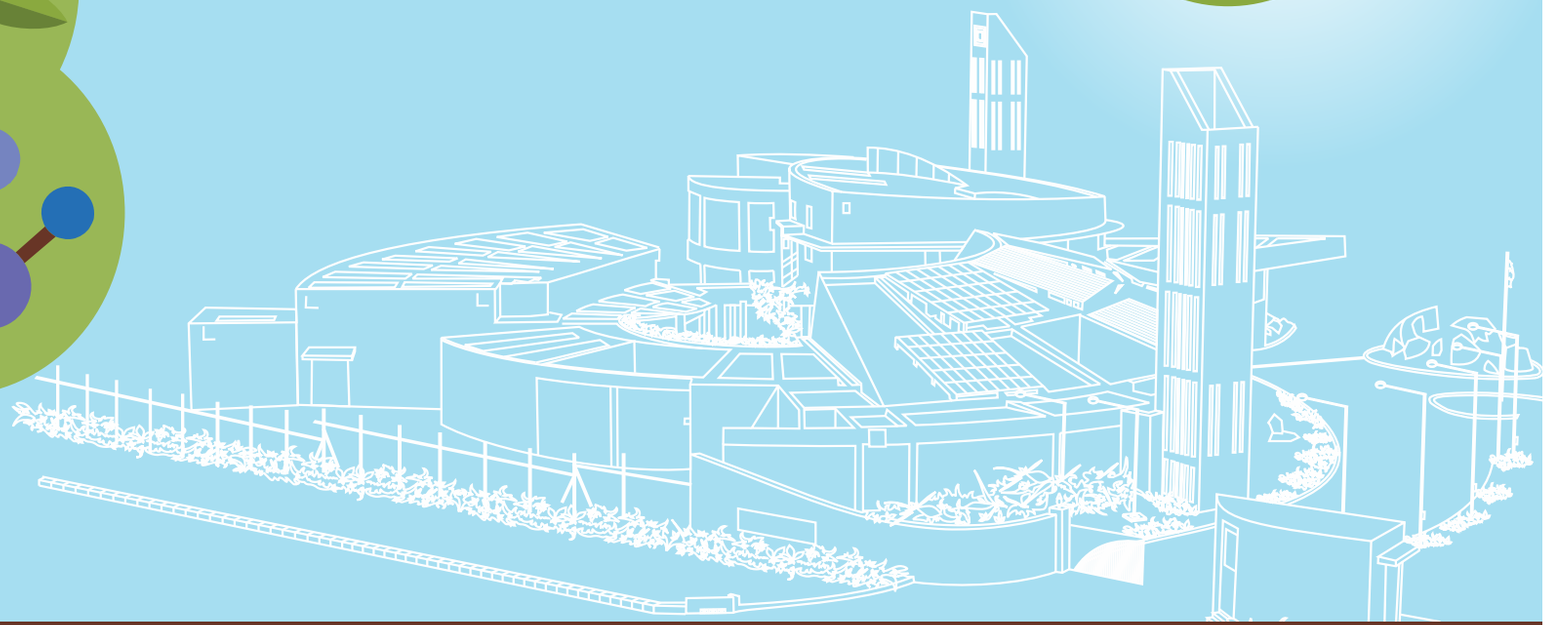
Confederation of Indian Industry

GreenCo Best Practices 2016



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MESSAGE

Today, Indian industry stands tall in adopting some of the finest technologies which are ecologically superior and economically viable. Stakeholders of Indian industry are clearly showcasing that economic growth and environmental sustainability can go hand in hand and that green makes good business sense.

CII has always been in the forefront in facilitating Indian industry gain the much needed competitive advantage. A major step towards this direction is the launch of GreenCo Rating System, which is evoking excellent response from the stakeholders.

It is heartening to witness how GreenCo rated companies are working closely with all the stakeholders in resource conservation, bottom-line improvement and looking much beyond compliance. This indeed augurs well to a greener India. I am sure, as you run through these pages, you will appreciate how GreenCo rated companies are playing a catalytic role in addressing ecological issues and concerns.

There is a need to further accelerate the adoption and promotion of green growth models across the sectors of Indian industry and in the process facilitate industry to emerge as a global leader in sustainable development.

I heartily congratulate Mr. Pradeep Bhargava, Mr. L S Ganapati and all the assessor panel members for their excellent contribution to the GreenCo movement.

Jamshyd N Godrej,
Chairman, CII- Godrej GBC

MESSAGE

It is encouraging to note that adopting and promoting green practices have become an integral part of the overall business growth strategy. Opportunities to increase competitiveness by going green and improving resource efficiency are widespread and far-reaching.

Building on this imperative, CII in partnership with various stakeholders has launched GreenCo Rating System - the first of its kind in the world for evaluating the performance of companies on the ecological front and also guide companies to make their products, services, operations and supply chain greener.

Encouraged by the success of GreenCo Rating, CII has developed this publication which showcases some of the finest practices incorporated in GreenCo rated companies and the respective savings achieved by them.

I heartily congratulate all the GreenCo rated companies for setting new benchmarks in environmental sustainability and also thank each and every one for being part of this inspiring journey.

Going green is not only good to the company but is also good to the community and to the country at large. We warmly invite you to partner with CII in facilitating a greener India.

Pradeep Bhargava
Chairman,
CII - GreenCo Rating System

When we look back at the growth & progress of GreenCo rating system, we are overwhelmed to witness how companies have gone that extra mile in making their operations greener and more sustainable.

We have seen how GreenCo rated companies have started excelling in areas that they were already good at; but it is fulfilling to see how GreenCo companies have explored innovative and futuristic green concepts and in the process are becoming globally competitive.

As you run through this publication, I am sure, you will appreciate the concerted efforts made by companies in greening their operations and paving way for others to replicate their success stories.

I heartily appreciate all the GreenCo rated companies for the contribution and efforts in taking forward the GreenCo movement in the country. We are sure, GreenCo rating will facilitate Indian industry in setting new global benchmarks in energy and environment management.

L S Ganapati
Chairman,
CII GreenCo Assessors' Panel

INTRODUCTION

Pursuing green has become the new driver for companies on the quest towards growth, competitiveness and global excellence. With number of businesses going green on the rise and several initiatives on different areas evokes a spark in an individual's mind on 'How Green is a Company'. CII, through an extensive stakeholder consultation and interaction with experts, has developed the "GreenCo Rating System" to evaluate how green is a company. This first of its kind in the world rating system, is a holistic mechanism to assess and analyze the company's performance on the green front. It is a framework to measure and monitor the environmental impact of a company's activities or operations. The GreenCo Rating System apart from assessing the companies also defines a path for continuous ecological improvement and guided phase growth.

The GreenCo Rating System has been receiving an excellent response from the Indian industry. As of June 2016, more than 200 companies are at various levels of execution of the rating system, out of which, 78 companies are GreenCo Rated. GreenCo's depth and spread of environmental parameters, its multi sector applicability and its neither-too-tough-nor-too-easy design are a few characteristics that have facilitated GreenCo to reach out to various companies across various sectors, sizes and regions. One of GreenCo's distinguishing characteristics is that the GreenCo Rating System is not just a rating system but a comprehensive mechanism that helps companies to evolve as those exhibiting superior environmental responsibility and performance.

GreenCo rating encourages companies to pursue relatively newer concepts such as working beyond the fence to harvest and manage water, third party purchase of renewable energy, raw material conservation through reduction and substitution, extending environmental conservation activities into the supply chain, responsible manufacture of products, life cycle assessment as a tool to reduce environmental impact of its product, process and service and many more are taken up by companies. The GreenCo rated companies have not only reduced their environmental impact but have also improved their competitiveness. 27 GreenCo Rated companies have achieved a recurring annual savings of Rs 543 Million. CII strongly believes in collaborative growth of Indian Industry by sharing, promoting and recognizing the best practices implemented in specific areas by GreenCo Rated companies. For the second time, CII – Godrej GBC organized the GreenCo Best Practices Awards 2016 on 15 June 2016 at Hyderabad.

GreenCo Best Practices Awards 2016 -
Objective

- Recognize and award best practices implemented by GreenCo rated companies
- Facilitate information sharing amongst industry
- Instill a sense of competition to motivate other industries to implement best practices

Eligibility Criteria
Any GreenCo Rated unit in India, which has taken proactive initiatives and has achieved environmental benefits, in any area under the purview of GreenCo, except Energy Efficiency, since this is specifically addressed in CII Energy Efficiency awards.

GreenCo Best Practices Book
This publication has been brought forward as an outcome of call for questionnaires for the GreenCo Best Practices Awards 2016. 65 questionnaires were sent out and 34 questionnaires were received. Every case study in this booklet includes –

- Brief profile of the company
- Background or project details
- Uniqueness of the project
- Replication potential of the project
- Trigger of the project
- Environmental benefits
- Cost economics

The compilation is intended for companies to learn from each other and replicate best practices wherever possible. Against each case study, name and contact details are included. It is recommended to reach out to them to learn more about the projects before replication of the projects. The publication was released during the 5th edition of the GreenCo Summit 2016 held on 16 & 17 June 2016 at Hyderabad.

Performance of participating companies

Amount of fossil fuel saved	27783.78 MT
Fresh water saving	374458 KL
GHG emission reduction	663980 MT
Raw Material Saving	101004.5 MT
Investment made	₹ 3.068 Billion
Annual Savings	₹1.9013 Billion

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ACC Limited
Kymore Cement Works

ACC Ltd., Kymore Cement Works was established in 1923 with total capacity of 0.09 MTPA. In 2012, the plant was rated the 1st among ACC plants and 4th in the Holcim group based on the group's internal performance index which covers production cost, product quality, energy consumption, maintenance cost, environmental protection, etc.

ACC Limited is a pioneer in extending co-processing services in the country to provide a safe and environmentally friendly method for the management of wastes to the industry and society. These services are provided under the brand name of Geocycle, which is the global waste management brand of Lafarge - Holcim, the promoter of ACC Limited. Lafarge - Holcim is one of the world leaders in cement manufacturing and has an experience of more than 30 years in waste co-processing. Co-processing is a globally recognized sustainable waste management technology, through which the waste is treated in energy-intensive industries such as cement instead of being buried or burned inefficiently.

ACC Ltd., Kymore Cement Works has won several prestigious awards such as Earth Care Award for Reduction of Green House Gases Emission in Large Enterprises Category - 2014, CII 14th National Best Energy Management Award - 2013, CII Environmental Best Practices Award - 2013, Eco-Corporate Yes Bank Award for Natural Capital - 2013, CII Environment Best Practices Award, Year 2011, National Energy Conservation Award - 2010 (First Prize) from BEE, Ministry of Power, Govt. of India, etc.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE, INDIA
GreenCo
GOLD
2014

GreenCo Gold

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AFR Preprocessing and Co-processing Facility

Project Background

The average quantity of waste to be handled by the plant is 90,000 tons per annum (TPA). The region has a promising waste market and a favorable regulatory frame work for co-processing. In view of this, decision was taken to set up a pre-processing platform in the plant, where different kinds of wastes from industrial, biological and municipal sources are mixed and processed by different techniques such as size reduction, screening, impregnation, blending etc. into uniform quality materials for using them as Alternative Fuel and Raw Materials (AFRs) in cement plant. This Preprocessing and Co-Processing Facility consists of setting up a pre-processing platform, storage shed and feeding system for coarse solid AFR at Kiln 1. The importance of pre-processing increases exponentially when it comes to making co-processing an ecologically sustainable and an environmentally friendly process, as feeding of a homogeneous mixture of waste of appropriate state, dimension and composition would result in complete utilization of energy and material value of the waste.

Pre-Processing Platform: The pre-processing platform has an average production capacity of about 15 TPH depending on waste mix and properties. The platform produces coarse solids (nominal 2D and 3D <75mm) for feeding into Kiln 1 ILC (In-line Calciner).

Co-processing at Kiln 1 ILC: The solid feeding facility at ILC Kiln 1 consists of a volumetric pre-dosing and gravimetric dosing of pre-processed waste received from the platform.

OH&S: Storage and handling of waste whether hazardous or non-hazardous requires utmost care and safety. All efforts were made to identify and assess the risks involved at each and every step beginning from waste identification till the disposal of waste. Geomembrane sheet is provided in floor of facility and firewater retention basin along with separate leachate collection system to avoid the contact of spillage material with soil and water. Automatic fire detection & suppression system provided to whole facility.

In 2015, Kymore co-processed 61,943 tons of waste with a thermal substitution rate (TSR) of 5%. This resulted in savings of 60,394 tons of tradition fuel and raw material. Between Jan - April 2016, Kymore has co-processed 28,790 Tons with TSR 8.31%. The target is to co-process 90,000 tons in 2016 and 93,300 tons in 2017.

Uniqueness of the Project

Kymore was the first cement plant in the country to initiate co-processing of non- recyclable plastic waste from MSW. In India, Kymore demonstrated the first DRE (Destruction and Removal Efficiency) Assessment by disposing ODS (Ozone Depleting Substance) in cement kiln.

Replication Potential

Many cement industries have been using AFR through co-processing. In order to further increase quantum of waste, pre-processing can be replicated in the cement industry

Trigger of the Project

To increase TSR and quantity of waste to be used as alternate fuel, pre-processing facility was set up.

Environmental Benefits

- Supporting India's INDC target of reducing emission intensity of GDP by 33 to 35 percent in 2030 from 2005 levels
- Co-processing ranks higher in the waste hierarchy than landfilling and incineration
- Saving CO_2 emission by replacement of fuel by waste
- Reduction in landfilling area requirement

Cost Economics

Investment made	:	₹ 620 Millions
Annual savings achieved	:	₹ 253 Millions
Payback	:	3 Years

Bangalore International Airport Limited (BIAL)

Bangalore International Airport Limited (BIAL) is a public limited company under the Companies Act formed to build, own and operate Bengaluru's Greenfield private sector-owned and operated airport - Kempegowda International Airport, Bengaluru. The airport was constructed through a private-public partnership, a first for airports in India.

The first phase of the Kempegowda International Airport, Bengaluru (KIAB) was concluded in March 2008 and it became operational on May 24, 2008. The Master Plan of this airport has been developed to fulfill the need for an operationally efficient and passenger-friendly airport for the city. It ensures that the size and capacity of the airport facilities, which is housed within a 4000 acres' area, can be gradually expanded basis passenger and cargo growth.

With 44 airlines connected to 67 destinations in India and globally, KIAB has become the airport of choice for international and domestic travelers. KIAB is South India's busiest airport and the third largest in the country. This airport currently handles over 18 million passengers. The enhancement of the existing terminal was undertaken due to the increasing passenger and air traffic. The enhancement work which began in August 2011 involved the extension of the terminal building in both directions and became operational in early 2014.

BIAL is committed to establishing this airport as one of India's leading projects in terms of quality and efficiency and set a benchmark for the future commercial development of Indian airports. The vision is to make the airport a model for sustainable progress that creates a positive impact on the community and works vigorously to set benchmarks in its green initiatives through water and waste management, energy efficiency, building social capital and enhancing bio diversity.

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GreenCo Platinum

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Case Study 2

Application of GSM technology in managing the Apron lighting system towards sustainable Airfield Operations

Project Background

Apron is a defined area, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fueling, parking or maintenance. Aircrafts stands is a designated area on an apron intended to be used for parking an aircraft. The high mast lighting system are designed in line with the DGCA - Civil Aviation requirement of having a minimum average of 20 lux on aircraft stand area and 10 lux on all other areas. Apron lighting system consist s of about 400 lamps each of 1000 W to illuminate the Apron area.

It has been proposed to partially switch off some of the high masts where there is no operational requirement. However, following were the initial constraints:

- The operations itself are dynamic in nature and would be varying based on the circumstances
- Immediate response would be required in case of operational requirement
- Accessing the location wouldn't be an easy task with the operational and safety movement constraints at Airside
- Staggered location of high mast proposed for switching off partially
- Consumption of conventional fuel in moving to the required locations as and when required

In order to overcome the challenge, GSM technology has been used along with the functioning of the high mast lighting. GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number.

Project Steps:

- Collection of Stand allocation data from AOCC & Airside operations department
- Field analysis on the provided data - The data of aircraft stand allocation has been collected for a period of one week in order to identify the stand which are not being used, especially during the night times
- Identification of stands which are majorly not being utilized
- Grouping the fixtures on energy saving mode and realigning the orientation of the fixtures to provide minimum illumination as per requirements
- Coordination with Airside operations and aviation safety for checking the feasibility and obtaining the clearances
- Installation of GSM device and testing with the administrator Mobile (Maintenance shift mobile)
- Response form the device about the status of the lights on request

Date of commencement	:	August 2015
Date of completion	:	September 2015

Uniqueness of the Project

Innovative cost effective initiative in the field of Airport systems with conventional lighting system in place

Replication Potential

This can be adopted at other airports where huge savings can be achieved in terms of energy, fuel resources and in turn GHG emissions.

Trigger of the Project

High mast lighting system is one of the prime consumer of energy at airside, located at Apron area. Ineffective utilization of the same could create a negative impact towards sustainability. During routine Airside operations, it has been observed that the utilization of all stands are not at equal proportion and in some cases aircrafts are not at all being parked in some of the stands in common due to related operational advantages. This triggered to optimize the use of high mast lighting system in coordination with critical departments Airside operations and Aviation safety team.

