UK STUDY TOUR – 2016
(Aluminium, Cement, Pulp & Paper and Textile Sectors)

Prepared by:
# Contents

1.0 Background  
2.0 Objectives of the Study Tour  
3.0 Details of the Discussions and Meetings organized during Study Tour
   (i) Meeting with International Aluminium Institute (IAI)  
   (ii) Visit to Hanson Cement, Heidelberg Cement group  
   (iii) Meeting with Mineral Product Associations  
   (iv) Meeting with ALTEK Europe Limited  
   (v) Meeting with Siemens and Fairport Engineering
      (member of Cement Industry Supplier Forum (CISF))  
   (vi) Meeting with Tetronics International  
   (vii) Visit at Grundon Waste Management Limited  
   (viii) Meeting at Textile Centre of Excellence, Textile Institute  
   (ix) Visit at The School of Materials, University of Manchester  
   (x) Visit at DS Smith, Kemsley Mill  
   (xi) Meeting with Confederation of Paper Industry (CPI)

## Annexures

a) **Annexure 1**: Program Agenda of Aluminium Sector - 26th to 28th September, 2016  
b) **Annexure 2**: Program Agenda of Cement Sector - 26th to 28th September, 2016  
c) **Annexure 3**: Program Agenda of Pulp & Paper Sector - 28th to 30th September, 2016  
d) **Annexure -4**: Program Agenda of Textile Sector - 28th to 30th September, 2016  
e) **Annexure -5**: Delegation List – Aluminium, Cement, Pulp & Paper and Textile sector
1.0 Background

Two Study tours comprising of senior industry representatives from four of India’s largest and most energy intensive sectors viz. Aluminium & Cement and Pulp & Paper & Textile, were organised to UK from 26th to 30th September 2016. The Study tours also comprised of representatives from Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India and Knowledge Exchange Platform/ Institute for Industrial Productivity (IIP) India. The detailed program of the study tour is provided at Annex-1-4 and the composition of the delegation is provided at Annex-5.

The study tour was organised under the Knowledge Exchange Platform (KEP) initiative, which is a Joint initiative of BEE and IIP. British High Commission (BHC) is supporting IIP in this initiative under their Prosperity Fund program. The mandate of KEP initiative is to assist the industry in meeting its energy efficiency targets by facilitating peer to peer learning and transfer of best practices within and across the targeted industry sectors of Perform Achieve and Trade (PAT) scheme. It also proposes to support the industry by bringing in knowledge on innovative approaches on energy management and international best practices for promoting energy efficiency, technology gap assessment and Energy Management System (EnMS), as a means of achieving continuous improvement in energy efficiency in the industry sector. The two study tours to UK were organised to support this objective of KEP.

2.0 Objectives of the Study Tour

The objective of the Study tour was to promote knowledge sharing and technology partnership between UK and India in the area of Industrial energy efficiency and provide practical exposure to industry, BEE and KEP officials through direct interaction with their counterparts in UK with a view to assess the viability and applicability of UK technologies and approaches in India, with the following objectives:

- **Create exposure** to understand the best available technologies in the area of energy efficiency presently being used and commissioned in UK.
Interactions with technology experts and technology developers to get an understanding whether these technologies will be a best fit and can be replicated in India and details of provisions that are required to ensure their adoption in India.

Interactions with Industry representatives, industry associations and knowledge exchange bodies in UK, to understand the drivers for promoting energy efficiency and the strategies and approaches being adopted by them to achieve policy and regulatory mandate for energy conservation.

Stimulate collaboration with the aim of enhancing transfer of technologies between UK and India, ensuring there is an ambitious, mutually beneficial, outcome-focused relationship.

In line with the above objectives, the following approach was followed:

- **Provide direct interaction** with the technology providers, industries, Industry Associations and policy makers which will help the industries to understand in depth about the best practices being followed in UK.
- **Visit to technology provider site** to understand more about the functionality of the technologies and the benefits that can be achieved by implementing these technologies.
- **Field visits** to the chosen industrial units and centres of excellence, to assess their performance in operational condition, energy performance, investment, pay back and other parameters relevant for their success and scale up in India.
- **Roundtable Discussion** to foster UK-India partnership for promoting Industrial Energy Efficiency and provide an insight to the industrial energy efficiency market in India, experiences and learning of UK policies in the area of energy efficiency and climate change, possible technology offerings from UK and networking opportunity to forge B2B collaborations.

### 3.0 Details of the Discussions and Meetings organized during Study Tour

The delegation met representatives of industry, industry association, technology providers, knowledge bodies and policy makers in UK and also visited selected industrial units, and centers of excellence. The key issues discussed in the meetings organized during the study tour are highlighted below:

(i) **Meeting with International Aluminium Institute (IAI)**

Current IAI membership represents over 60% of global bauxite, alumina and aluminium production. Since its foundation (as the International Primary Aluminium Institute), the members of the IAI have been companies engaged in the production
of bauxite, alumina, aluminium, the recycling of aluminium, or fabrication of aluminium or as joint venture partners in such.

The key objectives of the Institute are to: a) Provide the global forum for aluminium producers on matters of common concern and liaising with regional and national aluminium associations to achieve efficient and cost effective co-operation; b) Identify issues of relevance to the production, use and recycling of aluminium and promoting appropriate research and other action concerning them; and c) Encourage and assisting continuous progress in the healthy, safe and environmentally sound production of aluminium.

The Indian delegation members from Aluminium sector met the following representatives of IAI:

- Mr. Chris Bayliss, Deputy Secretary General, International Aluminium Institute (IAI)

Mr. Bayliss gave a brief introduction about IAI and informed that Institute was established in 1972 with members from pure Aluminium Companies (Aluminium producers to finished product). Now IAI have become more heterogeneous which encompass complete Aluminum value chain including integrated manufacturers, Refiners and downstream players too. IAI collates data from non-members also and present the same in their database.

IAI is now planning to open office in China, which produces aluminium to the tune of 52% world production with a similar level of consumption. Indian delegation informed IAI that India is lagging behind in terms of Aluminium alloy production and any support in terms of information would be of extreme help. Dr Agnihotri suggested IAI to organize joint programs to promote the use of Aluminum.

![Image of the Indian delegation members in a meeting with Mr. Chris Bayliss](image-url)
Mr. Bayliss informed that Europe is now focusing on doing value addition in the field of downstream Aluminum. Indian delegation requested help to improve upon technical losses and help in energy conservation to bridge the still existing performance gaps. Mr. Baliss explained that the key is measuring energy efficiency at each stage of the value chain and analyzing it.

