CHAPTER – IV

PROFILE OF LG POLYMERS

Since prehistoric times, man has exploited for his own use the properties of natural polymers such as horn, waxes and bitumen. Over the years, it has been gradually learned that the properties of such materials could be improved by techniques such as purification and modification with other substances.

By the turn of the 19th century with the explosion of scientific knowledge in fields such as chemistry and physics, coupled with demands from industry for materials with properties which could not be found in nature, the scene was set for the development of a whole range of new materials among them were early plastics.

The first known manmade plastic was introduced in 1862 at the Great International Exhibition in London by a man named Alexander Parkes. Called Parkesine at that time, it was an organic material from cellulose that could be molded after it was heated, and it could retain its shape when it was cooled. During the late 19th century, an American by the name of John Wesley Hyatt used celluloid to produce billiard balls, and this celluloid came to be known as the first thermoplastic.

Further improvements were made to plastics at the turn of the 20th century. Another form of plastic called cellophane was created by Dr Jacques Brandenberger from Switzerland. This material was the first transparent fully-flexible and water-proof plastic wrap. In 1907, Leo Baekeland, a chemist from New York, invented a liquid resin called Bakelite, a thermo set plastic that was capable of retaining its shape under any condition. Bakelite was used in the manufacturing of military weapons and machines as well as electrical insulators.

Each decade saw the introduction of new and more versatile plastics. By the 1920s, cellophane became a very popular material around the world. Later on, a young Harvard chemist called Wallace Hume Carothers succeeded in developing nylon, which was known as Fiber 66 at that time.
In the 1930's, there were acrylic resins for signs and glazing and the commercialization of polystyrene, which became the third largest-selling plastic, literally revolutionizing segments of the house wares, toys, and packaging industries. Melamine resins were also introduced; these later became a critical element (in the form of a binder) in the development of decorative laminate tops, vertical surfacing, and the like.

By the 1940s, many other polymers were introduced to the world, and these included acrylic, PVC, neoprene, polyethylene, Teflon, SaranTM, and others. The decade of the 1950s saw the introduction of polypropylene and the development of acetal and polycarbonate, two plastics that, along with nylon, came to form the nucleus of a sub-group in the plastics family known as the "engineering thermoplastics." Their outstanding impact strength and thermal and dimensional stability enabled them to compete directly and favorably with metal in many applications.

In the following decades, plastic began to be used in numerous products, ranging from packaging to new textiles, and it also paved the way for the invention of innovative products such as televisions and computers. In 2007, the total consumption of plastic had reached close to 100 million tones, and this has caused significant depletion of natural resources such as petroleum and natural gas.

Today, polyethylene is the wisely used plastic. On the other hand, the rise of polypropylene and the introduction of acetal and polycarbonate form the plastics family named as engineering thermoplastics. As we completely innovate, there are for sure more to expect

**The Natural Polymers:**

- The word polymer literally means poly(many) mer(unit)
- They are complex and giant molecules and are different from low molecular weight compounds like common salts.
- A unit may consist of a single atom or a small group of atoms linked chemically. A simple chemical unit repeats itself a very large number of times in the structure of a polymer molecule.
In the 17th century, an Englishman John Osborne made moldings from the natural polymer, horn by the 19th century, the molded horn industry was thriving and geared to sell mass produced items to the emerging middle classes. Gums from tropical trees were exploited especially Rubber and Gutta Precha for which Bewley invented the plastics extruder in 1847. Gutta Precha was used to protect and insulate the first submarine telegraph cables in 1850.

With his brother Charles, Thomas Hancock worked extensively with this material but is now best known for his discovery (1839) of his vulcanization of rubber whilst good year independently discovered it in America. There was the first deliberate chemical modification of a natural polymer to produce a molding material. In America in the 1850s shellac was being compounded with wood flour to mould union cases to display early photographs. Shellac based compositions were used until the 1940s to mould gramophone records.

Lepage worked in France with albumen and wood flour to produce his decorative Bios Durci plaques, and many others worked with a wide variety of ingredients including seaweed, peat, paper and leather. Nearly 10% of all British patents issued in 1855 referred to molding materials but the major breakthrough was in the modification of cellulose fibers with nitric acid to give the first semi-synthetic plastic material, cellulose nitrate.

Timeline - Precursors
1839 – Natural Rubber - method of processing invented by Charles Goodyear
1843 – Vulcanite - Thomas Hancock
1843 – Gutta-Percha - William Montgomerie
1856 – Shellac - Alfred Critchlow, Samuel Peck
1856 – Bois Durci - Francois Charles Lepag

Timeline - Beginning of the Plastic Era with Semi Synthetics
1839 – Polystyrene or PS discovered - Eduard Simon
1862 – Parkesine - Alexander Parkes
1863 – Cellulose Nitrate or Celluloid - John Wesley Hyatt
1872 – Polyvinyl Chloride or PVC - first created by Eugen Baumann
1894 – Viscose Rayon - Charles Frederick Cross, Edward John Bevan
Timeline - Thermosetting Plastics and Thermoplastics

1908 – Cellophane - Jacques E. Brandenberger

1909 – First true plastic Phenol-Formaldehyde trade named Bakelite - Leo Hendrik Baekeland

1926 – Vinyl or PVC - Walter Semon invented a plasticized PVC.

1927 – Cellulose Acetate

1933 – Polyvinylidene chloride or Saran also called PVDC - accidentally discovered by Ralph Wiley, a Dow Chemical lab worker.

1935 – Low-density polyethylene or LDPE - Reginald Gibson and Eric Fawcett

1936 – Acrylic or Polymethyl Methacrylate

1937 – Polyurethanes trade named Igamid for plastics materials and Perlon for fibers – Otto Bayer and co-workers discovered and patented the chemistry of Polyurethanes

1938 – Polystyrene made practical

1938 – Polytetrafluoroethylene or PTFE trade named Teflon - Roy Plunkett

1939 – Nylon and Neoprene considered a replacement for silk and a synthetic rubber respectively Wallace Hume Carothers

1941 – Polyethylene Terephthalate or Pet - Whinfield and Dickson

1942 – Low Density Polyethylene

1942 – Unsaturated Polyester also called PET patented by John Rex Whinfield and James Tennant Dickson

1951 – High-density polyethylene or HDPE trade named Marlex - Paul Hogan and Robert Banks

1951 – Polypropylene or PP - Paul Hogan and Robert Banks

1953 – Saran Wrap introduced by Dow Chemicals.