Environmental Benefits

Annual reduction in energy consumption	:	1.13 Lakh units
Annual reduction in GHG emission	:	0.1 Million tonnes of CO_2 eq

Cost Economics

Investment made	:	₹ 5000/-
Annual savings achieved	:	₹ 0.91 Millions
Payback	:	Less than a month

Case Study 3

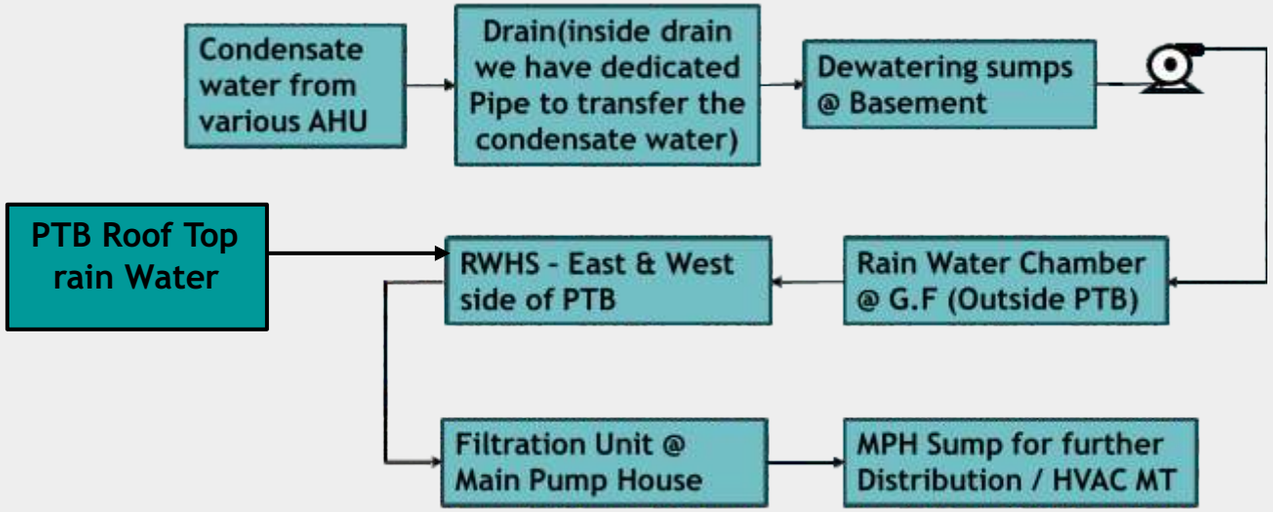
Recovery & reuse of condensate water from AHU's as well as utilization of rain water into potable application

Project Background

BIAL has a dedicated HVAC plant in Airport to cater to Passenger Terminal Buildings (PTB) and other associated buildings. Approximately 7 million litres per month water is required for cooling tower make up. Earlier BIAL utilized treated water to meet the requirement.

Approximately 57KL/day of condensate water from AHU's (Out of 94, 79 AHU are connected to RWH line) was sent to sewage line. This was a significant amount of water loss, which triggered BIAL to take this project.

Dedicated pipelines were introduced to collect the condensate from AHUs and connected to rain water harvesting system. The same filtration system has been utilized to convert rain water, which is collected from roof of PTB for drinking purposes.



Scheme for condensate collection

Date of commencement	:	September 2015
Date of completion	:	November 2015

Uniqueness of the Project

With the limited skill and expertise, it was a challenging task to implement the project which involves combined use of captured rain water and condensate water from each unit for cooling tower make-up.

Replication Potential

This can be adopted in all other airports as well as other buildings depending upon the availability of condensed water and rain water.

Trigger of the Project

- Huge loss of water from AHU's (57KL/day) wastage
- BIAL's commitment towards water conservation
- Effective utilization will reduce potable water intake up to 60ML per year

Environmental Benefits

- Potable water consumption reduced to 10%
- Recovery from rainwater : 60,000 KL/ year
- Recovery from AHUs : 20,761 KL/ year

Cost Economics

Investment made	:	₹ 2.8 Millions
Annual savings achieved	:	₹ 6.05 Millions
Payback	:	6.4 Months

Project Background

BIAL used pesticides with 10% emulsifying concentrate formulations, petroleum based solvents with odour requiring high dosage to kill pests. However, residual effect remained in the area of application, harmful for the ecosystem. Routine usage of pesticides to keep the pests under control for a year leading to pest resistance. Moreover, dependency of pesticides had become an addiction due to quick results, leading to increased use of pesticides.

Thorough study was carried out by BIAL, to understand the toxicity measurement of products used (LD50 and LC50, for both oral and dermal routes of exposure) and the associated environmental and health risks. BIAL also conducted research on various pesticide products available in the market, in collaboration with Bayer Environmental Science and Bayer pesticides were found environment friendly.

Pests were controlled chemically for around 6 months (June 15 - Nov - 15) until pest count reached an acceptable level. Integration of various non-chemical alternatives and chemical methods were done in a rational way. Pesticides were not used as a routine application anymore, but only as a last resort where a situation is serious to warrant a pesticide application (e.g. manual, mechanical, bio-friendly, biological, chemical control etc)

Date of commencement	:	November 2015
Date of completion	:	December 2015

Uniqueness of the Project

- Thoughtful regard for long term consequences on environment and health
- Creating a range of practical pest control alternatives to chemical use. Pesticides employed only when other alternatives are ineffective
- Understood the environmental impact of high toxic pesticides and also low bio degradability factor

Replication Potential

This can be adopted in all other airports as well as other industries for maintaining biodiversity.

Trigger of the Project

- Minimize adverse impacts to human health, environment as well as flora and fauna
- Overuse of pesticides speeds up development of pest resistance and diminishes their effectiveness in the long term

Environmental Benefits

- Reduction in usage of toxic substances (@ PTB) : a) Internal @ 27%, b) External @ 35%
- Reduction in chances of environmental contamination as products used are readily bio-degradable
- Elimination of health risk to humans due to limited pesticide use and pesticides used are HACCP certified
- Safer environment for workers handling pesticides. In case of accidental skin or eye exposure only symptomatic treatment required
- Gradual increase in bio friendly pesticides and bait formulations in this zeal for an environmental sensitive approach.

Cost Economics

- Annual savings : 0.6 Millions
- Pay back : 6 months

Cipla Limited
Kurkumbh

Cipla today has emerged as one of the world's largest generic pharmaceutical companies with a strong presence in over 170 countries. It has 34 state-of-the-art manufacturing facilities that make Active Pharmaceutical Ingredients (APIs) and Formulations, which have been approved by major International Regulatory Agencies. Cipla has over 2000 products in 65 therapeutic categories; with over 40 dosage forms, covering a wide spectrum of diseases ranging from communicable, non-communicable, common and emerging diseases to even rare diseases. Its Research and Development (R&D) center is focused on developing innovative products and drug delivery systems, giving the country and the world many 'Firsts'.

Cipla Limited, Kurkumbh located in Pune district, operating with nearly 1769 employees, has an annual production of about 538 Tonnes of APIs and Formulations. The facilities at Pune maintain high standards of occupational HSE practices and are certified for ISO 14001, OHSAS 18001 and ISO 50001 standards. This unit was rated GreenCo Silver in 2014.

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GreenCo
SILVER
2014

GreenCo Silver

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Case Study 5

Drying of ETP Sludge by Poly-house and Replacement of Sludge Decanter by Volute

Project Background

Earlier the plant used to dewater the sludge by decanter, which was later collected in polybags and disposed to CHWTDF with a moisture content of 85 to 87%.

In order to reduce the moisture content in the sludge, the plant has replaced the decanter by volute (latest sludge dewatering equipment), which significantly reduced the moisture content in sludge to 10-15%. It was later collected in drum, dried in poly-house and disposed to CHWTDF.

Before implementation of Project

Dewatering of Sludge by Decanter → Collection of Sludge in Polybags → Disposal to CHWTDF Moisture content 85 to 87%

After implementation of Project

Dewatering of Sludge by Decanter → Collection in Drums → Drying in Polyhouse → Disposal to CHWTDF Moisture content 10 to 15%

Date of commencement	:	January 2015
Date of completion	:	February 2015

Uniqueness of the Project

- Solar Energy is harnessed for drying of sludge (renewable energy)
- Low maintenance, low operation cost, no noise pollution

Replication Potential

This project has an excellent replication potential in industries across all sectors where high moisture content is observed in ETP sludge

Trigger of the Project

- To reduce the moisture content, weight, volume, transportation and disposal cost of sludge
- Application of advance technology, conservation of conventional energy as well as reduced maintenance cost

Environmental Benefits

- Reduction in quantity of hazardous waste
- Reduced Noise Pollution from 95 dB(A) to 65 dB(A)
- Reduced consumables
- Low Energy consumption; power consumption reduced from 20 kWh to 0.2kwh (i.e. 100 units to 2 unit/ day; annual electricity conservation of 32340 units)
- Maintenance & lubrication cost is substantially reduced

Cost Economics

For Poly-house

Investment made	- ₹ 0.5 Million
Annual savings achieved	- ₹ 0.3 Million
Payback	- Less than 2 Years

For Volute

Investment made	- ₹ 2.45 Million
Annual savings achieved	- ₹ 0.4 Million
Payback	- 6 Years

Cummins Technologies India Private Limited
Pithampur

Cummins is a global power leader that designs, manufactures, sells and services diesel engines and related technology around the world. Cummins serves its customers through its network of 600 company-owned and independent distributor facilities and more than 7,200 dealer locations in over 190 countries and territories.

Cummins Turbo Technologies is the global engineering leader, which is in the forefront of engineering design and produces some of the most durable and innovative turbochargers to meet global challenges of emissions reduction, fuel efficiency and total cost of ownership for engine systems from 2.8 to 92 litres.

Cummins Technologies India Ltd., established its unit in Pithampur SEZ in 2009 to manufacture Light Duty, Mid-range, HHp, HX30-35, HX40, HX80, HX82 turbochargers. Pithampur facility spread across 45,000 sq. m. is a first "Manufacturing Facility" in India to have physically challenged access features as part of design.

Cummins at corporate level strongly believes in five philosophies viz. Safe, Green, Clean, Lean and Diversity. Cummins has been taking concerted efforts towards each of philosophies. Good efforts in all verticals of resource conservation and waste management, product stewardship and facilitation of green practices of suppliers and vendors, implementation of several efficient systems has earned the plant several awards and accolades. With consistent improvement in resource efficiency plant has achieved prestigious GreenCo Gold Rating.

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GOLD
2016

GreenCo Gold

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Case Study 6

Implementation of Returnable Packaging for Key Customers & Suppliers to Reduce Carbon Foot Print

Project Background

Returnable packaging project for Customers: As per Cummins Corporate Supply Chain Initiatives Packaging 2020 strategy would be integrated with warehousing with a focus on cost reduction, returnable management and environment improvements. Majority of inbound / outbound packaging is one way packaging which results in creation of packaging waste and impact green supply chain at plants. To optimize use of packaging material and incorporate returnable packaging major thrust was given on Standardization efficiency, right sizing, right material specifications, optimized packaging impacting flow of material cost efficiency.

Returnable packaging project for Key Suppliers: - The initiative has been carried forward to India domestic customers for returnable packaging implementation and customer satisfaction, the project is being driven for key strategic customers across India. Green Supply Chain is an important deliverable for the business and GreenCo approach. Also reducing waste, CO_2 foot print savings, land fill elimination are key environmental friendly approach. It will reduce 60 % of card board waste at plants which is generated out of supplier packaging and CO_2 foot prints savings of 500 MT approximately.

Date of commencement	:	Q1 2015
Date of completion (based on current plan)	:	Q4 2016

Returnable packaging project for Customers

Before After

Returnable packaging project for Key Suppliers

Before After

Uniqueness of the Project

Returnable packaging project for Customers: The project is unique as it focuses on new designing of packaging in returnable and rental model resulting in less usage of corrugated or wooden packaging and thus resulting in waste reduction.
Returnable packaging project for Key Suppliers: Key domestic suppliers based on India are covered. This will impact 90 % of high runner in bound components sourced from various suppliers in India. This will also make visible our end to end supply chain approach for green supply chain. The project had been with zero investment and rental model which is unique in terms of any major change impacting supply chain improvement processes.

Replication Potential

Returnable packaging project for Customers: Similar models of returnable packaging can be implemented with other bulk parts where wooden or corrugated packaging is used.
Returnable packaging project for Key Suppliers: This is a supplier driven project with rental and sustainable model with impact to environment, quality improvement and cost reductions. With an approach where every business primarily focus on the key elements and with zero investment.

Trigger of the Project

This is a self-driven project aligning to plant environmental objectives, improving green supply chain drives, driving Green Co impact to key suppliers and partnering on environmental savings with linked benefits in part`s quality, reduced costs.

Environmental Benefits

Returnable packaging project for Customers:
- Carbon Foot Print Reduction by 5% (approx)

Returnable packaging project for Key Suppliers:
- Annual GHG emission reduction - 1000 MT(Tons of CO_2eq
- Annual reduction in paper or corrugated paper waste - 3 MT

Cost Economics

Investment made	:	On rental model, no investment either from Supplier or Cummins
Annual savings achieved	:	₹ 5 Millions

Chemical Management System

Project Background

Chemical Management System is one of the best practice in Cummins. Objective of complete system is to eliminate or reduce the usage of toxic & hazardous substances related to environment, health & safety by a systematic & process based approach. It is a centralized software based Database for MSDS and named as 'SDS management system'. Database lists all chemicals and oil which are used by plant. Material Request and Approval Process (MRAP) has been developed for all chemicals/ oil which need to be used and accessed through the site. MRAP contains a Mandatory questionnaire which is linked with EHS. MRAP collects information about Prohibited Substances (Black listed or gray listed). In case of its presence, the system doesn't allow the approval to make sure that there is no toxic or harmful substances are present in supply chain.

Highlights of the system are:

- Defined inventory level of chemicals & oils with regular monitoring & reporting
- Excellent visual management of NFPA labelling for easy understanding
- Identification & tagging of all the oil & chemicals

Tagging & identification with color coding of Oil & chemicals

Uniqueness of the Project

Chemical Management System: The system is unique because it is based on proactive & system based, having checks & controls on different levels of organization. It takes care of hazard & prohibited substances (Black listed or gray listed) which are harmful for the environment, right from the supplier selection up to the disposal of the chemical or oils.

- Centralized repository for chemical utilization in Cummins
- Reduction in toxic & hazardous substances
- Micro level detailing for all type of substances (Chemicals & oils)
- Automated material request & approval process
- Faster searching of documents
- Standardization of MSDS

Replication Potential

Chemical Management System: Similar type of Management Systems can be implemented in all sectors where chemicals/oils were used. This will be useful to reduce or eliminate the usage of toxic or banned chemicals.

Trigger of the Project

Cummins has five philosophies for offices and facilities one being green, which focuses on adopting green standards when constructing/manufacturing plants and non-manufacturing facilities. Cummins is committed to greener, cleaner and healthier environment.

Environmental Benefits

Reduction in use of toxic substances

Delhi International Airport Private Limited

Delhi International Airport Private Limited (DIAL) is a joint venture consortium of GMR Group, Airports Authority of India (AAI), Fraport and Malaysia Airports Holdings Berhad (MAHB). DIAL was formed in March 2006 following a competitive bidding process in which the consortium, led by the GMR Group, was awarded an exclusive concession to operate, maintain and develop the Indira Gandhi International Airport (IGIA) referred to as Delhi Airport.

Since its inception in 2006, DIAL has consistently raised service delivery and operational excellence by providing world class passenger services, pleasant ambience, myriad of passenger amenities and retail offerings. The transformation has catapulted Delhi Airport into the galaxy of top 5 airports in all categories and has won many awards and accolades from different quarters ranging from construction, service quality, operations, environment, etc. Delhi airport has received numerous awards including "Best Airport in India and Central Asia" by SKYTRAX and The Best Airport among 20-40 million passenger size airports by the Airport Council International (ACI) in ASQ survey 2014.

Delhi Airport is the busiest and largest airport in India in terms of passenger and cargo traffic according to data compiled by the AAI. This is the only airport in India with three runways and with a capacity to handle 62 million passengers and 1.5 million metric tons of cargo per annum. The geographic location makes it a suitable hub for international passenger traffic. Delhi airport currently accommodates 55 international airlines, 6 domestic airlines catering to 117 destinations which includes 64 international destinations. Delhi Airport is emerging as a leading aviation hub in South Asia. The unit was rated GreenCo Platinum in May 2016.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
PLATINUM
2016

GreenCo Platinum

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Case Study 8

Renewable Energy at the Operational Area (Airside) of Delhi Airport

Project Background

DIAL has installed 7.84 MW solar PV plant at IGI Airport and is the first airport in India to have a mega solar power plant at the airside. DIAL had initially set up a 2.14 MW plant, as a pilot project which was then expanded by another 5.7 MW, thus increasing the total installed capacity to 7.84 MW. Currently the renewable energy generated from the solar plant contributes to around 10% of total electricity consumption of Delhi Airport.

The continued development of airport has increased the energy requirement of DIAL. Several energy efficiency initiatives such as maximum day light, LED lighting, high efficient electro mechanical systems, state-of-art control and monitoring system to optimize use of all assets are carried out. In addition, different analysis tools to assess the energy scenario, demand and consumption pattern such as why-why analysis, fish bone analysis, market scan, 5S & kaizen project implementation, CIP & BLIP projects implementation are used.

The design of airports and their facilities is strictly regulated by government agencies to ensure that airports operate in a safe and efficient manner without any operational risks. DIAL carried out an initial glare and radiation impact analysis/reverberation study to assess the impact of glare from the solar panels on runways and on airport operational procedures. The study included analysis of data related to sun position and reflection, runway/cone versus reflection, reflection period, etc. The study brought out that the possible periods when reflections hit the considered area are less at a tilt angle of 33° and to reduce possible reflection impacts, the modules can be installed at a larger tilt angle than the planned 5° for summer. It also stated that a plane can be dazzled longer than several seconds, only if it approaches the PV power plant in a straight line, i.e. using the eastern landing approach and approaching at the northern edge of the approaching cone. The study was submitted to Directorate General of Civil Aviation, India (DGCA) and Airport Authority of India (AAI) and special permission was obtained. Delhi Airport has a plan of enhancing the total renewable energy generation capacity to 20 MW by the year 2020.

Date of commencement	:	October 2015
Date of completion	:	January 2016

Uniqueness of the Project

Before the implementation of the solar project in Delhi Airport, no airport was given the permission to have such a facility, since the design of airports and the infrastructure is strictly regulated by government agencies to ensure safe operations of airports. However the successful implementation of the solar plant in Delhi Airport has inspired many other airports in India to conduct similar studies of glare and radiation impact and implement solar power plants within the airport.

Replication Potential

The project is easily replicable. Successful implementation of the solar plant in Delhi Airport has inspired many other airports in India to conduct similar studies of glare and radiation impact and implement solar power plants within the airport. Some of the Indian airports that have come up with Solar PV plant are Hyderabad Airport, Cochin Airport and Mumbai Airport. The initiative has also inspired AAI to come up with 150 MW solar generation plant in 30 other airports which will be implemented phase wise.

Trigger of the Project

- *Achieving Mission*: Through deployment of technology and innovation to sustaining profitability with care for environment
- *Strategic Intent*: Achieving organizational level energy optimization through alternative energy source
- *Sustainability Intent*: Climate change mitigation and optimization of GHG emissions
- *Material Intent*: Energy cost optimization, energy efficiency improvement and land monetization

Environmental Benefits

- Total installed capacity : 7.84 MW
- Annual energy generation capacity : 11,760 MWh
- Annual GHG emission reduction : 11,407 tCO_2
- Annual fuel savings : More than 65 MT of FO / HFHSD
- Avoided PM, NOx and SOx emission from generation of equivalent amount of grid electricity

Cost Economics

Investment made : ₹ 320 Millions

Annual savings achieved : ₹ 82 Millions

Case Study 9

Delhi Airport Collaborative Decision Making (A-CDM)

Project Background

Airport Collaborative Decision Making (A-CDM) is the concept and a tool which aims at improving Air Traffic Flow and Capacity Management (ATFCM) at airports by reducing delays, improving the predictability of aircraft events, planning and optimizing the utilization of infrastructures and natural resources.

