CHAPTER 3

3.1 AUTOMOBILE INDUSTRY

3.1.1 Introduction to Automobile

Hundreds of years people have been compelled to find a better way to travel. It would be impossible to credit just one person for the development of the automobile. The word “automobile” literally means self-moving. People wanted a vehicle that could take them to new places. For many years people worked and lived within miles of where they were born and where they eventually died. Before the automobile, most people traveled on land from one place to another by foot, train, bicycle, or horse and carriage. Within a few years of the turn of the 20th century, the automobile would change society forever. Today, there are millions of vehicles on the roadways.

An automobile (or automotive) is a vehicle that is capable of propelling itself. Since seventeenth century, several attempts have been made to design and construct a practically operative automobile. Today, automobiles play an unimaginable role in the social, economic and industrial growth of any country.

Automotive industry is the key driver of any growing economy. It plays a pivotal role in country's rapid economic and industrial development. It caters to the requirement of equipment for basic industries like steel, non-ferrous metals, fertilizers, refineries, petrochemicals, shipping, textiles, plastics, glass, rubber, capital equipment, logistics, paper, cement, sugar, etc. It facilitates the improvement in various infrastructure facilities like power, rail and road transport. The automotive industry comprises of the automobile and the auto component sectors. It includes passenger cars; light, medium and heavy commercial vehicles; multi-utility vehicles such as jeeps, scooters, motor-cycles, three wheelers, tractors, etc.; and auto components like engine parts, drive and transmission parts, suspension and braking parts, electrical, body and chassis parts; etc.
3.2 HISTORICAL EVALUATION OF AUTOMOBILE INDUSTRIES IN INDIA

First car on India's roads run in 1897. Until the 1930s, cars were imported directly, but in very small numbers. An embryonic automotive industry emerged in India in the 1940s. Hindustan was launched in 1942, long time competitor Premier in 1944. They built GM and Fiat products respectively. Mahindra & Mahindra was established by two brothers in 1945, and began assembly of Jeep CJ-3A utility vehicles. Following the independence, in 1947, the Government of India and the private sector launched efforts to create an automotive component manufacturing industry to supply to the automobile industry. In 1953 an import substitution Programme was launched, and the import of fully built-up cars began to be impeded.

The Hindustan Ambassador dominated India's automotive market from the 1960s until the mid-80s. However, the growth was relatively slow in the 1950s and 1960s due to nationalization and the license raj which hampered the Indian private sector. Total restrictions for import of vehicles were set and after 1970 the automotive industry started to grow, but the growth was mainly driven by tractors, commercial vehicles and scooters. Cars were still a major luxury item. In the 1970s price controls were finally lifted, inserting a competitive element into the automobile market. By the 1980s, the automobile market was still dominated by Hindustan and Premier, who sold superannuated products in fairly limited numbers. During the eighties, a few competitors began to arrive on the scene.

To promote the auto industry the government started the Delhi Auto Expo which was had its debut showcasing in 1986. The Auto Expo of 1986 was a window for technology transfers showing how the Indian Automotive Industry was absorbing new technologies and promoting indigenous research and development for adapting these technologies for the rugged Indian conditions. The 9 day show was marked by then Prime Minister Rajiv Gandhi.
3.2.1 Growth of Indian Automobile Sector

The Indian automobile industry seems to come a long way since the first car that was manufactured in Mumbai in 1898. The automobile sector today is one of the key sectors of the country contributing majorly to the economy of India. It directly and indirectly provides employment to over 10 million people in the country. The Indian automobile industry has a well-established name globally being the second largest two wheeler market in the world, fourth largest commercial vehicle market in the world, and eleventh largest passenger car market in the world and expected to become the third largest automobile market in the world only behind United States of America (USA) and China which is a quite significant.

The growth of the Indian middleclass along with the growth of the economy over the last few years has resulted in a host of global auto giants setting their foot inside the Indian Territory. Moreover India also provides trained manpower at competitive costs making the country a manufacturing hub for many foreign automobile companies. India proves to be a potential market as compared to most of the other countries which are witnessing stagnation as far as automobile industry growth is concerned. A recent research conducted by the global consultancy firm Deloitte says that at least one Indian automobile company will feature among the top six automobile companies that will definitely dominate the car market by 2020.

In India, automotive is one of the largest industries showing impressive growth over the years and has been significantly making increasing contribution to overall industrial development in the country. Presently, India is the world's second largest manufacturer of two wheelers, fifth largest manufacturer of commercial vehicles as well as largest manufacturer of tractors. It is the fourth largest passenger car market in Asia as well as a home to the largest motor cycle manufacturer. The sector has shown great advances in terms of development, spread, absorption of newer technologies and flexibility in the wake of changing business scenario.
3.2.2 Challenges

Competition is fierce in the automobile industry. Worldwide overcapacity has created price pressures that are particularly challenging for manufacturers that are already having a tough time managing their overall productivity and costs. And most major areas of efficiency improvement have already been tapped.

