5.1 Introduction:

The present study has analysed the relationship of energy with economic and industrial development in India. The study has also analysed the impact of energy consumption and energy efficiency on the economic development of India. The study has also examined the impact of industrial energy consumption and industrial energy efficiency on the industrial development in India. The idea of estimation of energy efficiency has been extended by analysing production patterns of selected small scale industries in Mysore. Three different types of small scale industries in the study area were surveyed namely plastic, intermediate (spare parts, components, ancillary parts) and final product manufacturing industries. The primary data from 30 enterprises in each category and all together 90 enterprises were surveyed. The Data pertaining to inputs usage cost of production and otherwise obtained from the entrepreneurs or management personnel. The general information of entrepreneurs and enterprises were analysed by using the chi-square tests for equal distribution and chi-square for association. The means of parametric variables among selected plastic, intermediate and manufacturing industries in the study area were compared by using t-tests, ANOVA and Duncan tests. The technical efficiencies of small scale industries in the study area have been estimated by using deterministic input oriented DEA. The frontier, efficient, inefficient and the most inefficient firms have been identified. Accordingly, the detailed research work has been summarised and presented as findings of the study in the following section. Based on the findings and results, few suggestions have also been made in this chapter.

5.2 Findings of the Study:

The major findings of the study are presented below;

- The growth rates of GDP and industrial income were analysed and found that the growth rates of these parameters are significant at one per cent level in India. It has also been found from the growth rates that the growth of industrial income was higher than the growth of GDP.

- The growth rates of gas production, oil production, electricity generation and coal production have been analysed and found that growth of gas production was significantly high and followed by oil production, electricity generation and coal production.
• The growth rates of availability of electricity, oil, coal and gas were computed and found that the availability of gas was also significantly high and followed by electricity, oil and coal availability.

• The growth rates of total consumptions of electricity, petrol, coal and gas were computed and found that the rate of growth of total gas consumption was also significantly high and followed by electricity, oil and coal availability.

• The growth rates of consumption of electricity, petrol and coal and gas by the industrial sector were calculated and found that the use of gas in the industrial sector has significantly increased at a higher rate compared to electricity, petrol and coal. Accordingly, though the use of gas was less in total energy use, its use was significantly increased at a faster rate followed by electricity and coal. At the same time, the use of petrol in the industrial sector increased at a lower rate.

• The co-integration techniques were used to establish the long-run relationship between electricity, petrol, coal, coal and economic development and found that electricity generation, availability and total consumption of electricity have long-run stable relationship with economic development. Accordingly, electricity is inevitable for economic development.

• The electricity consumption by industrial sector has long-run stable relationship with the industrial development. Accordingly, even for industrial development electricity is inevitable.

• The oil production, petrol availability and total petrol consumption have long-run stable relationship with economic development. Accordingly, petrol is also inevitable for economic development.

• The petrol consumption by the industrial sector also has long-run stable relationship with the industrial development. Accordingly, even for the industrial development petrol is essential.

• The coal production, availability and total consumption have long-run stable relationship with economic development. Accordingly, coal is inevitable for economic development.

• The coal consumption by industrial sector also has long-run stable relationship with industrial development. Accordingly, even for industrial development coal is necessary.
• The gas production, availability and total coal consumption have long-run stable relationship with economic development. Accordingly, gas is inevitable for economic development. However, the gas consumption by the industrial sector does not having long-run stable relationship with industrial development. Accordingly, gas consumption in the industrial sector was inadequate for industrial development.

• It is found from the growth analysis of efficiency parameters that the energy efficiencies of electricity, petrol and gas have registered negative growth rates. It means that the use of electricity, petrol and gas have grown at higher rates than the growth rate of GDP. At the same time, coal has registered positive growth rate in the economy. It means that the growth of coal has increased at a lower rate than the growth rate of GDP.

• It is also found that at the industry level, electricity, petrol and coal have registered positive growth rates. It does mean that the growth rate of industrial income was higher than the rate of use of petrol, coal and electricity in the industry. The growth rate of gas efficiency in the industry has registered negative growth rate. It means that the growth of industrial income was lower than the use of gas in the industry.