A-CDM promotes intense collaboration between aviation partners by working more efficiently and transparently using improved quality of information and more timely exchange of information, which is interpreted in exactly the same way by all partners (airlines, Air Traffic Control (ATC), ground service units, etc.). The initiative is intended to integrate airport operations into the local and national ATM Network by linking inbound and outbound traffic through the airport turn-around process, synchronizing the passenger management events with the aircraft movement schedule managements. It is to meet the transport goal and adopting a pro-active attitude and anticipating problems before they arise, thereby allowing timely solutions, optimizing the utilization of infrastructure and reducing the use of aviation turbine fuel and its associated GHG emissions.

Past experience of airport operation showed that the exchange of key operational data is often insufficient, late or missing over all. Airport observed frequent delays, limited aircraft arrival and departure information, issues on airlines aircraft scheduling & planning, improper and underutilization of infrastructures, large use of ground vehicles and fuels leading to greenhouse emission besides customer dissatisfaction. Replacing the existing operational steps & process by an automated, transparent, reliable "tool" as an Information Technology enabled operational platform between partners was necessary.

Delhi A-CDM (DA-CDM) tool was developed in-house with the support of all the partners for a transparent and accurate data quality and safe operation in terms of accuracy, timeliness, reliability and stability on airport operations. Before going live, testing of the DA-CDM platform was conducted. The testing was split into two phases. In a first phase, DA-CDM software and philosophy was shared with the users and necessary support was provided to the airlines and ground handlers by imparting training to their staff. In the second phase, in consultation with airlines, trials were carried out during different time windows of the day generating Target Standard Arrival Time (TSAT)/ Target Take-Off Time (TTO)/ Estimate Landing Time (ELDT) by ATC in the live operational environment based on the generation of TOBT by the airlines and ground handlers.

Date of completion : June 2013

Uniqueness of the Project

DA-CDM was developed in-house with the support of all the partners for a transparent and accurate data quality and safe operation in terms of accuracy, timeliness, reliability and stability on airport operations. Delhi airport is the first airport in Asia Pacific to have initiated this advanced aircraft sequencing and planning tools.

Replication Potential

The project is easily replicable across all airports. After the initiative taken by Delhi Airport, few other airports in India have also started replicating the A-CDM process. It will be more effective when A-CDM is adopted and implemented by all other airports in India. Delhi Airport is perusing an Integrated A-CDM for Indian Airports.

Trigger of the Project

- Insufficient and unreliable information to all the partners of aviation function
- Multiple human interfaces on information communication and processing's between partners
- Issues on airlines aircraft scheduling & planning and coordination
- Irregular practice of managing, record and review for corrective and preventive actions
- Shortage of strategic plans of business partners on operational planning and improvements

Environmental Benefits

- DA-CDM helps high efficient, safe and environment friendly airport operation at Delhi Airport
- Airport operator is benefitted by reduced impact on emission and noise, Improved On Time Performance (OTP) of flights, improved resource planning like parking stand, gates planning, reduced fuel burning, etc.
- DA-CDM has led to proper planning and scheduling of events leading to optimum utilization of resources. For example, power used for aircraft operation during its stay on ground is provided through the BME which otherwise is provided by ground power unit or by the Auxiliary Power unit (APU) of aircraft.

Cost Economics

Investment made	:	Inhouse development
Annual savings achieved	:	Significant savings have been made in terms of fuel savings

New ATC Project at Delhi Airport

Project Background

The new Air Traffic Controller (ATC) project at the Delhi Airport comprises of the following features -

- 360 degrees unobstructed visibility of the entire airport
- Panoramic high speed lift giving a view of the entire airport
- A slim and elegant structure able to withstand seismic events, high winds and a dusty environment whilst providing a state of the art air traffic control facility

Design and Construction

Visibility

The tower has to have an uninterrupted 360 degree view of the airport including all of the runways and aircraft parking aprons, upwards and downward visibility. It was necessary to keep the size of the steel structure of the Visual Control Room (VCR) at the top of the tower to a minimum while ensuring that there were no structural elements in the main site lines.

Complex geometry

The mega structure had to be cast with its complex geometry in concrete simultaneously maintaining the elegant three dimensional shape which changes throughout the height of the tower. State of the art 3D virtual Building Information Modelling (BIM) to model the shape in 'facets' which could be cast in concrete using the slip form technique

Fire safety

Due to the tower's height, the evacuation of air traffic controllers in the event of a fire was of key importance. Developed a system of intermediate landings or safe refuges accessible via a staircase housed within one of the vertical concrete piers.

Date of commencement	:	January 2012
Date of completion	:	March 2016

Uniqueness of the Project

The slenderness ratio (The ratio of the height to the cross section) of the tower meant that the tower was susceptible to wind induced accelerations that were greater than the allowable threshold. This meant that the controllers sitting at 95m above the ground would experience movement and possibly motion sickness. An in depth structural analysis was undertaken in order to find a way to solve the problem. Detailed scale models of the tower were sent for wind tunnel testing to ascertain susceptibility to wind flutter, vortex shedding, etc. The outcome of the studies was that the team decided to control the accelerations by incorporating a tuned mass damper (TMD) at the top of the tower. The TMD counteracts the tower 'bending' under wind load which keeps movement below a threshold thus preventing problems for the controllers. The TMD is a complex piece of equipment which has to be tuned to the frequency of the tower for varying wind conditions.

Replication Potential

The environmental friendly concept adopted in the infrastructure resulting in energy efficiency, water conservation, emission reduction, etc. can be replicated in any infra structure project in airports.

Trigger of the Project

Environment friendly, efficient operating system, conservation of material & energy was the trigger behind the project. Height will ensure increased visibility of the aircraft aprons and runways which will help improve efficiency of aircraft movements around the airport. The state of the art technology will support the controllers in increasing the arrivals and departure rate of aircraft and thus improve capacity. The combination of both of the above will help improve 'on time' performance of flights.

Environmental Benefits

Features incorporated during design that make it efficient –

- More than 20 Lakh fly ash bricks used in place of burnt bricks
- Roof top rain water harvesting and deep down ground water recharge
- Sewage water recycling and use of treated water for landscaping/irrigation, washing, AHU Filter cleaning, etc. •Provision of glass façade and atrium
- Installation of variable frequency drives for all major equipment
- BMS & SCADA control for efficient operation and data capturing
- Variable air volume control system in every room for better control and to avoid heat losses in unoccupied area
- Tuned mass damper (harmonic absorber) mounted on structures to reduce the amplitude of mechanical vibrations. Installed for the first time in India

Cost Economics

Investment made : ₹ 3,500 Millions

Godrej & Boyce Mfg. Co. Ltd., Vikhroli & Interio

Godrej Interio is a business unit of Godrej & Boyce Mfg. Co. Ltd. - part of the Godrej Group, one of India's largest engineering and consumer product groups. It is India's largest furniture brand which has transformed itself from manufacturing the humble Storwel cupboard 80 years back to being a vibrant, innovative brand with a diverse portfolio.

Godrej Interio offers home and office furniture, along with solutions for laboratories, hospitals and healthcare establishments, education and training institutes, shipyards and navy, auditoriums and stadiums.

Godrej Interio Division has four manufacturing locations two of which are in Mumbai, one plant in Vikhroli and one in Bhgwanpur. Major products manufactured in Plant 13 are sheet metal products having mix of a knocked down and welded construction. New design chairs are manufactured in plant 14 which consist of mid back and high back chairs which come in cushion and net back options. The plant was re-assessed in 2016 and was rated GreenCo Gold.

Shirwal factory started its operation in 2011. Major products manufactured in Shirwal plant are wooden products. Since its inception the plant has been consistently taking various efforts to reduce environmental impact of operations in line with the Good and Green vision of Godrej. Plant was rated GreenCo Platinum in 2016.

Godrej Interio Vikhroli

Godrej Interio Shirwal

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Case Study 11

Resource Intensity Reduction in the Supply Chain through implementation of ZED module in Vendor Cluster

Project Background

- Shortlisting of Vendors
- ↓
- Assessment through CII
- ↓
- Proposal to Vendors
- ↓
- Acceptance of proposal by vendor
- ↓
- Road Map for basic and advanced cluster
- ↓
- Handholding visit by GI and CII
- ↓
- Training to vendors - 1. Classroom 2. Onsite
- ↓
- Monthly Review Meetings
- ↓
- Reward and recognitions - 1.National Level Program 2. GI Supplier Meet

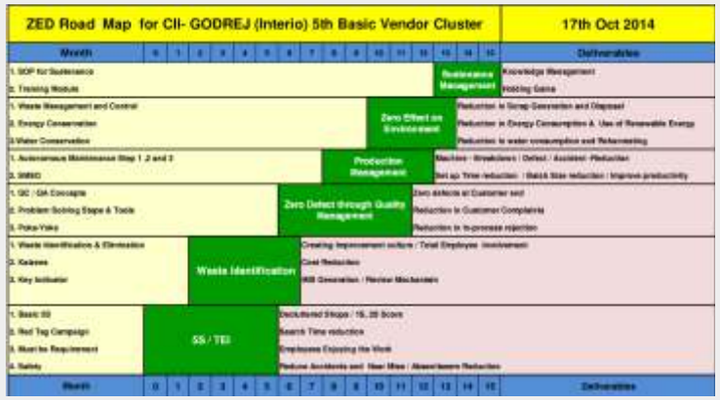
Godrej Interio (GI) has been driving Vendor Cluster Program since year 2010-11 for enhancing technical competencies of vendors like 5S, 3M & Kaizen, Monitoring of Business Key indicators, Poka Yoke, JH etc. GI has adopted a structured framework for implementation of Cluster Program.

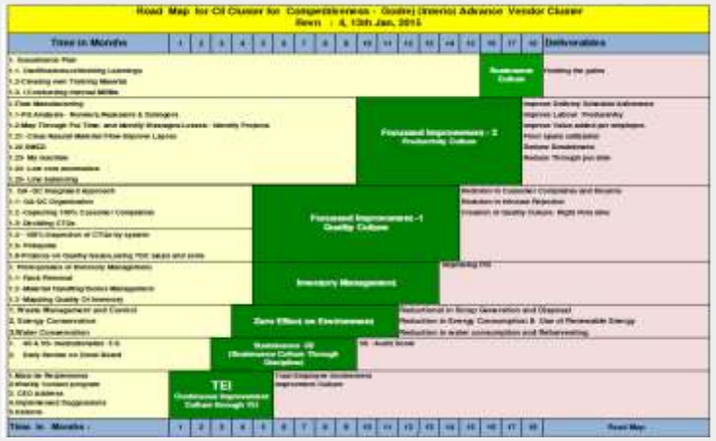
In year 2015-16, GI has pro-actively included ZED concept Basic Vendor Cluster and Advanced Vendor Cluster. Energy conservation, water conservation and waste management & control parameters are added under "Zero Effect on Environment" in ZED Road Map of Basic Vendor Cluster and Advanced Vendor Cluster. These parameters address reduction in scrap generation and disposal, reduction in energy consumption and use of renewable energy and reduction in water consumption and rain water harvesting

GI organizes training programs from expert and well-known authorities on sustainability and green manufacturing. These programs are arranged at Godrej as well as at suppliers end.

Monthly reviews are conducted by rotation with cluster suppliers. Suppliers present their ideas and thoughts including those on green manufacturing and processes. Supplier's progress is monitored on resource conservation as well as other initiatives during these meetings.

GI rewards its suppliers for commendable work done in resource conservation during annual supplier meet or monthly review meetings. GI also encourage vendors to participate in national level programs and present their initiatives.





Parameter	FY13-14	FY14-15	FY15-16	FY 16-17	FY 17-19
Energy, Water, Waste	Base line	15 % over previous year	5 % over previous year	5 % over previous year	3 % over previous year

Baseline and targets for suppliers

Uniqueness of the Project

First time introduction of ZED module in Vendor Cluster Program for the furniture industry.

Replication Potential

High replication potential for ZED cluster module in Vendor Cluster Programs of any industry. It is the one of the unique initiative which can be adopted by any industry to work with suppliers on Green Supply Chain

Trigger of the Project

- Implementation of Green Procurement Policy to aid the Good and Green strategy of the company
- Increase in bought out components, hence greater role of supply chain in product life cycle footprint

Environmental Benefits

Supplier Name	Weighted Average Reduction in Resource Intensity
Khutale Engg Pvt Ltd	41.90%
P M Electro auto	14.80%
Wud house Designs Pvt Ltd	24.90%
Carefine Woodworks Pvt Ltd	13.70%
Corru Cartons	5.90%
Jay Industries	15.30%
Silver Techno Mech Pvt Ltd	7.50%
Total Reduction	18%

Case Study 12

Installation of Reverse Osmosis project for water conservation

Project Background

Good & Green Vision of Godrej has target of 50% reduction in specific water consumption and achieve Water Positive by 2020.

In order to achieve the targets, plant team identified the highest water consuming areas and found out powder coating pre-treatment line is major consumer of water in the plant. Plant team brainstormed on the various available options and methods.

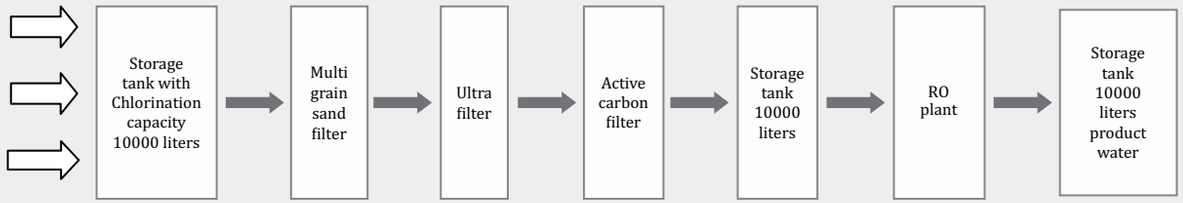
1. To reduce fresh water consumption
2. To reuse Water within process
3. Increase share of recycled water

Water requirement for pre-treatment (PT) line operation is 100 KL/day. Earlier this requirement was met by consuming BMC Water. Options were explored to reduce the use of Fresh water and increase the share of recycled water for PT line process. Godrej & Boyce Vikhroli establishment is equipped with centralized ETP and STP facilities which generates 1050 KL of water per day.

Plant team studied the possibility of using this recycled water for PT line operation. But this could not be used directly for the PT line process as the outlet parameters did not match the process requirements:

•pH	- between 6.5-7.5,	•Electric conductivity	- 10 µS / CM. MAX
•Total hardness	- NIL	•Chlorides	- NIL
•Silica as SiO2	- less than 0.4 ppm.		

The RO plant was set up to recycle the ETP water so that it can be used for our PT line process matching the requirement. The plant is capable of delivering upto maximum of 10 kL/hour which is more than the daily requirement of the Pre-treatment line.



Date of commencement : August 2013

Date of completion : September 2013

Uniqueness of the Project

As this is the first of its kind in the Godrej & Boyce, it stands a unique project with water recycling as per specific requirement.

Replication Potential

- High replicability and already horizontally deployed at Godrej Interio plant, Shirwal
- Future plan to set up RO project at Plant 14 and Plant 16 (Vikhroli facility)

Trigger of the Project

Good and green vision to reduce fresh water consumption and availability of technology to use treated water back into the process

Environmental Benefits

- Annual reduction in absolute Fresh water consumption : 23,200 kL
- Reduction in specific fresh water consumption : 30 %

Cost Economics

- Investment made : ₹ 4.2 Millions
- Annual savings achieved (FY 2015-16) : ₹ 1.5 Millions
- Payback : 3.8 Years

Case Study 13

Yield Improvement through Waste Reduction in Wood Processing

Project Background

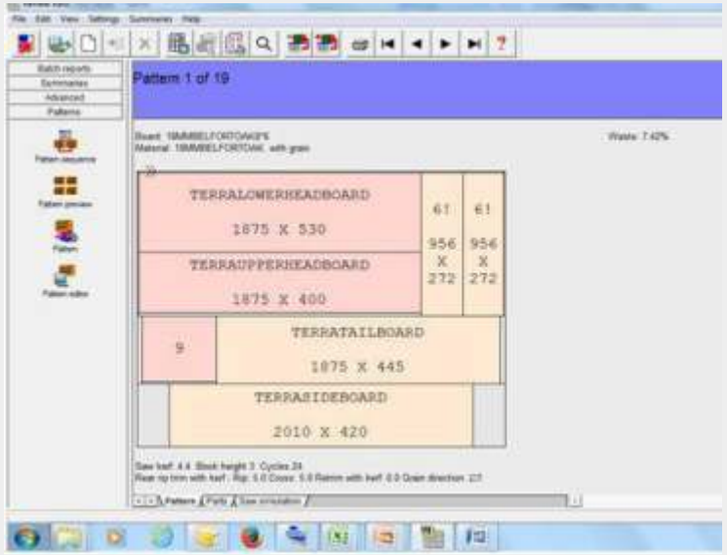
Particle Board

Medium density fibre

Godrej Interio, Shirwal being a wooden furniture manufacturing plant has wooden boards as major contributor in raw materials which contain Particle boards, Medium Density Fiber (MDF) boards. GI sources more than 10000 tons of particle boards and MDF per year. These particle boards are FSC or PEFC certified.

Particle boards are available in specific sizes and thickness. So optimization of particle boards in size available with supplier become an important exercise in order to increase yield and reduce waste. At Godrej Interio, in FY 2013-14, particle board scrap generated was 24% of total particle board consumed. High % of scrap, non-utilization of scrap and low yield led to high conversion cost. This was a trigger in initiating project- Yield Improvement through waste reduction in wood processing.

GI has adopted a 5 pronged approach to increase yield and reduce scrap- 1) Reduce Design Waste 2) Reduce in process rejections 3) Reuse of scrap in alternate products 4) Use of alternate size raw material 5) Redesign the product. Cut-rite software is used for better optimization of material which also helped in reducing process scrap. Design scrap and machine wise process scrap is monitored separately.



Date of commencement : July 2015
Date of Completion : April 2016

Uniqueness of the Project

Conservation of particle board through reduction in design and process waste.
360 degree approach for yield improvement

Replication Potential

- Same approach can be used to reduce waste in other industries as well to relook right from design to end process parts.