What to do? Cutting energy demand is always a tempting area. In a setback to the automobile industry, already under pressure because of declining sales, the government has notified mandatory fuel efficiency norms that would push up their production costs. At the same time, the move, once implemented, is likely to reduce the carbon footprint of the automobile industry. It is the first time that such norms have been introduced. Of the more than 80 car models plying on Indian roads at present, only around eight comply with these standards. Under the new norms, the industry will have to ensure that the mileage of cars on Indian roads improves by 10% by 2021. The second phase, for which the government did not specify a deadline, will begin from 2022 and targets a fuel efficiency improvement by 30%.

Failure to comply will invite a penalty. Under the Energy Conservation Act, 2001, car makers that fail to meet carbon emission norms will be fined Rs.10 lakh initially and asked to pay a penalty of Rs.10,000 a day till their car models meet the norms, said Ajay Mathur, director general, Bureau of Energy Efficiency (BEE).\(^1\)

A plant with a daily output of 1,000 vehicles can easily use several hundred thousand megawatt-hours (MWh) of electricity per year – as much as a medium-sized town. Huge pressing instruments shape sheet metal into body parts; robots assemble vehicle bodies with thousands of welding spots and glue dots; and the paint shop, which accounts for 45 to 60 percent of the plant’s energy use, has to keep paint at the right temperature, run large

ventilation systems, and power its robots. Elsewhere, conveyors bring the doors, engine, powertrain, and interior fittings to the assembly line for installation.

How much energy does each of these steps consume? Exactly when, where, and how much electricity, gas, and heat are being used? Only when a plant has answers to these questions can it identify measures designed to improve its energy efficiency.²

Automotive manufacturers and their part suppliers have persistent process requirements throughout their facilities - from corporate functions to shipping completed assemblies. Energy management in the Automotive Industry is essential for reducing energy cost and increasing plant uptime. In a global industry where competition is fierce, proactive auto companies are building the infrastructure to know how, when, and where all forms of energy are used in their facilities.

3.3 OVERVIEW OF INDIAN AUTOMOBILE INDUSTRIES³

3.3.1 Industry Performance in 2012-13

a. Production
   The cumulative production data for April- March 2013 shows production growth of only 1.20 percent over the same period last year. The industry produced 1,685,355 vehicles in March 2013 as against 1,845,868 in March 2012, which declined by (-) 8.70 percent. Figure No. 3.1 shows Gross turnover of the Automobile Manufacturers in India (In USD Million)

³ http://www.siamindia.com
Table 3.1: According to the Society of Indian Automobile Manufacturers, Gross turnover of the Automobile Manufacturers in India (In USD Million)

<table>
<thead>
<tr>
<th>Year</th>
<th>2006-07</th>
<th>2007-08</th>
<th>2008-09</th>
<th>2009-10</th>
<th>2010-11</th>
</tr>
</thead>
<tbody>
<tr>
<td>USD Million</td>
<td>30,476</td>
<td>36,612</td>
<td>33,250</td>
<td>43,296</td>
<td>58,583</td>
</tr>
<tr>
<td>(USD Conservation Rate)</td>
<td>45</td>
<td>40</td>
<td>46</td>
<td>47</td>
<td>46</td>
</tr>
</tbody>
</table>

Table Number 3.2: According to the Society of Indian Automobile Manufacturers, Year wise Automobile Production Trends (Year vs. Number of Vehicles)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Vehicles</td>
<td>17,77,583</td>
<td>18,38,593</td>
<td>23,57,411</td>
<td>29,82,772</td>
<td>31,46,069</td>
<td>32,33,561</td>
</tr>
<tr>
<td>Commercial Vehicles</td>
<td>5,49,006</td>
<td>4,16,870</td>
<td>5,67,556</td>
<td>7,60,735</td>
<td>9,29,136</td>
<td>8,31,744</td>
</tr>
<tr>
<td>Three Wheelers</td>
<td>5,00,660</td>
<td>4,97,020</td>
<td>6,19,194</td>
<td>7,99,553</td>
<td>8,79,289</td>
<td>8,39,742</td>
</tr>
<tr>
<td>Two Wheelers</td>
<td>80,26,681</td>
<td>84,19,792</td>
<td>1,05,12,903</td>
<td>1,33,49,349</td>
<td>1,54,27,532</td>
<td>1,57,21,180</td>
</tr>
<tr>
<td>Grand Total</td>
<td>1,08,53,930</td>
<td>1,11,72,275</td>
<td>1,40,57,064</td>
<td>1,78,92,409</td>
<td>2,03,82,026</td>
<td>2,06,26,227</td>
</tr>
</tbody>
</table>
b. Domestic Sales

The overall growth in domestic sales during April-March 2013 was 2.61 percent over the same period last year. While in March 2013 overall sales fell by (-) 7.76 percent over March 2012.

