic Energy Consumption (EEC – Energy Rupees/Value added Rupees), the values for the cluster were comparable and found to be 0.39, 0.22 and 0.21 respectively.

Another important feature observed was the wide variation in energy efficiency values among firms within each of the clusters which point at the existing unrealized energy conservation potential. Since SEC is more useful in giving actual insights into the difference in energy efficiency at a disaggregated level (Phylipsen, et al, 1997), comparison of brick firms within a given product cluster was based on SECs. In the Malur cluster, SEC (MJ/brick) varied from a minimum of 7.37 to a maximum of 17.50 with a
standard deviation of 1.760. The corresponding values for the Tiruvallur cluster were 1.67, 3.55 and 0.46, while for Krishna cluster it ranged from 3.01 to 7.20 with a standard deviation of 0.87. Then, comparing the mean cluster SEC values with the best among the sampled firms, an energy saving potential of about 35.4%, 30.7% and 34.13% was estimated in the Malur, Tiruvallur and Krishna clusters respectively. Even higher energy conservation potential existed in the clusters if one considered the option of technology-shift in addition to other measures. In brick industry, replacement of presently employed Intermittent Downdraught Kilns (IDK), and Brick Clamps with Vertical Shaft Brick Kilns (VSBK) was expected to save around 45-71% of energy use.

To establish the importance of energy in value of output, first the energy cost in and total variable cost and value of output was found which showed the energy cost was certainly a major component of total variable cost in all the three clusters. Further, the Cobb-Douglas production function was estimated in each of the three energy-intensive brick industry clusters. The high values of adjusted $R^2$ (0.924, 0.864 and 0.986 in the Malur, Tiruvallur and Krishna brick clusters respectively) meant the estimated production functions were able to explain most of the variations in value of output with considered factors of production in each industry. Further, the significant beta coefficients of energy (0.673, 0.266 and 0.200 in the Malur, Tiruvallur and Krishna brick clusters respectively) in each of the clusters established that it was indeed an important input affecting output.

The third objective of the study was to analyze the internal and external factors influencing energy efficiency in the brick clusters. The high values of adjusted $R^2$ (0.71, 0.69 and 0.64 in the Malur, Tiruvallur and Krishna brick clusters respectively) along with statistically significant ‘F’ value. Additionally, both the coefficients have negative signs indicating that with the increase in factor scores the SEC is going to reduce, in other words, the energy efficiency is going to increase. Considering this, it is concluded that the considered set of two factors does possess a linear relationship with energy efficiency (SEC) in the brick clusters.

The perception among the sample entrepreneurs in the three brick clusters was that entrepreneurial characteristics are of vital importance for small business success including energy efficiency. This denotes that the perception amongst entrepreneurs essentially does not differ too much from entrepreneurs in one cluster to the other. The external
environment signals that besides individual entrepreneurial initiatives the enabling environment supporting these efforts is of utmost importance. The result of this study established that key to success and improving energy efficiency lies in concentrating on both the internal as well as external factors.

The fourth objective of the study was to identify and prioritize the barriers and drivers to energy efficiency improvement with an intention of scuttling the former and boosting the latter. A factor analytic approach was adopted for identifying crucial barriers for energy efficiency improvement. Thirty two statements representing various dimensions of the barriers were recognized before performing the factor analysis. The factor analyses on the thirty two statements representing the barriers were then reduced to eleven factors in all the three clusters with explanation of variances of 76%, 73.45% and 73.3% in the Malur, Tiruvallur and Krishna brick clusters respectively. The results showed that “management finds production more important than energy efficiency”, and “Lack of awareness of the terms like energy efficiency etc.,” were the top two barriers in Malur cluster. Similarly the “present technology is easy and they are familiar with it and not confident of new technologies” and “management is concerned about investment cost of energy efficient technologies” were ranked as the top two barriers in Tiruvallur cluster. Whereas “size of the unit is too small, the production volume is too low and hence incentive for better technology and energy efficiency improvement is low” is the top barrier and “management finds production more important than energy efficiency”, and “Lack of awareness of the terms like energy efficiency etc.,” were ranked as the next top barriers to be addressed for energy efficiency improvements in the Krishna cluster.