Trigger of the Project

High waste of 24% of wood was the major trigger behind initiating the project

Environmental Benefits

- Reduction in scrap from 24% to 16% in last three years.
- Reduction in raw material consumption : 350 tons/year
- Reduction in scope 3 emissions due to waste transportation: 95.6 $MTCO_2e$

Cost Economics

- Investment made : ₹ 1.2 Millions
- Annual savings achieved (FY 2015-16) : ₹ 34 Millions
- Payback : 6 months

Godrej & Boyce Mfg. Co. Ltd., Lawkim Motors Group

Godrej Lawkim Motors Group is one of the divisions of Godrej & Boyce Mfg. Co. Ltd. Godrej & Boyce Mfg. Co. Ltd. has a vision to be in every home and workplace with a mission to enrich quality of life everyday and everywhere. Environment is one of the core values of the company and an enduring source of the company's strength. The company's vision is three fold –

- Creating a greener India
- Ensuring employability
- Innovating for good & green products

Godrej Lawkim Motors Group located in Shindewadi was established in 1992 and has a total area of 16 acres, 56% of which is green cover. The company's customers include- Godrej Appliances, Hitachi, Reliance, Jet Airways, ONGC, Carrier, Atlas, Emerson, etc.

The company set up - Naoroji Godrej Centre for Plant Research, first of its kind institute in India that is dedicated to preservation of threatened species and medicinal plants.

Godrej Lawkim Motors Group has won several prestigious awards like – National Safety Council, Kaizen Excellence Award, Inclusive Innovation Award, Paryavaran Gaurav Puraskar, Greentech Environment Excellence Award, etc.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
PLATINUM
2016

GreenCo Platinum

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Case Study 14

Nurturing unique Plant life of Western Ghats through purposeful research in Biodiversity & plant Conservation with a special emphasis on Medicinal plants

Project Background

Abutilon ranadei Woodrow

To Compensate the damage to the environment, happening due to growing industrialization, Lawkim (Division of Godrej & Boyce mfg co Ltd.) have established Naoroji Godrej Center For Plant Research (NGCPR), as a vehicle to implement the actions, towards environment protection. The centre got established in the year 1992, - the same year when Lawkim Established its New Plant at, Shindewadi (Dist- Satara).

NGCPR is the first of its kind research centre in India, perhaps in the world exclusively dedicated to the conservation and preservation of threatened and medicinal plants by a corporate entity.

The centre carries out research programs in the field of botany, agriculture, Forestry & Ecology, to help the local community for the livelihood. The centre also captures tacit knowledge of local communities w.r.t medicinal usage of plants.

During last 25 years achievement of the centre includes,

1) The documentation, study, propagation and utilization of local medicinal plants with antidiarrhoeal activity in the Parinche valley (Maharashtra)- The provision of a model. Approved by Department of Science & Technology (DST)
   In collaboration with Foundation for Medical Research (FMR), National Chemical Laboratory (NCL) & The Foundation for Research in Community Health (FRCH).
2) Successfully conserved two globally threatened species-1)Frerea indica & 2)Abutilon ranadeii
3) Discovered new species of Texa - Brachystelma naorojii & Arysaema murrayi var. sonubeniae
4) Published 53 research publications.
5) 55 species of orchids, out of which 8 are threatened are conserved at NGCPR.
6) 72 flowering species which are endemic & threatened are conserved at NGCPR.
7) Afforstation project with Maharashrta Government has been undertaken & total 1.20 lac of plants were planted in Palashi Village near Shirwal. Plan is to plant 10 Lac plants till year 2020.
8) NGCPR successfully developed multiplication techniques through vegetative cuttings and seeds, Identified pests & pollinators. It also recognized locality wise morphological & floral variations.
9) Haritarium – Preparation of digitized information database on threatened and endemic plants of Maharashtra - Sponsored by Department of Science and Technology, Govt. of India (DST).

NGCPR helps local community for horticulture and advanced farming techniques. The efforts of the centre helped to improve the ground water level at the plant site, which is evident by the availability of water even during the peak summer. The Bio-diversity of the area substantially improved. The pre & post photographs are self explainatory.

Brachystelma

Uniqueness of the Project

Naoroji Godrej Centre for Plant Research has pioneered the concept of industrial botanical gardens. The LAWKIM factory campus where NGCPR is located is a home for more than 80 endemic and threatened species. Some of these species are critically endangered and some others are extinct from wild. All these species are carefully nurtured and multiplied by technically competent research staff. Other than rare taxa, NGCPR research gardens at Ajanuj and Lawkim ltd campus maintain a variety of wild germplasm consisting of wild edible plants, aromatic plants, bamboos and orchids.

Replication Potential

The essence of the project is to support research activity for the betterment of Environment. Any industry can take up relevant projects to their area and help to improve environmental performance.

Trigger of the Project

Lawkim decided to establish plant near Shirwal area, which was draught prone area and nothing was being cultivated in this area. It was felt that proper scientific research is required to identify the plants, which are native to this area and how to revive these plants scientifically.

Environmental Benefits

- Successfully conserved two globally threatened species - 1. Frerea indica & 2. Abutilon ranadeii
- Discovered new new species of Texa - Brachystelma naorojii, Arysaema murrayi var. sonubeniae
- Published 53 research publications.
- 55 species of orchids, out of which 8 are threatened are conserved at NGCPR.
- 72 flowering species which are endemic & threatened are conserved at NGCPR.
- Afforstation project with Maharashrta Government has been undertaken & total 1.20 lac of plants were planted in Palashi Village near Shirwal. The plan is to plant 10 Lac plants till year 2020.

Cost Economics

• Investment made	:	₹ 7 Millions
• Annual savings achieved (FY 2015-16)	:	N/A.
• Payback	:	Not applicable.

Godrej & Boyce Mfg. Co. Ltd.,
Precision Engineering Division, Vikhroli

Godrej | PRECISION ENGINEERING

Godrej Precision Engineering division (GPE) is the youngest division of Godrej & Boyce group and was established in 2002. Godrej Precision Engineering Division delivers customized solutions meeting exacting quality requirements in the high technology domain.

GPE's core strength lies in being able to carry out precision manufacturing backed by design and engineering skills. GPE has got a legacy of over five decades of machine tool building experience. TQM based work culture, kaizen initiatives aimed towards continuous improvements in processes to deliver customized solutions to delight our customers is a way of life at Godrej Precision Engineering.

GPE Division manufactures mission-critical, precision components & systems requiring high accuracy level and reliability for segments as varied as Nuclear Power, Defence Research & Production, Wind Power, Precision Manufactured parts for Steel and Power. The unit was rated GreenCo Silver in 2015

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
SILVER
2015

GreenCo Silver

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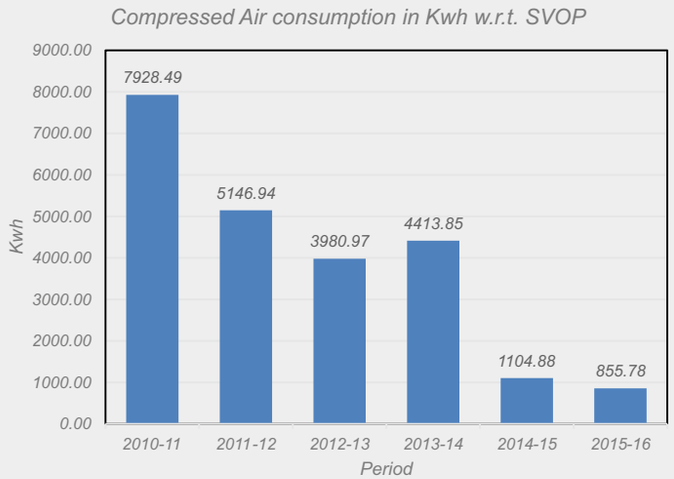
Reduction in Consumption of Compressed Air

Project Background

Godrej Precision Engineering uses compressed air for various processes like Shot Blasting, Painting, etc. Few machines require 6 bar compressed air supply. In fabrication department pneumatic hand tools were used for grinding purposes. Compressed air is also used on machining centers for cleaning of chips and components. As a part of environmental initiatives, GPE took various measures over the period to reduce consumption of compressed air.

- In 2011-12, GPE replaced pneumatic compressed air grinders with high frequency grinders
- In 2012-13, instead of ordinary nozzles for cleaning purpose, Trans vector nozzles were installed on all machines
- In 2014-15, to avoid uncalled usage of compressed air, the compressed air line was closed in areas where it is not required

To ensure further reduction of compressed air, air lines were studied in the plant. And it was observed that, out of 90 locations, only 5 locations required compressed air at 6 bar, whereas all other location air was used for cleaning purpose. Hence it was decided to have two separate lines one at 6 bar pressure and other at 2 bar pressure.



Date of commencement : November 2015

Uniqueness of the Project

With step by step approach, multiple improvements was done over the years to reduce usage of compressed air. Compressed air consumption is brought down by separating the high pressure and low pressure line as per process requirement.

Replication Potential

Improvements and its benefits are shared with other divisions in Godrej. Same can be implemented in any manufacturing unit where compressed air is used.

Trigger of the Project

Significant increase in compressed air consumption

Environmental Benefits

- Annual reduction in energy consumption : 21,000 KWh
- Annual reduction in GHG emission : 17.22 $MTCO_2eq$

Cost Economics

- Investment made : ₹ 40,000 /-
- Annual savings achieved (FY 2015-16) : ₹ 0.21 Millions
- Payback : Less than 3 months

Godrej & Boyce Mfg. Co. Ltd.
Tooling Division, Vikhroli

Godrej launched its state-of-the-art tool room way back in 1935. Constant innovation ensures that even today, Godrej Tooling, is one of India's most advanced tool room. Since inception, the company has emerged as a key player in design, manufacture and proving of tools.

Godrej & Boyce, Tooling division, manufactures custom-built, high quality tooling that caters to a wide range of players in the automobile sector. The company has long experience in pressure die casting dies, thermocompression moulds, complex and large sheet metal tooling for auto panels and progressive dies.

In order to fulfill the "Good & Green Vision" towards brighter living of all stakeholders and long term roadmap towards environment sustainability, tooling division has developed a unit level roadmap, to optimize resource consumption, minimize environment load and manufacture products with minimal impact. The unit was rated GreenCo Silver in 2016.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
SILVER
2016

GreenCo Silver

Contact Person
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Reuse of Solid Carbide Waste & Graphite Waste

Project Background

In the process of die manufacturing, solid carbide cutters are used for CNC milling operation. When it becomes unusable, it goes as waste. Similarly, Electrical Discharge Machining (EDM) operations is done using graphite electrodes. It was observed that, 27% graphite material goes into waste in the process of cutting the required sizes of block from mother block.

By re- fluting & regrinding, unusable carbide cutters become reusable cutter of smaller diameter. After taking trials, it proved that the quality and performance was same as the original cutter.

The left-out graphite material blocks were used as small electrodes through re-designing electrodes as per the sizes available.

Carbide waste – Without flute

Carbide waste – With flute

Graphite waste

Modified graphite electrode

Date of commencement	:	April 2015
Date of completion	:	March 2016

Uniqueness of the Project

Recycling of original raw material without downgradation its in property

Replication Potential

The project can be easily replicated in all engineering companies that involves use of die for manufacturing.

Trigger of the Project

- High cost of solid carbide cutters
- Elimination of graphite waste support green initiative of the company
- Re fluting and regrinding made it possible to make cutter of smaller diameter

Environmental Benefits

- Number of cutters & plain drills that were re fluted and reground (FY 15-16) : 520 & 121
- Annual reduction in raw material (graphite) consumption : 340 Kg

Cost Economics

For Carbide Waste

Investment made	: ₹ 0.47 Million
Annual savings achieved	: ₹ 1.4 Million
Payback	: 4 Months

For Graphite Waste

Investment made	: NIL
Annual savings achieved	: ₹ 0.32 Million
Payback	: Immediate

Godrej Industries Limited
Valia

Godrej Industries Limited (GIL) is part of the Godrej group, one of the leading business groups in India and is in the businesses of Oleo chemicals, surfactants, finance & investments and estate management. Godrej Industries also has substantial interests in several industries including property development, oil palm plantation, animal feeds and agro-products, poultry, personal care and household care, etc., through its subsidiaries and associate companies

Godrej Industries is India's leading manufacturer of Oleo chemicals and makes more than a hundred chemicals for use in over two dozen industries. GIL has built a strong manufacturing base capable of delivering international quality products at competitive prices. The company's products are exported to 40 countries in North and South America, Asia, Europe, Australia and Africa, and it leads the Indian market in the production of fatty acids, fatty alcohols and alpha olefin sulphonates.

Godrej Industries Limited, Valia manufactures different types of Oleo chemical products such as Fatty acids, Fatty alcohols, Surfactants and Glycerine. All the products are derived from plant or animal based materials and are Biodegradable in nature. The plant produces 97288 Tonnes of products per annum with a turnover of 904 Crores. The plant area is 6,00,000 m^2 with total 424 employees working in the unit. Godrej Industries Limited, Valia has attained the distinction of being the "1st Oleo Chemical Company" to receive the prestigious GreenCo Rating.

The unit was rated GreenCoSilver in 2015

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
SILVER
2015

GreenCo Silver

Contact Person
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Screw Expander - Harnessing Electric Energy from Steam

Project Background

Godrej Industries Limited is committed to reduce the energy consumed to manufacture each unit of their product by 30% against 2011 benchmark. The plant has been continuously reducing specific energy consumption and has reduced its SEC by 16% from 2011 data.

The plant has systematically implemented energy conservation projects through the following activities:

- Installation of variable frequency drives
- Optimization of pumping system
- Natural gas conservation activities in boilers
- Optimization of compressed air network
- Optimization of cooling tower operations
- Use of heat pumps
- Use of energy efficient motors & LED lighting screw expander installed at Valia Plant

GIL Valia uses steam for its manufacturing processes and requires steam at different pressures for meeting different process requirements. To meet the varying steam pressure requirements, the plant produces steam at a higher pressure. Steam passes through Pressure-Reduction Valves (PRVs) at various locations in the steam distribution system. The driving force was the amount of steam getting wasted through pressure reduction. The objective was to use the steam pressure and to generate power, without affecting the process.

Screw Expander

GIL Valia installed a Steam Expander System, a unique rotary device that converts expansion energy from steam into usable electricity via simple wet steam cycle. The Screw expander works where turbines can't because they can process both wet steam and liquid water. The steam expander is generating approximate 100 kWh power at inlet steam pressure of 15 bar and outlet at 3.6 bar.

Date of completion of the project : April 2016

Uniqueness of the Project

The screw expander projected implemented in GIL valia is the first installation in India and 20th installation in the world as reported by M/S Forbes Marshall.

Replication Potential

This project can be implemented in any industry where pressure reduction devices are used to reduce steam pressure.

Trigger of the Project

Main reason to implement this technology was to utilize the steam pressure (which is otherwise getting reduced/wasted by PRV) for generating power, without affecting the process parameters. Through this initiative GIL Valia was able to conserve energy.

Environmental Benefits

- Energy conservation - generation of electricity from pressure reduction
- Reduced dependency on costly grid electricity
- Reduced carbon footprint by 15 tCO_2 eq per year

Cost Economics

- Investment made : ₹ 6 Million
- Annual savings achieved : ₹ 30 Million
- Payback : 2 Years

Case Study 18

Powering GIL, Valia from Solar Roof Top

Project Background

Godrej Industries Limited is committed towards realizing its vision to become net zero carbon emissions by 2020. GIL valia has recognized the importance of increasing their renewable energy portfolio that helps to meet their energy needs and which is economically viable.

The plant currently meets 20% of its total energy requirement through biomass based briquette boiler and other RE sources. GIL Valia has planned to achieve its near term target of 35 % renewable energy use by setting up additional biomass based boiler, purchase of Renewable energy and installation of solar roof top projects.

To increase the mix ,GIL Valia forayed into harnessing solar energy through the installation of solar roof top based on BOOT model and commissioned its first solar rooftop captive power plant in the factory of 37.2KW capacity.

The plant is also in its way to set up additional 600 KW of Solar PV project .

Date of completion : March 2016

Uniqueness of the Project

The solar roof top project of capacity 37.2 kW based on BOOT Model is the first installation within the group companies of Godrej Industries Limited

Replication Potential

This project can be implemented in any industry where enough roof space is available and solar insolation is good.

Trigger of the Project

Godrej Industries Limited is committed towards realizing its vision to become net zero carbon emissions by 2020. Main reason to implement this project was to increase GIL Valia's overall renewable energy portfolio and decrease dependency on grid electricity.

Environmental Benefits

- Access to reliable, green and sustainable source of energy -157 kWh/day
- Addition of renewable energy to the total energy mix
- Reduction in carbon footprint by 24 tCO_2 eq per year

Cost Economics

• Investment made	:	Nil
• Annual savings achieved	:	₹ 0.12 Millions
• Payback	:	Immediate

Hindustan Unilever Limited
Mysore

Hindustan Unilever Limited (HUL) is India's largest consumer goods company. It is owned by the British-Dutch company Unilever, which controls 52% majority stake in HUL. Its products include foods, beverages, cleaning agents and personal care products. The Mysore unit was acquired by Brooke Bond India Ltd., from Kothari General Foods Limited and subsequently merged with Hindustan Unilever Limited.

The Mysore unit of HUL is located at Hebbal Industrial Area, Mysore, and occupies an area of 31 acres. The products manufactured in the plant are instant coffee and conventional coffee. The instant coffee plant was built in the year 1987 and commissioned in 1988 with a capacity of 8 TPA. The conventional coffee plant was commissioned in the year 1998. With a sales turnover of about Rs. 400 Crore per year, the plant has a capacity of about 20 TPA .

