CHAPTER VI

SUMMARY OF FINDINGS, SUGGESTIONS AND CONCLUSION
Introduction

Competing and succeeding in today’s business environment requires clear strategies on managing cost by improving energy efficiency. Energy management, the process of understanding and managing energy cost to energy efficiency and energy generation strategy has become a significant management issue. Energy management involves organizations and people as much as technology. All organizations can save energy by applying the same sound management principles and techniques they use elsewhere in the business for key resources such as raw materials and labour. Energy saving through better management of resources results in cost savings, environmental benefits through reduction of carbon dioxide emissions and in many cases productivity enhancement through better process controls employed for energy conservation and quality improvement.

With a contribution of 40% to the country’s industrial output and 35% to direct exports, the SME sector has achieved significant milestones for the industrial development of India. Till the opening up of Indian economy in 1991 through LPG, these SMEs, particularly those loosely classified under the rural/ traditional industry category, were all enjoying the protectionist industrial regime of the Central and State governments. 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 post-reforms 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. 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 both lack of awareness or prohibitive costs and lack of competence.
This research study attempts to address some of the research gaps and has the following objectives: to identify the impact of energy management on the profitability indices or financial ratios of energy efficient and less efficient factories, taking a particular SME sub-sector - the Tile industry; to analyse the factors of motivation for certain units to improve their energy efficiency and the impediments for others not to innovate or modernize; to understand the preparedness of the industry to implement a successful energy management program and the extent of government support / facilitation; and to suggest measures and means to improve energy efficiency as applicable to the number of actors and institutions with this responsibility.

It was in the year 1915 that the first clay roofing tile manufacturing factory came into existence in Thrissur district. This was essentially a follow up of what began in Calicut (Kozhikode) and Mangalore almost two decades back. The 70s were the golden period of this industry in Thrissur. There were more than 400 SMEs in Thrissur and nearby areas. That was the time of innovation in product range and new markets emerged. But unfortunately in the 90s factories in this area started falling sick one by one mainly due to unscientific planning and consumption of resources like raw material and firewood leading to sharp rise in production cost and restriction from the people on clay mining. Increasing awareness on environmental degradation during the time fuelled this situation. The last decade has witnessed few entrepreneurs and investments coming into this sector.

There are fifty three registered clay based tile factories in organized sector functioning in Thrissur district under the SME category. A census method data collection in Thrissur district in Kerala, which has the highest concentration of tile factories in the SME category, has been employed for this study. Based on the analysis of the primary data, the surveyed factories were classified into (comparatively) energy efficient (having a higher energy efficiency index, EEI, than the average) and not so energy efficient units (with EEI less than average) for testing the hypotheses.
**Major Findings**

**Energy cost is the major production cost**

The major cost of production is the energy cost with a share of 56% of the operating cost. Tile factories use firewood (two units use saw dust also) as the fuel in their kilns, which is the heart of the tile making process. Firewood is becoming scarce and its cost is continuously rising. Entrepreneurs attribute this to the stiff environmental regulations which curtail wood cutting from forests, rise in transport cost and rising demand from other traditional small scale industries. However, there is a less known truth of firewood usage in terms of its new customers which is certain to cause serious ramifications on the fuel economics of such traditional industry sector.

**Less understanding on the impact of the recent trend of fossil fuel substitution by biomass in Kerala**

Firewood at a cost of Rs 1500/- per tonne and average calorific value of 4000 kcal/kg while provides energy output at 1600 kcal/ Re with an efficiency of 60%, furnace oil (the fossil alternative, which is the main fuel in medium and large industries) at a cost of Rs 30,000/- per tonne and average calorific value of 10500 kcal/kg provides an energy output of only 280 kcal/Re with an efficiency of 80%. This makes replacement (at least partial) of furnace oil by firewood a cost effective option in industries to increase profitability and there is widespread changeover happening in the State, either through the direct combustion route or the gasification route (which is quite common in crumb rubber industries, for generating hot air in their dryers). This trend will contribute to rising firewood cost as well as further fuel its scarcity, along with the environmental pressure restricting wood felling in the forests. In these days good quantity of firewood finds its way from the rubber estates after slaughtering the rubber trees aged above economic life. There is no sign of such an understanding on the side of policy makers or energy agencies or traditional users of firewood to deliberate on alternative options or the impact of this trend in the near future.
Raw material tops in the “issue” list

There are ways and means to reduce energy consumption in these factories by adopting energy efficient processes and practices, incurring some expenditure for its implementation. But the majority factories prefer to address the issue of raw material rather than energy, even if funding assistance is provided to them to take care of the investment requirements. Recently with the reporting of lowering of water table in areas where clay is mined and erstwhile agricultural land being converted into clay mining area (due to less returns from agriculture, lack of agricultural labour and more returns when leased / sold for clay mining) turning this into barren land eventually, clay mining has turned out to be the single largest issue for tile factories. When they are forced to travel long distances for clay and when new mining areas are not being identified they end up excavating poor quality clay which leads to more breakages and poor quality products at kiln outlet. Thus, though cost-wise energy finds the top position demanding concerted attention, the tile factories and their association are seen fighting for government permissions and concessions in clay mining, which is the raw material required to run the factory. As the objective of this study is not to analyse the impact of raw material scarcity and associated problems, this aspect has not been examined in detail further.