1954 – Styrofoam a type of foamed polystyrene foam was invented by Ray McIntire for Dow Chemicals

1964 – Polyimide

1970 – Thermoplastic Polyester this includes trademarked Dacron, Mylar, Melinex, Teijin, and Tetoron

1978 – Linear Low Density Polyethylene

1985 – Liquid Crystal Polymers
Polymer Industry:

The polymer industry started in particular for spectacular growth because of its wide range and applications. A polymer basically comprises of thermoplastic, it has wide applications, very much advantageous, cost and energy efficient too. A polymer can be recycled so it can be reshaped a number of times by applying heat and pressure.

In order to meet the basic needs of the growing population and to enhance the overall standard of living our natural resources are being exploited. In order to attain a better quality of life, synthetic fibers, plastic, synthetic rubber, will be complementing the natural products like cotton, jute, paper, wood, metals.

Being cyclical commodities that are widely traded, commodity polymers are priced on import parity basis in the domestic market. Thus, the margins earned by the domestic producers of resins are largely determined by the international tolling margins, import duty levels, and the domestic demand-supply situation. Foreign exchange rates also play a role in influencing margins. Indian commodity polymer producers have lately been going through a down-cycle, precipitated largely by the global economic slowdown that began in mid 2008, sharp volatility in feedstock prices, and surge in capacity additions in West Asia, which has served to increase competition from imports. The domestic industry, on its part, is also likely to witness significant capacity additions over the medium term.

On the global supply side, while many polymer capacity addition projects have been announced, the slower-than-expected progress of such projects because of the shortage of engineering and manpower resources, overbooked vendors and contractors, feedstock constraints and problems in plant stabilisation are causing delays in the commissioning of the new capacities, thereby affecting incremental product availability. While these delays have pushed back the much anticipated down-cycle in the sector, a supply glut is expected in the near term and this should persist for the next few years, which in turn would exert pressure on petrochemical margins.
At present the demand of polystyrene in some areas of application in India is as follows:

<table>
<thead>
<tr>
<th>Applications</th>
<th>Demand In Tons Per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Audio/video</td>
<td>1420</td>
</tr>
<tr>
<td>2. TV/VCR</td>
<td>24000</td>
</tr>
<tr>
<td>3. Refrigerator/Washing machine</td>
<td>19200</td>
</tr>
<tr>
<td>4. Clocks</td>
<td>8900</td>
</tr>
<tr>
<td>5. Households</td>
<td>2400</td>
</tr>
<tr>
<td>6. Stationary</td>
<td>1200</td>
</tr>
</tbody>
</table>

**Indian Plastic Industry:**

The plastic industry is considered as sunrise industry and has been exhibiting a consistent export growth rate in the past. The plastics industry in India has made significant achievement ever since it made a modest but promising beginning by commencing production of polystyrene in 1975. The chronology of manufacture of polymers in India is summarized as under

- 1975 – POLYSTYRENE
- 1959 – DPF
- 1968 – PVC
- 1978 – POLYPROPYLENE

Commodity polymers are used mostly in the manufacture of various plastic products that find application in sectors such as packaging, storage, automotives, construction, and irrigation. Although there are several grades of commodity polymers, the major ones—PE, PP and PVC—account for an estimated 90% of the total commodity polymer consumption in India. The domestic commodity polymer industry is characterised by the presence of a few resin producers and several downstream processors, who in turn sell semi-finished or finished plastic articles to end-consumers. The Indian polymers industry is small by international standards, accounting for only around 3.5% of the global production. However, the rate of growth of Indian polymer consumption is among the highest in the world, and this is because of the low base effect and burgeoning demand from several end-users.
The potential Indian market has motivated Indian entrepreneurs to acquire technical expertise, achieve high quality standards and build capacities in various facts of booming plastic industry. Phenomenal developments in the plastic machinery sector coupled with matching developments in the petrochemical sector, both which supported the plastic processing sector, and facilitated the plastic processors to build capacities to serve both the domestic market and overseas markets.

The per capita consumption of polymers in India at about 6 kg is far below the global average of 29 kg and below that of China at 24 kg and of Asia at 22 kg. The domestic per capita consumption as well as the absolute consumption of commodity polymers is expected to grow because of various economic and demographic factors. Some of these factors are increase in urban population and shift of population from rural to urban areas; rise in per capita income; growth of middle class; growth in infrastructure including national highways; growth in housing sector; increasing penetration of synthetic bags in food grain packaging; changing lifestyle with increase in demand for FMCG products and cosmetics; change in food habits; and steadily rising application of polymers in the agriculture sector.

**Polyethylene**

The Indian per capita consumption of PE at about 2 kg is only about a fifth of the global average, which stands at about 10 kg. The under penetrated Indian PE market reported a compounded annual growth rate (CAGR) of about 12% from 2003-04 to 2009-10, although there were large year on year fluctuations. Around 30% of the domestic demand of PE is met by imports, which have also been growing at robust rates because of domestic supply constraints and rising demand. To meet import competition, some domestic petrochemical producers are developing specialty, niche and value-added grades of PE that fetch higher margins and are less prone to competitive pricing pressures from imports.

Given the spread of modern retail formats, increasing consumer spending, housing sector growth and rising disposable incomes, almost all grades of PE are expected to report high growth rates over the medium to long term. Basing on the grade the polyethylene can be classified into three:

- High-density Polyethylene (HDPE),
- Linear low-density Polyethylene (LLDPE)
- Low-density Polyethylene (LDPE)
High-density Polyethylene (HDPE):

GRAPH – 4.1

HDPE is the high density version of PE plastic. It is harder, stronger and a little heavier than LDPE, but less ductile. HDPE is lighter than water, and can be moulded, machined, and joined together using welding (difficult to glue). The appearance is wax-like, lusterless and opaque. The use of UV-stabilizers (carbon black) improves its weather resistance but turns it black. Some types can be used in contact with food.

GRAPH – 4.2

GRAPH – 4.3
Linear low-density Polyethylene (LLDPE):

GRAPH – 4.4

Linear low-density polyethylene (LLDPE) is a substantially linear polymer (polyethylene), with significant numbers of short branches. LLDPE is a colorless, non flammable, non reactive solid with no odour. LLDPE has penetrated almost all traditional markets for polyethylene; it is used for plastic bags and sheets (where it allows using lower thickness than comparable LDPE), plastic wrap, stretch wrap, pouches, toys, covers, lids, pipes, buckets and containers, covering of cables, geomembranes, and mainly flexible tubing.