The plant has received many accolades for its excellent work in areas of sustainability. Some of the major awards received are:

- Unilever Bronze Award for safety
- TPM Level I award by JIPM
- "Most fuel efficient boiler" awarded by Boiler Inspectorate
- HUL South Asia Kaizen competition

The unit was rated GreenCo Silver in 2013

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
SILVER
2013

GreenCo Silver

Contact Person
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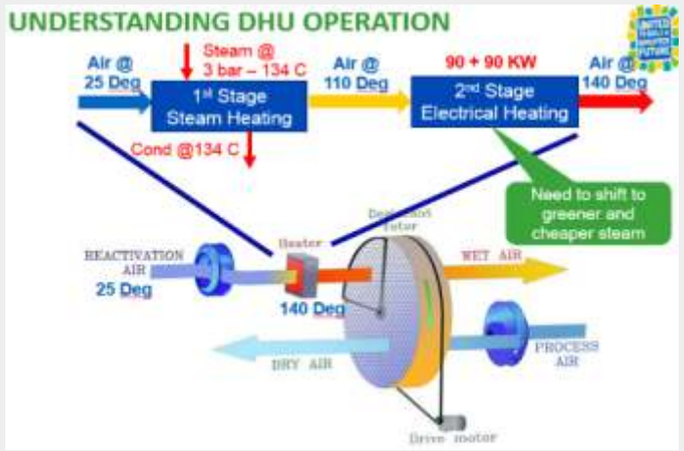
Elimination of Electrical Heater in De-humidifier (DHU) using Renewable Energy

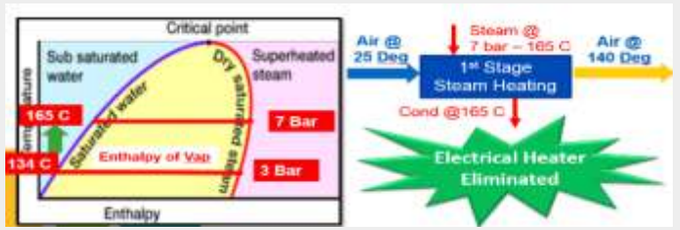
Project Background

The dehumidifier used for instant coffee manufacturing required regenerative air at 140 degrees which was achieved through partial steam heating and the rest was achieved through electrical heating of 90KW.



Electricity used in the plant is generated from conventional source and is also expensive. The plant found an opportunity to utilize steam that can be generated from the process waste generated in-house. The source is a renewable source of energy and is also a much cheaper option.

Currently, due to lower steam pressure @ 3 bars, the air was only able to achieve 110 degrees and the remaining heating was done using electricity. Hence the steam heater was upgraded to 7 bars, which has required saturation temperature to achieve air temperature of 140 degrees, thus completely eliminating the electrical heater.



Date of commencement : August 2015
Date of completion : October 2015

Uniqueness of the Project

This project has been delivered at the minimum cost of 1.5 Million, by designing the steam heater optimized for achieving the required 140 degrees, leading to complete elimination of electricity usage in heating application. On the contrary, majority of the industry still relies on electricity for heating applications where high temperatures and precision in heating is required.

Replication Potential

This project has excellent replication potential wherever heating requirement is met through non-renewable sources such as HSD, fuel or electricity and there is steam available through renewable sources such as biomass.

Trigger of the Project

The factory is currently operating at 55% green energy footprint and there is an ambitious path and clear plan in place to become carbon positive by 2017. The plant has a unique combination of 30% electrical, 36% HSD, and 33% steam usage. Hence there is a need to shift as much as possible to renewable steam might also be cheaper in the long run.

Environmental Benefits

- Annual reduction in electricity consumption : 1,512 MWh
- Reduction in GHG emissions : 1,200 Tons of CO_2eq

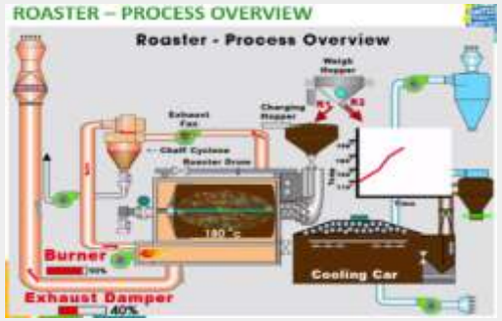
Cost Economics

- Investment made : ₹ 1.5 Millions
- Annual savings achieved (FY 2015-16) : ₹ 7.8 Millions
- Payback : 3 Months

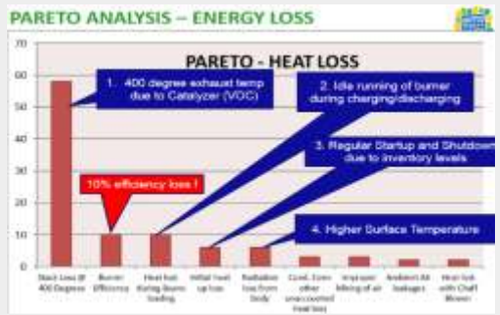
Greenhouse Gas Emission Mitigation – Roaster Burner and Damper Modulation

Project Background

Roaster is an equipment which runs on HSD to generate hot air at 500 degrees and roast the green coffee beans to get desired color and taste profile. The process is highly energy intensive and contributes to approx. 2766 Tons of CO_2 every year.



To reduce GHG emission, the HSD usage in the roaster per batch had to be minimized. The plant identified the biggest contributors to energy loss in the process, as shown below:



To control the damper for optimized exhaust flue gas, the damper was automated based on temperature profile of roaster. During charging-discharging, the burner operated on full load even when it is not needed. Now, with the modulation unit, the burner operates on low fire during charging-discharging.

Date of commencement	:	February 2015
Date of completion	:	August 2015

Uniqueness of the Project

Roasting of coffee beans is a process that required huge amount of energy, precision in control and expertise in operation. With this project, the major losses were targeted and innovative solution through optimized control of key elements that provided better performance in terms of GHG emission than the equipment manufacturer had originally designed has been brought out.

Replication Potential

Though the project has been done in roaster for coffee beans, the same can be replicated where there is a requirement for variable loading of heating but burner is designed for constant load. Optimized air flow circulations in the equipment results in better heat recovery.

Trigger of the Project

HSD is one of the major contributors in energy footprint in the plant and contributes heavily to GHG emission. In line with the goal of becoming carbon positive by 2017, the project was taken up.

Environmental Benefits

- Annual reduction in energy consumption : 4085 GJ
- Annual reduction in GHG emission : 307 Tons of CO_2eq
- Annual saving in fuel : 95 kL HSD

Cost Economics

- Investment made : ₹ 2 Millions
- Annual savings achieved (FY 2015-16) : ₹ 3.8 Millions
- Payback : 7 Months

Hindustan Petroleum Corporation Limited
LPG Bottling Plant, Hyderabad

Hindustan Petroleum Corporation Limited (HPCL) is a Government of India Enterprise and a Fortune 500 Company. It holds the Navratna status and had a gross sales of Rs. 2170 Billion for FY 2014-15. The Company has launched a new Cultural motto 'HP First', FIRST stands for: F: Free, Frank and fair, I: Integrity, R: Respect for Individual, S: Sustainable Performance, T: Team Spirit. HP First is a renewed identity for HPCL.

India is the fifth largest consumer of LPG in the world after USA, China, Japan and Saudi Arabia and the third largest consumer in the domestic sector after China and USA. In India, catering to nearly 4.5 Crore customers across the country and with a strong network of 3500 distributors, Hindustan Petroleum Corporation Limited has an overall LPG market share of 26.7% and has achieved LPG sales of 4.2 MMT.

Hindustan Petroleum Corporation Limited, LPG Bottling Plant, Cherlapally is HPCL's state-of-the-art LPG bottling plant, spread over nearly 58 acres of land and is the biggest out of all HPCL units. The Cherlapally plant caters to the entire state of Telangana covering nearly 23 Lakh customers, 10 districts and 141 distributors. HPCL, Cherlapally supplies LPG in various denominations namely 5 kg cylinders, 14.2 kg cylinders, 19 kg cylinders, 35 kg cylinders, 45.7 kg cylinders and also in bulk. The unit was rated GreenCo Silver in May 2015 and has attained the distinction of being the First LPG Bottling Plant in India to have received the prestigious GreenCo Rating.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
SILVER
2015

GreenCo Silver

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Case Study 21

Mandatory Inspection at LPG Consumer Premises through an Android based Mobile Application to Enhance Safety

Project Background

A mobile phone application which runs of Android platform has been developed to inspect the consumer premises on safety of the installation and to educate them on safety precautions during use of LPG and equipment. The application is touch enabled and captures all the relevant data such as, the consumer's registered address proof, type of hotplate, positioning of the equipment, type and age of the hose used, use of spurious/unauthorized equipment and other unsafe practices, all of which are captured in pictorial form.

Consumers' willingness to give up subsidy is also captured. Signature of the customer is taken on touch pad as token of his concurrence for the job carried in his presence. The application will also make the dealer responsible for the safety of the consumer. Customers with spurious hoses, expired suraksha hoses or other non-standard hoses, operating under unsafe conditions are blocked in the system and are released only after the customer rectifies/replaces the defect. Photographs of the installation taken during inspections are stored in a website for later use. The process, will not only enhance the safety at the customer premises but also reduce the loss of LPG and equipment loss due to accidents at customer premises.

- More than 1.5 Lakhs consumers have been covered up to March 2016 through the mobile based application and the statistics reveal that
- More than 22% of the consumers are using non-standard hoses
- More than 34% of the consumers are using suraksha hoses which does not have a valid date
- More than 10% of the consumers are using different regulators
- More than 2% T connections were found during the inspections

All the connections with T joints, non-standard hoses were blocked and customers were advised to rectify the defects immediately. Nearly 19,000 hoses and T connections were removed thereby improving the safety at customers' premises.

Date of commencement : June 2015

Uniqueness of the Project

- This project is first in the Indian oil industry. The app ensures quality of mandatory inspection. Proof of the mandatory inspection is recorded with pictures. Reports are generated for each parameter, which helps the distributors rectify unsafe practices at the consumer premises. It also enables ease of data retrieval.
- Awareness creation sessions were carried out for all safety ambassadors (Mechanics) engaged in the initiative at the Cherlapalli LPG plant. Field visits were done and information on downstream safety checks were given.
- The initiative increases the awareness among the consumers on safe and right use of products and equipment.

Replication Potential

Mandatory inspection mobile application can be replicated across India, covering total 15 crore consumers across the entire oil industry. The initiative was conceptualized and piloted at Hyderabad LPG unit catering the Hyderabad market and later on was replicated in the districts of Ananthapur, Vijayawada and Visakhapatnam. The initiative can also be replicated in other industries which involves checks to be performed at the customer premises.

Trigger of the Project

LPG consumer premises has to be inspected by trained mechanics to check the safety of the installation and to educate the customers on the precautions to be taken for safe usage of LPG and equipment. The inspections were generally carried out manually by third party agents who work for the distributors. Quantity used to take precedence over quality with the third party agents as there was no trail of the job carried out by the third party agent other than the counter foil of the inspection report. Hence there was a need to develop a robust system with traceability which holds the distributor accountable for the safety of the consumer.

Environmental Benefits

- Ensures safe kitchen thereby minimizing possibility of fire incidents at customer premises, reducing loss of human lives and property
- Ensures responsible use of product, minimizes loss of LPG and equipment, resulting in material conservation
- Reports are generated and stored digitally, thereby avoiding huge amount of paper that would have otherwise been consumed by distributors

Cost Economics

- The app is provided free of cost to the distributors for any number of users/agents with separate user id and password wherever required
- Annual maintenance charge of Rs. 25/- is collected from the distributor

Hindustan Petroleum Corporation Limited
New White Oil Terminal, Visakh

Hindustan Petroleum Corporation Limited (HPCL) is a Government of India Enterprise and a Fortune 500 Company. It holds the Navratna status and had a gross sales of Rs. 2170 Billion for FY 2014-15. HPCL operates 2 major refineries, one in Mumbai and the other at Vishakhapatnam producing a wide variety of petroleum fuels and specialties. The Mumbai refinery has a capacity of 6.5 MMTPA and the Visakh refinery has a capacity of 8.3 MMTPA. Infrastructure is the key for sustained market growth and has remained a major action area of the corporation with 36 Terminals, 69 Depots, 46 LPG Bottling Plants, 7 Lube Blending Plants, 35 Aviation Fuel Stations, 4 Major Product Pipelines, 1,638 SKO Dealers, 3,952 LPG Dealers and 13,233 Retail Outlets. The Company has launched a new Cultural motto 'HP First', FIRST stands for: F: Free, Frank and fair, I: Integrity, R: Respect for Individual, S: Sustainable Performance, T: Team Spirit. HP First is a renewed identity for HPCL.

HPCL's state-of-the-art white oil terminal, the New White Oil Terminal (NWOT) located in Vizag was commissioned in October 2012 and is spread across an area of 75 acres. HPCL, New White Oil Terminal, Vizag handles 10 grades of products varying among Motor Spirit, High Speed Diesel, Kerosene, Naphtha, Aviation Turbine Fuel and Mineral Turpentine oil. The volume handled in the facility has increased from 861 TKL to 1770 TKL between 2013-14 and 2015-16. Product dispatch by road covers the states of Andhra Pradesh and Odisha and product dispatch via rail covers the states of Chhattisgarh, Jharkhand, Odisha, Telangana and West Bengal.

HPCL, NWOT, Vizag is the first terminal in the industry to have fully implemented the M. B. Lal Committee recommendations on safety. Various others features in NWOT include the state-of-the-art NABL accredited laboratory ensuring quality standards of all products, Safety Instrumented System (SIS) meeting the requirements of the SIL 2 level, IGBC Gold Rating for the admin building, level 6 in International Safety Rating System (ISRS) and many more. The unit was awarded GreenCo Gold in February 2016.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE, INDIA
GOLD
2016

GreenCo Gold

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Case Study 22

Ship to Ship Transfer improving Supply Chain Efficiency

Project Background

HPCL, being an essential commodity supplier, needs to ensure availability of product in all parts of the country, for which, timeliness of delivery and alternative options for product transshipment is a prerequisite.

As part of the regular tanker loading operations, HPCL's location at Budge Budge is supplied with VR BS IV High Speed Diesel (HSD) product through tankers. Since Budge Budge is a riverine port, the draft available is limited to 7.2 meters. Owing to the limited draft, vessels of maximum 8000 MT capacity only can be accommodated at the port. Since Budge Budge caters fuel supplies to Kolkata and the adjacent areas, the consumption rate of the location was significantly high. Hence, continuous inward and outward movement of vessels without any hindrance was an imperative.

Since the Visakh port has only three jetties for Petroleum, Oil & Lubricants (POL) products, smaller ships had to wait to be loaded until the bigger vessel completes unloading to onshore tanks. The vessel to be sent to Budge Budge tends to be lined up for loading at the Visakh port for a long time. The delay in loading sometimes puts the Budge Budge location at the verge of drying.

The problem was addressed by carrying out Ship to Ship (STS) transfer of cargo within the port limits, since the Visakh port is a natural port and has minimum wave currents. While the larger sized vessel (mother vessel) is berthed alongside the jetty (along with the shore), the smaller sized vessel (daughter vessel) is fastened to one side of the mother vessel with the support of fenders (springs). Simultaneous transfer of cargo is carried out from mother vessel to daughter vessel on one side and from the mother vessel to the shore on the other side.

Date of commencement : January 2013

Uniqueness of the Project

The initiative is carried out for the first time in the industry. Similar initiatives was not carried out in Visakh ports earlier.

Replication Potential

Similar initiatives can be carried out at other ports, petrochemical or chemical industries. The strength of waves and wind currents needs to be studied to ensure efficient application of the idea.

Trigger of the Project

Budge Budge, being a high consuming location and HPCL, being a major market supplier, the necessity of continuous supply was essential. Besides, there has also been reported instances wherein product crisis was realized owing to delay in loading at Visakh port.

Environmental Benefits

- Annual fuel savings : More than 65 MT of FO / HFHSD
- Annual GHG emission reduction : 220 tCO_2eq
- Nil vessel waiting period for daughter vessel. Since the tanker operation was completed without physically arriving inside port limits, fuel savings on pilot boats and lighting around jetties was achieved
- Reduced turnaround time since the discharge flow rate of mother vessel has been increased by 600 kL/hour
- Reduction in chances of product crisis at Budge Budge port resulting in improved supply chain efficiency

Cost Economics

- Investment made : Nil
- Annual savings achieved : ₹ 14.35 Millions

Case Study 23

Reclamation of Marine Loading Arm Line Quantity

Project Background

HPCL has initiated the use of marine loading arms for handling discharge from ocean tankers. Unlike traditional systems of utilizing flexible hoses which are unsafe and prone to oil spills, marine loading arms are made of all steel body, hydraulic operated, with no manual intervention and provide a quick connect-disconnect facility for connection with the tanker manifold pipelines.

As per design, loading arm must be drained before the connection is broken off. In order to facilitate the same, as a regular practice, the quantity of cargo contained in the equipment (line quantity) was drained back to the tanks of the tanker and downgraded as slop (low grade fuel) and accumulated along with other liquids in slop tanks. In cases where the same tanker carries different grades of cargo, every switchover between different grades stored in different tanks and discharged through different manifold lines, require that the line quantity be downgraded as slop.

Since the number of tankers handled had increased along with the varieties of grades, a considerable loss in product receipt was realized. NWOT in-house team decided to implement a temporary storage tank below the equipment which will serve as a buffer storage unit for the line quantity. The line quantity will then be discharged using a high discharge head low capacity pump to the shore tanks after disconnection of marine loading arm. Hence a storage tank of 4000 L capacity was constructed and the line quantity instead of being drained back to slop tanks, is completely pumped to the shore tanks. Besides savings on cargo, the initiative has minimized the stock loss.

Date of commencement : June 2013

Uniqueness of the Project

The solution to the problem was brainstormed by the in-house team and was implemented successfully. The initiative resulted in nil down gradation of product and 100% recovery of product was achieved.

Replication Potential

Similar projects can be undertaken in other industries that handle liquid cargo import or export at various ports.

Trigger of the Project

Loss of stock and loss of time due to pumping of line quantity product back to the cargo and pumped again as slop at the end, triggered the implementation of the project.

Environmental Benefits

- Annual product/material saving : 140 kL
- Annual fuel savings : 40.7 MT of FO / HFHSD
- Annual GHG emission reduction : 138 tCO_2eq
- Reduced tanker berthing time, turnaround time thereby reduced fuel usage

Cost Economics

- Investment made : ₹ 0.8 Million
- Annual savings achieved : ₹ 10.2 Million
- Payback : Less than one month

Hindustan Petroleum Corporation Limited
Visakha Vijayawada Secunderabad Pipeline, Visakh Terminal

Hindustan Petroleum Corporation Limited, a Government of India Undertaking, is in the business of refining and marketing petroleum products. Visakha Vijayawada Secunderabad Pipeline (VVSPL) is a 572 kilometer long cross country multi-product petroleum pipeline of HPCL. Challenging task of transporting petroleum products with stringent quality specifications is done through this pipeline from HPCL's Visakhapatnam Refinery to the customers i.e. HPCL marketing terminals at Rajahmundry, Vijayawada, Suryapet and Secunderabad. These terminals cater to the demand of the customers of all oil marketing companies spread across the states of Andhra Pradesh, Telangana and parts of Karnataka, Tamil Nadu and Maharashtra.