Entrepreneurs not appreciative enough of energy-environment issues

Though the entrepreneurs are not very ignorant of different pertinent energy - environment management issues, the majority factories (rather the management) are not quite appreciative as well of such aspects. Most of the entrepreneurs do not show the right aptitude, comprehension and drive required to tackle multi-dimensional problems such as energy efficiency, which requires attention and intervention in all the major three elements of a business enterprise - the people, the technology and the organization.

A few entrepreneurs seek short-cuts to reduce electricity costs

To take advantage of exemption of electricity duty and insulation from tariff hike for five years for new industries as per the Industrial Policy 2001 of Government of Kerala, new units are registered by the same entrepreneurs running an old factory in a different name.
Labour amenities best in any traditional cluster in the country

Facilities provided to workers, like separate toilets for male and female employees, EPF and ESI services, electrified shelters for workers from outside the State; one month wages as bonus in an year, minimum wages as per Government rules, etc., is understood to be the best in the country in any traditional industry cluster. One of the main reasons attributed to this is the high literacy rate in Kerala.

Product diversification calls for better quality - a hitch for entrepreneurs

Kerala, Tamilnadu and Karnataka are the major markets. Due to the change in life style and housing styles (concrete roofs replacing tiles ones), there is a considerable drop in the number of traditional customers of roofing and flooring tiles. However, with the rise of tourism in Kerala catalysed by its greenery and unique ayurvedic treatment systems, buildings of such enterprises started using nature friendly clay tiles for roofing (above the concrete roofs for aesthetics), flooring (for better health conditions) and terracotta artifacts. Even such demand is found from neighbouring states and far off areas like the Middle East, particularly UAE. Sensing this demand and seeing the success of a few entrepreneurs in diversifying their product range to suit the modified taste of customers, around 60% of the factories have gone in for product diversification and marketing in such niche segments.

This changeover from the traditional customer base to the new group has also caused a radical shift in the quality sense of the stakeholders, thanks to the quality consciousness of the new customer group which do not hesitate to pay more for better quality products. With least process controls, share of first quality products (which fetch maximum price) became lesser and led to increased rejections and last quality products. Rejections in terms of broken pieces in a clay factory, since it comes after baking inside the kiln, cannot be reused due to change in its internal structure which is non-reversible and therefore is a waste which occupies space and needs to be taken out from the factory, mainly used as landfills. Entrepreneurs are not aware of how quality can be improved in their traditional low-tech process except that their keen attention in all steps of tile making process would make the worker more attentive and would make him/ her put in efforts to see that each unit operation is performed the way it should be done. This increased
attention of the owners in the unit operations has lead to local level innovations after rigorous research and development. Though lot of hard work has been done in many units, since high quality products fetched more revenue, such quality enhancement activities are done in strict isolation and maintaining utmost privacy, which resulted in many failures due to the trial and run methodology. Many units have undergone the same trials done by others before perfecting, particularly in pre-drying of green tiles before entry to the kiln.

**Professional rivalry prevails**

Professional rivalry something like an oligopolistic market (in terms of number of factories and competition but not on size) prevails and there is no much scope for a co-operative competition. Product differentiation and interdependence are not seen in this cluster. However, some of the characteristics of an oligopoly like ability to set price, barriers to entry and exit and good knowledge of own costs are witnessed in this cluster. Recently the cluster development program of Government of India has led to the formation of a consortium and resulted in developing a common centre housing testing and blending facilities. Probably the enhanced dialogues between the owners who are members of the consortium could lead to better co-operation among units in future.

**IT tool for process control a success but could not carry on**

There was a conscious intervention of the EMC Kerala in 1997-1999 to demonstrate the usability of cost-effective tailor made IT based process control and optimization tools, so far believed to be a high-tech sophisticated system, which do not have a conducive atmosphere or utility in traditional industry sector. In the year 2003-2004, four to five factories installed this system. However, for want of system providers, this could not be marketed in more tile factories and they could not go in for this tool.

**Entrepreneurs resorting to low interest home loans**

There have been many cases in which the entrepreneur has taken loans from nationalized banks stating the purpose as renovation of an existing house and routed this money for financing a modernization program in the factory, due to
lesser interest rates for home loans. Taking into account the credit worthiness and customer profile, bank managers help them in such activities. It is also a fact that due to lack of rapport with the tile entrepreneurs, government energy agencies or the industries promotion agencies are not fully aware of such actions.