Mr. Baliss informed that Gulf manufacturers are working on heat recovery from the pot and he will forward a presentation for information on the same. Dr. Agnihotri and Mr. Mankad informed that concept of Aluminium Parks, having aluminium smelters and secondary aluminium producers so that molten aluminium can be used directly for casting without re-melting of aluminium ingots, needs to be promoted to which Mr. Chris supported.

Take Away:

1. IAI is keen to partner with JNARDDC to collaborate on data and knowledge sharing, R&D and technology development.
2. Potential for collaboration for new product development (alloy development) in India based on some of the best practices implemented by members of IAI.
3. Promoting the concept of Aluminium Parks, having aluminium smelters and secondary aluminium producers was discussed with IAI. This will help in enhancing energy efficiency in Aluminium recycling process where the molten aluminium can be used directly for casting without remelting of aluminium ingots.
4. IAI members have some good models for waste heat recovery that have high possibility for replication in Indian Industry- Waste heat recovery potential and its feasibility from Aluminium Smelters is proposed to be explored by Indian Aluminium Sector based on the learnings from IAI.
5. IAI has offered to share benchmarking/energy data, which will help in enhancing the energy productivity of Indian Aluminium Sector

(ii) Visit to Hanson Cement, Heidelberg Cement group

Hanson Cement is a part of the Heidelberg Cement Group, and produces around one tenth of the UK's Cement needs. Hanson is at the forefront of sustainable cement production, namely through the increasing use of non-fossil fuels for the kilns. At present they substitute about 58 per cent fossil fuel with a target to take it to 65%. They produce aggregates (crushed rock, sand and gravel), ready-mixed
concrete, asphalt, cement and cement related materials. Their principal markets are the major conurbations in England and Wales and the central belt of Scotland. Turnover for the UK business in 2014 was £1.2 billion and employment of around 3,500 people in jobs ranging from specialist and professional managers through to production operatives.

The Indian Delegation members from Cement sector met the following officials from Hanson Cement:

- Mr. Iain Walpole, Senior Environment Manager, Hanson Cement
- Mr. Mat Newton, Senior Energy Manager, Hanson Cement

The meeting started with a presentation by Mr. Walpole on the insights of plant’s operation and working standards. He mentioned that they have installed their 2nd Kiln during 1986 having size of 4.2 meters dia x 56 meters long with a capacity of 0.833 Million Tons per annum along with close circuit Polysys Cement Mill of size 4 meters dia x 16.2 meter length with a capacity of 1.3 Million Tons per annum.

The plant is working with 130 employees over and above they engage contract labour based on their requirement, shutdown etc. He informed the participants that the plant maintains their safety systems and their Last Time Injury (LTI) was recorded 3 years back.

He mentioned that Hanson Cement is using different types of Alternate Fuels which includes Tyre Chips, Waste Chemical Solvents, wood scrap, Meat & Bone Meal (MBM), Sludge, Packing material & RDF to the tune of 60%. They have agreement with third party for supply of required processed AFL to the plant. The third party ensures the consistent supply of AFL and also sharing some percentage of cost benefit to the plant for using the same. The Kiln has installed by pass filtration system of 12MT to extract chloride laden dust from the Kiln Gasses.
UK Cement Industry has a commitment to reduce Green House Gases by 65% by 2050. Industry has reduced CO2 emission by 54% (13 million tons to 6 million tons) between 1990-2014. The average power consumption for clinker is 85 kWh / Ton and on cement 136 Kwh / Ton. They make cement of 4400 blain at power consumption of 50 Kwh / MT.

He informed the participants that Hanson Cement has 12 MW capacity solar plant which produces 3 MW power and the same is supplemented for their required power. UK produced cement fulfil their requirement to the extent of 83% whereas 17% is being imported. Out of the requirement, 10% of cement is catered from Hanson Cement.

**Take Away:**

1. High potential for collaboration in the area of best practices and technology use of Alternate Fuel and Raw materials- Hanson’s average Thermal Substitute Rate (TSR) is around 65% whereas in India it’s less than 1%
2. Understand the pre-processing techniques for a variety of waste (meat and bone waste, pulp & paper waste, biofuel etc) for usage in cement industry- explore the possibility of using similar wastes in India
3. Understand the bypass operation and incineration techniques employed by UK Cement industry and its’ economics – bypass helps in reducing chlorine content in the waste for use as fuel in cement industry

**Meeting with Mineral Product Associations**

Mineral Products Association (MPA) is the trade association for the aggregates, asphalt, cement, concrete, dimension stone, lime, mortar and silica sand industries. With the recent addition of British Precast and the British Association of Reinforcement (BAR), it has a growing membership of 480 companies and is the sectoral voice for mineral products.

The Indian delegation members from Cement sector met the following representatives of IAI:

- Dr. Diana Cassey, Senior Advisor, Energy & Climate Change, Mineral Products Association Limited

She made a brief presentation about MPA and Cement industries in UK. She mentioned about the key mineral industry facts viz. there are more than 480 members, 250 MT annual production, 70,000 people employed directly by them to the industries, 2.5 million people employees supplied to the industries, £9 billion
annual industry turnover, £400 billion turnover by the industries to whom they supply. She mentioned that about 44% of fuel switching is taking place by Waste Derived Fuel (WDF) and 20% by biomass, which has led to avoiding 500,000 tonne of coal. She informed the industries that various practices are being followed by the cement industries to recover waste and use them as fuel viz. CKD being recovered on site, fuel ash is being recycled as mineral content, AFR in interground and kiln feed. In terms of direct emissions of CO₂, the sector has reduced emissions by 54% since 1990.

She also explained the role of EU ETS in clinker benchmark based on the greenhouse gas emissions performance index. The flat benchmarking curve shows that there is little scope for reducing emissions. The benchmark that was given to the industries was 0.766 kgCO₂/t of Clinker.

**Take Away:**

1. Understand how landfill regulations in UK is helping to promote use of waste as fuel in cement industry- whether learnings can be replicated in India
2. Understand the strategy and technologies for de-carbonization of UK Cement Industries

(iv) Meeting with ALTEK Europe Limited

It is a technology-based company with specialist expertise and experience in the design, manufacture and installation of aluminium dross and scrap processing systems. Their engineers have, between them, over 200 years of international experience in developing and refining solutions to dross and scrap recycling.