GRAPH – 4.5

GRAPH – 4.6
Low-density Polyethylene (LDPE):

GRAPH – 4.7

LDPE is the low density version of PE. This has less hardness, stiffness and strength compared to HDPE, but better ductility. It is opaque and only thin foils can be transparent. LDPE is used for packaging like foils, trays and plastic bags both for food and non-food purposes. Used as protective coating on paper, textiles and other plastics, for instance in milk cartons.

GRAPH – 4.8

GRAPH – 4.9
Polypropylene (PP)

The Indian per capita consumption of PP at 2 kg is only about a fourth of the global average of 7 kg. PP demand in India reported a CAGR of about 13% from 2004-05 to 2009-10, although the year on year growth rates varied significantly. India remains a net exporter of PP with about a quarter of the total production being exported. The country also imports PP, the volume of which was about 15% of the domestic production, given that the landed cost of imports at certain coastal locations is low and that there is a requirement for some specialised grades not manufactured in the country. Although the demand drivers for PP remain the same as mentioned before, what provides additional impetus to PP consumption is the increasing replacement of metal parts by PP in automotives and appliances mainly because of the advantages of lower weight and corrosion resistance that PP offers.

Polyvinyl Chloride

...
The Indian per capita consumption of PVC at 1.5 kg is only about a third of the global average of 5 kg. PVC demand in India reported a CAGR of about 11% from 2005-06 to 2009-10, although there were large year on year variations. India is a net importer of PVC, with imports meeting around 40% of the total domestic demand. Moreover, the country’s dependence on PP imports has been rising because of increasing demand, lower prices of imports vis-à-vis domestic produce, and lack of commensurate growth in domestic capacity.

The agriculture sector is the major consumer of PVC in India, accounting for about 60% of the total consumption. The prospects for PVC consumption by the agriculture sector appear bright at present, given that the use of PVC pipes for irrigation is expected to increase with both the Central and State Governments focusing on bringing a larger area under irrigation as well as conserving water through various schemes (e.g. micro-irrigation and water harvesting). Agriculture apart, the higher outlay being made for infrastructure development through plans such as Bharat Nirman (rural infrastructure) and the National Highways Development Programme (NHDP) are also expected to drive growth in PVC demand. While the overall PVC market has exhibited healthy growth rates during the last decade, there have been certain pockets where demand growth has either been negative or muted. In recent years, environmental and safety issues as well as substitution by PE have impacted PVC consumption negatively in certain segments.

The plastic processing sector comprises of over 30000 units which involved in producing a variety of items like injection moldings blow 19 molding extrusion and calendaring. The capacities built in most segments of this industry are coupled with inherent capabilities which made U.S capable of servicing the overseas markets. The economic reforms launched in India since 1991, have added further fillip to the Indian plastic industry. Joint ventures and foreign investments have given easy access to technology from developed countries, which opened new vistas to further new facilitate for the growth of this industry.

Notwithstanding the sizeable capacity additions anticipated in India over the next three to four years, the domestic demand-supply balance should remain favourable for PE and PVC resin producers, even as the PP resin market should remain in surplus. It is however not the demand-supply dynamics but increasing import competition from West Asian manufacturers that makes for a pressing concern, given that such competition could translate into subdued tolling margins for incumbents and new entrants over the medium term.
Domestic manufacturers who have a moderate to high share of specialty/niche grades that are not produced by West Asian manufacturers could however partly avoid the pressures exerted by larger imports. Import competition apart, the other near-term concerns relate to the ability of domestic manufacturers to pass on increases in feedstock prices in a scenario of rising crude oil prices to consumers and to manage any slowdown in short-term demand against the possible backdrop of rising resin prices.

Visakhapatnam Profile:
Visakhapatnam (popularly known as Vizag) is a port city on the southeast coast of India. With a population of over and above 1,750,000 it is the second-largest city in the state of Andhra Pradesh (after Hyderabad) and the third-largest city on the east coast (after Chennai and Kolkata). Visakhapatnam is located 625 Kilometers (388 miles) east of the state capital, Hyderabad. The city is home to several state-owned heavy industries and a steel plant; it is one of India's largest seaports and has the country's oldest shipyard. Visakhapatnam has the only natural harbour on the east coast of India.
The city was named after “Visakha” the Hindu god of valor. It is nestled among the hills of the Eastern Ghats and faces the Bay of Bengal on the east. Visakhapatnam is the administrative headquarters of Visakhapatnam district and headquarters of the Naval Command of the Indian Navy. Visakhapatnam has a nickname The City of Destiny and, more recently, the Goa of the East Coast. Like its west-coast counterpart it offers attractive beaches, late rite hillocks and a pleasing landscape. It is also a focus of urban and tourist development.

Demographics

Visakhapatnam is a cosmopolitan mix of people from various parts of India. From a population of a few thousand during the 18th and early 19th centuries, the population grew steadily. The city doubled its population from 1990–2000, due to a large migrant population from surrounding areas and other parts of the country coming to work in its factories, also due the recent developments in the sector of IT and ITES.

Communication & Connectivity:

Roads: Visakhapatnam is well connected with Roads which has a length of 6597.98 Kilometers of which 112.24 Kilometers of National Highway runs through the district connecting important places of the district.
**Rail:** Visakhapatnam District is well connected with all the Metros and it is Divisional Headquarters of S.E. Railway and runs on Broad Gauge. There are 21 railway stations with a length of 179 Kilometers of railway.

![Visakhapatnam Railway Network](image)

**Air Port:** Visakhapatnam is well connected with other parts of the country like Delhi, Calcutta, Bombay, Bhubaneswar, and Chennai. There is a proposal an International Air Port for better and faster industrial growth by improving its run way.

**Visakhapatnam Port Trust:** Visakhapatnam has a Natural Harbour and it is one of the Major Ports in India. The Port handles Imports & Exports of heavy Cargo. It has a number of berths which include Fertilizer, Ore, Jetty etc. and Cargo berths which can handle millions of Cargo.

**Telecommunications:** The District is well connected by Telecommunications. It has 81 Telephone Exchanges with 151376 lines capacity along with all modern infrastructure systems like Cellular, Pager services.

**Industrial Infrastructure:**
**V.E.P.Z:** Visakhapatnam Export Processing Zone located at Duvvada Village is an ideal destination for setting up an Export Oriented Industry. It was set up in an area of 360 Acres of land with ready built plots & sheds. The standard design factory (SDF-II) is under construction and will be ready for occupation shortly. Infrastructure and facilities available at V.E.P.Z are.