**Government not so keen to facilitate professional support services**

Though energy cost is hounding the entrepreneurs, they don't have a proper professional managerial outlook or preparedness to address this problem in appropriate ways. It is a common feeling that the government, with the largest repository of wealth, having established agencies / organizations to support such traditional sector in terms of elevating its capability to effectively address the business demands of the post-reforms quality conscious regime, is not keen on such efforts.

**No financial incentive for energy conservation**

There is no subsidy program or incentive scheme on energy conservation suitable for the tile factories to avail either from the agencies / department of industries or energy (subsidy exists for pollution control devices). The easiest traditional way to tackle the rising cost of energy, as done by many other energy consuming categories (mostly consumers with commercial tariff, hotels, hospitals, etc) is to pass on this to the customers. This approach enables them to stick on to their claim that they are pre-occupied with day-to-day problems like raw material shortage/ delivery, labour issues, etc., and therefore have neither the time nor the curiosity to address energy efficiency issues.

**Energy conservation potential**

The estimated energy conservation potential of this tile industry sector in Thrissur district consisting of 53 operational factories is Rs. 2.15 Crores per annum with an initial investment of Rs 7.5 Crores making the simple pay back period of 3.5 years.
The hugging spree of technological advancements in tile industry

However, it would be a false deduction to summarise that tile factories are averse to modernization, considering the following hugging spree of technological advancements by the same entrepreneurs, particularly in the area of communication tools being employed now and the mechanization brought to clay mining, transportation and preparation. Interestingly, most of these changes are made without the usual minimum financial analysis — simple payback period -- employed for other investment options like energy efficiency. While in and around the kiln (the heart of the factory) various modernization activities are happening, the kiln stood alone without any real technological intervention.

No service provider in Kerala for workers’ training

In this small state of Kerala, training programs are being organized by government and non-government agencies in the area of energy conservation and management, once in a month, on an average. But neither Government nor non-government agencies organize regular training programs for workers. According to NGOs, there is no budgetary support from government agencies for such a task and small and traditional sector do not like to pay for such events.

No business development service for tile industry and no proposal as yet

Business development services have not grown much in this traditional sector as it has in other clusters like hand tools, bicycles, glass, food processing, etc. While it is learnt that the Tile Industry Association has not given any proposal or memorandum for setting up any business development services to the Government, there is no evidence of any proposal in this regard from the Government side as well, based on recommendation from any energy/industry promotion agencies.

Awareness level not significantly different in an energy efficient factory

The awareness level is not seen as a significant criterion which determines the energy efficiency of a factory in the tile industry in Thrissur district. Entrepreneurs do not attach considerable importance to the macro level energy-environment interface issues for their decision making on being energy efficient;
rather, the profitability of their action is more significant. According to them, to curb the carbon emissions by switching over to energy efficient technologies, it is not the traditional industries which should take the lead role, but it is the Government that should assume the responsibility of providing energy efficient techniques/practices at affordable or reduced cost; and there is no great need to convey the context or reason for being energy efficient, but the requirement is to convey how to be energy efficient, from where energy efficiency services--technical, managerial and financial--can be availed, what are the schemes in vogue to apply for, where to apply, etc.

Qualification level significantly different in an energy efficient factory

The mean Qualification Level of energy efficient factories for both Group A (>8000 tiles per day) and Group B (<8000 tiles per day) is significantly different from energy inefficient factories in the respective groups. It is observed that to a great extent, qualification relates to the level of:

- **language command** of the entrepreneur, which in turn plays a significant role in his discussions with other stakeholders, including the technology service provider, the new generation customer more worried about the quality rather than the incremental price for that, the Central/State Government agencies, research and development institutions, etc.;

- **acceptance of change** - organizational, technological, political and socio-economical, which demands a changeover from certain conventional practices within a stipulated timeframe to take advantage of the new opportunities and

- **monitoring** and evaluation of certain progressive interventions attempted and the extent of professional documentation required for that purpose (It is a fact that the tile industry employ 90% unskilled labour, significantly increasing the responsibilities of the entrepreneur to find cost reduction options).
Motivation for energy efficiency

It is clearly acknowledged by the majority of the factories that energy cost reduction is their topmost priority (if the problems related to raw material availability, which is an external factor not considered) to reduce operating cost and reap more profits. Those qualified entrepreneurs able to discuss their energy related issues with research and development centres and energy agencies have taken advantage of their help in improving energy efficiency, for example the IT tool for temperature control developed by EMC. Some of them having access (through library and attending seminars) to literature on energy efficiency improvement in similar factories outside the State have experimented certain things, like the drying of green tiles using exhaust heat from kiln.