The Indian Delegation members from Aluminium sector met the following officials from Hanson Cement:

- Mr. Alan Peel, Managing Director, Altek Europe Limited
- Mr. Andy Gibbs, Technical Director, Altek Europe Limited
- Mr. Andrew Rhotes, Business Director Alusalt, Altek Europe Limited

ALTEK started its operations with 5 people in the year 2003. Now Altek people strength has grown to 60 having total plant area of 24000 sq ft. The company is in the field of supplying electromagnetic stirrers, rotary furnaces and Alusalt technology for the treatment of dross. Indian delegation visited the manufacturing facility and saw the production of Electro Magnetic Stirrer. Indian delegation was taken around their pilot facility for alusalt and dross testing laboratory.
ALTEK developed machinery for 100% recycling of dross in the year 2015. This project came up with an investment of Euros 3.6 million of which 70% was funded by European Union and balance by M/s. ALTEK. Project target was to build zero waste plant with 15000 T/year capacity.

Mr. Alan Peel explained that on an average 1.5% dross gets generated in melting and 50 to 60% of the Aluminum in the dross can be recovered. If the dross is not treated in time, the Aluminum metal will burn on its own and will get destroyed. He provided some tips for energy conservation like use of stirrers for improved heat transfer and lower dross generation (stirring with doors closed), use of positive pressure in furnaces for lower dross generation (reduced air entry), temperature control below 782 deg C above which dross generation increases very rapidly.

For Alusalt Technology, he provided some Ballpark numbers for 20,000 Tonnes of Dross Handling per year. Total capex is about GBP 5 million. Simple payback is 3 years considering 90% LME prices for Al recovery, cost of salt @ GBP 120/MT and landfill cost @ GBP 70/MT. The operating cost of this technology is GBP 1.2 million per annum considering electricity prices of GBP 0.10 / KWH. Output of this technology is NMP (NON-METALLIC PRODUCT) which is safe for disposal. The financials mentioned above considers zero sale value for NMP.

Dr. Agnihotri informed ALTEK group that JNARDDC has also developed (patented) a process for safe and economical disposal of dross with zero waste concept. Dr Agnihotri also expressed his desire to collaborate with ALTEK regarding much economical solution to dross generated during secondary processing of the metal on zero waste concepts.

Dr Peel agreed to collaborate and look into joint funding from British/Indian government to further explore the possibility.

Indian delegation conveyed it’s thanks to the entire team of ALTEK Group for hosting the meet at their work and was quite impressed and highly appreciated the efforts made by the company team for dross treatment and making it a valuable product.
(v) Meeting with Siemens and Fairport Engineering (member of Cement Industry Supplier Forum (CISF))

The principal divisions of the Siemens are Industry, Energy, Healthcare, and Infrastructure & Cities, which represent the main activities of the company. The company is a prominent maker of medical diagnostics equipment and its medical health-care division, which generates about 12 percent of the company's total sales, is its second-most profitable unit, after the industrial automation division.

Fairport Engineering has a long pedigree of developing and delivering engineering projects for the Power, Biomass, Alternative Fuel, Coal, Quarry, Mineral, Cement, Advanced Recycling, Waste, Ports and other heavy industries. Formed in 1982 Fairport Engineering has a history of working with some of the world’s leading companies – Scottish and Southern Energy, Cemex, Saint-Gobain, Rio Tinto Alcan, Lafarge, Tarmac, Heidelberg Cement, RWE nPower, Hanson, EDF, Brunner Mond, etc.

The Indian delegation from the Cement sector met the following representatives of Siemens and Fairport:

- Mr. Jeremy Chang, Digital Factory, Control Systems, Siemens
- Mr. Gary Palmer, Industry Automation & Drive Technologies, Siemens
- Mr. Neil Webnetz, Finance Division, Siemens
- Mr. Richard Woosnam, Project Manager, Fairport Engineering Limited
- Mr. Richard Maslen, Chemical Engineer, Fairport Engineering Limited
- Mr. Alistar Starkie, Brand Development Manager, Fairport Engineering Limited

Take Away:

1. Practices such as Use of stirrers for improved heat transfer and lower dross generation (stirring with doors closed), and temperature control below 782 deg C above which dross generation increases very rapidly, needs to be promoted in Indian Aluminium Sector as is being done in UK industries.
2. Discussions with Altek on examining the use of Alusalt technology for the dross recycling system under Indian situation for its techno economic viability.
3. ALTEK group and JNARDDC will explore collaboration to promote dross technology in India. To take this forward they will assess economic viability of dross generation during secondary processing of the aluminium metal on zero waste concepts and possibility of joint funding will be explored jointly by the both organizations.
A presentation made by M/s. Siemens and Fairport Engineering in which they shared their experience in technology upgradation in cement, petro chemical and Gas Projects. M/s. Siemens is supporting Industries for certification and implementation of ISO 50001 and also takes the assignments for monitoring, training and has developed simulators for data analysis to reduce the Energy to the most optimum level.

Fairport Engineering is providing solutions to the cement and petro chemical industries in the field of Pollution Control improvements, grinding energy improvements, pneumatic conveying improvement with latest pneumatic conveying techniques and also for upgrading the existing system for efficiency improvement, for reliability improvement, for increasing usage of alternate fuels to the extent of 100% TSR (liquid and solid secondary fuels). They are into design and installation of AFR system. They also undertake overall energy reduction by drive systems improvements. They supplied multi fuel burner to replace the existing burner to increase AFL usage and low NOx & SOx.
It was informed that U.K. follows ESOS (Energy Saving Opportunity Scheme). The company employing more than 250 Nos. required to have Energy Manager to implement the Energy consumption reduction in-turn reduction in CO₂ emission. Fairport has designed and implemented plant for municipal waste recycling to produce fuel in the form of RDF to support Cement Industry in U.K.

M/s. Siemens and M/s. Fairport have an interest to assist the Indian Industries with their rich experience. They have shown interest in undertaking Indian Cement Industry study for identifying the potentials for improvement in the field of AFR usage, power reduction, CO₂ reduction etc.

They are supporting with their expertise and capabilities with the factories to supply technology for:

- Utilization of waste heat recovery, multi fuel burners
- Reduction in Nox and Sox
- Process optimization by flow analysis, intelligent automation, big data collection and computer flow modelling and also Energy efficiency improvements

Take Away:

The Cement industry representatives showed keen interest in the technology options and services offered by Siemens and Fairport Engineering, which also has high possibility of adoption in the Indian cement sector as a whole. Some of the key areas of interest are as follows:

1. Assistance in Data Acquisition, Big Data Analytics & Digital Modelling
2. Technology options for use and handling of alternative fuels in Indian cement plants to reduce fossil fuel consumption

(vi) Meeting with Tetronics International

Tetronics has patented Plasma Waste Treatment Technology to treat Spent Pot Liner, a by-product from Aluminium industry. The process chemistry in Plasma Waste Treatment technology is considered robust and tolerant to fluorinated chemical environment.