1. Fully developed plots of sizes ranging from 0.5 Acre and above are available for long lease basis for a period of 15 years with tariff of Rs.16/- Sq.Mt. per annum with liberal concession in lease rentals of 75% in first year, 50% in second year and 25% in third year.

2. Ready built spaces available in the standard design factory (SDF) which has 32 sheds of sizes ranging from 468 Sq.Mt. to 1100 Sq.Mt. These sheds are available on renewable lease basis for 5 years with a rental of Rs. 375 per Sq.Mt. per annum with a concession of 50% in the first year, 40% in the second year and 25% in the third year.

3. Sufficient power is available within the zone and required to pay only 50% of the applicable development charges

4. Strategic location

5. Attractive Tax Incentives

6. Simplified approval procedures

7. Well developed support services like Transport, Telecom, Medical, Educational accommodation and Banking

**Jawaharlal Nehru Pharma City** Developed by Ramky Group with APIIC equity participation in 2120 acres with a project cost of Rs 292 crores at Parwada, 33 Kilometers from Visakhapatnam town to promote Bulk Drug, Pharma and chemical industries.

**A.P. Special Economic Zone** Govt. of India accorded permission for SEZ at Visakhapatnam under public private participation. 9200 Acres (Phase I : 3500 Ac & Phase II: 5700 Ac) in Atchutapuram and Rambilli Mandal near Visakhapatnam.

**Industrial Scenario:** The District has 73 Large and Medium Industries in Mining, Explosives, Power and Cement with in investment of Rs.10702 Crores. Industrial Development is conspicuous in Visakhapatnam urban agglomeration with the large scale industries like Hindustan Shipyard, Hindustan Petroleum Corporation, Coromandal
Fertilizers, Bharat Heavy Plates and Vessels, L.G.Polymers Ltd., Hindustan Zinc Plant and the recent giant Visakhapatnam Steel Plant and a host of other ancillary Industries. The Visakhapatnam Steel Plant is the biggest with an authorised share capital of Rs.7466 crores with a licensed capacity of 2.8 Million Tonnes of salable steel 3.0 Million Tonnes of Pig Iron and 8.32 lakhs Tonnes of by product. About 25,000 persons are expected to be employed. The project has provided employment to 16300 persons. On the country side agro based industries like Sugar Factories, Jute Mills and Rice Mills are flourishing besides brick and tile units.

Visakhapatnam also owes its economic growth to the availability of an educated English-speaking workforce; English is the first language in many institutions of higher education in the city. The availability of an educated workforce allowed ITES companies such as HSBC, IBM Daksh, Sutherland and Acclaris to flourish. The city has 102 small and medium software and call-centre companies, of which about 10 began their operations from 2005–2007. In this year WNS Global Service a US based company has started its BPO operations in Visakhapatnam and also WIPRO is opening their long pending development center in this year.

Profile of LG Polymers:

The company was incorporated in 1961 as “Hindustan polymers” for manufacturing styrene monomer, polystyrene and its co-polymers at Visakhapatnam, India, merged with McDowell & Co., Ltd... of UB group in 1978. LG chemical considered India as an important market and in its aggressive global growth plan identified Hindustan polymers as a suitable company for entering Indian market through 100% takeover by LG chem. (south Korea), Hindustan polymers was renamed as LG polymers India private limited (LGPI) in July 1997.

In the year 1997, LG Chem., Korean multinational took over the company from McDowell & Co ltd. The objective is high productivity with low man power. Under
McDowell the company produced the raw material, styrene on its own which led to the losses. But as it was taken over by Korean Company; the raw material was imported from Korea and Saudi Arabia at a comparatively low cost. By reducing the man power and also the cost of production slowly the company came out of losses and started increasing profits and ultimately the company reached a profitable stage. For the first time they made a profit of 28 Crores. Later due to market and cut throat competition, they faced losses. Further, to meet customer satisfaction, LG Started improving the quality instead of increasing the price to meet the market compensation. At present they face stiff competition from
- Supreme Industries
- Pushpa Polymers
- BASF

History of LGPI:

1961: Initially the company started and incorporated as shri ram mills group
1962: The Company was again incorporated as “HINDUSTAN POLYMERS”
1964: The Company had collaborated with “BX PLASTIC LTD LONDON” to produce polystyrene
1967: Alcohol production plant was started
1972: DCM (Delhi cloth mill) has taken change of organization
1973: The faced losses, due to high cost and scarcity of raw material
1978: McDowell & Co. Ltd. Has taken over the company from DCM
1989: EPS production plant was started
1991: Polystyrene modernization plant was constructed
1997: LG Korean multinational took over the company from McDowell & co. Ltd

Products:
- Polystyrene (PS)
- Expandable Polystyrene (EPS)
- High impact polystyrene (HIPS)
- General purpose polystyrene (GPPS)
Polystyrene (PS)

Brand name of LGPI Polystyrene is LGSTRENE. General Purpose Polystyrene (GPPS) and High Impact Polystyrene (HIPS) products have their general purpose as well as specialty grades. Tailor-made grades also are being made available based on specific vendor requirement. They also make a wide range of colored polystyrene to meet specific customer requirement.

LGPI FR HIPS is a Deca Bromo based Flame Retardant grade. UL94V0 (All color) and UL94V2 (Natural and black) are certified grades by UL USA laboratory.

Polystyrene is an inexpensive amorphous thermoplastic that is vitreous, brittle and has low strength. However it is also hard and stiff. Foamed PS is used for packaging and insulation purposes.

It is not weather resistant, and therefore not suitable for outdoor uses. It is a versatile thermoplastic, which can be processed in various ways namely, injection moldings, extrusion, to give several intricate shapes. It is available in wide range of grades ranging from general purpose and high impact to highly specialized grades. This finished product is more favorably priced with respect to the properties compared to other thermoplastics. The consumption of India alone about 5 years back was about 1 lack MT. It was expected to double by 2000 A.D. that happened. The annual growth is being expected to be more than 20% for the coming 3 years and at 12-15% for the next 3 years thereafter.