Passenger Vehicles segment grew at 2.15 percent during April-March 2013 over same period last year. Passenger Cars declined by (-) 6.69 percent, Utility Vehicles grew by 52.20 percent and Vans grew only by 1.08 percent during April-March 2013 as compared to the same period last year. However, in March 2013 passenger car sales further declined by (-) 22.51 percent over March 2012. Total passenger vehicles sales also declined by (-) 13.01 percent in March 2013 over same month last year.

The overall Commercial Vehicles segment registered de-growth of (-) -2.02 percent in April- March 2013 as compared to the same period last year. While Medium & Heavy Commercial Vehicles (M&HCVs) declined by (-) 23.18 percent, Light Commercial Vehicles grew at 14.04%. In March 2013, M&HCVs sales further declined by (-) 26.16 percent over March 2012.

Three Wheelers sales grew by 4.87 percent in April-March 2013. Passenger Carriers grew by 8.58 percent during April-March 2013 and Goods Carriers registered de-growth at (-) 9.20 percent during this period.

Two Wheelers registered growth of only 2.90 percent during April-March 2013. Scooters, mopeds and motorcycles grew by 14.24 percent, 1.53 percent and 0.12 percent respectively over same period last year. However, in March 2013 all sub-segments of two wheelers, scooters, motorcycles and mopeds registered de-growth at (-) 3.18 percent, (-) 8.32 percent and (-) 4.54 percent respectively. Table No. 3.3 indicates Year wise Automobile Domestic Sales Trends (Year vs. Number of Vehicles)
Table Number 3.3: According to the Society of Indian Automobile Manufacturers, Year wise Automobile Domestic Sales Trends (Year vs. Number of Vehicles)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Vehicles</td>
<td>15,49,882</td>
<td>15,52,703</td>
<td>19,51,333</td>
<td>25,01,542</td>
<td>26,18,072</td>
<td>26,86,429</td>
</tr>
<tr>
<td>Commercial Vehicles</td>
<td>4,90,494</td>
<td>3,84,194</td>
<td>5,32,721</td>
<td>6,84,905</td>
<td>8,09,532</td>
<td>7,93,150</td>
</tr>
<tr>
<td>Three Wheelers</td>
<td>3,64,781</td>
<td>3,49,727</td>
<td>4,40,392</td>
<td>5,26,024</td>
<td>5,13,251</td>
<td>5,38,291</td>
</tr>
<tr>
<td>Two Wheelers</td>
<td>72,49,278</td>
<td>74,37,619</td>
<td>93,70,951</td>
<td>1,17,68,910</td>
<td>1,34,35,769</td>
<td>1,37,97,748</td>
</tr>
<tr>
<td>Grand Total</td>
<td>96,54,435</td>
<td>97,24,243</td>
<td>1,22,95,397</td>
<td>1,54,81,381</td>
<td>1,73,76,624</td>
<td>1,78,15,618</td>
</tr>
</tbody>
</table>

Table Number 3.4: According to the Society of Indian Automobile Manufacturers, Domestic Market Share for 2011-12

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Vehicles</td>
<td>15</td>
</tr>
<tr>
<td>Commercial Vehicles</td>
<td>5</td>
</tr>
<tr>
<td>Three Wheelers</td>
<td>3</td>
</tr>
<tr>
<td>Two Wheelers</td>
<td>77</td>
</tr>
</tbody>
</table>
c. Exports

During April-March 2013, overall automobile exports registered de-growth of (-) 1.34 percent compared to the same period last year. Passenger Vehicles grew by 9.02 percent, while the other segments like Commercial Vehicles, Three Wheelers and Two Wheelers fell by (-)13.35 percent, (-) 16.22 percent and (-) 0.72 percent respectively. In March 2013, Passenger Vehicles, Two & Three Wheelers grew by 3.07 percent, 3.51 percent and 7.50 percent respectively. While Commercial Vehicles declined by (-) 28.33 percent. The following table No. 3.5 indicates Year wise Automobile Exports Sales Trends (Year vs. Number of Vehicles)
Table Number 3.5: According to the Society of Indian Automobile Manufacturers, Year wise Automobile Exports Sales Trends (Year vs. Number of Vehicles)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Vehicles</td>
<td>2,18,401</td>
<td>3,35,729</td>
<td>4,46,145</td>
<td>4,44,326</td>
<td>5,07,318</td>
<td>5,54,686</td>
</tr>
<tr>
<td>Commercial Vehicles</td>
<td>58,994</td>
<td>42,625</td>
<td>45,009</td>
<td>74,043</td>
<td>92,663</td>
<td>79,944</td>
</tr>
<tr>
<td>Three Wheelers</td>
<td>1,41,225</td>
<td>1,48,066</td>
<td>1,73,214</td>
<td>2,69,968</td>
<td>3,62,876</td>
<td>3,03,088</td>
</tr>
<tr>
<td>Two Wheelers</td>
<td>8,19,713</td>
<td>10,04,174</td>
<td>11,40,058</td>
<td>15,31,619</td>
<td>19,47,198</td>
<td>19,60,941</td>
</tr>
<tr>
<td>Grand Total</td>
<td>12,38,333</td>
<td>15,30,594</td>
<td>18,04,426</td>
<td>23,19,956</td>
<td>29,10,055</td>
<td>28,98,659</td>
</tr>
</tbody>
</table>