Treating SPL using plasma also presents an opportunity to recover useful sources of fluorine and energy for the aluminium production process. The remaining waste is then
converted into an inert, non-hazardous vitrified material for disposal. The technology is considered economically viable even at a small scale to allow it to be co-located with primary smelting plants. In doing so, this avoids the need for transportation of SPL.

The Indian delegation members from Aluminium & Cement sectors met the following delegates of Tetronics International:

- Dr. Tim Johnson, Technical Director, Tetronics International
- Mr. Peter Keeley, Doctoral Researcher, Tetronics International
- Ms. Lesley Vernon, Commercial Manager, Tetronics International

Mr. Peter Keeley in his presentation gave a brief introduction of Tetronics’ technology to treat the spent potliner (SPL), which is a hazardous waste generated by Aluminium plants, which offers commercial and technical advantage over existing waste management options, while conserving natural resources. He mentioned they offer Waste Recovery Plants to meet a growing number of waste management challenges including the recovery of pyrometallurgical wastes; one of the many potential waste streams in SPL. Various benefits can be achieved by using its technology viz. it vitrified SPL into an environmentally stable disposable product, tolerant of a fluorine rich environment, safe and future proof treatment of problematic orphan waste material, compact plant that can be readily retrofitted to existing installations and it recovers fluorine and energy for the aluminium production process.

Dr. Tim Johnson in his presentation informed the industry members about the Plasmarock technology which has been developed by Tetronics. This technology is a strong, environmentally stable product that is recovered from the Tetronics’ waste
recovery process and has the potential to greater value as a building aggregate. He also briefed on how fly ash is treated by Plasma to get converted to Plasmarock. Tetronics informed that they are world leaders in Plasma and have more than 90 installations world over and have recently developed this technology for SPL treatment. He mentioned that due to Plasmarock’s unique combination of high mechanical strength and hardness, as well as high resistance to chemical leaching, makes it perfect for use as a material that has been used, then recycled and recovered i.e. secondary aggregate material in road paving, pipe bedding or other markets. Tests have proven that this technology is less vulnerable to the cracks and weaknesses that may reduce other materials resistance to fracture. Benefits of using Plasma technology re viz. Plasma is omnivorous, making it ideal for treating hazardous and industrial waste, excellent operating and environmental performance, broad versatility and controllability for exceptional levels of material recovery, clean heat source, which does not involve combustion and close process and environmental control whilst minimizing plant operating costs.

Indian delegation members also looked at table top models for converting municipal solid waste to power using advanced plasma technology. Officials from Tetronics mentioned they have supplied plants upto 60 MW capacity. Indian delegation highlighted the importance of using alternate fuels, such as SPL which has a calorific value of 3000-4500 kcal/kg, in the cement kilns in order to cut costs and save precious fossil fuels.

As hundreds of thousands of tonnes of spent pot lining is being stockpiled in almost all the Indian aluminium smelters and with an annual net availability of 32,000 tonne per year, are awaiting the development of a successful and economic way of disposing of it, the cement sector is equally willing to utilize detoxified SPL in its cement kilns. Therefore deployment of a technology, such as developed by Tetronics, is worth considering.

**Take Away:**

- Use of Tetronics Plasma Technology has high potential for adoption in India for detoxifying SPL generated by Aluminium Sector.
- Opportunities for generating value from waste as the Plasma Technology has Plasmarock can be used as a product of its own or in a range of building applications.
(vii) Visit at Grundon Waste Management Limited

Founded in 1929, Grundon is the UK’s largest family-owned supplier of integrated waste management and environmental solutions. Operating from depots across the south of England they work in partnership with customers to help minimise the financial and environmental impacts of their waste. They provide a total waste management service for the reduction, reuse, recycling, recovery and disposal of waste, delivered via a combination of specialist services, contract management and the operation of their own facilities.

The total waste management service includes the collection, treatment, recovery, recycling and disposal of non-hazardous waste streams, in addition to dealing with all aspects of hazardous waste, including contaminated waste, clinical and healthcare waste and waste electrical and electronic equipment (WEEE). They also offer additional services including special event waste management and industrial cleaning services.

The Indian delegate members from Paper and Textile sector met the following representatives of Grundon:

- Mr. Neil Grundon, Deputy Chairman, Grundon Waste Management Limited
- Ms. Eva Grundon, Grundon Waste Management Limited
- Mr. Jamie Brooks, Regional MRF Manager at Grundon Waste Management Limited

Mr. Neil Grundon briefly explained the delegation about Grundon, the Material Recovery Facility (MRF), Lakeside Energy from Waste (EFW) plant and operation strategy. While explaining MRF, he mentioned that this facility can be described by the three ‘R’ i.e. Reduce, Reuse and Recycle. This is an area where Grundon has positioned itself for over 50 years of environmentally friendly waste management in the UK by using the most technologically advanced system. This facility doesn’t need to receive the segregated waste, its mixed recyclables which are processed in the MRF relieving customers of another waste complex and space consuming problems. It starts with the collection trucks full of mixed recyclables. Over a hundred thousand tons of waste is collected in a receiving bunker. The next process is about sorting i.e. separating the mixed recyclables to individual materials streams. At the start, the revolutionary redwave infrared machine also sorts, identify the materials and gradually channelize them into their respective streams, sending them into the sorting process on different conveyors.
Magnetic and eddy currents separates the extracts from Ferrous and Non Ferrous metals. The magnetic process involves a belt which attracts steel and other metals containing iron. The eddy current separator containing spinning magnets sends non-ferrous materials such as aluminium off the conveyer. After this process, a manual sorting process is carried out in order to find out if anything has been missed out by the mechanical processes. Now sorted recyclables like paper, cardboard, plastics, cans and glass are conveyed into separate bunkers. From the bunkers, they are sent to high density machines which compress the materials into bales, which are then transported to the reprocessing plants where they are ultimately fed back into the industry through materials.

When the waste reaches the last stage when it cannot be recycled, it generally goes to the landfill site and is termed at residual waste. This waste is transported to Lakeside EFW where the energy recovery from waste takes place. At Lakeside, this residual waste is put to productive use by burning it at high temperature under controlled conditions, which results in less landfill and lots of energy production. This facility processes more than 400,000,000 tons of residual waste every year.