Applications of Polystyrene (PS):
- TV / Radio Cabinets  - Disposable Containers  - Audio / video cassettes
- Refrigerator lining  - Food packaging  - Imitation Jewellery
- Crystal ware  - Ball pens / novelties  - Tail lights

Expendable Polystyrene (EPS)

Brand name of LGPI Expendable Polystyrene (EPS) is LGexpol. LGexpol expandable polystyrene offers versatility of usefulness over a wide application range. Grades are made to suit all requirements with strict emphasis on quality.
EPS resin is produced by mixing foaming agents in the process of polymerizing styrene monomer. This resin employs pentane as the major foaming agent and never uses Freon gas depleting the ozone layer. EPS (expanded polystyrene) is an excellent material for packaging and for construction as it is light yet rigid foam with good thermal insulation and high impact resistance. It is versatile foam plastic, which has extensive application in thermal insulation and also has good acoustic properties. The present consumption in India is about 20000 MT. Expanded polystyrene is made from expandable polystyrene, which is a rigid cellular plastic containing an expansion agent. EPS is obtained from oil as can be seen from the below diagram.

Applications of expandable Polystyrene (EPS):
- Packing  
- False ceiling  
- Disposable cups and trays  
- Outdoor decoration  
- Loose fills  
- Building and constructions  
- Marine application  
- Cold insulation  
- Lost foam castings  
- Sound proofing of buildings

GPPS
General-purpose polystyrene (GPPS) is a clear, hard, usually colorless thermoplastic resin. Resin products with various physical and mechanical properties are available, many with additives blended into the formulation to affect process ability, color, or other characteristics.

Basic grades of LGPI GPPS & their properties:

TABLE – 4.1: LGPI PRODUCES FOLLOWING MAJOR TYPE OF GPPS GRADES

<table>
<thead>
<tr>
<th>Grade</th>
<th>TS (Kg/cm²)</th>
<th>Impact Strength (Kg-cm/cm of notch)</th>
<th>MFI (gm/10 min at 200°C-5 Kg load)</th>
<th>VSP (°C)</th>
<th>Blue Ting</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGG-101</td>
<td>380</td>
<td>1</td>
<td>10 ± 2</td>
<td>94</td>
<td>Medium</td>
</tr>
<tr>
<td>LGG-1011</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LGG-103</td>
<td>380</td>
<td>1</td>
<td>11 ± 2</td>
<td>94</td>
<td>High</td>
</tr>
<tr>
<td>LGG-104</td>
<td>480</td>
<td>1.2</td>
<td>4.5 ± 1</td>
<td>99</td>
<td>Medium</td>
</tr>
<tr>
<td>LGG-1041</td>
<td>480</td>
<td>1.2</td>
<td>4.5 ± 1</td>
<td>99</td>
<td>High</td>
</tr>
<tr>
<td>LGG-1043</td>
<td>480</td>
<td>1.2</td>
<td>4.5 ± 1</td>
<td>99</td>
<td>Water blue</td>
</tr>
<tr>
<td>LGG-105</td>
<td>440</td>
<td>1.1</td>
<td>7 ± 1</td>
<td>96</td>
<td>Medium</td>
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<tr>
<td>LGG-1052</td>
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<td></td>
<td></td>
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<tr>
<td>LGG-108</td>
<td>360</td>
<td>1</td>
<td>16 ± 2</td>
<td>92</td>
<td>High</td>
</tr>
</tbody>
</table>

Source: Company reports
GPPS Chemicals and their function:

- Sandoplast Blue: Sandoplast blue is the ingredient that contributes in the tinge of PS granules. Sandoplast blue absorbs all light except the corresponding tinge.
- Sandoplast Violet: Sandoplast violet does same work as “Sandoplast blue” it only modifies the wavelength of light to be absorbed and hence the tinge varies.
- Optical Brightener: It is the additive, which is designed to enhance the appearance of plastic, paper or fabric. These molecules are fluorescent, which absorb the energy in UV portion of spectrum and then re-emit it in the visible portion of spectrum, which modifies the light reflected from granules.

**OPTICAL BRIGHTNER:** 2,2 -(2,5-Thiophenediyl) bis (5-ter-butyl benzoxazole)

Initiator: Luprox is used as initiator here. It is a peroxide type of initiator and initiates the polymerization by the means of heat.

**HIPS**

High Impact Polystyrene (HIPS) is a low cost plastic material that is easy to machine and fabricate. HIPS can be processed by all conventional techniques using standard conditions and has well balanced properties in terms of impact, rigidity and surface gloss. PS a very versatile material suitable for many applications and is used extensively in the production of sheet for packaging and vacuum forming. It is frequently used machining pre-production prototypes, since it has excellent dimensional stability and is easy to fabricate, paint and glue. Natural (translucent white) HIPS is FDA compliant for use in food processing applications.
# TABLE – 4.2: GRADES AND APPLICATIONS OF HIPS

<table>
<thead>
<tr>
<th>GRADE</th>
<th>Characteristic</th>
<th>APPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGH – 301, 3012</td>
<td>High Gloss, good Impact, Good flow</td>
<td>Refrigerator table top, Washing machine front panel protector, Vacuum cleaner housing, Sanitary &amp; House ware, Air conditioner housing, Toys, Ball pen barrel, Umbrella handles, Wall clock frames, Air cooler front panel.</td>
</tr>
<tr>
<td>LGH – 302</td>
<td>High Impact, Good flow</td>
<td>TV Cabinets, Audio Cabinet, Video Cassettes, Novelties, Stationery item</td>
</tr>
<tr>
<td>LGH – 304, 3041</td>
<td>Extrusion Grade, High Gloss, Contact Clarity</td>
<td>Disposable Cups / Trays, Thin wall containers / trays / cups. Foam extrusion applications.</td>
</tr>
<tr>
<td>LGH – 306</td>
<td>High Flow, High Strength</td>
<td>TV Cabinets, Audio Cabinets</td>
</tr>
<tr>
<td>LGH – 308</td>
<td>ESCR</td>
<td>Deep draw Disposable Cups/Trays, Thin wall containers / trays / cups. Foam extrusion applications.</td>
</tr>
<tr>
<td>LGH – 309</td>
<td>ESCR</td>
<td>Refrigerator liners, Containers for food &amp; dairy packaging specially for fatty acid</td>
</tr>
<tr>
<td>LGH – 314</td>
<td>Super Flow, High Strength</td>
<td>TV Front &amp; Back cabinets especially in GAIN application and for high flow length moulds.</td>
</tr>
</tbody>
</table>