The nine potential drivers of energy efficiency enhancement considered in the study included ‘EE (Energy Efficiency) as a tool to reduce energy consumption’, ‘EE as a tool to reduce per unit cost’, ‘EE as a tool to reduction in wastage’, ‘EE as a tool to meet shortage of energy supply and rising energy price’, ‘EE as a tool to minimize environmental degradation’, ‘EE as a tool to Improve compliance with governmental regulations’, ‘EE as a tool to occupational, health and safety improvement’, ‘EE as a marketing label and status symbol in improved product quality’, and ‘EE as a tool to achieve competitiveness and sustainability of the unit’. Utilizing the entrepreneurial experience and value judgment, these drivers were prioritized. Further, to obtain the relative strength of each driver, weighted average score was computed using normalized weights. Again, the ranking of
drivers revealed that the ‘EE as a tool to reduce per unit cost’ is top choice in all the three brick clusters and ‘EE as a tool to achieve competitiveness and sustainability of the unit’ ranked second in the Malur and Tiruvallur cluster. However, ‘EE as a tool to meet shortage of energy supply and rising energy price’ ranked second in the Krishna cluster. At the same time ‘EE as a tool to occupational, health and safety improvement’, ‘EE as a marketing label and status symbol in improved product quality’, ‘EE as a tool to minimize environmental degradation’, were ranked towards the end by the brick clusters. The almost identical ranking of both barriers and drivers is significant considering the cluster dissimilarities in terms of socio-economic conditions, geographical location, entrepreneurial background, raw material, energy carriers used and so on. This suggests that irrespective of dissimilarities the entrepreneurs in the brick clusters encounter identical hurdles and are motivated by similar set of benefits associated with energy efficiency improvement.

The final objective was to compare the three south Indian brick industry clusters. Based on the energy and environmental performance of the three brick clusters, a large variation was observed in the energy performance of the studied kilns. The IDK (SEC/KG of product of 3.26) consumes four times more energy compared to VSBK (most efficient kiln). Further, since VSBK technology uses less energy consumption the negative environmental pollution due to energy use is also reduced. Based on the environmental pollutants the CO2 concentration levels (46032.82 tons) is high in the biomass-fueled IDK Technology. This shows that there is large scope for increasing energy efficiency thereby reducing the negative environmental pollution. Further, by busting the barriers and boosting the drivers energy efficiency can be enhanced from the current levels.

9.4 MAJOR CONTRIBUTIONS OF THE THESIS

The central focus of this study was studying energy consumption empirically in the three energy-intensive brick industry clusters by assessing the prevailing level; causes and consequences of it, and estimating the potential for conservation; obstacles and motivators for achieving the same. Unlike other studies which deal with energy issues only from a technical perspective, this study looked at energy efficiency not only from a technical perspective, but also from managerial, economic, organizational and behavioral perspectives. While the approach and outcome of the study objectives were covered at length in the previous chapters, the following are the specific contributions of this work:
• The study covered three highly energy-intensive brick industry clusters in three south Indian states.
• A scientific sampling procedure was followed and hence the findings of the study are applicable to the entire population in the respective clusters.
• The thesis analyzed current pattern of energy consumption and estimated the associated environmental implications in terms of air pollution.
• The study has responded to the questions “Where do the clusters stand?” in terms of energy efficiency, and “How much of unrealized potential existed in these clusters?” based on the primary data obtained from the field.
• The ‘production functions’ were estimated in each of the industries under reference leading to appreciation of the role played by energy input in the value of output and the total variable cost.
• A comprehensive theoretical model was put forward to analyze the factors influencing energy efficiency in the study clusters.
• A quantitative approach was adopted to analyze barriers and drivers for energy efficiency enhancement.
• A barrier analysis was conducted using factor analysis. The barriers were prioritized based on the value judgment of brick owners who are the main stakeholders of efficiency augmentation.
• The potential drivers for energy efficiency improvement were identified and prioritized utilizing a weighted average scheme, again from an entrepreneurial perspective.

9.5 POLICY RECOMMENDATIONS
The brick clusters under this research study were characterized by outdated technologies with low energy efficiency and high emissions; low mechanization rate; and dominance of small-scale brick kilns with limited financial capacity. The prevailing status and practices are by no means sustainable. Brick industry has every reason to upgrade its production technologies in order to save valuable natural resources, reduce air pollution, and increase energy efficiency. However, for the transformative development of the brick industry this research makes the following policy recommendations.
Recognize brick kilns as a formal industry. This would enable easier access to financial resources which in turn will enable investment in energy efficient technologies and improved working conditions.

Create a “Brick Technology Center” for understanding the current situation in terms of technologies being followed, resource consumption and to raise awareness about the benefits of energy efficient technologies.

Such center should:
(a) Promote pilot projects of new technologies with improved provisions (e.g., mechanized, higher labor productivity and larger product lines);
(b) Improve use of existing dissemination channels (e.g., field visits to pilot plants, video demonstrations of the technologies) and introduce new channels (e.g., newsletters, industry journals, conferences, and Internet blogs).

Support research and development aiming at: (a) exploring alternative raw materials that are locally available, and use of higher level of mechanization; (b) conducting new studies such as energy consumption studies, and brick technology surveys.

Introduction of a national programme for improvement of the brick sector in the mission mode. This can be in the form of a “National Programme on Brick Sector Efficiency Improvement” thereby training several stakeholders with regard to the benefits of adopting energy efficient technologies (e.g. brick owners, workers and the financial sector).