During this process, the plant generates enough power to supply nearly 50,000 homes. He mentioned that the household waste is delivered to a massive bunker that can hold around 7500 tons of waste. The grab cranes mix the waste and then load it into a hopper where hydronic rams push it into an incinerator. At this point, the waste is converted into fuel, which burns at around 950 deg C for at least two seconds. This creates heat to produce power as it turns water into superheated steam which drives the high pressure turbine to power an electric generator. Once the steam has done its job turning the turbines, it condenses and returns to the boiler. After the combustion flow process, only ash and metals are left as residue which is moved away from the conveyor belts and the metal is separated by magnets which are collected for recycling.
and the ash is taken away for reprocessing. The ash is then used for road building and construction as a substitute for raw materials taken from the land and sea.

Around a 3rd of the plant is devoted of cleaning of the exhaust gases; the hot gases from the combustion process are treated to remove pollution. For instance, lime is used to absorb acid gases, activated carbon to fix combustion by product and ammonia to remove oxides of nitrogen. Advanced filtering systems also capture the ash and small particles which would otherwise go upto chimney. The gas cleanup residue is disposed of in an appropriately licensed disposal facility. The entire operation is constantly monitored against the environmental standards and the plant operates to the strict environmental permits. The environment agency has 24 * 7 accesses to the plant and the online monitoring data. The plant uses the power generated by itself and generates a surplus power around 34 MW of electricity which is exported every year into the national grid.

After this brief introduction, the Indian delegates got an opportunity to visit the MRF facility where they saw entire process from manual sorting of plastic, glass, paper, cans being manually and mechanically sorted and then being sent to various conveyor belts for further sorting and being transported to the industry for processing.
Figure 9 Control Room to monitor the operations being carried out

Figure 10 Manual sorting of waste

Figure 11 Various bins to collect waste like food waste, green waste and recyclable waste

Figure 12 Mr. Jamie Brooks explaining the delegates about the facility

Figure 13 Sorting of material through Redwave machine

Figure 14 Segregated material sent after the scanning via Redwave machine
Figure 15 Collection of Glass waste after sorting process

Figure 16 Collection of Paper waste after the sorting process

Figure 17 Indian Delegation with the officials from Grundon Waste Management Limited
Take Away:

1. Indian Delegation appreciated the integrated waste management facility at Grundon, which offers the possibility for efficient separation and recovery of recyclable materials, cost-effective waste management and energy recovery from waste heat, and wanted to explore the possibility of setting up similar facilities in India.
2. Mr. Harvinder Rathee, Head Engineering, Arvind Limited proposed to arrange a meeting of Mr. Neil Grundon and his team with the Chairman & Managing Director of Arvind Limited in India in order to explore various channels for collaboration.
3. Mr. Ashok Kumar Mehta, Vice President, BSL Limited invited Ms. Eva Grundon to his plant in India to explore waste processing possibilities in Indian textile industries.
4. The other delegates also offered to arrange a meeting at their corporate offices in India with their senior top management officials to explore various possible ways for collaboration.

(viii) Meeting at Textile Centre of Excellence, Textile Institute

The Centre offers quality assured, flexible training at all levels from pre-entry traineeships to foundation degree equivalent programs. The Centre operates as a Group Training Association and works closely with its member firms to ensure the voice of the industry steers skills development. The Textile Centre of Excellence also works with a range of public and private sector organizations to help develop activity to stimulate innovation and to enhance skills in areas of relevance to the region’s manufacturing industry.

The Indian delegate members from Textile sector met the following representatives of Textile Centre of Excellence:

- Ms. Rebecca Unsworth, Director of Professional Affairs, Textile Centre of Excellence, Textile Institute
- Mr. Graham Downhill, Manager, Textile Centre of Excellence, Textile Institute

Ms. Unsworth briefly explained the delegates about the role of Textile Centre of Excellence and its operating strategy. The centre was established in 1976 and has 95 member companies from textile manufacturers and processors. The centre looks at the four different markets viz. fashion, automotive/aerospace/transport, corporate/furnishing and technical textiles. The role of the centre is to provide trainings at all levels, research and developments, represent the textile sector in UK and Europe and to look out for various funding support for the sector.

This was followed up by a presentation by Mr. Graham Downhill on the technology “Multiplexed Laser Surface Enhancement (MLSE) system invented by MTIX Limited.”
MLSE system enables fibres and fabrics to be converted or enhanced hydrophilicity, hydrophobicity, fire retardancy and antimicrobial functionalities without the use of harmful chemicals or water, all at 55 metres per minute.

MTIX has developed a control system which provides integrating multiple system elements, a simple operation interface, allows full access to the individual components providing a reliable recipient batch processing schedule and performance reporting for batch traceability.

MLSE equipment can be used to produce the full spectrum of natural and synthetic materials sub straights of width upto 2 metres. The fabric is then taken off and then put on rolls or strollers.

In the processing zone, there are multiple syntheses which are introduced into the fabric on a single pass. Providing the continuous supply of different environments in MLSE process zone involves a gas feed system (nitrogen generation system). The nitrogen generation minimises the processing cost and minimises gas bottle handling. The installed chillers keep the system components within the defined process parameters. All the discharge from the system is gaseous, which is passed through a catalytic filter before being exhausted cleanly into the atmosphere.

While explaining the expert analysis of this technology, Mr. Downhill mentioned that with the use of this technology about 99 % of energy consumption can be reduced, greenhouse gas reduction over the baseline of 90.09 %, resource (chemical) use reduced by 94.8 %, water consumption can be reduced by more than 75.5 % and use of hazardous source can be eliminated completely.
(ix) Visit at The School of Materials, University of Manchester

The School of Materials is a school of Materials Science at the University of Manchester. The school is one of the largest departments in Europe that has a material science focus. In Textiles, new educational themes were developed and the concept of integrated, technology supported Textile Management, Design, Fashion and Retailing programmes were introduced reflecting the diverse nature of the business.

The Indian delegation members from the textile sector were met by the following representatives of The School of Materials, University of Manchester:

- Dr Simeon Gill, Lecturer in Fashion Technology Management, The School of Materials, University of Manchester
- Mr. Vivek Koncherry, Research Associate, The School of Materials, University of Manchester
- Mr. SS Roy, Research Associate, The School of Materials, University of Manchester

During the visit at the School of Materials, Mr. Vivek Koncherry described about the various technology innovation and research work being done on old/ new machines, composite and technical textiles. He explained about a machine based on “Multifunctional Carbon Fibre Flat Tape for Composites” developed at the university. Advanced Carbon Composites is one of the fastest growing High Value Manufacturing sectors in the UK with applications in high-end cars, thermal management, radiation shielding, stealth, structural health monitoring and energy storage etc. Current approaches to incorporate functional material into bulk-resin formulations have been ineffective and prohibitively expensive.