Visakha Vijayawada Secunderabad Pipeline starts from Visakhapatnam and traverses through East Godavari, West Godavari, Krishna, Nalgonda and Ranga Reddy Districts. The pipeline from Visakhapatnam to Vijayawada was commissioned in May 1998 and was later extended upto Secunderabad during March 2002. VVSPL passes through 3 rail crossings, 40 canal crossings and 10 river crossings and crosses mighty Godavari River over a unique 2.6 kms, above ground Standalone Trestle Bridge. Elevation of the pipeline above mean sea level varies from 4m at Visakhapatnam to 472 m at Ghatkesar.

The other significant features of this pipeline are:

- Constructed and operated as per latest national and international standards of ANSI B31.4, API and OISD
- Products handled - Petrol/Diesel(BS III & BS IV) / SKO / ATF
- Main pumping station at Visakhapatnam
- Intermediate Booster Pumping Stations-Cum-Receiving stations at
- Rajahmundry, Vijayawada and Suryapet
- Receiving station at Ghatkesar near Secunderabad
- 2 nos. Intermediate Pigging Stations & 21 Sectionalizing stations

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
PLATINUM
2016

GreenCo Platinum

Contact Person
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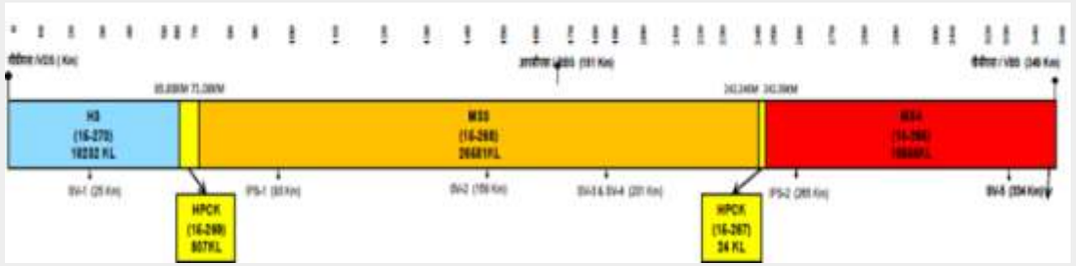
Introduction of HPCK (HP Pipeline Compliant Kerosene) in Pipeline

Project Background

VVSPL is a multi-product pipeline which transports various hydrocarbon products such as Diesel (HSD), Kerosene (SKO), Petrol (MS) and Aviation Turbine Fuel (ATF), sequentially with segregation and pre-calculated batch sizes. SKO is required to be sandwiched between MS & HSD to act as differentiator, because of compatible chemical property. As per MoPNG directive for clean fuel implementation, BSIV (Bharat Stage) grade was implemented in Telangana State w.e.f. April 2016. Interphase boundary management of the batches becomes most critical, as the fuels grade goes up. MS & HSD batch volume can increase significantly to accommodate this interphase, while keeping SKO neat. Industry practice has been to sandwich BSIV MS and BSIV HSD with sweet kerosene (as per IQCM), but the SSKO capacity of old refineries is limited, apart from huge cost of production and process requirements. VVSPL took the initiative of developing a new product for handling this special situation.

Before Implementation:

After Implementation:



Date of commencement : October 2015

Date of completion : February 2016

Uniqueness of the Project

Introduction of BS4 products in Telangana necessitates SSKO plug for segregating HSD and MS (petrol) in multiproduct pipeline, as mandated by Industry Quality Control Manual. HPCL Visakh Refinery is not configured to produce adequate SSKO. VVSPL team brainstormed with QC departments of Marketing & Refinery, Supplies and technical/operations group of Visakh Refinery to develop an intermediate product which was christened HPCK. This product is an intermediate of 2 process streams and expected to cost much lower than SSKO, which needed to be imported otherwise.

Replication Potential

This can be easily implemented in other similarly configured refinery-pipeline systems.

Trigger of the Project

- Implementation of BS4 grade in Telangana and operational constraint of multiproduct pipeline.
- Had the existing process of SKO plug been continued, the costs would be very high due to large SKO inventory required of 1700 KL per batch against HPCK requirement of 700 KL.
- The HSD & MS inventory cost will also reduce due to batch size reduction from 60,000 Kl to 20,000 KL

Environmental Benefits

- Material conservation

Material conservation due to	Initial quantity	Reduced quantity	% reduction
Reduction in interface quantity	400	50	12.5
Reduction in product down-gradation	300	130	43.3
Reduction in BS- IV batch	60	40	66.7

Cost Economics

- Investment made for HPCK : ₹ 63 Million / batch

- Annual Savings
- Product cost - (6.8-6.3) X 50 batch per year : ₹ 250 Millions
- Inventory Cost - 20000kL x 50000 X 10% : ₹ 100 Millions
- Payback : Immediate

Ex-Vijayawada Pumping and Capacity Utilization

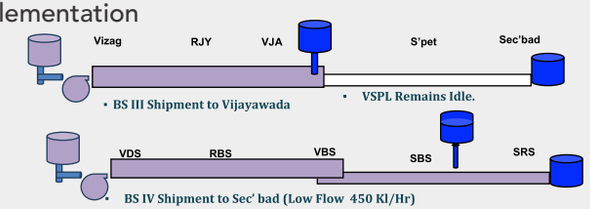
Project Background

VVSPL is a multi-product pipeline which transports various hydrocarbon products like Diesel (HSD), Kerosene (SKO), Petrol (MS) and Aviation Turbine fuel (ATF) After Telangana State Govt. made mandate the use of BSIV (Bharat Stage) grade in the entire state and to meet this demand, either the batch size need to be increased or increasing the frequency of launch of BSIV grades.

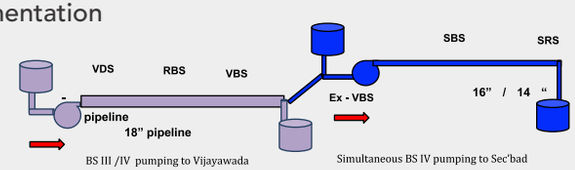
VVSPL is telescopic by construction and Vizag-Vijayawada section is 18"which progressively reduces to 16" and 14". Thus BS IV grades, while crossing Vijayawada, limit the overall flow rate of pipeline to 450 Kl/hr. thus reducing pipeline capacity by ~18%. Any such capacity constraint, due to different grade requirement of both states, will also cause demand-supply imbalance and entail usage of more energy intensive/uneconomic modes like road/rail. Typically pipeline transport costs 1/4th of rail cost in terms of energy and tariff.

This problem was successfully eliminated by the implementation of EX-Vijayawada pumping. Separate tankage facility identified for buffer storage of BSIV grade product at Vijayawada. EX-Vijayawada pumping facility was developed at a cost of Rs. 2.5 Crores, complete with station facility and instrumentation. Existing pumps of terminal were reconfigured to serve as base boosters for input to mainline booster pumps. Process and ERP reconfiguration carried out for integrating the facility to regular operation and safety requirements. Product Scheduling is adopted to store E IV grades at Vijayawada as buffer in a single tank which will be pumped back to utilize the idle Secunderabad line during E III product intake in Vijayawada, and be empty in time to receive the next BS IV batch. By Full capacity utilisation of pipeline during BS4 grade transportation to Telangana and Improved product delivery time to Secunderabad. In short after this implementation VVSPL acts as two pipelines with timely delivery of product that too at lower power consumption and improved pipeline utilization.

Before Implementation



After Implementation



Date of commencement : January 2015

Date of completion : March 2016

Uniqueness of the Project

As the pipeline is in two different states with two different grades of products, this very unique and rare situation that can happen to any other company. However, the project is replicable.

Replication Potential

Any process industry which faces imbalance between the units due to statutory/environmental or any other reasons, can adopt similar buffering and de-bottlenecking concepts. Important for situations, where no infrastructural expansion to match the different processes is practicable.

Trigger of the Project

- Separate fuel grades BS3- AP & BS4- Telangana state
- Sub optimal operation of pipeline for BS4 supplies to Telangana
- Idling of Vijayawada-Secunderabad Section during BS3 delivery in AP

Environmental Benefits

- Enhancement of pipeline utilization : 18%
- Annual energy savings : 1,150 MWh
- Annual GHG emission reduction : 1,120 tons

Cost Economics

Investment made	:	₹ 25 Million
Annual savings achieved	:	₹ 6.53 Million
Payback	:	3.5 Years

Implementation of Maintenance Free Earthing System

Project Background

VVSPL transports various hydrocarbon products through intermediate pumping locations namely, Rajahmundry, Vijayawada, Suryapet and the receiving location at Ghatkesar. Since all locations have electrical, telecom & instrumentation equipment, Oil Industry Safety Directorate (OISD) mandates to have good earthing systems to improve service continuity and avoid damage to equipment and human life.

The earthing system, installed as per IS 3043 (code of practice for earthing) was designed using GI Earthing Conductors. Since Suryapet is a rocky ground, difficulties were faced during installation, and hence 45 earth pits, for an area of 9000 sq. metre were installed to reduce/maintain the allowable grid resistance value. The value needs to be checked every six months for which the pits had to be reconditioned using charcoal and salt and watered after reconditioning. During the process, it was observed that the GI earthing was being corroded and owing to the nature of the ground, it was difficult to maintain resistance values. It was imperative to frame a permanent solution ensuring basic safety by providing correct earthing system and hence further studies continued for this project.

Uniqueness of the Project

A 1035 grade steel bar conductor, coated with nickel and molecularly bonded copper coating of 250 Micron (0.25 mm) thickness is used. This ground enhancement material is permanent and will not leach any chemicals into ground. Ground enhancement material (GEM) with a resistivity of less than 0.12 ohm-meter (about 5% of the resistivity of bentonite) is placed around the rod in an augured hole or around grounding conductors in a trench.

The conductor is of high tensile strength, more than 90,000 psi due to cold drawn steel. Ground Enhancement Material (GEM - basically a Portland cement) is used as backfill material that solidifies on drying and is insoluble in water. GEM is anti-corrosive, good conductor of electricity and has low resistivity. It is very effective in reducing soil resistivity especially in rocky and sandy soils. Copper is chemically bonded to steel core and will not be easily damaged due to rough handling. The Ohmic value is retained more than 35 years and no maintenance is required after installation.

Replication Potential

This method can be promoted with consistent OHMIC value for a period of 40 years. Oil & gas installations, power generating stations and sub-stations can implement this earthing system for better maintenance of equipment and safety system. Life cycle cost of this method is Low Cost in Long Run and environment friendly qualifying IEEE-80, IEEE 142 and IEC 62561-7 standards and ground rod is listed under UL*467.

Trigger of the Project

The soil resistivity checks indicated levels as high as 1000 ohm-meter. The nature of land at existing earth pits was rocky and with low moisture content. On observing the grounding potential difference at specific local grounding boxes, and in between new and old grounding systems, it was noticed that a lot of soil variation existed all along the plant. Also, the potential difference between the equipment and the earth pit was huge.

Environmental Benefits

Eliminated the use of reconditioning material (such as charcoal & salt) and water.

Cost Economics

Before implementation -

- Annual cost of reconditioning the earth pits – Rs. 55,000/- (inclusive of charcoal and salt)
- Additional cost – Labour cost, water cost (watering to recharge earth pits carried out for nearly 3/4th of the year)

All the above mentioned cost is eliminated with the implementation of this earthing system

ITC, Paperboards & Specialty Papers Division
Bhadrachalam Unit

ITC's Paperboards and Specialty Papers Business - India's largest, technologically advanced and most eco-friendly paper and paperboards business. The business caters to a wide spectrum of packaging, graphic, communication, writing, printing and specialty paper requirements through its four world-class manufacturing units, which are today all FSC certified.

A front runner in introducing cutting edge environmental practices in India, ITC established the country's first Elemental Chlorine Free fiber line and Ozone Bleaching technology. ITC also became the first in the country to gain membership of the Global Forest & Trade Network (GFTN) of the World Wildlife Fund (WWF).

Committed to developing a sustainable raw material base, ITC's pulpwood is largely sourced from renewable plantations under its Social and Farm Forestry programme which assists tribals and farmers to convert their wastelands into commercial plantations – turning an unproductive asset into a sustainable livelihood option.

ITC Limited- Paperboards and Specialty Papers Division - Bhadrachalam unit located at Sarapaka Village, has emerged as one of the most modern and contemporary players in the business worldwide. The Bhadrachalam unit is an integrated Pulp and Paperboard Mill commenced its production in the year 1979. Today, the annual production capacity ITC Bhadrachalam Unit is 405,000 TPA of Paperboard and 140,000 TPA of Paper from 7 paper machines.

ITC Bhadrachalam Unit upgraded their rating to GreenCo Platinum in March 2016.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
PLATINUM
2016

GreenCo Platinum

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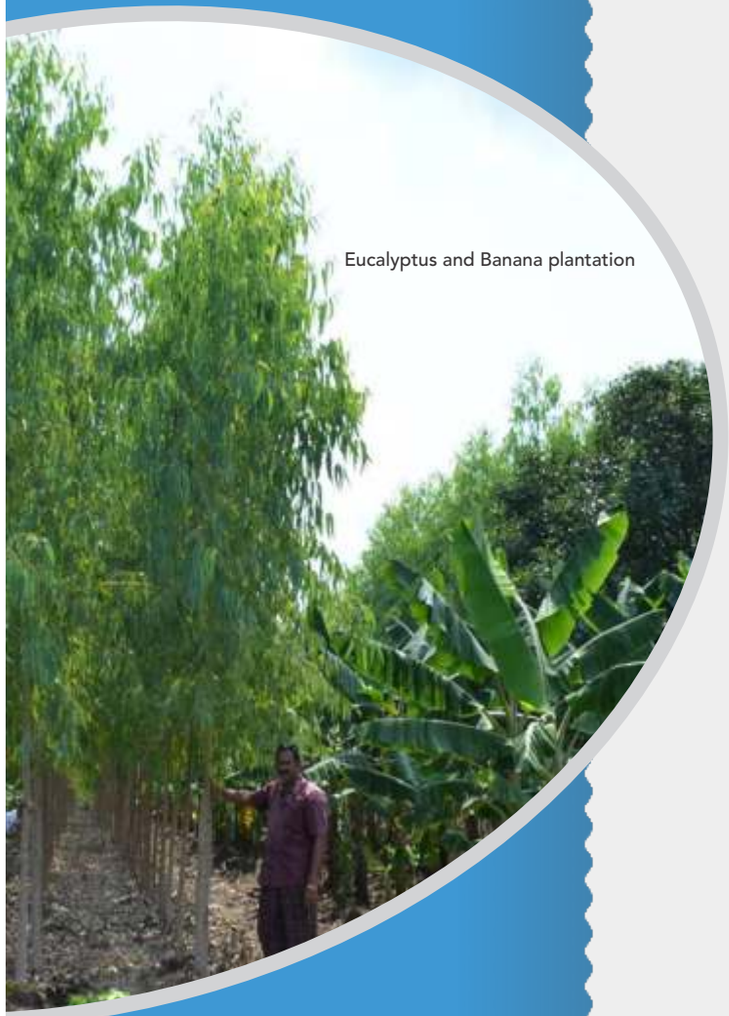
Case Study 27

Sustainable agroforestry model for Eucalyptus grown as pulpwood on farm lands in India.

Project Background



Eucalyptus and Banana plantation

A new concept named as "Agro-forestry Model" has been evolved after a series of experimental trials with different planting geometries. Under this model, pulpwood trees are planted in rows leaving a wide gap of 8 m between rows to allow maximum sunlight for growing food crops. The primary advantage of this model is that every year, the farmer can cultivate food crops and also harvest the trees after 4 years interval. The food crop facilitates an additional annual income for the farmers and in case of the food crop loss due to drought, flood, pest, diseases, etc the income from the tree harvest would hedge the risk for the farmers. It is noteworthy that the land allocation to forestry in such models is only 25% and the remaining 75% land is available for agriculture crop. This programme was kicked off in the month of April, 2010 and so far 28,000 hectares of land has been covered under the Agro-forestry model.

Benefits of Agro-Forestry Model

1. Improving the productivity & profitability of farm lands where one crop is grown in a year.
2. Contributing to the food security by restoring farm soil fertility for food crops.
3. Reducing deforestation and pressure on natural forests by providing pulpwood grown on farm lands.
4. Increasing diversity of farm lands by growing trees along with agriculture crops.
5. Trees act as wind and insect barriers
6. Higher carbon sequestration will help in mitigating the global climate change.
7. Reducing poverty through increased production of agro-forestry products.
8. Reduces the risk of rain-fed agriculture
9. Higher economic returns to the farmers
10. This model is best suited for small & marginal farmers

Date of Commencement	:	2010-11
Date of Completion	:	2012-13 and work in the field still going on

Uniqueness of the Project

Agroforestry is the future of pulp and paper industry as it not only helps meet the wood demand but also reduce pressure on the natural forest and agricultural land alike for growing pulpwood plantations. Agroforestry can help meet food and wood demand of the country. Thus, agroforestry is agronomically sustainable, environmentally desirable and economically beneficial.

Replication Potential

The project can be adopted by all Indian Paper Industry.

Trigger of the Project

ITC PSPD's major raw material to produce paper is wood. To avoid indiscriminate felling of forests for paper, ITC wanted to create a channel to ensure sustainable sourcing of wood. The model created had to be sustainable in itself and hence ITC chose to collaborate with the society. The agro forestry model adopted will ensure livelihood for farmers and also ensure sustainable sourcing of wood thereby protecting the forests.

Environmental Benefits

Increasing diversity of farm lands by growing trees along with agriculture crops & higher carbon sequestration will help in mitigating the global climate change. Through this project, ITC has been Carbon Positive for more than ten years.

Biogas generation using ETP secondary sludge waste

Project Background

ITC PSPD-BCM is operating the Effluent Treatment Plant to take care of the discharges of all section. The secondary bio sludge generated in the process was being disposed to the secondary board manufacturing units mixing the secondary sludge with Primary sludge. The heat potential in the secondary bio sludge is lost which can be utilized in the process.