Source: Company reports
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TS- Kg/cm² (Min)</td>
<td>290</td>
<td>280</td>
<td>270</td>
<td>240</td>
<td>240</td>
<td>220</td>
<td>230</td>
<td>240</td>
</tr>
<tr>
<td>2</td>
<td>Elongation (% Min)</td>
<td>30</td>
<td>35</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>Impact Strength (Kg-cm/cm³ Min)</td>
<td>7</td>
<td>9</td>
<td>7.5</td>
<td>7.8</td>
<td>8</td>
<td>7.8</td>
<td>8</td>
<td>8.5</td>
</tr>
<tr>
<td>4</td>
<td>Color – WI (Min)</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
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<tr>
<td>5</td>
<td>Total Volatiles (PPM Max)</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1200</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Contamination</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>MFI (gm/10min @ 200°C/5kg Load)</td>
<td>5.5±1</td>
<td>5.5±1</td>
<td>4.75±0.75</td>
<td>7.5±1</td>
<td>9±0.5</td>
<td>11±1.5</td>
<td>4±0.75</td>
<td>3.2±0.5</td>
</tr>
<tr>
<td>8</td>
<td>VSP (0C Min)</td>
<td>97</td>
<td>97</td>
<td>96</td>
<td>93</td>
<td>93</td>
<td>92</td>
<td>98</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>ESCR Properties @ 4 Hrs (%)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<td>Butter</td>
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<tr>
<td></td>
<td>C5</td>
<td>80</td>
<td>60</td>
<td>80</td>
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<tr>
<td></td>
<td>CSO + OA</td>
<td>80</td>
<td>60</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

Source: Company reports
Chemicals Used in HIPS:
Additives added in HIPS Production:
a) Impact modifier  f) Initiator
b) Diluent           g) Optical Brightener
c) Plasticizer   h) UV stabilizer
d) Anti Oxidant   i) Chain transfer agent
e) Lubricant   j) Chain terminating agent

Impact Modifier : Rubber is used as Impact Modifier
Diluents : It facilitates the proper heat transfer.
Anti Oxidant : Primary antioxidant and secondary antioxidant are used to prevent the oxidative degradation.
Lubricant : It reduces the fraction between polymeric chains as well as between Polymer & metal (barrel etc.)
Initiator : Initiator initiates the polymerization.
UV Stabilizer : It is used, to prevent the UV degradation.

Advantages of HIPS:  Applications Include:
• Good impact resistance  • Machined prototypes
• Excellent machinability  • Low-strength structural components
• Good dimensional stability  • Housings
• Excellent aesthetic qualities  • Covers
• Easy to paint and glue
• Low cost
• FDA compliant

Flame Retardant Hips
- LGS-5Z3 (Y)  - LGS-5Z400/481  LGS-5Z300.
* Where ‘Y’ can be two to three digits

HYPOL
HYPOL brand consists of flexible transparent Polystyrene (FTPS), which is being used in Hangers, disposable cups, toys, and High Gloss Super Impact Polystyrene, which is being used for ABS replacement mainly in Washing Machine, Refrigerator top table, telephone body and as cap layer application in refrigerator liner.
ABS and SAN

LGPI is in trading of LG Chemical’s different grades of ABS and SAN in India. ABS resins are hard, rigid, and tough, even at low temperatures. They consist of particles of a rubber like toughened suspended in a continuous phase of Styrene-Acrylonitrile (SAN) copolymer. Various grades of these amorphous, medium-priced thermoplastics are available offering different levels of impact strength, heat resistance, flame retardance, and palatability.

Most natural ABS resins are translucent to opaque, and they can be pigmented to almost any color. Grades are available for injection molding, extrusion, blow molding, foam molding, and thermoforming. Molding and extrusion grades provide surface finishes ranging from satin to high gloss. Some ABS grades are designed specifically for electroplating. Their molecular structure is such that the plating process is rapid, easily controlled, and economical.

Compounding of some ABS grades with other resins produces special properties. For example, ABS is alloyed with polycarbonate to provide a better balance of heat resistance and impact properties at an intermediate cost. Deflection temperature is improved by the polycarbonate and modeling ease. Other ABS resins are used to modify rigid PVC for use in pipe, sheeting, and molded parts. Reinforced grades containing glass fibers upto 40% are also available.

Related to ABS is SAN, a co-polymer of styrene and acrylonitrile (no butadiene) that is hard rigid, transparent, and characterized by excellent chemical resistance, dimensional stability, and ease of processing. SAN resins are usually processed by injection molding, but extrusion, injection-blow molding, and compression molding are also used. They can also be thermoformed, provided that no post mold trimming is necessary (because the material is not toughened, thermoformed shapes may crack during conventional trimming operations).
Application ABS & SAN:

Molded ABS products are used in both protective and decorative applications. Examples include safety helmets, camper tops, automotive instrument panels, and other interior components, pipe fittings, home-security devices and housing for small appliances, communications equipment, and business machines. Chrome-plated ABS has replaced die-cast metals and plumbing hardware and automobile grills, wheel covers, and mirror housing.

Typical products vacuum-form from extruded ABS sheet are refrigerator liners, luggage shells, tote trays, mover shrouds, boat hulls, and large components for recreational vehicles. Extruded shapes include weather seals, glass bending, refrigerator breaker strips, conduit, and pipe for drain-waste-vent (DWV) systems. Pole and fittings comprise one of the largest single application areas for ABS.

Typical application for molded SAN co-polymers include instrument lenses, vacuum-cleaner and humidifier parts, medical syringes, battery cases, refrigerator compartments, food-mixer bowls, computer reels, chair shells, and dishwasher-safe house ware products. Because of their compatibility with many higher priced resins, SAN resins are also used as color-concentrate carriers for some engineering resins.

Styrene

Styrene is being traded by LGPI and is being catered to various organized and unorganized sectors in India. They supply Styrene in small to bulk quantities all over India.

Styrene is a clear, colorless liquid that is a component of materials used to make thousands of everyday products for home, school, work, and play. Styrene is used in everything from food containers and packaging materials to cars, boats, computers and video games. Derived from petroleum and natural gas by-products, styrene helps create thousands of remarkably strong, flexible, and light-weight products, representing a vital part of our economy and quality of life.

The styrene used in these products is manufactured synthetically in petrochemical plants. However, styrene also occurs in the environment and is found in many common foods such as coffee, strawberries and cinnamon.
Vision of LGPI:

LG Polymers India Pvt. Ltd. is committed to customer satisfaction and shall meet customer needs and expectations by timely delivery of quality products through continual improvement of technology, infrastructure and work environment with innovation and total participation.

To become an internationally recognized company in quality and customer satisfaction by adopting international standards and techniques QC, TQM, TPM, SQC and SPC.

Mission of LGPI:

Consistent with the vision and values of LGPI strives to strengthen India’s industrial base through effective utilization of men and materials. The means envisaged to achieve high technology and productivity are consistent with modern management practices.