Take Away:

1. Understand the use multi-laser technology which can be very profitable as it eliminates the use of chemicals and hazardous waste which would thereby result in environmental and economic benefits.
2. The delegation members from Raymond Limited, BSL Limited, Vardhman Textiles and Arvind Limited invited Mr. Downhill to their plants in India so as to understand the technology better, analyze the cost-benefit analysis and explore the scope of replication in their respective units.
The aim of this research was to deliver multifunctional (to advanced structural composites) by way of printing highly viscous polymeric paste, containing functional material on carbon fiber tows. Multifunctional Carbon Fiber developed was tested for its magnetic properties and bending stiffness. MCF characteristics were noted by using mechanical tests and the results were validated using simulation software.

Figure 20 Multifunctional Carbon Fibre Flat Tape machine for Composites

Figure 21 Delegation visiting the technical textile room

Figure 22 Mr. S.S Roy explaining experiments being carried out at new machines

Figure 23 Visiting the Green Room facility where analysis and designing are carried out

Figure 24 Visiting the Laboratory facility
Mr. S.S Roy explained about a machine based on “Energy Absorption optimization for Braided Composites”. He mentioned that braiding is a composite preform manufacturing technique that involves continuous, interlaced yarns or tows to form a desired reinforcement prior to or during the resin. The idea behind this research was to study effects of varying braid Angles continuous and discontinuous edge upon ductility of braided composite, effect of axial tow insertions and hybridization by introducing different fibers in axial and bias directions. At the end of the research it was concluded that Braid angle and tow boundary conditions have significant effect on mechanical properties and energy absorption properties of the flattened tubular braided composite. Also, by increasing number of triaxial reduces the necking behaviour reduces energy absorption properties and increase stiffness of braided composite.
Visit at DS Smith, Kemsley Mill

Kemsley Mill was originally built by Edward Lloyd in 1924 to produce newsprint. At that time, its four paper machines were the largest in the world. The mill has an annual production capacity of around 800,000 tonnes and is the second biggest recovered fibre-based paper operation in Europe. In 2008, DS Smith invested over £100m to purchase and rebuild PM6 to make lightweight corrugated case material (CCM). Kemsley Mill produces Light Medium, the first recycled lightweight paper manufactured in the UK.

The Indian delegation members from Paper sector met the following representatives of DS Smith, Kemsley Mill:

- Mr. Craig Nicol, General Manager, DS Smith, Kemsley Mill
- Mr. Guy Lacey, Technical Manager, DS Smith, Kemsley Mill
- Mr. Graham Appleby, Site Facilities Manager, DS Smith, Kemsley Mill

The officials from DS Smith mentioned that the plant has been operating in 35 countries with 28,500 employees. This includes packaging, recycling, paper and plastic. They are mainly into kraft / kraftliner and corrugated boxes. Turnover in 2014-15 was £3.8 billion. They have 9

Take Away:

1. The members were keen to learn more about the ‘technical textile’ and sought for detailed research materials along with appropriate case studies which they can refer in order to understand the sector in depth.
2. The delegation found the braided composite technology extremely interesting and sought for more information and detailed cost-benefit analysis.
paper mills and 15 paper machines. They produce 2.8 million tons out of which 2.4 million tons is corrugated case material (kraft / kraftliner) and rest is speciality paper like plaster board liner, solid board and paper plate etc. They also have de-inking plant. The plant produces all variety of kraft / kraftliner including white top with de-inking pulp.

They explained their various energy efficiency schemes; most of them were mainly like VFDs, use of flash steam, blower in place of vacuum pumps, rebuilds to use better technology etc. One innovative approach being carried out by the plant is, using booster water from primary to secondary to tertiary screen in place of collecting and pumping the whole material back from primary to secondary to tertiary.

They have also installed a combined heat and power plant (CHP) based on waste recovered from the plant including ETP sludge. Input to this plant is 15-16 tons of waste per hour which includes plastic, DIP sludge with 65% solids and effluent sludge with 30% solids and they are generating around 22 tons of steam per hour at a pressure of around 2

### Take Away:

The industry members found the plant visit extremely interesting and were keen to learn more about two innovative practices implemented in DS Smith so as to look at out a way of replicating it in their respective units:

1. The technology which helps to use booster water from primary to secondary to tertiary screen which is highly energy and resource efficient. The Indian industry delegation was keen to explore partnership with the technology provider to understand if the same technology can be replicated in their plant as per their requirements and operating conditions.

2. The approach followed in installation of CHP plant led to high energy efficiency and monetary benefits. The Indian industry delegation were keen to carry on the discussion with the technology provider to know if the same boiler can be supplied which has a smaller capacity along with predrying facility.
(xi) Meeting with Confederation of Paper Industry (CPI)

The Confederation of Paper Industries (CPI) is the leading organisation working on behalf of the UK’s Paper-based Industries. CPI represents the supply chain for paper, comprising paper and board manufacturers and converters, corrugated packaging producers, makers of soft tissue papers and collectors of paper for recycling.

The Indian delegation members from Paper sector met the following representative of Confederation of Paper Industry (CPI):

- Mr. David Morgan, Confederation of Paper Industry

Mr. Morgan gave a brief presentation on the Paper Industries in UK. He mentioned that during the period of 2000-2015, the consumption of paper and paper board in UK had reduced from 12.9 to 9.1 million tons in 2015; paper production reduced from 6.6 million to 4 million tons in 2015 and the number of paper mills reduced from 95 to 49 in 2015.

He mentioned that the recovered paper collection has increased from 5.1 million tons in 2000 to 8 million tons in 2015. In 2015, 3.3 million tons of recovered paper was used by UK mills and 4.9 million tons was exported. The sector turnover is around £6.5 billion per year.

Major operating costs are fibre, energy and chemicals in descending order of the cost structure. Paper manufacturing is using mainly gas as a fuel (9 twh and rest is bio-mass (4 twh) annually. Total carbon emission from UK paper mills is 2.4 million tons CO₂ per year. Carbon emission has reduced by 55% on specific basis since 1990.

Take Away:

1. To understand the strategies and practices adopted to reduce the CO₂ emissions, so that they can also implement those best practices in their respective units.