Profitability ratios significantly different in an energy efficient unit

The mean Profit Margin of energy efficient factories for both Group A (>8000 tiles per day) and Group B (<8000 tiles per day) is significantly different from energy inefficient factories in the respective groups; having a difference of 15% more in Group A (ee) and 24% more in Group B (ee). The mean Return on Assets of energy efficient factories for both Group A (>8000 tiles per day) and Group B (<8000 tiles per day) is significantly different from energy inefficient factories in the respective groups; having a difference of 37% more in Group A (ee) and 82% more in Group B (ee). The mean Asset turn of energy efficient factories for Group A (>8000 tiles per day) is not significantly different from energy inefficient factories in that group; however, the mean Asset turn of energy efficient factories for Group B (<8000 tiles per day) is significantly different from energy inefficient factories in Group B. Asset turn need not be a parameter having considerable difference for (comparatively) energy efficient and energy inefficient factories.

The mean Contribution of energy efficient factories for both Group A (>8000 tiles per day) and Group B (<8000 tiles per day) is significantly different from energy inefficient factories in the respective groups; having a difference of 50% more in Group A (ee) and 32% more in Group B (ee). Labour Productivity of (comparatively) energy efficient and energy inefficient tile factories are both different, having a difference of 49% more in Group A (ee) and 43% more in Group B (ee).
Environmental impacts of tile industry

Key environmental impacts associated with tile industry are discussed below:

Resource extraction and depletion: Excavation of clay for tile production can alter the landscape in ways that are harmful to the environment and may invite local wrath. In earlier days, irrational ways of clay mining has created clay pits, leading to decrease in ground water level, becoming safety hazards, erosion of soil and rendering the land unusable for farming or other productive purposes. Some such land pockets got slowly converted to waste disposal sites, rainwater and waste water accumulation areas leading to pollution associated with municipal garbage and habitat for mosquitoes.

Inefficient use of fuel: High fuel use increases pollution - particularly carbon dioxide and particulate matter emissions. Wood being the main fuel, this also increases deforestation and associated environmental impacts, leaving less fuel wood for future use. Inefficient production technologies and techniques and excessive fuel consumption are typical in tile industry.

Inefficient use of non-fuel inputs: Inefficient production techniques like the one followed in most of the tile factories without any process controls reduce productivity and create excessive waste. Added to non-availability of controls, improper tile formation and low-quality inputs results in breakage of more number of tiles during firing and must be discarded. This leads to decreased output and increases waste disposal costs and/or using scarce space inside the factory for dumping this waste.

Dust: Dust is most prevalent and most dangerous when clay is extracted and finished tiles are transported following the firing process. Inhaling dust can lead to respiratory diseases.

Chemical pollution: A few tile factories have recently started glazing some of their tiles. Glazing requires materials that contain acids or metals and improper handling or excessive contact can lead to metal poisoning, skin irritations or lung disease.

Tile Industry: SWOT Analysis

The main products of tile industry such as roofing tiles, flooring tiles, ceiling tiles, etc, are used for construction of buildings, both residential and commercial. Main raw material is clay. Major operating cost is fuel and power. Therefore, the future of tile industry would depend largely upon on the demand for its products, availability
of good quality raw material and prudent use of costly fuel. A SWOT analysis attempted below would provide a comprehensive outlook on this.

### Tile Industry: SWOT Analysis

**Strength**  
- Strong hold in domestic market  
  - Developed good trust and relationships  
- No import of clay products  
- Proximity to market  
  - Wide choice of shapes, size and colours tailored for each end use  
  - Products diversified to terracotta artefacts, glazed tiles, etc  
- Good marketing network  
- Good transportation facilities

**Weakness**  
- No process control; leading to increased fuel consumption and decreased productivity (high breakage and rejection rate)  
- Lack of rational clay mining strategy  
  - Obsolete technology in many unit operations; Inefficient and old systems  
- High dependence on labour and less of automation  
  - Lack of quality standards/ policy, product standardisation and energy management system

**Opportunities**  
- Recent trend of clay roofing tiles paved over concrete roofs for aesthetics and preventing solar heat ingress into roof (alternative choice being the costly aluminium truss work)  
- Clay flooring tiles widely used in ayurvedic resorts and hospitals as they are very safe and healthy, mainly for people suffering from rheumatic disorders  
- Cluster development program enabling creation of common facility centres and testing facilities

**Threat**  
- Resistance from people on clay mining  
- Availability of imported and domestic less cost ceramic flooring tiles  
- Rising cost of fuel, power, chemicals and labour  
  - Firewood and other biomass fuels which are comparatively cheaper being widely used by other medium and large industries leading to rise in cost  
- Government agencies shying away from providing support services to the sector considered to be on its negative growth phase

*Source: Deduced from the Participatory Rural Appraisal conducted on the spot with the entrepreneurs*
Suggestions

Based on the detailed study of the energy management practices in the tile industry, the extent of their preparedness in addressing one of the major cost reduction avenues and taking note of the existing status of different stakeholders having direct and leadership role in enhancing energy efficiency, the following suggestions are presented, with due justification, to make them more pragmatic.