3.4 ENERGY TREND IN INDIAN AUTOMOBILE INDUSTRIES

3.4.1 Energy Cost in Car Manufacturing

Manufacturing of car (Press, Body, Paint, Assembly shop alone) consumes about 500-700 KWH /Vehicle and energy cost is about 9-12% of total manufacturing cost. A 20% reduction of energy cost shall be about 2-2.4% reduction in manufacturing cost. India produces about 1.2 million cars a year and the total reduction could be about 1, 44,000 MWH equivalent to INR 720 million.

---

4 M. Bhaskar, Chief Consultant, 2009, Management in Automotive Plants & Process, Energy Management Group, Schneider Electric
### Table Number 3.6: Specific Energy Consumption for different vehicle categories

<table>
<thead>
<tr>
<th>Category</th>
<th>KWH/ Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Car, SUVs</td>
<td>500-700</td>
</tr>
<tr>
<td>Commercial Vehicle</td>
<td>1100-1500</td>
</tr>
<tr>
<td>Tractors</td>
<td>500-650</td>
</tr>
<tr>
<td>Two Wheelers</td>
<td>30-35</td>
</tr>
</tbody>
</table>

Compressed Air alone consumes about 55-75 KWH/vehicle. In automobile industry, typical automobile manufacturing unit consumes, Electricity - 550 KWH/vehicle and LPG- 25 Kg/vehicle.

### 3.4.2 Break-up of energy consumption

Table No 3.7, Typical Energy Consumption trend of an Automobile Industry

<table>
<thead>
<tr>
<th>Shops</th>
<th>% Energy Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint Shop and it’s utilities</td>
<td>35%</td>
</tr>
<tr>
<td>Engine and Trans-Axle and it’s utilities</td>
<td>25%</td>
</tr>
<tr>
<td>Compressed Air and other Utilities</td>
<td>16%</td>
</tr>
<tr>
<td>Other Areas</td>
<td>24%</td>
</tr>
</tbody>
</table>
Figure Number, 3.2, Typical Shop wise Percentage Energy Consumption trend of an Automobile Industry

3.4.3 Shop- wise utilities for focus on Energy Conservation

<table>
<thead>
<tr>
<th>Shop</th>
<th>Equipment and Utilities for focus on energy conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press</td>
<td>Press auxiliaries and Hydraulic packs, Compressed Air, Lighting, Cooling Tower</td>
</tr>
<tr>
<td>Body shop</td>
<td>Compressed Air, Cooling Tower, Ventilation System, Lighting, Pumping System</td>
</tr>
</tbody>
</table>
### 3.4.4 Energy savings Opportunities in the auto industries

As Galitsky and Worrell (2003)\(^5\) point out, the primary forms of energy utilized in the automobile parts and assembly sector are electricity, steam, gas, and compressed air. Electricity consumes approximately two thirds of the energy budget for vehicle assembly plants, utilized primarily for compressed air, metal forming, lighting, ventilation, air

---

\(^5\) Galitsky and Worrell, (2003). Energy Efficiency Improvement and Cost Saving Opportunities for the Vehicle Assembly Industry
conditioning, painting, material handling, and welding. Motors that drive plant equipment consume around 70 percent of total electricity demand, highlighting the importance of energy efficient motor systems. Fuel usage primarily centres on general heating as well as ensuring correct temperature and humidity in the painting line.

Galitsky and Worrell (2003) conduct an analysis on the energy saving opportunities available to automobile assembly facilities, using a number of US assembly plants as case studies. They identify over 90 energy saving practices and technologies, splitting them into cross cutting utility measures and process-specific measures. Cross cutting utility measures offer immediate energy savings without impacting on the assembly process. They involve energy efficiency improvements to motors, compressed air, lighting, hot water and steam distribution, hot water and steam generation, power supply, and heating, ventilation, and air conditioning.

While the savings brought about by each individual measure are small, the cumulative savings are substantial. Importantly, the majority of measures are financially profitable, offering relatively quick payback periods or even coming at a net negative cost depending on the size, age, and specific activity of the plant. The process-specific energy efficiency measures identified relate to painting, welding, and stamping. In addition to energy savings, many of the identified technologies yield improvements to product quality.