LG polymer recognizes that honesty and integrity are essential ingredients of a strong and stable enterprise. Profitability provides the main spark of economic activity.

Overall the company seeks to scale heights of excellence in all that it does in an atmosphere free from fear and one which encourages innovativeness and creativity.

Functional Divisions:

- Industrial relations and human resources
- Accounts and EDP
- Material and logistics
- Production
- Engaging
- Technical services and research and development
- Quality control department
- Marketing
- Environment and safety
- Innovative
**Industrial Relations and Human Resource Department:**

This department consists of 2 sections. i.e., HR and IR. This department is headed by Sr. Manager (IR&HR). This department looks after all HR functions of the organization from recruitment to separation. It also conducts welfare programmes free of cost in the surroundings areas like medical camps, welfare of school children etc.

**Functions:**
- HR planning
- Recruitment and selection
- Employee induction and development
- Wage and salary administration

**HR-Policy of LGPI:**
- To provide a realistic and generous understanding and acceptance of their needs and enlightened awareness of the social problem of the industry.
- To provide adequate wages, good working conditions and effective machinery for redresses of grievance and suitable opportunities for promotions and self development through internal and external programmes
- To create a sense of belonging through women and purpose full activities in an integral part of human relations ensuring their willing cooperation and loyalty personnel rules and programmes help in translating procedure into concrete action.

**Employee Welfare Activities in LGPI:**
- Medical subsidy-officers, staff, workmen
- Medi-claim policy-officers, staff, workmen (ICICI Lombard)
- Group personal accidents policy-officer, staff, and workmen
- Canteen facilities
- First aid centre
- Periodical health check up for all employees
- Group Janatha Personal Accident Policy – all employees of LGPI
• Scholarships to the meritorious students of employees children (staff & workmen)
• Picnics (once in a year)
• Sweets distribution to employees 5 times in a year
• Uniform, shoes, socks to all employees at works (including casual labour)
• Marriage Gifts
• Family Planning Incentive
• Retirement Gift
• Funeral Expenses
• Venkatapuram Village Welfare Activity
• Rain Suits for Staff & Workmen
• Literary Programme
• Venkatapuram Village School Activity
• Employee Shop Management on No Profit No Basis
• Works Committee
• Benevolent Fund Committee
• AP Labour Welfare Fund
• Scooter Loans
• Production Reward / Ex-Gratia / Bonus
• Festival Advance
Accounts Department:

The department of LGPI deals with the record keeping of various transactions and management of financial resources. It is headed by accounts director it deals

Functions:
- Financial accounting
- Management accounting
- Investment management
- Taxation

Material and Logistics Department:

This area deals with the storing of materials, material control and issue of materials to department wherever needed. This work is done in close coordination with purchase management and various other functions too.

Functions:
- Material management
- Packaging
- Logistics
- Inventory management
- Engineering and machine service

Raw material supplied from Goa, Ahmadabad, Faridabad, Delhi, Mumbai, Chennai, Calcutta etc., raw materials are rubber and other chemicals.

Production Departments:

These departments are headed by G M production. The production plant is located in Visakhapatnam. In this division G M heads production activity and it deals with production functions of the plant and reporting to the Director (Operations). This department consists of 3 production plants like GPPS, HIPS and EPS.
Quality Control Department:

This department takes care in maintaining the quality of the products produced in the plant after production, various tests & testing devices are used to test the required properties are present in the finest product.

- Universal testing machine
- Gas-liquid chromatography

Quality Policy of LGPI:

At LG Polymers India Pvt. Ltd the employees are committed to customer satisfaction and shall meet customer needs and expectations by timely delivery of quality products through continual improvement of technology, infrastructure and work environment with innovation and total participation. To maintain this quality they conduct “quality circle concept”.

Quality Objectives:

- To develop a well trained and motivated work force for continuous improvements in quality.
- To build corporate image as quality polystyrene producer, giving requisite thrust on customer satisfaction. And establishment of assured perfect market with in the country.
- To develop a well trained workforce for continuous improvement of quality.
- To maintain the best quality product In the market.

Total Productivity Management (TPM):

TPM is a part of quality management just like QC (Quality Circles) activities and are carried out in small groups. Both QC and TPM are aimed at zero defectives in production putting tighter a particular shop floor system to present and past results are compared throughout the entire production system life cycle.

In the year 1970 production is started through the implementation of total productivity management method in the plant. To achieve high plant productivity vide a comprehensive
system and total employee participation. TPM is a methodology used for max equipment efficiency.

- Establishing a TPM system has improved production and productivity of the plant.
- All employees are involved in the first time operations of the plant.
- TPM motivation management normally by autonomous small group.

Full participation by all departments including equip planning, operation maintenance department.

Marketing Department:

The marketing department of the company had an intense network to market their products in the domestic & overseas markets. LGPI central marketing office is situated at Mumbai and regional sales offices at all metro cities (i.e., Mumbai, Delhi, Bangalore, and Kolkata). Consignments are delivered through stockiest in all important cities in the country.

Objectives:

- To increase sales volume and market share
- To design demand strategies
- To explore new markets
- To develop new product application
- To build higher sales realization
- To make prompt collections
- To build high sales returns
- Sustaining competitive edge in the market
- To provide better customer service to customer

Standards:

ISO-9002: Quality system model for assurance in production as installation.
Goals of LGPI:
• To maintain a 100% customer satisfaction
• To maintain a 100% quality in production of product
• To maintain our company reputations as a best company in world

Environment and Safety Department:
This department is mainly concerned with following objectives
• To run the organization with safety and security of property and people.
• To comply with environmental laws laid by the government.
• To give feedback of compliance.
• To Educate, motivate and planning people for safe work.
• To incorporate safety systems and designing of format for every job.
• To protect from fire through crews, alarms and smoke detectors.
• To monitor the environment.

Pollution Control and Environmental Protection:
It is located far from the city, so there is not much pollution control caused towards the people and environment. They have planned a lot of greenery inside the firm, which controls pollution.

Environmental Policy:
LG Polymers India Pvt., Ltd., shall ensure that they manufacture a product range of general purpose, high impact and expandable polystyrene resin the most environmental friendly way possible by:
1. Meeting all the legal requirements related to internal and external environment requirements and striving to exceed them where possible.
2. Ensure a safe working environment for all the employees.
3. Achieving excellent levels of house keeping in all areas, and maintaining a clean and green work environment.
4. Using best available options for waste disposal and management, while actively working to reduce wastes at source.
5. Striving to continually improve unit consumption of resources and reduce total demand where possible.