*****
ANNEXURES
Program (Aluminium Sector)
Study Tour 1: 26th to 28th September, 2016

<table>
<thead>
<tr>
<th>26th September 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timing</strong></td>
</tr>
</tbody>
</table>
| 10:00 am to 3:30 pm | Meeting with Chris Bayliss, Deputy Secretary General, International Aluminium Institute (IAI) | IAI membership represents over 60% of global bauxite, alumina and aluminium production | Mr. K.K. Chakarvarti  
Mr. J. M. Mankad  
Dr Anupam Agnihotri |

<table>
<thead>
<tr>
<th>27th September 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timing</strong></td>
</tr>
</tbody>
</table>
| 10:30 am to 7:30 pm | Field Visit to Altek facility in Chesterfield, UK | ALTEK is a technology based company with expertise and experience in aluminium dross and scrap processing systems. They have supplied technology/ equipment in over 450 locations spread over 60 countries. | Mr. J. M. Mankad  
Dr Anupam Agnihotri |
### 28th September 2016

<table>
<thead>
<tr>
<th>Timing</th>
<th>Meeting detail</th>
<th>Detail of the organisation</th>
<th>Detail of Delegate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30am to 01:30 pm</td>
<td>Roundtable Discussion, BEIS Conference Centre</td>
<td>Agenda attached separately</td>
<td>All four sector delegates to join</td>
</tr>
<tr>
<td>2:30 pm to 08:00 pm</td>
<td>Meeting with Stephen Gill and his team at Tetronics International and field visit to their facility in Swindon</td>
<td>Tetronics has patented Plasma Waste Treatment Technology to treat Spent Pot Liner, a by-product from Aluminium industry that can be used as an Alternate Fuel in Cement Industry.</td>
<td>Mr. Sajjan Singh Jain, Mr. Mahendra Kumar Patil, Mr. Umang Gupta, Mr. Somnath Bhattacharjee, Mr. J. M. Mankad, Dr Anupam Agnihotri, Ms. Ritu Bharadwaj, Ms. Sanyukta Dasgupta</td>
</tr>
</tbody>
</table>
### Program (Cement Sector)
#### Study Tour 1: 26th to 28th September, 2016

**26th September**

<table>
<thead>
<tr>
<th>Timing</th>
<th>Meeting detail</th>
<th>Detail of the organisation</th>
<th>Detail of Delegate</th>
</tr>
</thead>
</table>
| 8:00 am to 04:30 pm | Field trip to Hanson Cement, Ketton, Near Peterborough— Showcasing Energy efficient technologies  
And  
Meeting with Diana Casey from the Mineral Product Association (MPA) at the Hanson site and a presentation to the delegation on the work of the MPA | Hanson Cement is owned by Heidelberg Cement and produces around one tenth of the UK’s Cement needs. Hanson is at the forefront of sustainable cement production, namely through the increasing use of non-fossil fuels for the kilns. At present they substitute about 58 per cent fossil fuel with a target to take it to 65%.  
Mineral Products Association (MPA) is the trade association for the cement, concrete, dimension stone, lime, mortar and silica sand industries. It has a growing membership of 480 companies and is the sectoral voice for mineral products. | Mr. Sajjan Singh Jain  
Mr. Mahendra Kumar Patil  
Mr. Umang Gupta  
Ms. Ritu Bharadwaj |
### 27th September, 2016

<table>
<thead>
<tr>
<th>Timing</th>
<th>Meeting detail</th>
<th>Detail of the organisation</th>
<th>Detail of Delegate</th>
</tr>
</thead>
</table>
| 8:00 am to 05:45 pm     | Field trip to Fairport, Cement Industry Suppliers Forum member in Manchester – to include lunch | The Cement Industry Suppliers Forum (CISF) was formed under an initiative led by the British Cement Association (now MPA Cement) to develop closer links between the cement companies and their technology suppliers, materials and services. The field visit will showcase Fairport’s expertise (CISF member) in emission reduction through focusing on process optimisation leading to energy reduction and emission abatement plus efficiency improvements | Mr. Sajjan Singh Jain  
Mr. Mahendra Kumar Patil  
Mr. Umang Gupta  
Mr. K.K. Chakarvarti  
Ms Sanyukta Dasgupta |

### 28th September, 2016

<table>
<thead>
<tr>
<th>Timing</th>
<th>Meeting detail</th>
<th>Agenda attached separately</th>
<th>Detail of Delegate</th>
</tr>
</thead>
</table>
| 08:30am to 01:30 pm     | Roundtable Discussion, BEIS Conference Centre                                  | Tetronics has patented Plasma Waste Treatment Technology to treat Spent Pot Liner, a by-product from Aluminium industry that can be used as an Alternate Fuel in Cement Industry.                                                                 | Mr. Sajjan Singh Jain  
Mr. Mahendra Kumar Patil  
Mr. Umang Gupta  
Mr. Somnath Bhattacharjee  
Mr. J. M. Mankad  
Dr Anupam Agnihotri  
Ms Ritu Bharadwaj |
| 2:30 am to 08:00 pm     | Meeting with Stephen Gill and his team at Tetronics International and field visit to their facility in Swindon |                                                                                                                                                                                                                           | Mr. Sajjan Singh Jain  
Mr. Mahendra Kumar Patil  
Mr. Umang Gupta  
Mr. Somnath Bhattacharjee  
Mr. J. M. Mankad  
Dr Anupam Agnihotri  
Ms Ritu Bharadwaj |
## Program (Pulp & Paper Sector)
### Study Tour 2: 28th to 30th September, 2016

### 28th September 2016

<table>
<thead>
<tr>
<th>Timing</th>
<th>Meeting detail</th>
<th>Detail of the organisation</th>
<th>Detail of Delegate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30am to 01:30 pm</td>
<td>Roundtable Discussion, BEIS Conference Centre, 1 Victoria Street, London SW1H 0ET</td>
<td>Agenda attached separately</td>
<td>All four sector delegates to join</td>
</tr>
</tbody>
</table>

### 29th September 2016

<table>
<thead>
<tr>
<th>Timing</th>
<th>Meeting detail</th>
<th>Detail of the organisation</th>
<th>Detail of Delegate</th>
</tr>
</thead>
</table>
| 9:30 to 03:30 pm        | Field visit to the Grundon Waste Management Ltd. (Colnbrook Depot) MRF facility at Colnbrook, Slough Organised by PITA | Sensor and waste management technology is of relevance to Textile and Pulp & paper sector in India for their mandate under the Ganga Action Plan | Mr. P. K. Suri
                          |                                                                              |                                       | Mr. Sandeep Bhalla                                                               |
                          |                                                                              |                                       | Mr. A K Mehta                                                                    |
                          |                                                                              |                                       | Mr. Dharam Bir Arora                                                             |
                          |                                                                              |                                       | Mr. Harvinder Rathee                                                             |
### 30th September, 2016

