CHAPTER 5
CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION

This research aims was to investigate the Cleaner production methodological scope in foundries and to understand the modifications of processes needed to shift from a common process to CP. Experimental and field study approach yields the following conclusions:

1. It is evident from the studies, that when unit of the foundry is considered, the integrated approach to both environment friendliness and system efficiency should be considered. Implementation of any system will result in increased production cost without increasing the productivity. But the integrated approach discussed in studies will largely cut the increased production cost due to CP approach. Control of pollution parameters and the standard requirements should not be taken in isolation but should be taken in totality with social need, market growth and economic suitability of the industry and indigenously best available technology to achieve the objectives.

2. This sector having turnover 40,000 tons/year, for MSME foundries, for different castings mainly in Grey Iron and S.G. Iron, and Production growth is reducing till date. Demand is also decreasing on an average by around 30 per cent. This is indicating that the industry should posses’ competence with the global demand.

3. The price of coke has risen over the recent year and is presently about INR 30,000 for each ton. The major part of energy is used in the melting process. It was found that, conventional type cupola furnace used by nearly 90% of the foundry units, about 10% industry use electric induction furnace for melting. Low ash coke is in used by
most of foundries. Thus MSME foundries in these areas have the conventional sand casting production which consumes high resources such as energy. The specific energy consumption ranges between 1100–1300 kWh per ton of good castings.

4. The pollution measuring machine was set up in order to take reading. Iron is used as raw material. The gas rate of SPM 1829.9 μg/m$^3$ and followed by the NO$_2$ 171.4 μg/m$^3$ and SO$_2$ 42.5 μg/m$^3$. Most of the foundries in Gujarat had not adopted DBC technology till now. They are using local cupolas which are having less efficiency due to high coke consumption. So it is recommended to implement DBC which was demonstrated by TERI, with the support of the Swiss Agency for Development and Cooperation (SDC).

5. Most MSME foundry units have not used pollution control systems to meet the emission standards. Since most companies are not reusing or recycling their sand, major equipment used in foundry units are local made melting furnaces, Sand millers, Knock-out machine they are using coke as well as electricity in a foundry melting, hence Improvement potential areas are air emissions, efficient use of raw materials and energy, waste reduction along with any recycling and re-use options. Air pollution as well as disposal of foundry wastes is major issues in the cluster.

6. Skilled labors are not interested in MSME foundries Rejection rate of casting is depends upon product but general rejection rate is 15 to 20 percentage so there is need of approach which focus on pollution control and less resource consumptions.

7. Result of study at GIDC revels that the pollution from cupola furnace is much higher than settle on range of pollution by Gujarat pollution control board. It is necessary to reduce the emission of harmful gases and so pollution level by using appropriate substance. It is also essential to improve design of cupola furnace to make it efficient and set gas cleanout units that are able to reduce dangerous gases.
8. Energy efficiency is one more factor to consider this can be solved by installing the dived blast cupola design instead of normal cupola furnace. This will improve overall efficiency of furnace and reduce harmful emission.

9. Scrubbing gases with appropriate wet scrubber is one more solution. Different kind of venturi scrubbers can be used as these types of scrubbers have 99% working efficiency and set up cost is moderate. Moreover, change in any particle size does not affect working efficiency of this type of scrubber. Therefore concentration of SPM in harmful emission of gases is unlike to vary with the any changes in the characteristics of input raw substance which is common in such type of foundry industry. Nevertheless gas cleaning method needed to be employed where it is difficult to get enough water for process.

10. Results of data collection indicate that CO emission is very high immediately after firing the fuel as temperature of gases is above 200°C throughout this period. Although, air is passed through charge hole but instant combustion of carbon monoxide might not happen. At this stage, it is essential to enter afterburner to speed up combustion process.

11. Some simple modification in cupola design can improve efficiency of furnace. Also some basic and economical pollution control devices can be added to design of furnace. This modification leads to overall less emission and bring down pollution under the range of Gujarat pollution control board.

12. Cupola can easily melt scrap material which is not at all clean by very small coke overconsumption and little environmental approach, if the proper gas treatment is done.

5.2 RECOMMENDATIONS
Among many objectives of the Cleaner Production (CP) for sustainable development (SD) is to use all the resources efficiently as much as possible and thus to use best available and suitable technologies and processes
without drastic change as it requires skill as well as money considering wholistic approach.

With this regards CP implementations may be applied in continual manner such as short terms, medium terms and long term measures. With the aid of these studies following measures may helpful and can be applicable in present conditions to achieve the benefits of CP in terms of SD.

1. Short terms measures can be categorized in which no substantial investments such as
   - Housekeeping such as maintenance of compressor, scrap storage, placing lid on induction furnace etc
   - Inspection in terms of energy audit and management.
   - Training awareness programmes for both foundry owner as well as workers too.