3.5 AUTOMOBILE INDUSTRIES IN PUNE UNEDR STUDY

Pune is a major industrial hub and hosts one of the biggest industrial zones not only in India but in the entire Asia. The city is a home to the Indian operations of major automobile companies and several other industries. There are thousands of engineering units of various sizes including those of the major auto manufacturers, and as such, this area is often referred to as the ‘Detroit of East’.
For the study purpose, based on data available with Society of Indian Automobile Manufacturers and factual data, the following automobile industries in Pune manufacturing passenger cars are considered as shown in Table No. 3.8. These are the world’s leading automobile industries.

### Table 3.8 Name and address of Automobile industries under study

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tata Motors Limited</td>
<td>Sector No 15/15 A, Chikhali, Pcntda, Pune - 412114</td>
</tr>
<tr>
<td>2</td>
<td>Mahindra Vehicles Manufacturers Ltd</td>
<td>A/1 Phase, Chakan, Chakan Industrial Area Village Nighoje Taluka Khed MIDC, Pune - 410501</td>
</tr>
<tr>
<td>3</td>
<td>Volks Wagen India Private Limited</td>
<td>E-1,Phase-3,Mhalunge Road, Chakan, Village Nighoje Kharabwadi, Pune - 410501</td>
</tr>
<tr>
<td>4</td>
<td>General Motor India Private Limited</td>
<td>Plot No A/16 Phase 2, Navlakh Umbre Village Road, Talegaon Dabhade, MIDC Near Talegaon Floricultural Park, Taluka Maval, Pune - 410507</td>
</tr>
<tr>
<td>5</td>
<td>Fiat India Automobiles Private Ltd</td>
<td>B-19, Pune-Ahmednagar Road, Ranjangaon, MIDC Industrial Area, Pune - 412220</td>
</tr>
<tr>
<td>6</td>
<td>Mercedes Benz India Private Limited</td>
<td>E 3, Chakan, Phase III Chakan Industrial Estate Kuruli &amp; Nighoje Taluka Khed, Pune - 410501</td>
</tr>
</tbody>
</table>
3.5.1 TATA MOTORS - Tata Motors Limited

a. Introduction

Tata Motors Limited is India's largest automobile company, with consolidated revenues of INR 1, 88,818 crores (USD 34.7 billion) in 2012-13. It is the leader in commercial vehicles in each segment, and among the top in passenger vehicles with winning products in the compact, midsize car and utility vehicle segments. It is also the world's fifth largest truck manufacturer and fourth largest bus manufacturer.

b. Mission

The Tata Motors Group's over 60,000 employees are guided by the mission "to be passionate in anticipating and providing the best vehicles and experiences that excite our customers globally."

c. History

Established in 1945, Tata Motors' presence cuts across the length and breadth of India. Over 8 million Tata vehicles ply on Indian roads, since the first rolled out in 1954. The company's manufacturing base in India is spread across Jamshedpur (Jharkhand), Pune (Maharashtra), Lucknow (Uttar Pradesh), Pantnagar (Uttarakhand), Sanand (Gujarat) and Dharwad (Karnataka). Following a strategic alliance with Fiat in 2005, it has set up an industrial joint venture with Fiat Group Automobiles at Ranjangaon (Maharashtra) to produce both Fiat and Tata cars and Fiat powertrains. The company's dealership, sales, services and spare parts network comprises over 6,600 touch points.

Tata Motors, also listed in the New York Stock Exchange (September 2004), has emerged as an international automobile company. Tata Motors is also expanding its international footprint, established through exports since 1961. The company's commercial and passenger vehicles are already being marketed in several countries in
Europe, Africa, the Middle East, South East Asia, South Asia, South America, CIS and Russia. It has franchisee/joint venture assembly operations in Bangladesh, Ukraine, and Senegal.

It was Tata Motors, which launched the first indigenously developed Light Commercial Vehicle in 1986. In 2005, Tata Motors created a new segment by launching the Tata Ace, India's first indigenously developed mini-truck. In 2009, the company launched its globally benchmarked Prima range of trucks and in 2012 the Ultra range of international standard light commercial vehicles. In their power, speed, carrying capacity, operating economy and trims, they will introduce new benchmarks in India and match the best in the world in performance at a lower life-cycle cost.

Tata Motors also introduced India's first Sports Utility Vehicle in 1991 and, in 1998, the Tata Indica, India's first fully indigenous passenger car.

In January 2008, Tata Motors unveiled its People's Car, the Tata Nano. The Tata Nano has been subsequently launched, as planned, in India in March 2009, and subsequently in 2011 in Nepal and Sri Lanka. A development, which signifies a first for the global automobile industry, the Nano brings the joy of a car within the reach of thousands of families.