6. Ensuring that the neighboring community is not put to inconvenience.

7. Developing and maintaining an extensive green belt.

8. Maintaining a high level of environmental awareness of among all the employees.

9. Continually improving the environmental management system.

**Innovative Department:**

This department is headed by HOD, innovative department and is supported by the technical advisor. This department deals with the emerging competitions in the market and provides innovative ideas for the achievement of sustainable growth and experience in the market.

Its aim is to constantly aspire for customer oriented product with reduced cost prices. It conducts various turnaround and cultural activities.

**TABLE – 4.4: MAJOR ACTIVITIES & ACHIEVEMENTS**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Activity</th>
<th>Details</th>
</tr>
</thead>
</table>
| 1      | Six Sigma Projects | • Full time member in “Unification of 306 & 306D”  
          |                 | • Full time member in “Unification of 306 & 314”                         |
| 2      | Quality Circles  | • Participated in QC for the case study of – “Black Spots – LGHG 5X721S”.  
          |                 | • Presented a QC as a team leader – “Comparison of L&T and Cincinnati Injection Moulding machine” |
| 3      | Innovative      | • Actively participated in the suggestion & safety Card scheme, Reminding activities and TPM methodology.  
          |                 | • Actively participated in releasing Technical Bulletins and One point Lessons. |
|   | Monitoring HIPS runs | - Monitored the properties in each run for LGH-306D, LGH-309.  
- Monitoring of MFI trend for each run of HIPS grades. |
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<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Analysis of Chemicals</td>
<td>- Learnt the procedures of chemicals analysis like Zinc stearate, Anti-oxidants, TNPP etc.</td>
</tr>
<tr>
<td>6</td>
<td>Blending trials</td>
<td>- Blending trials of GPPS and HIPS on Moulding Machine</td>
</tr>
</tbody>
</table>
| 7. | SAP | - Presently followed retrieval of stocks for different grades and properties through Batch No from SAP.  
- Retrieval of sales figures for different grades and properties through Batch No from SAP |
| 8. | Safety | Participated in safety week celebrations. |
| 9. | Others | - Involved in Routine documentation (WR, MR, presentations etc.).  
- Involved in weekly reports & Monthly Complaint Report making. |

Source: Company Reports

The Top 10 Trading Partners for LG Plastic Products are:

1. USA  
2. UAE  
3. ITALY  
4. UK  
5. BELGIUM  
6. GERMANY  
7. SINGAPORE  
8. SAUDI ARABIA  
9. CHINA  
10. HONGKONG

Six Sigma projects in LGPI:

The management of LG has seen the success of Six Sigma projects which were carried out in Korea and have implemented the same in LGPI, Visakhapatnam, which have given tremendous results. In the past 11 years the LGPI has undertaken 119 Six Sigma projects through which the soft savings are approximately $7,500,000.
Total Projects : 119
No. of Yellow Belt (YB) Projects (YB) : 10
No. of Green Belt (GB) Projects (GB) : 54
No. of Black Belt (BB) Projects (BB) : 41
No. of Master Black Belt Projects (MBB): 14

Brief descriptions of some eminent projects are given below:

1) Project Title : Maximization of Business opportunity through Productivity improvement
   Year : 2002
   Department : EPS
   Project Type : Black Belt
   Benefit : Rs. 328.70 Lakhs / $ 671,000

2) Project Title : Product development for LGEIL requirement
   Year : 2003
   Department : HIPS
   Project Type : Master Black Belt
   Benefit : $ 239,000

3) Project Title : Credit notes and Debit notes standardization
   Year : 2003
   Department : EDP
   Project Type : Master Black Belt
   Benefit : System improvement

4) Project Title : EPS MUC reduction through reduction in chemical Consumption
   Activity Background: MUC reduction in EPS was observed in 4 segments i.e., fixed cost, variable cost, Chemical cost, Utility cost. In there segments Chemical cost reduction was not concentrated much in respect with alternative vendors. Among the chemicals used found 5 major chemicals which are contributing 83 % of total cost. So this project has been taken to reduce in the chemical side cost reduction, to reduce further MUC even at higher production rate
5) Project Title: Fines reduction in EPS process
Activity Background: At present 2.2% fines are being generated in the EPS plant. EPS being a fast moving grade, opportunity is being lost to the extent of 30 MT of EPS every month. So there is an urgent need to reduce fines in EPS process.

6) Project Title: Marketing system streamlining for sales segment. Activity Background: It has been observed that the sales trend comes down during the same period of the year. Hence this project is taken up for streamlining the business improvement methods for sales.

7) Project Title: Cost reduction on Chemicals and vendor development
Activity Background: Since the speed world market it is essential to develop the new and alternator vendors to procure chemicals as some of the chemicals is crossing more than Rs 2.5 crores.

8) Project Title: Tensile Strength consistency improvement in HIPS Grades
Activity Background: Quality improvement further as per the customer’s
9) Project Title: Improvement to Internet bandwidth by Deployment of Broadband facility

Activity Background: Deployment of Broadband facility (1 Mbps at Vizag & 512 Kbps at Mumbai) for better extranet access & faster web browsing. Continue existing 64 Kbps BSNL Internet LL for mailing application. Discontinue existing SIFY 64kbps Internet LL due to higher port charges, with internal resources and with minimum expenditure.

Year: 2007
Department: EDP
Project Type: Green Belt
Benefit: Rs. 12.50 Lakhs/$ 32,000

10) Project Title: Coating Chemicals Cost optimization.

Activity Background: Scope resisting for reduction of coating chemical.

Year: 2008
Department: EPS
Project Type: Black Belt
Benefit: Rs. 96.00 Lakhs

11) Project Title: Inventory days reduction with SCM mode

Activity Background: A TFT team will be formed with Production, Logistics and CSPD to study and monitor the overall situation of Inventory control.

Year: 2008
Department: Synergy (Material / Accounts / Production / CSPD and marketing)
Project Type: Black Belt
Benefit: Rs. 48.00 Lakhs

12) Project Title: High Strength GPPS
Activity Background: To meet the market demand of nearly 60 MT / Month this project is taken up

Year : 2010
Department : GPPS
Project Type : Green Belt
Benefit : Rs. 20.50 Lakhs / $46,000

References:
2. Annual Reports of LGPI, Visakhapatnam
5. http://www.lgpi.co.in/
7. Six Sigma project details – LGPI, Visakhapatnam