2. Medium terms involve selection of Best available techniques (BAT) depending upon suitability in present conditions in terms of technology and human point of view such as
   - Variable frequency drive screw compressor.
   - Energy efficient motors.
   - Purchase of good quality coal.
   - Efficient energy distribution system.
   - Increasing shaft height of cupola furnace
   - Conversion of conventional cupola to Divided Blast Cupola (DBC)
   - Use of capacitors to get the benefits of Power factor (PF) from Electricity boards.

3. Long terms measures required environmental perspectives in terms of sustainable development for foundries along with economical benefits for a justified period of times such as In this studies only two devices are used
(Dust and fume collector and ventury scrubber) and found to be effective others devises and processes can be can be used as below:

- DBC in place of Cupola.
- Induction furnaces
- Adequate sand reclamations system
- Use of dry dust collectors methods like fabric filters
- Reclaim sand used in molding.
- Dust emission control technologies such bughouses, and electrostatic precipitators (ESPs).
- Wet scrubbers. Scrubbers can also used to control mists, acidic gases, as well as amines.
- Pressure sand filter.
- Air Exhausters.

5.3 DISCUSSION
Small and medium scale foundry industry is a vital part in the Indian industries and would keep on playing an important part in the Indian economy later on. It has been watched that a many of the small scale industry in this area today, are not intrigued with innovative upgrades and their quality, effectiveness and because of this benefit have really declined throughout the years. Globally, numerous new organizations are coming into the field and the competition is currently expanding rivalry from bigger units. To stay in the market the units thus, need to embrace more up to date and innovative ways to deal with update their technological capacities and hence stay focused. The small scale units, in any case, have constrained limit and assets to put resources into the innovative capacity improvement. The contextual analyses in the small scale areas easily demonstrate the advantages of vitality effective process.
Subsequently it can be said that energy efficient methodology is one of best approach for showing the advantages of energy and productivity improvement in medium and small scale industry.

The work appraises cleaner production approach at general level, with an emphasis on production practices in the foundry industry in a lower technology, developing economical justification that was less industrialized. It is an effort for bridging theoretical and practical gaps to cover the scope of CP through sustainable manufacturing in the foundry applicable for a developing country to identify the lessons that can be learnt and to identify the points of applications with studies done elsewhere.

Using above strategies and recommendations foundry industries may build up eco-friendly casting. This work set a framework that may be applicable in the small and medium scale foundry industry in Indian context.

5.4 MAJOR CONTRIBUTIONS

Major contributions include the transfer of the compiled information from the research work to industry to assist the Cleaner Production for sustainable development by following ways:

1. Few of the major contributing factors that were studied and identified for the poor energy performance in a ferrous small and medium scale foundry industry.

2. Various energy conservation proposals including technology upgradation are identified for small and medium scale foundry industry.

3. Economic Justification for savings for replacing conventional blast Copula with modern divided Blast Copula is prepared.

4. Role of APFC (Automatic Power Factor Compensation) to get more incentives from electricity board is explained with economic justification for a studied foundry.

This work makes two broad Key conceptual contributions.
1. It explores challenging issues in Indian small and medium scale foundry industries pertaining to environmental sustainability.

2. It provides concise description of cleaner production options for Indian small and medium scale foundries that will be helpful for further studies.

3. QAP plan was developed and it may replicate for future product.

Our biggest success regarding this work is, studied foundries implementing the concept of cleaner production and they are adopting the technology and process-change, for example Foundry “A” has installed Device (Dust and Fume collector) to minimize fumes and burnt gases from induction furnace, use of quality scrap, adoption of Quality assurance plan. Also they are agreed with reduction of waste by adopting value stream mapping measure.

5.5 FUTURE SCOPE

Framework developed in this investigation can assist foundry industry for implementing cleaner production system with high productivity, resulting in higher quality and less pollution for sustainable growth with fewer modifications. This work can be extended to other casting techniques (continues casting, die casting etc.) and all ferrous and non ferrous small and medium scale foundry. It can potentially lead to a new approach for Indian foundry industry to compete with globalization for sustainable development through cleaner production. It is hoped that some useful and affordable CP systems may emerge from these studies in future. Following are the specific area which needs devoted and disciplined study, this are as below.

1. Exhaust capture efficiency is possible by use of various systems, such as draughts, hoods and partial covering of the furnace.

2. During observation it was also noted that ordinary coal was used by the firms so in that coal there is a less amount of oxygen and high carbon so high quality of coal may be used to have a complete consumption.
It is essential to study various kinds of coal and its suitability and economics.

3. To promote this Industry, a holistic approach is necessary to cope with the situation. Policies must be promoted and proper feasible training programme could be developed to improve and promote the best available technology. This could help in survival with prosperity of these industries.

4. The existing study is done in the area of Gujarat state. The foundry units in India are located in 20 different geographical Hub so there is need to study every hub and need to develop some guides within the constraints of sustainability.

In summary, the CP approach will definitely directly contribute to the sustainable development of the industry and country.