Tata Motors is equally focused on environment-friendly technologies in emissions and alternative fuels. It has developed electric and hybrid vehicles both for personal and public transportation. It has also been implementing several environment-friendly technologies in manufacturing processes, significantly enhancing resource conservation.
d. Pune Facility

The Pune unit is spread over two geographical regions- Pimpri (800 acres) and Chinchwad (130 acres). It was established in 1966 and has a Production Engineering Division, which has one of the most versatile tool making facilities in the Indian sub-continent. It houses a Vehicle manufacturing complex which is one of the most integrated automotive manufacturing centers in the Country producing a large variety of individual items and aggregates. Over the years, this division has developed expertise in design and manufacture of automated dies, fixtures and welding equipment.

The Passenger Vehicle Division in 'K' block executes the entire process of car manufacture over five shops - the engine shop, the transmission shop, press and body shops, paint shop and the trim and final assembly shop. The shops are fully automated ensuring that there is minimal chance for error in the manufacturing processes.

After the car is completely assembled, it goes through several checks like wheel alignment, sideslip test, brake test, shower test, and a short test run before it is ready for dispatch. All systems such as materials management, maintenance and other activities are computerized, enabling smooth operations and minimum inventory needs.

The Electronics Division is engaged in the production of a wide variety of Machine Tool Controllers, PLCs, Test rig instrumentation, Servomotors, Proximity Switches. In addition, it has developed a number of components such as flashers, horns, timers that are used in Tata Motors' vehicles.

e. Energy Conservation Initiatives

Special efforts are being made on undertaking specific energy conservation projects like:
Installation of Waste heat recovery for paint baking oven flue gas to heat water of process, improvement in burning efficiency of burners by controlling the air - fuel ratio with the help of flue gas analysis.

Conversion of electrical heating into Natural Gas heating system of washing machines
Conversion of electrical heating into LPG heating of Endogas generators.

Installation of Variable Frequency Drives for various applications like Blower's and Pump's Motors as a flow control strategy for energy conservation.

Installation of CFL, LED bus bar indicators, Use of 54Wx4 T5 lamps for high bay lights, Installation of energy savers in lighting circuits, Installation of LED street lights.
Installation of Light pipes and Transparent Polycarbonate sheets, Installation of Solar water heating system for Crèche.

Modification in electrical logic for automatic switching On-Off operation of hydraulic motors, coolant pumps, blowers etc. Optimization of AC plant operations, removal of unwanted AC systems.

Wind Ventilators, downsizing of motors, trimming of impeller of oversized water recirculation pump, Delta to star connection of motors etc.

f. Participants in the study

Utility Engineers and Managers.
3.5.2 VOLKS WAGEN - Volks Wagen India Private Limited

**Address:** E-1, Phase-3, Mhalunge Road, Chakan, Village Nighoje Kharabwadi, Pune – 410501

**a. Introduction**

The Volkswagen plant in Chakan occupies a total area of over 2.3 million square meters (575 Acres), with buildings covering about 115 thousand square meters, which means, the total premises is 2x1 kilometers.

A workforce of over 3500 people was engaged in building during its peak construction stages. The plant was built with an investment commitment of INR 3800 Crores (580 million Euros) by Volkswagen India Pvt. Ltd. It is the largest investment by a German company to date in the Indian growth market.

**b. Pune Facility**

Pune plant has a production capacity of 110,000 vehicles a year. The construction of the plant commenced in 2007 and has been built in a record time of 17 months.

The Pune plant is one of the most modern in the Volkswagen Group. It has a high level of vertical integration and a large share of local suppliers. The facility is the only production plant operated by a German automaker in India that covers the entire production process from press shop through body shop and paint shop to final assembly.

The facility uses futuristically designed state-of-the-art equipment. For example, the Body shop uses the Diode Laser Brazing (DLB) technology, whereas the Roof & Side Framer laser technology is used for welding the roof to the body of the car. The facility is also one of the few environment friendly manufacturing plants around the
area. For Example, the Exhaust of the Paint shop is re-burnt and the resultant heat and energy is reused.

c. Products

Full-fledged production has taken off at the plant with the production of the **Skoda Fabia** in May 2009, followed by a Polo based model in December 2009 and the Vento in August 2010.

From May 2009 the Pune plant started rolling out the Skoda Fabia. Fabia is a premium hatchback that combines looks with performance and economy. It is available in petrol and diesel variants. The sleek looking Fabia is the first car in India with a huge passenger and cargo space designed with premium looks.

From December 12, 2009 the new Pune plant has started rolling-out the hatchback version of the **Volkswagen Polo**.

The made-in-India Polo was presented to the general public for the very first time at the Auto Expo 2010. The market launch throughout India followed in March. For Volkswagen, the Polo market launch has brought access to one of the Indian passenger car segments with the highest-volume unit sales.

On June 3, 2010 Volkswagen India celebrated the roll-out of the 10,000th car from its plant in Chakan, Pune.