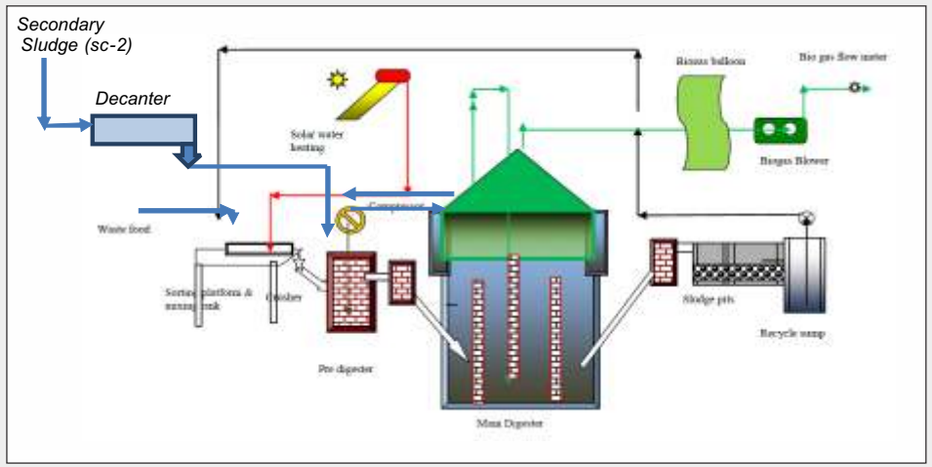
The following options were identified to utilize the secondary sludge in better way.

- To dewater, increase the consistency above 60% & consume in the bio mass boiler after further reduction of the moisture.
- To generate the bio gas by utilizing the bio sludge & the canteen kitchen waste to consume in canteen in place of LPG.

The above two options were brainstormed among the team & analyzed feasibility of implementation of the above two options.

First option was to improve the secondary bio sludge consistency was attempted by adding polymer & passing through dewatering machine but results were not positive as the fine bio sludge processing was difficult. Hence team contemplated on the option for generating the bio gas from the secondary sludge. M/s BARC which has developed a technology "Nisargruna" bio gas generation from food waste in rural areas was approached.

Based on the lab analysis of ETP Secondary Sludge, a study was carried out and biogas plant was set up with a blend of Bio Sludge and Canteen Food Waste at a ratio of 95:5



Uniqueness of the Project

The secondary bio sludge generated in the process was being disposed to the secondary board manufacturing units mixing the secondary sludge with Primary sludge. Earlier heat potential in the secondary bio sludge was being lost which is now being utilized for biogas generation.

Replication Potential

Project can be implemented in Indian Paper Industry, but prior study on lab analysis of Secondary ETP sludge is required to check feasibility of Biogas generation

Trigger of the Project

In its pursuit for identifying better way of handling the hazardous waste and recycling of waste, most feasible and economically viable.

Environmental Benefits

Reuse of Solid waste
Biogas generation : 40 m3/day

Cost Economics

Annual savings : ₹ 4,36,000 /-

ITC PSPD Papyra App

Project Background

In an initiative to reach a larger network and be continuously in touch with customers, ITC PSPD launched a mobile application named "Papyra" which has been designed to help a user in choosing the right paper / paperboard for their product and assist them in making an appropriate and sustainable choice. It guides on the basis of end use in packaging, graphic or specialty applications and gives a comparative report between different grades suitable for that application.

Salient Features:

- Suggests papers & boards from our portfolio based on end use segment
- Helps compare grades based on two options - Cross Direction Stiffness &Caliper Comparison
- Grammage slider function-- The App recommends a grammage for each grade based on the application and also accounts for some source reduction potential. User can change the grammage by moving the slider and the App will re-calculate the quantity required based on that grammage choice
- The App calculates the tonnage (for a chosen GSM & Carton dimension) between different grades with similar functional properties
- In case a user wants to compare some other grades, the App gives a provision of selecting any 3 grades from our portfolio
- Papyra Pop-up—Papyra character plays the role of host in the App guiding the user in making the right choice by giving facts and tidbits
- Tech Guru Section—This section gives the user a complete guide on Paper and board properties and usage
- Product Specification—User can download product specifications simply by a click
- The app was launched on 8th July 2015 on android and IOS platforms and web version available at http://www.itcpspd.com/papyra/

Uniqueness of the Project

First such app in the Indian Pulp and Paper Industry.
The traditional approach for any packaging manager to arrive at the right substrate for their carton / packaging needs is to adopt an iterative approach . This not only led to a waste of time but led to over engineering or under engineering the packaging thereby placing an unnecessary load on the environment.

Replication Potential

It can be easily replicated by any paper business.

Trigger of the Project

- Long time taken from design to implementation of a new packaging or graphic application,
- Myriad choices leading to confusion for the packaging team
- Iterative approach that led to wastage of key resources

Environmental Benefits

Ease of access for customer to select accurate packaging material based on the requirements thereby resulting in material conservation.

Cost Economics

Investment made : ₹ 0.85 Millions

JCB India Limited
Ballabhgarh Unit

JCB is the World's largest privately owned ECE Company and World's No. 1 manufacturer of Backhoe and Loadall. JCB employs over 8,000 people on 4 continents and sells products in 150 countries through 1,500 dealer locations. JCB worldwide presence includes manufacturing facilities in UK, USA, Brazil, China and India (Ballabgarh - Haryana, Jaipur – Rajasthan, Pune – Maharashtra).

JCB started Indian operations in 1979 as a joint venture company. The company offers a wide range of equipment such as backhoe loaders, loading shovels, tracked excavators, skid steer loaders, compactors and loadall. In the last 4 years, JCB increased its market share in all the product segments and today the population of JCB machines is more than 2, 00,000 in India.

JCB is India's largest ECE manufacturer, sustaining ECE market share of 53% and Backhoe Market Share at 75% year over year. In 2010, JCB expanded their manufacturing footprint at Ballabgarh and started producing JCB BS III engines. This state-of-the-art facility produces the most advanced engine in the earthmoving and construction equipment industry. Also, the Ballabgarh plant is the World's Largest Backhoe Loader Plant.

This unit was rated GreenCo Silver in 2015.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
SILVER
2015

GreenCo Silver

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Case Study 30

Waterless Cooling for DG Sets, Air Conditioners, Chillers & Engine Testing Cells

Project Background

Initially JCB was using water-less cooling towers for the DG sets only. Later, they had explored the possibility to install water-less coil coolers in air conditioners for chillers as well for the engine Plant. Therefore, in the engine plant for air conditioning of the shop floor, water-less cooling towers (AHUs) were installed. In this application, water isn't required on regular basis only 100 Ltr per month is required to be added as make-up water.

Before

After

Date of commencement	:	January 2013
Date of completion	:	July 2013

Uniqueness of the Project

- The chiller used is water free
- About 100 Ltr of water per month is required to be added as a make-up
- If water was used regularly in the cooling tower, 5000 Ltr / day / cooling tower would be consumed

Replication Potential

Replicable across all engineering and other industries

Trigger of the Project

To reduce amount of water consumed

Environmental Benefits

- Monthly water saving : 7,70,000 lt / month
- Monthly energy saving : 440 kW / month
- GHG emission avoided : 440 kg / month

Cost Economics

- Investment made : ₹ 5.2 Millions
- Annual savings : ₹ 0.4 Millions

Case Study 31

Material Conservation through removal of redundant part from loader tower

Project Background

During VAVE (Value Addition Value Engineering) workshops, JCB had received inputs from associates that, the Weld Plate is an extra part in their vehicle which can be eliminated. Hence the part can be eliminated without effecting quality or strength of the loader tower.

Date of commencement : April 2015

Date of completion : July 2015

Uniqueness of the Project

- Material Conservation as an approach to prevention of pollution is understood and implemented
- Morale boost of the employees as an idea given by them has been implemented
- The improvement is done without impacting the quality or performance of the product

Replication Potential

Easy to understand and replicable in engineering / automobile sector

Trigger of the Project

The major trigger of project was to reduce environment and cost impact. The idea was generated in a VAVE work shop and was evaluated by the Product Engineering team. It was concluded that the particular part is redundant and can be removed without having any impact on the strength and quality of loader tower

Environmental Benefits

Annual material saving	:	11.6 tons MT
Annual energy savings	:	2112 kWh
Annual reduction in GHG emission	:	1921 kg

Cost Economics

Annual savings	:	₹ 13000

JK Lakshmi Cement Limited Grinding Unit Kalol

K Lakshmi Cement Limited, one of India's leading players in the cement manufacturing sector. JK Lakshmi Cement comes in three variants: Portland Pozzolana Cement, OPC 53 Grade and OPC 43 Grade. Its PPC is used in all types of RCC work, underground structures, bridges, general building work and hydro power station. OPC 53 Grade is used in pre-stress work, precast element, bridges and atomic power station. OPC 43 Grade is used in commercial building industrial constructions, multi-storied complexes, and heavy duty floors. JK Lakshmi Cement also has introduced a new range of products, namely, JK LaxmiPlast - a Plaster of Paris (POP) solution, JK GypGold-light-weight gypsum based plaster and JK Smart Blox-an energy saving product. JK Lakshmi Cement's manufacturing units are located at Sirohi - Rajasthan, Kalol - Gujarat, Jhajjar - Haryana and Durg - Chhattisgarh.

The plant at Kalol, a blending unit of the JK Lakshmi Cement group, manufacturers OPC and PPC grade cement. The annual production of the plant is around 491410 MT. The unit has demonstrated commitment towards sustainability through the various certifications it has achieved, namely, ISO 9001, ISO 14001, ISO 50001, OHSAS 18001 and ISO 14064. Various technologies such as a fully automated weighbridge, high efficiency LV classifier, variable frequency drives, clinker crusher, screw compressors, etc. are used in the plant to improve the efficiency and reduce the environmental impact. JK Lakshmi Cement, Kalol is the third unit in the cement grinding sector to be GreenCo rated and was rated GreenCo Silver in June 2015.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
SILVER
2015

GreenCo Silver

Contact Person
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Green Power - Innovative Windmill

Project Background

The project began with the implementation of an innovative idea to utilize available power. Earlier, the air from the bag filter fan exhaust located at the packing plant section was released into atmosphere. The innovative arrangement comprised of a small wind mill (partly developed by the team) that utilized the waste air discharged from the exhaust fan. Renewable power is generated and that meets most of the illumination power requirement of various offices inside the plant. The R&D team carried out trials during the development of this project by working out the most efficient location for windmill installation at different positions and altitudes.

Date of commencement	:	April 2013
Date of completion	:	July 2014

Uniqueness of the Project

The concept is unique and innovative since the PLF of wind mill is enhanced more than 80% compared to the conventional arrangements in which the maximum PLF is recorded between 17-25% depending upon the site location.

Replication Potential

The concept is easily replicable and can be replicated in industries that uses bag filters or any air exhaust air/gas fan systems. Power generated from these sections can be used to meet the lightning demands in office. Cumulative impact of power generation from such installation could result in significant reduction in consumption of electricity, which is generally sourced from conventional sources like coal, etc.

Trigger of the Project

Main trigger behind the project was the freedom of thinking and implementing ideas towards doing something different. Everyone is motivated towards conservation of natural resources. This project is a good example of implementation of an innovative thought towards use of available resources.

Environmental Benefits

- Annual energy savings : 1650 units
- Annual GHG emission reduction : 1,353 $kgCO_2e$
- Eco-friendly mode of power generation, thereby causing minimal environmental impact

Cost Economics

- Investment made : ₹ 0.125 Millions
- ·Annual savings : ₹ 10,000/-

Water Positive status through Rain Water Harvesting

Project Background

JK Lakshmi Cement, Kalol is a water positive unit through its rain water harvesting practices. The unit was designed keeping water conservation in mind.

The rain water harvesting system of JK Kalol unit comprises of the following :

- Six scientifically designed rain water harvesting structures with horizontal filtration modules during monsoon season
- Slope engineered paved area and drains laid within the premises in order to maximize the ground water recharge

All possible roofs inclined in order to maximize rain water harvesting with gutters at the downpipe Total roof top catchment area is about 8814 square meter and the quantity of harvested rain water, on an average is 4260 kL per annum in the last three years. In FY 2014-15, total rain water harvested was about 20,000 kL which was reused in the process and used to recharge three bore wells.

PHASE - I
Date of commencement : 2009
Date of completion : 2010

PHASE - II
Date of commencement : 2013
Date of completion : 2015

Uniqueness of the Project

- Rain water harvesting practices since conceptual stage of the plant
- Flow inclination towards various decentralized rain water harvesting structures covering the entire plant
- All methods of harvesting are being followed; roof top water is harvested and recharged to the service bore well and stored in the plant water tank; runoff is diverted underground through recharge borewell
- Continuous monitoring of the impact of rain water harvesting on ground water levels and consumption

Replication Potential

Very high replicability in all the industries. Scientifically designed water harvesting systems can achieve maximum harvesting when compared to the conventional rain water harvesting systems.

Trigger of the Project

The project was the result of ideology of JK Lakshmi, Kalol's project team and its commitment to become water positive.

Environmental Benefits

- Annual water savings : 20,000 KL
- Reduction in fresh water consumption in the last 5 years = 41%
- Increase in water table levels and reduced TDS level

Cost Economics

- Investment made : ₹ 1.13 Millions

Vermicompost

Project Background

The project was implemented to handle organic solid waste generated in the premises effectively and was completed in two phases.

Phase 1 - Conventional composting solution
Initially, under solid waste management plan, the facility was developed considering shortest path for haulage between composting site and waste generation source. Three composting beds with appropriate dimensions were developed.

Phase 2 - Vermicomposting
Further value addition was done in the organic waste management system when vermicompost was prepared after adding steps to the conventional organic waste management system. Facility for vermicomposting was made in the existing greenhouse in the premises.

Date of commencement	:	January 2013
Date of completion	:	March 2013

Uniqueness of the Project

- Simple low cost and highly effective project
- Model facility/example for sharing green practices with the stakeholders, visitors, etc.

Replication Potential

Because of its simplicity and sustainable process, the project has high replicability in all industries. Availability of organic solid waste and garden waste will determine the quantity of organic manure produced.

Trigger of the Project

Idea of being self-sustainable and suggestions from stakeholders was the trigger behind the project. Initial implementation of conventional composting system was the initiative by employees and the vermicomposting system was a suggestion from a visitor during plant visit during engagement programmes.

Environmental Benefits

- Average generation of vermicompost : 3,500 Kg
- Avoided use of equivalent amount of inorganic fertilizers

Cost Economics

- Investment made : ₹ 50,000/-
- Payback : 7 months

JK Tyre and Industries Limited
Chennai Tyre Plant

JK Organization owes its name to late Lala Juggilal Singhania and his illustrious son late Lala Kamlapat Singhania. JK Organization, founded over 100 years ago is an eminent industrial group in the country. The group has multi-business, multi-product, multi-location operations like JK Tyre & Industries, JK Paper, JK Lakshmi Cement, JK Seeds, JK Sugar, JK Insurance, Umang Dairies, etc.
JK Tyre & Industries has 6 plants in India and 3 plants in Mexico with a current capacity of 20 million tyres per year. The vision of the company is to be the most admired company in India committed to excellence. The company has a mission to be the number one tyre brand in the country, provide customer support 24x7, be a green company, deliver enhanced value to all stakeholders and enhance global presence through acquisitions / JV / strategic partnerships. According to All India Tyre Manufacturer's Association, JK Tyre & Industries contributes to about 21% of the tyre market in the country.

JK Tyre & Industries Ltd., Chennai is located on Sriperumbudur-Tambaram road in Kolathur Village, 50 km from Chennai. The plant occupies an area of 101.7 acre with total built up area of 28.4 acre and proposed green area of 25 acre. Total number of employees equal 993 and number of contractors equal 398. Once the expansion of the plant is completed, the total production capacity will equal 322 TPD. OEM customers of the plant include – M&M, Renault Nissan, MSIL, GMI, Ashok Leyland, Daimler, Tata Motors & State Transportation.

The unit was rated GreenCo Gold in 2014.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE, INDIA
GreenCo
GOLD
2014

GreenCo Gold

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Case Study 35

Elimination of Poly film usage in Bead Apexing Process

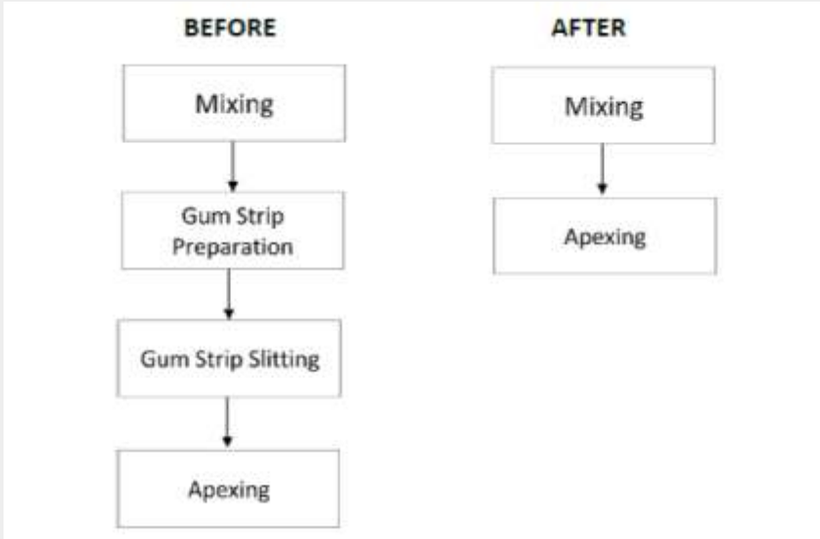
Project Background

JK Tyre has taken significant work in waste management activities. One of the projects describing here is the elimination of poly film usage in bead apexing Process.

Apexed bead is one among the eight components to build the tyre. Apexed Bead is the output of the bead spexing process. The input materials required to produce apex (part of apexed Bead) are hard apex, soft apex & gum strip.

Hard apex & soft apex will be extruded together from the extruder and gum strip will be received from previous process. Since gum strip is a rubber material and winded up in a roll, Separator (poly film) is required to prevent it from sticking with one other till it reaches the application area.

In order to eliminate the consumption of poly film, team brainstormed and suggested that an additional extruder can be commissioned in the machine for online application of gum strip. This idea was given as design requirement. As a result of implementing this, two process and the material movement time has been eliminated. The capacity on the feeding machines was improved since this production quantity was eliminated and also the setup change time was reduced.



Uniqueness of the Project

Green manufacturing process by eliminating the poly usage (plastic)

Replication Potential

Similar manufacturing process industries can adopt this idea to reduce the non value added activities.