• It is also identified that the electricity efficiency has decreased in the economy. But it has increased in the industry. The petrol efficiency has decreased in the economy and as well as in the industry. The coal efficiency has increased in the economy as well as in the industry.

• It is also found that the gas efficiency has decreased both in the economy and in the industry. Accordingly, efficiencies of electricity, petrol and coal have increased in the industrial sector and have contributed for the growth of industrial income in India.

• The study has analysed the impact of efficiency of total electricity efficiency, total electricity consumption, total petrol efficiency, total petrol consumption, total coal efficiency and total coal consumption, total gas consumption and total gas efficiency on the economic development and found from the impact analysis that electricity consumption does not have significant positive impact on economic development. But efficiency of efficiency has made significant impact on the determination of economic development. The total petrol consumption and
efficiency of petrol have made positive significant influence on economic
development of India. The total coal consumption and efficiency of coal have
made positive significant impact on economic development of India. The total gas
efficiency has not played a vital role in the growth of GDP of India. At the same
time, gas has failed to explain the changes in economic development.

- The study has also analysed the impact of the industrial electricity consumption,
  industrial electricity efficiency, industrial petrol consumption, industrial petrol
efficiency, industrial coal consumption and industrial coal efficiency, industrial
gas consumption and industrial gas efficiency on industrial income in India.

- The industrial electricity efficiency and consumption have made positive impact
  on industrial income in India. The increase in the electricity consumption and
  efficiency will significantly increase the industrial income in India. The use of
  electricity in the industrial sector has been played significant and efficient role in
determination of industrial output. The industrial petrol efficiency has made
positive impact on industrial income in India. It is the efficiency of petrol plays a
vital role in the determination of industrial income of India. The industrial coal
efficiency has positive impact on industrial income in India. The total coal
efficiency plays an important role in the growth of industrial income of India. The
industrial gas efficiency does not significantly increase industrial income in India.
The industrial gas efficiency has not played a vital role in the growth of industrial
income of India.

- The study has analysed the primary information collected from 90 firms and found
  that the working days are significantly more in the plastic industry and
  significantly less in the intermediate and manufacturing industries.

- The study has analysed the numbers of causal, permanent and total labourers in
  the 90 firms and found that numbers of causal, permanent and total labourers are
  significantly less in the plastic industry and more in the manufacturing and
  intermediate industries.

- The study has analysed the costs of permanent, causal and permanent labour in the
  90 firms and found that the costs of permanent, causal and permanent labour
  significantly less in the plastic industry and more in the manufacturing and
  intermediate industries.
The study has analysed the initial investment, additional investment and total investment in the 90 firms and found that the initial investment was significantly less in the plastic industry moderate in the manufacturing industry and high in the intermediate industry. The additional investment was not significantly different in the plastic, intermediate and manufacturing industries. The total investment was significantly less in the plastic industry and high in the intermediate and manufacturing industries.

The study has analysed the different costs of the firms and found that the cost of raw materials is significantly less in the plastic industry and high in the intermediate and manufacturing industries. The expenditure on administration is significantly less in the intermediate and plastic industries and high in the manufacturing industry. The expenditure on transport is significantly less in the plastic industry and high in the manufacturing and intermediate industries. The rent is significantly less in the plastic industry and high in the intermediate and manufacturing industries. The office overhead cost is significantly less in the intermediate industry and high in the plastic and manufacturing industries.

The study has also analysed the expenditures on energy and found that the total expenditure on energy was significantly less in the plastic industry and high in the manufacturing and intermediate industries. It has also been found from the study that the energy cost of plastic industry was relatively high compared to its other costs. The energy efficiency was significantly less in the manufacturing industry, moderate in the plastic industry and high in the intermediate industry.

It has been also revealed by the cost, income and profit analysis that the total fixed cost was significantly less in the plastic industry and high in the manufacturing and intermediate industries. The total variable cost was significantly less in the plastic industry and high in the manufacturing and intermediate industries. The total cost was significantly less in the plastic industry and high in the manufacturing and intermediate industries. The total income was significantly less in the plastic industry and high in the manufacturing and intermediate industries. The profit was significantly less in the manufacturing and intermediate industries and high in the manufacturing industry.
• It has also been found from the study that the manufacturing and intermediate industries have generated more employment opportunities compared to the plastic industry.