**Government agencies engaged in promotion of energy conservation and renewable energy**

The following are the Government agencies / groups created for promoting energy conservation and renewable energy usage in the State, established as per the provisions of certain national regulations, guidelines, etc., in different time periods when priorities were slightly different towards energy conservation, renewable energy, environmental protection, economic gains through energy management, etc.

- EMC Kerala, the State Designated Agency of Bureau of Energy Efficiency, Government of India;
- ANERT, the State Nodal Agency of Ministry of New and Renewable Energy, Government of India;
- Demand Side Management Cell of the Kerala State Electricity Board;
- Environmental Management Institute under the Forest Department, looking after the CDM (Clean Development Mechanism) projects;
- Kerala State Council for Science, Technology and Environment, under the Department of Science and Technology; and
- Local Self Governments (3-tier panchayats) having vast powers under the Panchayat Raj Act and co-ordinated by the Department of Local Self Government

The task of an institution charged with developing energy efficiency programs is **not to carry out the energy efficiency projects themselves, but to create the conditions which permit projects to be executed** and have a maximum
impact in terms of technical, economic, social and environmental efficiency. It is a role which requires considerable skills in leadership, dialogue, prompt intervention and assessment of the problems and constraints which affect a very wide range of partners. In particular, as decentralization of decision-making is a prerequisite for the success of an energy efficiency strategy, the institution must be skilled at empowering others to make decisions. The institution must have sufficient financial resources to give direct financial incentives (subsidies) for some operations (energy audits, preliminary studies, demonstration operations, innovation aids, aids for diffusion of advanced equipment). This is not strictly the case now and it is highly imperative to review its policies and programs.

EMC Kerala reviews the energy audit reports received from the industries, though conducting an energy audit is not strictly verified nor any penal provisions imposed for non-compliance. Energy audit is not mandatory for the tile industry sector as this falls under the SME category. The Government agency does not possess a database on sector-specific energy consumption indices or patterns. Nor has it a comprehensive database/information on the end-use demand pattern or estimated saving potential in any of the energy consuming sectors (domestic/agriculture/industry - SME or large) in the State. Preliminary energy audits need to be made compulsory by the Government of Kerala. A panel of energy auditing firms is to be announced based on the criteria of their expertise in this field (evaluated with the help of previous audit reports and feedback from client) and infrastructure possessed (including certified energy auditors, instruments, field offices and support staff) to carry out preliminary energy audits as per the quality standards prescribed. 75% of the cost of a preliminary energy audit needs to be subsidized. This would encourage industries to undertake the audit and the consultants need to be advised to electronically file the audit report in proper formats developed. Once appropriately compiled, a good database can be generated and reports created in different formats, like specific to industry sub-sector, districts, industry category (small, medium and large), etc. Such a good database would enable the agency to properly commission studies to identify areas and strategies for appropriate intervention. This is particularly important in view of the fact that changes are fast happening in the consumer behaviour which has direct bearing on the energy consumption trend, for example, fuel switching from fossil fuels to biomass including firewood. The government agency needs to have the right information on such changes, commission studies to assess its impacts,
identify appropriate intervention measures through participatory means for attempting implementation. The energy agency needs to have good rapport with the industry associations and professional bodies, not only treating them as a channel to reach stakeholders but also considering them its partners or supporters to lobby in the political decision making and bureaucratic circles for getting clearance for its energy efficiency promotional proposals. This is currently lacking.

EMC Kerala was instrumental in introducing the concept of Information Technology (IT) based monitoring systems in traditional industrial sector, through a model demonstration program in the tile industry in Thrissur district, through active participation of the Tile Industry Association. The IT based temperature monitoring and control system enables proper process control inside the kiln, the heart of the tile making process without making any major modifications in the existing kiln structure/ hardware. For lack of technology providers to manufacture such systems using the available designs (which could be improved upon) and provide after sales support, this IT intervention could not move ahead after its demonstration in around four units in Thrissur. This program - IT intervention in traditional industry sector - which is almost wound up, needs to be reviewed and other private/ public research and development centres involved in IT based activities encouraged to continue this activity which was found very beneficial. This is a classical example where the techno-financial viability of a project is established through a demonstration program by the Government and even if widely publicised, will alone not suffice to achieve major progress in energy efficiency. It would be worthwhile exploring partnerships from academic institutions, preferably the large number of engineering colleges recently come up in Kerala, scattered throughout the State. Such academic institutions, if properly oriented and motivated, can be empowered to provide technical advisory services to SMEs. The market for services and technologies in the field of energy efficiency will develop too slowly without Government intervention. The key to success is local service providers who can convincingly convey the concept of energy efficiency and make a living from such services. In order to develop this service market, some form of Government intervention seems to be necessary.