<table>
<thead>
<tr>
<th>Timing</th>
<th>Meeting detail</th>
<th>Detail of the organisation</th>
<th>Detail of Delegate</th>
</tr>
</thead>
</table>
| 09:30 am to 05:00 pm | Field Visit to DS Smith, Kemsley Paper Mill, Sittingbourne ME10 2TD Phone: 01795 518900 | DS Smith is primarily in the corrugated packaging market, has the largest paper mill in the UK, whose energy is supplied by a variety of innovative means, and also has a network of smaller plants producing the packaging papers, boards and boxes for their market. Confederation of Paper Industries (CPI) represents 70 Member companies along the supply chain for paper, comprising recovered paper merchants, paper and board manufacturers and converters, corrugated packaging producers and makers of soft tissue papers. Members range in size from large multi-national organisations with multiple sites in the UK, to single site SMEs. | Mr. P. K. Suri  
Mr. Sandeep Bhalla  
Mr. John Craven |
# Program (Textile Sector)
## Study Tour 2: 28th to 30th September, 2016

### 28th September 2016

<table>
<thead>
<tr>
<th>Timing</th>
<th>Meeting detail</th>
<th>Detail of the organisation</th>
<th>Detail of Delegate</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30am to 01:30 pm</td>
<td>Roundtable Discussion, BEIS Conference Centre, 1 Victoria Street, London SW1H 0ET</td>
<td>Agenda attached separately</td>
<td>All four sector delegates to join</td>
</tr>
</tbody>
</table>

### 29th September 2016

| Timing                  | Field visit to the Grundon Waste Management Ltd. (Colnbrook Depot) MRF facility at Colnbrook, Slough Organised by PITA | Sensor and waste management technology is of relevance to Textile and Pulp & paper sector in India for their mandate under the Ganga Action Plan | Mr. P. K. Suri  
Mr. Sandeep Bhalla  
Mr. A K Mehta  
Mr. Dharam Bir Arora  
Mr. Harvinder Rathee  
Mr. A S Baldua  
Mr. Sanjay Sharan |
|-------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------|
### 30th September 2016

<table>
<thead>
<tr>
<th>Timing</th>
<th>Meeting detail</th>
<th>Detail of the organisation</th>
<th>Detail of Delegate</th>
</tr>
</thead>
</table>
| 08:00 am to 06:30 pm | Meeting and field visit to Manchester  
Meeting with Graham Downhill, Textile Centre of Excellence, Textile Institute  
Visit to School of Materials at Manchester University | see link  
http://www.texi.org/   
see link  
http://www.materials.manchester.ac.uk/ - which has a particular focus on textiles | Mr. A K Mehta  
Mr. Dharam Bir Arora  
Mr. Harvinder Rathee  
Mr. A S Baldua  
Mr. Sanjay Sharan  
Mr. T C Gupta  
Ms. Vinni          |
### Delegation List - UK Study Tour

#### Aluminium & Cement Sector

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name</th>
<th>Designation</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shri Jagrat Maheshprasad Mankad</td>
<td>Sr. Vice President &amp; Head - Corporate Technical and Energy Services</td>
<td>Aditya Birla Management Corporation Pvt. Ltd.</td>
</tr>
<tr>
<td>2</td>
<td>Shri Umang Gupta</td>
<td>Senior Engineer</td>
<td>Shree Cement, Beawar</td>
</tr>
<tr>
<td>3</td>
<td>Dr. Anupam Agnihotri</td>
<td>Director</td>
<td>Jawaharlal Nehru Aluminium Research Development and Design Centre</td>
</tr>
<tr>
<td>4</td>
<td>Shri Sushil Kumar Wali</td>
<td>Wholetime Director</td>
<td>JK Lakshmi Cement Limited</td>
</tr>
<tr>
<td>5</td>
<td>Shri Sajjan Singh Jain</td>
<td>President</td>
<td>Mangalam Cement Limited</td>
</tr>
<tr>
<td>6</td>
<td>Shri Mahendra Kumar Patil</td>
<td>Joint President (Works)</td>
<td>My Home Industries Private Limited</td>
</tr>
<tr>
<td>7</td>
<td>Shri Kishan Kumar Chakarvarti</td>
<td>Expert Consultant</td>
<td>Bureau of Energy Efficiency</td>
</tr>
</tbody>
</table>

#### Pulp & Paper and Textile sector

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name</th>
<th>Designation</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Shri Pavan Kumar Suri</td>
<td>Executive Vice President (Works)</td>
<td>JK Paper Mills, Jaykaypur</td>
</tr>
<tr>
<td>9</td>
<td>Shri Sandeep Bhalla</td>
<td>General Manager (Development)</td>
<td>JK Paper Limited</td>
</tr>
<tr>
<td>10</td>
<td>Shri Harvinder Rathee</td>
<td>Engineering Head</td>
<td>Arvind Limited</td>
</tr>
<tr>
<td></td>
<td>Name</td>
<td>Position</td>
<td>Organization</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>11</td>
<td>Shri Ashok Kumar Mehta</td>
<td>Vice President</td>
<td>BSL Limited</td>
</tr>
<tr>
<td>12</td>
<td>Shri Sanjay Sharan</td>
<td>Director (Works)</td>
<td>Raymond Limited, Jalgaon</td>
</tr>
<tr>
<td>13</td>
<td>Shri Ajay Satyanarayan Baldua</td>
<td>General Manager- Engg Services</td>
<td>Raymond Limited, Vapi</td>
</tr>
<tr>
<td>14</td>
<td>Shri Dharam Bir Arora</td>
<td>Vice President</td>
<td>Vardhman Textiles Limited</td>
</tr>
<tr>
<td>15</td>
<td>Shri Tara Chand Gupta</td>
<td>General Manager (Plant Head)</td>
<td>Vardhman Fabrics, (A Unit of Vardhman Textile Ltd, Ludhiana)</td>
</tr>
</tbody>
</table>

**IIP & BHC Team**

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Shri Somnath Bhattacharjee</td>
<td>Director</td>
<td>Institute for Industrial Productivity India</td>
</tr>
<tr>
<td>17</td>
<td>Ms. Ritu Bharadwaj</td>
<td>Chief of Program</td>
<td>Institute for Industrial Productivity India</td>
</tr>
<tr>
<td>18</td>
<td>Ms. Vinni</td>
<td>Project Officer</td>
<td>Institute for Industrial Productivity India</td>
</tr>
<tr>
<td>19</td>
<td>Ms. Sanyukta Dasgupta</td>
<td>Policy Advisor</td>
<td>British High Commission</td>
</tr>
</tbody>
</table>