From August 3, 2010 the Pune plant started rolling-out the mid-size sedan, the **Volkswagen Vento**. Vento is a complete made in India car with the longest wheel-base in the premium mid-size sedan segment making it exceedingly comfortable for the rear-seated passengers- a need for most Indian customers in this segment. After launching its compact car Polo in February this year, the Vento is Volkswagen’s
second car targeting the mass market. It is positioned at the upper-end of the country's mid-sized sedan segment.

d. Workforce:

Volkswagen India Pvt. Ltd., in its commitment towards the economic development of the state of Maharashtra, plans to hire more than 1000 skilled employees by the end of 2011, primarily from the region itself.

e. Sales:

The three brands of the Group – Audi, Skoda and Volkswagen – delivered in total 53,341 vehicles to customers from January to December 2010 as compared to 19,001 cars sold from January to December 2009, up by 34,340 cars, taking the company’s growth to 180.7% percent. Furthermore, this year Volkswagen Group India achieved impressive sales growth of 151.4% by delivering 81,360 cars from January to September 2011 as compared to 17,367 cars during the same time period last year.

f. Energy Conservation Initiatives

Volkswagen have announced plans to cut the energy and water consumption at its Pune production facility as part of the company’s ‘Think Blue. Factory’ initiative. With the installation of the high-volume low-speed fans, the energy consumption at the plant is slated to go down by 436 megawatt hour per annum, while the reduction of water usage at the said facility, by 1,636 cubic meter annually. The 436 megawatt hour energy savings amounts to annual energy consumption of around 120 Indian households. The 11 new HVLS fans installed at the assembly line in the plant would replace air handling units and ambiators. These fans are equipped with built-in variable frequency drive to suit all seasons and thus help in lowering down the energy consumption as per requirement. Under the company’s ‘Think Blue. Factory’ initiative, which is operational at the Pune plant since 2012, Volkswagen aims to
reduce the impact on environment due to manufacturing process by 25 per cent per car by 2018.

g. Participants in the study

Utility Engineers and Managers

3.5.3 FIAT - Fiat India Automobiles Private Limited

Address: B-19, Pune-Ahmednagar Road, Ranjangaon, MIDC Industrial Area, Pune – 412220

a. Introduction

FIAT Group Automobiles India Private Limited (FGAIPL) is a fully owned subsidiary of FIAT Group Automobiles, Italy. The company was incorporated in Mumbai, India, in March and distributes FIAT® and Jeep vehicles in the country through an independent dealer network. The company is currently selling the FIAT® Linea and Punto models, which are manufactured by the Tata-FIAT® joint venture plant at Ranjangaon.

b. FIAT Group

FIAT® is an international auto group that designs, produces and sells vehicles for the mass market under the FIAT®, Lancia, Alfa Romeo, FIAT® Professional and Abarth brands, as well as luxury and performance cars under the Ferrari and Maserati brands. The Group has increased its global reach through the integration with Chrysler Group and recently expanded its product portfolio with Jeep and Chrysler brand models that are produced in North America and now also distributed in Europe through the new Lancia-Chrysler and Jeep sales networks. FIAT® also operates in the components
sector, through Magneti Marelli and Teksid, and in the production systems sector, through Comau.

FIAT Group Automobiles designs, produces and sells automobiles under the FIAT®, Alfa Romeo, Lancia and Abarth brands, and light commercial vehicles under the FIAT® Professional brand. In Europe, it also distributes Jeep brand vehicles. From January 2012, the activities of FIAT® Powertrain – which researches, develops and produces engines (power output from 65 to 235 hp) and transmissions for passenger cars and light commercial vehicles (torque up to 400 Nm) – were transferred to FIAT Group Automobiles.

c. Chrysler Group LLC

Chrysler Group LLC, formed in 2009 to establish a global strategic alliance with FIAT S.p.A., produces Chrysler, Jeep, Dodge, Ram, Mopar, SRT and FIAT® vehicles and products. With the resources, technology and worldwide distribution network required to compete on a global scale, the alliance builds on Chrysler Group’s culture of innovation, first established by Walter P. Chrysler in 1925, and FIAT’s complementary technology that dates back to its founding in 1899.

d. Products

Linea, Punto

e. Energy Conservation Initiatives

Real Time Automatic Power Factor Control Panels have been installed to achieve unity power factor resulting in better / quality power and substantial savings in the energy bill and Day Light Panels and energy efficient luminous installations have helped in the plant to reduce energy consumption.
Administrative controls to ensure optimal usage of lighting, air-conditioning and ventilation systems are in place, which have ultimately resulted in further energy conservation.

f. Participants in the study

Utility Engineers and Managers

3.5.4 GENERAL MOTORS - General Motors India Private Limited

Address: Plot No A/16 Phase 2, Naulalkh Umbre Village Road, Talegaon Dabhade, MIDC Near Talegaon Floricultural Park, Taluka Maval, Pune - 410507

GM India started its Indian journey in 1996 and offers products under the Chevrolet brand in the country. Its flagship brand, Chevrolet, was introduced in India in 2003, under the banner "For a Special Journey Called Life''.

a. Products

Chevrolet has emerged as one of the fastest growing automotive nameplates in India today. GM India presently makes the Chevrolet Tavera, Chevrolet Optra, Chevrolet Aveo, Chevrolet Aveo U-VA, Chevrolet SAIL U-VA Hatchback, Chevrolet SRV, Chevrolet Spark and Chevrolet Captiva for the Indian market at its manufacturing facilities at Halol, Gujarat and Talegaon in Maharashtra.