As the EC Act 2001 mandates nomination of Energy Managers and conducting mandatory Energy Audits in designated consumers (designated as per the notification by BEE on a national level), it would be too optimistic to consider that
traditional small and medium industry sector like the tile industry would fall in that ambit quite soon. Therefore, to make available the benefits envisaged as per the provisions of the EC Act 2001, the State Government should consider announcing an “Energy Efficiency Policy” for the State after proper consultations with the different stakeholders. It would be worthwhile exploring enticing the SMEs to commit to a certain percentage of reduction (which is measurable with not-so-complicated verification protocols) in their specific energy consumption (energy consumed per unit of production) over a time-frame against a commensurate concession from the Government side, by way of concessions for energy audits and / or soft loans/ subsidies for implementation as short term measures and considering tax reliefs as medium/long term measures, for which necessary consents from different department are needed. Such voluntary agreements are less costly for the administration than the traditional approach which implies announcing regulatory standards (inviting criticisms from the industry) and checking compliance, tasks which are quite demanding. From the industry perspective, they should be very receptive as they also have a say on the extent of reduction they need to do and when; they could decide on the appropriate means to achieve this - the management, the internal regulations and the know-how.

It is a common feeling that higher energy costs alone will trigger widespread introduction of measures related to energy efficiency. Working with the small and medium-sized industry often gives a very different picture. They tend to resort to the easiest traditional way of tackling the rising cost of energy, as done by many other energy consuming categories (mostly consumers with commercial tariff, hotels, hospitals, etc), namely, passing the same to their customers. This approach enables them to stick on to their claim that they are pre-occupied with day-to-day problems like raw material shortage/ delivery, labour issues, etc., and therefore have neither the time nor the curiosity to address energy efficiency issues.

**Government agencies in charge of industrial promotion**

There are umpteen agencies as mentioned in this section in Kerala engaged in industrial promotion. However, none of these agencies possess a valid current database on the tile industry in Thrissur, which is the only district in the
whole country with a population of more than 100 clay tile manufacturing units, though only 50% of them are currently operational.

- Small Industries Development Corporation (SIDCO)
- Kerala Bureau of Industrial Promotion (K-BIP)
- Kerala State Industrial Development Corporation (KSIDC)
- Kerala Financial Corporation (KFC)
- Kerala Power and Infrastructure Finance Corporation (KPIFC)
- Regional Research Laboratory of National Institute of Science and Technology (former Central Scientific and Industrial Research)
- Department of Industries and Commerce
- District Industries Centre (under Department of Industries and Commerce)
- Small Industries Service Institute, Thrissur (a Government of India body)
- Kerala Infrastructure Development Corporation Limited (KINFRA)
- Bureau of Public Enterprises (under Department of Industries and Commerce)

It is understood that with the support of UNIDO, a diagnostic study was conducted in this sector along with other small and medium industry clusters. It is astonishing to find that none of the agencies listed above readily possess this diagnostic study report. It is highly satisfying that, as a result of the diagnostic study, a common facility centre for mining, testing and blending clay and testing clay products as per BIS specifications has been commissioned in Thrissur district.

With close coordination with the energy agencies, regular skill upgradation programs need to be designed and organized through professional associations/ bodies / selected non-governmental agencies exclusively for workers including technicians and supervisors, both from the production and maintenance field. These programs need to be structured so as to impart necessary hands-on skill to them on different process optimization techniques, apart from the classroom sessions for sensitizing the basic theoretical aspects. Government should come forward to bear 100% expenses for such programs, making the industries pay for the trainees’ travel, boarding and lodging expenses as token of their commitment. It needs to be noted here that Government do not possess good /
descent residential facilities to organize continuous programs like this for this category, as the present facility at Kerala Institute of Local Administration (KILA) at Mulankunnathukavu, Thrissur is exclusively being utilized (almost to its maximum capacity) for training of Panchayat officials, volunteers, etc.

The Government should also think in terms of establishing Business Development Services facilities as indicated below in Public-Private Partnership (PPP) mode or attaching this to an already existing agency, after carefully assessing its capacity to deliver the services. Of late, it is being observed that Government finds it easy and eager to build new agencies rather than reforming the already created ones. The business development facilities need not be made sector-specific for want of optimum economic size for its operations, but can be established for SMEs, with priority to the traditional industry sector in Kerala.

Business Development Services now absent in Kerala State
specific for clay tile processing

- Technical training institutions
- Research and Development Laboratory
- Management institutions
- Testing facility
- Incubation centres
- Marketing expertise
- Product design and development institute

**Government Financial Authorities and Financial Institutions**

Enormous literature is available for various means of funding energy efficiency actions. Subsidy or direct grant is one of them. However, the latest observation, commonly prevailing or made prevailing among different stakeholders except the beneficiary is that subsidy is disgraceful. Government agencies, of late, has started administering subsidies in different names as incentives or (partial) financial support. Discussions with the tile industry entrepreneurs reveal that there
is no subsidy at present prevalent in Kerala for aiding energy efficiency actions. Through the EMC Kerala, subsidies or direct grants may be given to:

- Research, Development and Demonstration programs in new technologies (like in tile industry - ceramic fibre lining in the kilns, better insulating bricks for the kiln walls, process controls, utilization of fly ash to partially substitute clay, partial fuel switching from firewood to saw-dust, pre-drying / pre-heating of green tiles, renewable energy applications like solar drying, group monitoring of selected motors, etc). These programs may involve upstream organizations (private and public sector research institutions) or downstream players (equipment manufacturers and design offices). Reimbursable grants can be provided for successful projects which offer the advantage of recuperating the subsidy and thus permits an efficient use of available funds.