Enhancing capacities of policy makers and government at regional, state and national scale on the status and need for change, and to enforce the existing regulations and policies, such as the ban of traditional high polluting kilns (e.g. Rural Clamps, IDK), and impose an emission levy based on “polluter-pay principle”.

Government along with local small industries associations can initiate awareness programmes on these aspects through seminars and exhibitions. Also, schemes can be introduced to provide soft loans for the entrepreneurs to encourage the replacement of old kiln technologies with new energy efficient kilns. Local industry associations can be actively involved in organizing special programmes to show case the performance of most energy efficient unit in the cluster. It will provide an opportunity for the fellow entrepreneurs to learn from the ‘Champion’ and attempt such measures in their respective
Technology up-gradation alone will not result in efficient use of energy. The quality of human resource available is also equally significant in determining the level of energy use. It is a possibility that the best technology used by untrained manpower producing bad products with inefficient use of resources. Therefore a perfect match between the technology and quality human resource is essential to optimize the resource use and thereby reduce the environmental impacts. Any technology up-gradation in a unit should be preceded by having quality workforce in place. Any government agency promoting technology up-gradation should ensure appropriate training to the existing manpower simultaneously. That is, the employee training should be made a part of the technology up-gradation package.

These measures would go a long way in giving a new direction for promoting energy efficiency in small scale brick industries and thereby contributing to reduction in negative environmental impact and finally leading towards their competitive growth and sustainability.

9.6 SCOPE FOR FURTHER WORK
Most of the initiatives to increase energy efficiency in Indian MSMEs have adopted a technocratic lead approach. But, energy lead initiatives must necessarily have the scope to encompass the other non-technology issues as well for producing discernible results. Further, a bottom-up participatory approach involving the main stakeholders of the system in identifying the various constraints and motivators for energy efficiency enhancement helps in assessing the ground realities apart from reducing implementation hitches. This research has made contributions towards strengthening this approach in energy efficiency enhancement of MSME clusters.

The present study was based on the empirical data gathered by administering a structured questionnaire during the field visits of brick clusters. Hence, one of the objectives of analyzing the barriers and drivers for energy efficiency improvement in this work has focused on brick firms by incorporating the entrepreneurs’ perspective only. However, future research may analyze the barriers and drivers involving more number of stakeholders such as development institutions, policy makers, researchers and NGOs.
connected with MSMEs and so on.

The other dimension involving the same brick product clusters may be extended focusing on new technologies and comparison of energy efficiencies of kilns like Round Klin, Tunnel Klin and Vertical Shaft Brick Klin. Similarly, comparative studies of energy-intensive products may also be conducted between: less successful and more successful clusters, clusters and dispersed firms, MSME clusters and large firms, etc. with giving more importance to external linkages and knowledge flows.

It is well established that the brick sector is the backbone of the infrastructure industry of India. The unique characterization is its decentralized small scale production activity providing large scale employment and income generation opportunities – a characterization of the MSME industry. Considering the fabric of the brick industry, there is a large scope for improvement in terms of resource efficiency, especially looking at the energy consumption. Top soil usage is also a concern for the future. It is apparent that with rising national and international concerns on the environment there will be increasing pressure on the Indian brick sector to improve. To catalyze and sustain the brick manufacturing process, policy will play a crucial role and studies involving these aspects may also be undertaken.

9.7 CONCLUSION

Micro Small and Medium Industries plays an important role in Indian economy in terms of employment as well as exports. Their sustained economic performance is imperative for India’s economic development. Individually, a small scale unit’s energy consumption may not be high but together the consumption in millions of small scale units across the country will add up to a very large quantity and likely to place a very high demand on limited energy resources. Energy efficiency improvement may be an important objective from country’s perspective in order to preserve scarce natural resources, reduce environmental damages and minimize dependency on imported energy carriers.

However, this need not be an important issue from the perspective of an entrepreneur who is running a small scale unit. He will be motivated to take any initiative on energy efficiency improvement provided energy is an important issue for him either as it accounts for major share in the total cost of production or energy savings is likely to result in significant increase in gross profits. Under such situations, the unit can adopt efficiency
improvement measures either as a “cost cutting strategy” or as a “profit maximization strategy”. Unless these benefits are realized no small scale unit will come forward to implement any efficiency improvement measures. This brings out the fact that the government intervention is imperative to trigger such initiatives through extensive information campaigns and policy supports to achieve higher energy efficiency in small industry clusters.

It is believed that this empirical study of energy consumption along with its associated issues in the three energy-intensive brick industry clusters would be able to assist in triggering the concerned stakeholders to seriously consider energy efficiency improvement for the sustainable and long term growth of this sector. The analysis of causes, consequences, constraints and motivators is likely to assist in fine-tuning the MSME policy in general and energy-intensive brick clusters in particular for the survival and sustainable growth of this sector in the long run.