General Motors Technical Centre Located in Bangalore is one of the 10 design Studios, 8 R&D facilities and 12 Engineering Facilities around the world. It is actively involved in Research, Design, Analysis and Development of vehicles and Power trains both globally and for the Indian market.
b. Participants in the study

Utility Engineers and Managers

3.5.5 MAHINDRA VEHICLE MANUFACTURERS LIMITED

Address: A/1 Phase, Chakan, Chakan Industrial Area Village Nighoje Taluka Khed MIDC, Pune – 410501

a. Introduction

Mahindra Vehicle Manufacturers was set up in 2007 to push their technology to the edge. They designed and built a Greenfield facility at Chakan, near Pune, Maharashtra, to integrate the best in technology, environmental sustainability, social responsibility, and operational excellence. Spread across 700 acres and planted with approximately 10,000 trees, Chakan offers a flexible and eco-friendly manufacturing layout for multiple Multi-Purpose Vehicles, sport utility vehicles, and commercial vehicles that allow them to respond rapidly to changing customer needs.

b. Products

With a current capacity of 3.2 million vehicles per year and a future-ready expandable module setup, they have the flexibility to constantly innovate and adapt to changes in market demand or customer requirements. They currently manufacture Mahindra & Mahindra’s entire medium and heavy commercial vehicle range including the 0.75 ton Maxximo, Single and Double Cab Pik-Ups and the whole new range of Mahindra Trucks. The new global SUV, XUV 500 is also manufactured here. They also manufacture and assemble SsangYong Rexton by Mahindra - the first premium product from the Ssangyong portfolio to be offered in India
c. **Manpower**

Their staff of over 2,000 is highly trained in the fields of mechanical, electronic, civil and electric engineering as well as paint technology. They partner with two regional tribal Industrial Training Institutes (ITIs) to facilitate a match between educational quality and content and industry demands. Their partnership has resulted in periodic faculty training sessions, a restructuring of the curriculum, and the recruitment of students to an apprenticeship training scheme. They also maintain our own residential training centre which provides a month-long training to the selected trainees before they initiate work at the shop floor.

d. **Energy Conservation Initiatives**

They use solar energy and waste heat from the oven exhaust to power activities in the paint shop, reducing our consumption of gas and electricity for an overall reduction of 3,500 tons of CO2 per year. A cluster of 70 solar dishes provides the energy for cooling the paint used for the vehicle bodies. And by recycling waste water through reverse osmosis and multiple effect evaporation, they achieve zero water discharge across the entire plant.

e. **Participants in the study**

Utility Engineers and Managers

**3.5.6 MERCEDES BENZ - Mercedes Benz India Private Limited**

**Address** - E 3, Chakan, Phase III Chakan Industrial Estate Kuruli & Nighoje Taluka Khed, Pune – 410501
a. Introduction

Established in 1994, Mercedes-Benz India Pvt. Ltd. pioneered the luxury car market in India and boasts of more than 128 years of cutting edge innovation in the luxury automobile industry globally. With a world class production facility spread over 100 acres in Chakan, near Pune, set up in 2009 and an independent assembly facility for passenger cars; the facility is among the fastest green-field operations ever to be created and is rated among the top most CKD plants of Mercedes-Benz, globally. The current expansion plan which aims at doubling the capacity to 20,000 units annually will ensure Mercedes-Benz India is ‘future ready’.

b. Products

The plant manufactures the Mercedes-Benz C-Class, E-Class, S-Class sedans and the ML-Class and GL-Class SUVs. It is also flexible to accommodate additional production of other models from the Mercedes-Benz model range on the same assembly line, if required by future market demand.

c. Awards

Mercedes-Benz India also emerged as the most awarded luxury automotive brands in 2013, receiving as many as 16 coveted awards from various prestigious automotive media introducing exciting products for the Indian customers.

d. Energy Conservation Initiatives

Roof Top Solar Plant helps in protecting and preserving resources. A 1 KW PV system each month prevents 150lbs of coal from being mined. It prevents 300lbs of CO2 from entering the atmosphere Saves 105 gallons of water from being consumed.

e. Participants in the study

Utility Engineers and Managers