- Energy audits, feasibility studies and demonstration operations to accelerate dissemination of proven technologies in another sector, but not tried out in tile sector.

While providing subsidies, against the present practice followed in many other areas, the fund management should be kept simple in terms of procedures. Normally, when subsidies are provided (in other areas), it is found that the government agencies which manage this fund consider the disbursement as a means to achieve their target of utilization and the impact is neither measured / projected / reported. This unprofessional way of fund management would be taken as the excuse to stop the subsidy regime claiming non-receipt of intended goal. When the subsidy or grant scheme is implemented, to achieve the intended result, the Government should ensure that the program management is tight with good monitoring and it should work very closely with the beneficiaries which would help limit procedural complexity.

One of the strategies EMC employed while providing grant to its earlier IT intervention program in the tile industry sector is to limit the subsidy to 25% of the system (project) cost so as to extend this scheme to four willing units on first come first served basis. This strategy was successful for the particular project as the total
cost of one system was less than a lakh of Indian Rupees and the beneficiary could afford investing the balance project cost. When the total project cost is above a threshold value which the investor cannot afford after the subsidy element of 10% to 30% of the project cost, then the grant/subsidy scheme would not work as in many initiatives of Government of India, as the beneficiary cannot find the remaining funds. In that case, appropriate types of loans are therefore needed. In this situation soft loans have to be devised with a maximum interest rate of 6%, to its consumers in the traditional small and medium industry sector like the tile industry, through a host of financial institutions in public domain headquartered in Kerala. It is to be noted here that MNRE provides soft loan for installing solar water heaters to domestic consumers @2% interest rate and commercial consumers @3% interest rate. While soft loans are offered, the cost of interest subsidy needs to be covered from the Energy Conservation Fund or through a separate budget allocation till the fund is constituted.

There are various other options like leasing contracts, third party financing schemes, equity capital through venture capital companies, government guarantees for operation of energy service companies, tax allowances, accelerated depreciation, etc., which are not being discussed here as these are considered highly extraneous for the state agency to address in a short term period. It is to be noted here that though very many financing schemes are experimented in energy efficiency and renewable energy field in India with the involvement of international agencies like the United States Agency for International Development (USAID), a model financing policy is yet to be emerged. USAID is very active in providing consultancy services to the Kerala Government for creating the Energy Conservation Fund. On the other hand, India is very successful in terms of accelerating its house construction business sector by the single financing scheme of providing the least interest rate for home loans @7%-8% along with income tax rebate when the prime lending rate is in the range of 16%-12%. It still remains unknown the real reason for not adopting this success story in the energy efficiency business sector. The draft EC fund rules being developed also do not look into this successful financing example. It is suggested that at least on an experimental basis, this way of financing energy efficiency projects through an interest subsidy may be explored.
While inviting financial institutions (FIs) into this energy efficiency financing foray to disburse funds at less interest to beneficiaries with no financial commitment to the FIs as the difference in their prime lending rate and the interest rate for the soft loan is reimbursed, care should be taken to make them aware that this is not another Government effort/ scheme to reach its financial target alone, but an important socio-economically relevant intervention required at this juncture when the whole world is discussing on combating the impacts of global warming caused due to indiscriminate energy conversion. It is a fact that when customers are made aware of the low interest car loan/ house loan / gold loan scheme through catchy banners and frequent promotional campaigns, participating banks in the MNRE soft loan scheme for solar water heaters seldom show any concern to make its customers aware about this scheme, though there is no net financial loss for the operating bank, but they gain an additional transaction.

Tile industry association

Though the economic and ecological importance of energy efficiency seems sufficiently well-proven for appropriate political decisions to take place for its implementation, when it really comes to making decisions, considerable delays are being observed. For example, though the Energy Conservation Act 2001 stipulates creation of an energy conservation fund (EC Fund), Kerala State or for that matter any state in India is yet to create an EC Fund. Though, there are complex reasons for this 'policy delay', it is due essentially to ignorance of the policy’s economic value and pressure from energy users. It is, therefore, essential to develop special information campaigns on business potential and social impacts due to energy efficiency and lobbying strategies aimed at bureaucrats and political decision makers to make conducive policies for energy efficiency promotion including allocation of necessary funds. Memorandums of Tile Industry Association have seldom addressed this issue or being aimed at the energy ministry / agencies in charge of energy efficiency promotion.