• The technical efficiency of firms has been estimated and found that most of the firms are technically inefficient. The major reason for the technical inefficiency of firms was due to energy slack. The excess use of energy sources has resulted in low level of technical efficiency of the firms. It has also been found from the study that the excess use of energy and technical inefficiency was very high among the plastic producing firms. Accordingly, the study suggests that the inefficient firms have to redesign their energy using pattern and system.

• It has been proved from the slack estimation that there are more number of plastic firms which have used excess energy sources to produce the expected level of output. 14 plastic firms, 9 intermediate firms and 7 manufacturing firms have used excess energy sources to produce the excepted level of output. It is found that the plastic firms have more slacks in their production process compared to the intermediate and the manufacturing firms.

5.3 Suggestions:

In the following section, few suggestions have been based on the research findings and tested proofs;

• It has been proved by the study that energy is a prerequisite for development and industrial development. Accordingly, inadequate availability of energy will have negative impact on the process of economic and industrial development. Therefore, there is a need for adequate supply of energy for industrial and economic development.

• It has been found from the study that energy efficiency has made significant impact in determination of economic and industrial development than the consumption of energy. Therefore, the major focus has to be given to increase the energy efficiency (which has multiple positive environmental implications) rather than the simply increasing the energy supply.

• The use of clean energy (gas) was found to be very less in the industrial sector compared to other energy sources. Therefore, government has to encourage the
use of clean energy in the industrial sector. At the same time, there is also necessary to promote research and technology for the use of gas in the industrial production process.

- The government needs to formulate policies to induce the small scale entrepreneurs in Mysore to invest in creating a mixed supply of energy which consists of clean and renewable resources.
- The use of standard energy conservation practices have not been found in the small scale firms in Mysore. Therefore, the ministry of industries should give proper directions to the small scale industries to follow the energy conservation practices as given in the manufacturing policy for eco-efficiency.
- Most of the firms in Mysore have not used star rated energy equipment for saving energy. Therefore, it is necessary to made mandatory to use of star rated energy equipment.
- Most of the small firms in Mysore have inefficiently used excess energy for production. Therefore, it is necessary to follow the peer firms for effective use of energy sources for better energy efficiency and technical efficiency.
- Last but not the least, as it has been found from the study that the excess use of energy and the technical inefficiency are very high among the plastic producing firms, the inefficient plastic producing firms are required to redesign their energy using pattern and system.

5.4 Conclusion:

The present study has analysed the long-run relationship of energy with economic and industrial development in India. The study has also analysed the impact of energy use and energy efficiency on the GDP and industrial income in India. It is found from the study that energy has long-run stable relationship with economic development. It is also clear from the analysis that energy has long-run stable relationship with industrial development. The short-term disturbances in the long-run relationship have been corrected in one or two time periods. The long-run relationship between energy and economic development is restored. The long-run relationship between energy and industrial development is also restored by correcting short term disturbances in the long-run relationship between them. The energy consumption and efficiency have made significant impact on the determination of
economic development. The industrial energy consumption and industrial energy efficiency have also made significant impact on industrial development in India. Therefore, energy plays a vital role in the determination of economic and industrial development in India. The energy efficiency also plays an important role in the determination of economic and industrial development in India. The present study has also analysed the energy use practices in selected small scale industries in Mysore. The technical efficiency of firms has been estimated and found that most of the firms are technically inefficient. The major reason for the technical inefficiency of firms is due to energy slack. The excess use of energy sources has resulted in low level of technical efficiency of the firms. It has also been found from the study that the excess use of energy and technical inefficiency is very high among the plastic producing firms. Accordingly, the study suggests that the inefficient firms are needed to redesign their energy using pattern and system. As a matter of fact, it is necessary to follow the peer firms for effective use of energy sources for better energy efficiency and technical efficiency. At the same time, it is also necessary to follow energy conservation methods. It is also required to use star rated energy equipments for better energy efficiency and performance. The present study is a genuine and legitimate effort to assess the energy efficiency of small scale firms in Mysuru and it can be extended to medium and large scale industries; the study can also be extended to firms in other places, regions and states.