Training and putting staff in charge of internal professional energy management (as additional responsibility) backed by an external service provider (certified energy auditor) is a good recipe to enhance energy efficiency. Energy conservation is a state of mind that starts in everybody’s head and is not necessarily brought about merely with better equipment or process technology. Therefore
periodic awareness camps for workers can be organized under the banner of the association with support from government agencies to solicit participation from all quarters to this move.

Tile industry employees association may also take up this issue of energy efficiency as part of their agenda and co-operate with the management to provide necessary sensitization to the workers. They can also debate and come out with innovative proposals demanding reward for workers in an energy efficient unit, if using a few measurable parameters, it can be established that workers in that unit has contributed towards this achievement.

Linkage between these agencies

In line with the fragmentation of families (joint family into nuclear families) and land (combined holdings into smaller divisions), institutions are also either created for very specific narrowed purpose or highly disintegrated leading to incoherent decisions or policy announcements. There is seldom any formal continuous communication channel between these institutions listed above except that heads of the institutions at times find themselves as members of a few committees. Plethora of institutions often leads to the confusion as to which agency should take the lead in coordination. When the key subject is that of energy conservation, the agency created for that purpose - the EMC Kerala, should take this important role and devise a strategy of having a continuous and deep link *inter alia* with the following well-targeted contacts making maximum use of them as information clearing houses or intermediaries for its promotional schemes.

- Other Government Agencies engaged in energy conservation and renewable energy promotion;
- Government agencies engaged in industrial promotion;
- Research centres, Academic bodies and institutes;
- Chambers of commerce and industry;
- Professional associations and trade unions; and
- Press, Consumer associations, societies, non-governmental organizations, etc.
The support institutions must ensure that their services are redesigned to meet client concerns which will primarily be focused on:

- Finding time for initial discussions and making an informed choice;
- Reluctance to turn over information to third party;
- Confidentiality of process and company information;
- Credibility of technical advice;
- Client knowledge on the reasonableness of proposals;
- High cost of finance;
- Fitting the services into company's experiences;
- Lack of knowledge about what the providers can do;
- Difficulties in establishing the baseline; and
- Confirming the real savings with ongoing measurement.

The scope for increasing efficiency in the use of energy and other inputs is very large and technical services combined with performance contracting approaches can potentially make a contribution to improvement. But progress in this area faces a classic dilemma. Without coordinated and systematic effort there is not enough evidence to convince the different policy actors to increase the focus on efficiency investments and the energy agency should take that lead role and this requires focussed dialogues with many stakeholders.

Areas identified for further research

The intention in this thesis is not to imply that energy efficiency indices are alone sufficient to explain industrial performance in any production system. Analysis of organisation, human resources, productivity, finance and marketing are also important. However, the energy efficiency dimension is both a necessary and often misunderstood component. Future research on SMEs or industrial clusters would benefit from analysis of:

- knowledge acquisition models for enhancing production capacity, technological capabilities including productivity and energy efficiency; institutions which play a technological role in clusters, such as training schools and research centres;
- aspects like business awareness, alliances and networking of factories and their impact on economic efficiency;
- quality of tertiary education, which is important in building a technology base, is normally characterized by outdated curricula, insufficient practical
training and little contact with the needs of industry posing as barriers to enhancing export competitiveness, increasing local content and technological deepening which is important in order to reduce dependency;

- rapport of sub-sectoral centres and research institutes with the SMEs and how effective they were in assisting SMEs to upgrade their technologies; and

- strategic action plans of government energy agencies and industry promotion organisations vis-a-vis the growing needs of government support for the SMEs.

Conclusion

The results from this research study have relevance, in one way or other, to a number of different actors and institutions. These range from individual factories in Thrissur to other tile factories in India and to industry associations. There are issues that are relevant to the intermediary research and technical support agencies, EMC Kerala and agencies under Department of Industries. There are other issues that are of relevance to policy level institutions such as the Ministry of Micro, Small and Medium Enterprises and BEE. EMC Kerala in association with the Tile Industry Association, research institutions, Certified Energy Auditors and Department of Industries can suggest and offer (through other identified partners from educational institutions and industry associations) a number of new services to the industry. These need to be started initially on a grant or subsidy basis to check that the advice or service in fact works as predicted. After that has been demonstrated to a number of factories, say ten, the subsidy element can be reduced to a reasonable figure in consultation with the Tile Industry Association, possibly over a period of one to two years. New services may include Preliminary energy audits (at full subsidy), Worker training with a syllabus focussed to their needs, Detailed energy audit and Implementation contract service. An effective strategy to break through one of the major barriers identified - the lack of easy availability of affordable finance - need not be through a plethora of discussions and studies as currently undertaken, all of which culminate in the recommendation that “innovative financing schemes may be identified”, but through experimenting the classic example India created in the housing sector finance by reducing the interest rate for loans to an attractive scale. The Energy Conservation Fund being created in Kerala, by virtue of being a small amount compared to the enormous needs, has to be properly administered with great focus in one or two sectors in a year, without diluting / spreading, for better results.

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