Trigger of the Project

Commitment towards our mission statement on sustainable growth

Environmental Benefits

- Waste reduction (poly film) per annum : 3.6 MT
- Energy required for recycling the waste quantity (during transport and recycling) has been eliminated

Cost Economics

- Investment made : ₹ 3.5 Millions
- Annual savings achieved : ₹ 5.79 Millions
- Payback : 7.25 Months

Kirloskar Brothers Limited
Sanand Unit

Kirloskar Brothers Limited (KBL) is a world class electrical pump manufacturing company with expertise in engineering and manufacture of systems for fluid management. KBL provides complete fluid management solutions for large infrastructure projects in the areas of water supply, power plants, irrigation, oil & gas and marine & defense. KBL engineers and manufactures industrial, agriculture & domestic pumps, valves and hydro turbines.

All plants of KBL are ISO 9001, ISO 14001, & OHSAS 18001 management standards certified. The plants have also implemented Total Quality Management tools using the European Foundation for Quality Management (EFQM) model. KBL is the only pump manufacturing company in India and ninth in the world to be accredited with the N and NPT certification by American Society of Mechanical Engineers (ASME).

Kirloskar Brothers Limited, Sanand iunit ocated in Sanand of Ahmedabad district. The unit manufactures submersible pump sets and presently has a production capacity of about 55,000 pumps per annum on an average. Within a short span of operation, KBL Sanand has the distinction of achieving various certifications and awards.

The unit has been rated GreenCo Silver in 2014.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
Greenco
SILVER
2014

GreenCo Silver

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Case Study 36

Reduction in CO_2 emissions by localizing the Supply Chain

Project Background

In order to meet with the production demand and capacity enhancement material inventory has to be controlled. Therefore, KBL Sanand worked with their vendor base and brought them nearer to Ahmedabad so that material can be made available Just-In-Time.

KBL Sanand also worked on KANBAN implementation while working with their vendors

Date of commencement : April 2015
Date of completion : September 2015

Uniqueness of the Project

- Reduction in inventory targets to 3 days,
- Online material availability
- Materialized KANBAN system
- Modified machining systems - switched over from conventional machining lathe to special purpose machine with hi-tech PLC controls to reduce cycle time, improve quality & reduce rejection
- Precision machining dimensions of boring & threading pitch 1.25 mm/thread that drastically reduced rejection figure

Replication Potential

Replicable in any engineering industry

Trigger of the Project

With the demand and capacity enhancement material inventory had to be controlled. Therefore there was a need to bring vendors nearer

Environmental Benefits

- Annual raw material savings : 6000 MT
- Reduction in GHG emissions : 24.13 MT

Cost Economics

- Investment : NIL
- Annual Savings (Rs) : ₹ 3.42 Millions
- Payback : Immediate

Kirloskar Oil Engines Limited
Kagal

Kirloskar Oil Engines Limited incorporated in 1946 is the flagship company of the Kirloskar group. Kirloskar Oil Engines Ltd (KOEL) has a nation-wide network of operations that delivers high-quality products. KOEL has advanced manufacturing units in India at Pune, Nashik, Rajkot and Kolhapur.

KOEL specializes in the manufacture of both air-cooled and liquid-cooled diesel engines and generating sets across a wide range of power output from 5kVA to 3000kVA. Group also offers engines operating on alternative fuels such as bio-diesel, natural gas, biogas and straight vegetable oil (SVO). The "Kirloskar Green Genset" is the market leader and most preferred brand among customers in the power generation and telecom industry in India.

KOEL strongly driven by Vision and Values; recognizes responsibility towards the society. KOEL is committed to raising the quality of life and social well-being of communities and consistently contributing to the progress of community.

Kagal (Kolhapur) unit of Kirloskar group offers IC engines and Diesel Generator sets. Plant has established good systems which have been built upon their environmental management system and quality management system as a baseline and having comprehensive certification coverage including ISO 14001, ISO 9001 and ISO 18001. KOEL Kagal unit have taken several sustainability initiatives and won several awards and accolades.

The unit was rated GreenCo Gold in 2015

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GOLD
2015

GreenCo Gold

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Case Study 37

Reduction in raw material consumption through design modifications

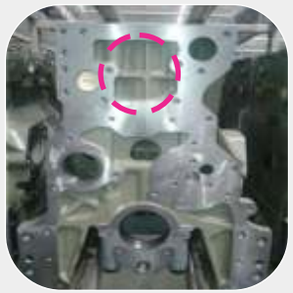
Project Background

Raw material consumption for manufacturing of engine parts is very high. In addition to this separate balance weight needs to be added with machining activities for crankshaft. Integral crankshaft can be developed so the external balance weights and machining activities can be eliminated.

Also due to increased production load frequent expansion is going on. During expansion of the plant, requirement of structural steel is very high which results into increased budget. Thus during brainstorming sessions, ideas and innovations are generated from employees to overcome above issues.

Date of commencement : September 2015

Before



After

Reduction of material weight through introduction of Crankcase Vave

Before

After

Introduction of Integral Crankshaft

Before

After

Reduction in structural steel consumption

Uniqueness of the Project

The initiative is carried out for the first time in the engine manufacturing industry.

Replication Potential

Similar initiatives can be carried out at other engineering industries. The structural load needs to be studied to ensure efficient application of the idea.

Trigger of the Project

An extra machining activity before testing of engine was time and material consuming and to avoid the same integral crankshaft and Vane crankcase is developed. Exhausted budget for new expansion was the trigger for reduction in structural steel.

Environmental Benefits

- Annual raw material savings : 4970 Tons
- Annual GHG emission reduction : 3174 tCO_2e

Cost Economics

- Savings per annum : ₹ 208 Millions

Reuse and recycle the wastages

Project Background

Engine oil and hydraulic oil are the backbones of engine manufacturing and testing industry. Thus, high consumption and contamination of the same is obvious. To avoid cost involved oils need to recycled and reused.

To transport and pack the manufactured material wood packaging was used. Being nature conscious industry alternative for the same like corrugated boxes, metal caging is identified.

Date of commencement : May 2015

Reuse of hydraulic oil

Reduction and substitution in consumption of packaging material

Replication Potential

Similar initiatives can be carried out at other engineering industries. A property of recycled oil needs to be checked before usage.

Trigger of the Project

High consumption of engine oil and hydraulic oil and associated increase in cost.

Environmental Benefits

- Average % of oil recycled : 93%
- Annual savings in wood consumption : 3749 Tons

Cost Economics

Savings per annum : ₹ 92.1 Million

Lucas TVS Limited
Padi

Lucas TVS was established in 1962 as a Joint Venture between Lucas Plc. UK and TVS Group, India. Lucas started operations in India from 1930 as Lucas Indian Service for providing warranty and aftersales service to many of the imported vehicles which carried Lucas parts. Initially with starters, dynamos and distributor products, Lucas TVS, over the years, commenced providing complete system solutions in auto electricals, specialized motors for air compressors, stop - start systems, engine cooling modules, ignition products, diesel fuel injection systems, etc.

Lucas TVS is one of the few companies in the World to be awarded the Deming Application Prize and the Deming Grand Prize and setting benchmarks in the industry. Lucas TVS is currently supplying to over 90% of automotive manufacturers in India and is also exporting to North America and Europe. Lucas TVS products find applications in two/three wheelers, passenger cars, commercial vehicles, tractors & stationery engines.

The Padi unit established in 1963, manufactures starter motors, alternators, wiper motors and compressor motors. JUSE's Deming Grand Prize and Deming Application Prize winner, also has the certifications, namely, TS 16949, ISO 14001, BS OHSAS 18001 and ISO 50001 in place. The unit is equipped with a well-established research and development wing with individual centers for engineering and advanced engineering. Quality has been a key focus area of Lucas TVS and facilities for a combined bi-axial vibration test, engines and simulator test rigs for starter reliability, blower motor endurance test rigs, Daimler engine endurance test, cold room testing, etc. have helped Lucas TVS ensure the quality of its products. With established systems and good performance over the years, the unit was rated GreenCo Gold in May 2016.

Lucas-TVS Limited

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
GOLD
2016

GreenCo Gold

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Case Study 39

Copper Conservation in Alternator-Stator Winding Process

Project Background

Stator plays a major role in the alternator by converting the mechanical energy into electrical energy. The manufacturing process of stator comprises of the following steps - stamping, curling, riveting, coining, insul insertion, painting, winding, winding cum peg insertion, binding, varnishing, ID cleaning, OD turning and performance testing.
The objective of the initiative was to reduce the copper consumption by minimizing waste generation through elimination of loose winding occurring during stator manufacturing process.

Problem
Out of the six winding machines in the stator line, the copper waste generation in IZ 0085 winding machine was the highest, approximately 2.5 Kg/machine, which interrupts the automatic cycle of the stator winding process.

Root cause
It was observed that the machine cycle stops after the winding cycle, before the former sequence in the machine. On analysis, it was found that the pusher cable cum cylinder pulls the former cylinder from its home position. However, the actual process of the machine is that after the pusher cylinder reaches its forward position, the former cylinder should be operated. But, due to the pusher cable load, the former cylinder position was disturbed during auto cycle. As a result, the star formation of the winding was altered leading to significant copper scrap generation.

Solution
A shuttle valve was introduced on the inlet of the former cylinder with an air pressure of 0.5 to 1 bar. With the pneumatic circuit modification, a set sequence was established for the pusher and former cylinder operation, thereby reducing the copper wastage by 2.5 kgs/day.

Date of Commencement of the project : August 2015

Date of Completion of the project : September 2015

Uniqueness of the Project

The initiative is carried out for the first time in winding machines in Lucas TVS.

Replication Potential

The project is replicable across the sector. The concept is introduced in similar machines in Lucas TVS.

Trigger of the Project

The copper waste generation in the winding machine is approximately 2.5 kg/machine which also interrupts the automatic cycle of the stator winding process.

Environmental Benefits

- Energy savings : 34 units / kg of copper production
- Reduction in GHG emission : 44.6 kgCO_2e per day
- Reduction in water consumption : 1,100 litres per day

Cost Economics

- Investment made : ₹ 3,000/-
- Annual savings achieved : ₹ 0.38 Millions
- Payback : Less than two days

Utilization of Renewable Energy

Project Background

Lucas TVS is motivated to use renewable sources of energy to meet its power requirement which is clearly evident in their corporate objectives that states to utilize renewable energy. With a current renewable energy substitution of 77%, Lucas TVS Padi unit has a target of 10% increase in renewable energy in the year 2016-17. While, out of the 77%, off site renewable energy substitution is 71% and the remaining 6% is met through the onsite rooftop solar PV plant. Lucas TVS Padi unit has installed a 1.2 MW Solar PV plant on its rooftop that generates about 5000 units of electricity per day, which substitutes about 6% of the overall electrical energy requirement of the unit.

Date of commencement of the project : January 2016

Date of completion of the project : March 2016

Uniqueness of the Project

The 1.2 MW rooftop solar PV plant on metallic roof is one of the first large capacity rooftop plants in Chennai. The rooftop plant helps in 1 C temperature reduction within shop floor. The rooftop solar PV plant helps Lucas TVS Padi unit meet the Renewable Purchase Obligation (RPO) requirements as posed by the Government of Tamil Nadu.

Replication Potential

The concept is simple and can be easily replicated in all industries.

Trigger of the Project

Corporate objectives of utilization of renewable energy and reducing GHG emissions was the trigger behind the project.

Environmental Benefits

- No. of units generated per day : 5000 units
- Reduction in GHG emission : 3148 $KgCO_2e$ / day

Cost Economics

- Investment made : Zero investment; installed on the BOOT concept
- Annual savings achieved : ₹22.5 Lakhs
- Payback : Immediate

Cycle Time Reduction in Switch Body Manufacturing Process at Supplier End

Project Background

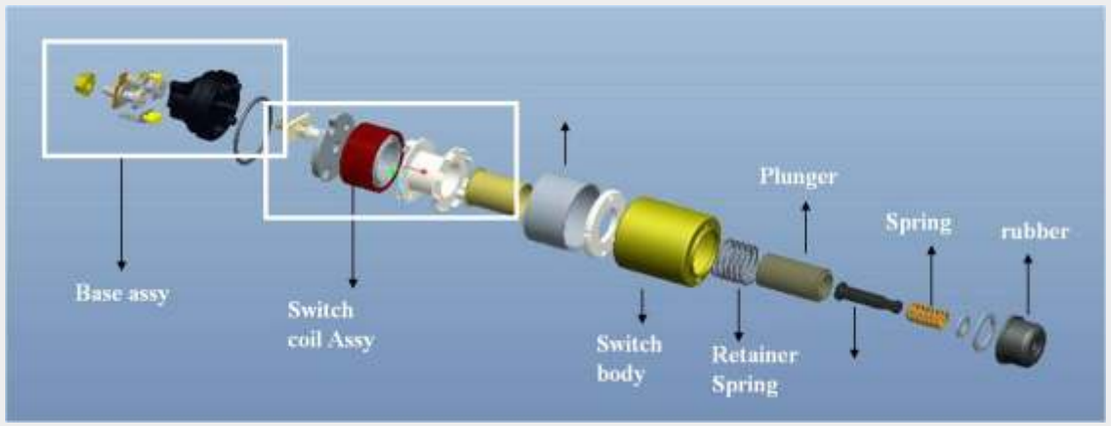
Gear reduction starter is a high volume and a new generation product. The switch body is the child component of the gear reduction starter. It plays an important role of facilitating housing of critical switch component such as winding assembly and also supports subsequent main switch assembly to ensure adherence of electrical parameter.

Switch body was manufactured by the cold forging process followed by the phosphating and heat treatment stages. The switch body also required more thickness in machining, since the used wall thickness has to be maintained at 4.5 mm instead of 2.5 mm (drawing requirement) to avoid forging defects. Hence an alternate process to eliminate hazardous process and material wastage had to be identified.

After series of trials and studies, the deep drawing process was identified to be an effective process. However, the challenge remained in producing smaller parts with higher thickness. The projected was implemented with minor changes in drawing.

Date of Commencement : June 2014

Date of Completion : August 2014



Uniqueness of the Project

The project apart from reduction in cycle time has also eliminated the hazardous phosphating and heat treatment stages in switch body manufacturing process.

Replication Potential

The initiative is easily replicable in all other starter switch bodies.

Trigger of the Project

The high volumes of switch body requirement and intent to eliminate hazardous processes were triggers of the project.

Environmental Benefits

- Monthly energy savings : 25,000 units
- Reduction in GHG emissions : 13,225 $KgCO_2e$
- Elimination of hazardous process such as phosphating, heat treatment and shot blasting

Cost Economics

- Investment made : ₹ 50,000/-
- Annual savings achieved : ₹3.7 Millions
- Payback : Five days

Nippon Paint India Private Limited
Chennai

Nippon Paint, headquartered in Japan, has over 136 years of experience in the paint industry. Over years, Nippon Paint has grown to be the number one paint manufacturer in Asia and among the leading paint manufacturers of the world. Nippon produces high-quality paints and coats for automotive, industrial and decorative sectors. Over the years, Nippon Paint has perfected its products by means of breakthrough paint technology, with an emphasis on innovation and eco-friendliness. After over ten years in the Indian market, Nippon Paint is steadily becoming a household name. Apart from a range of interior, exterior and enamel finishes, Nippon has many specialty products that showcase its technological prowess.

The Nippon Paint factory located at Sriperumbudur near Chennai caters to the decorative segment of Nippon Paint in India. Spanning across an area of 11.37 acres of land, the plant is Nippon's first greenfield project in India. Nippon Paint, Chennai manufactures both water based paints and solvent based paints, with the water based paints taking nearly 85% of the product mix.

Nippon's Lean for Growth (LFG) principle emphasizes the concepts of LEAN, sustainable growth and delivery of margin. It encompasses three other main concepts followed by Nippon which are 'Total Quality Management' which is to do it right the first time, 'Strong Manufacturing Program' which is a key enabler to deliver consistent and quality products and 'Productivity and Efficiency Reporting Tool' which is productivity and efficiency data tools. Nippon Paint, Chennai has incorporated GreenCo in its LFG principle thereby imbibing concepts of GreenCo in its day-to-day operations. The unit was rated GreenCo Gold in April 2016. Nippon Paint, Chennai has the distinction of being the first paint manufacturing company in India to be GreenCo Rated and multiple products being GreenPro certified.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GOLD
2016

GreenCo Gold

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Nippon Aqua Enamel

Project Background

Consumption of water based products in today's market, especially in household segment has increased drastically up to 80%. When working in confined or poorly ventilated spaces, the evaporation of solvents can be uncomfortable for workers or even flat out hazardous to their health. For this reason, many projects have started demanding for low or no volatile organic compounds (VOC) products. Hence it was important to meet customer requirements by offering water based products with performance closely matching that of solvent based products. This would help in achieving low VOC content and reduce carbon footprint. Nippon's Aqua Enamel was launched to meet industrial requirement through water based paints providing performance of solvent based paints.

Date of commencement	:	January 2014
Date of completion	:	April 2016

Uniqueness of the Project

Nippon aqua enamel is completely a water based system of low VOC content and will deliver the same output as that of a solvent based alkyd enamel. Nippon aqua enamel can be applied even on metal, wood and concrete system. The product has been accepted and approved by Godrej and Boyce Mfg. Co. Ltd. and many other companies are looking to use this product.

Replication Potential

The product and its characteristic is replicable by any paint industry.

Trigger of the Project

Nippon Paint India Private Limited, Chennai, being a GreenCo Gold rated and GreenPro certified company, considers it their responsibility to initiate new products with reduced VOC content and carbon footprint thereby making it eco-friendly. Use of low VOC paints should be extended to industrial use in addition to decorative segment.

Environmental Benefits

Reduced risk of health hazards – Exposure to solvents and other organic liquids is one of the most common chemical health risk at work places. Generally, organic solvents are combustible, often highly volatile and extremely flammable. Some solvents produce vapours that is heavier than air which may move on the floor or ground. A distant ignition source, such as a spark from welding or caused by static electricity is a prevalent hazard. Water based products eliminates such risks.

Energy conservation – The raw material used for making resins is often natural oils and additives, resins needs to be synthesized and cooked at 170 - 230 degree centigrade for several hours. The process, in addition to being a time-consuming one, requires huge amount of electrical energy. In contrast, water based emulsion used for making water based paints are made at a much lower temperature in a short duration, thereby conserving natural sources and reducing carbon footprint.

Nippon aqua enamel is a low VOC, heavy metal free, eco-friendly, high durability product. Its improved durability can also delay the painting cycle time.

Cost Economics

Investment made: The product was a result of the Research and Development (R&D) efforts of Nippon India.

Sundram Fasteners Limited
Krishnapuram

Sundram Fasteners Limited (SFL) is one of India's largest and most diversified Auto Components Company. SFL manufactures and supplies a wide range of auto / industrial components such as fasteners, radiator caps, extruded parts, gear shifters and engine parts.

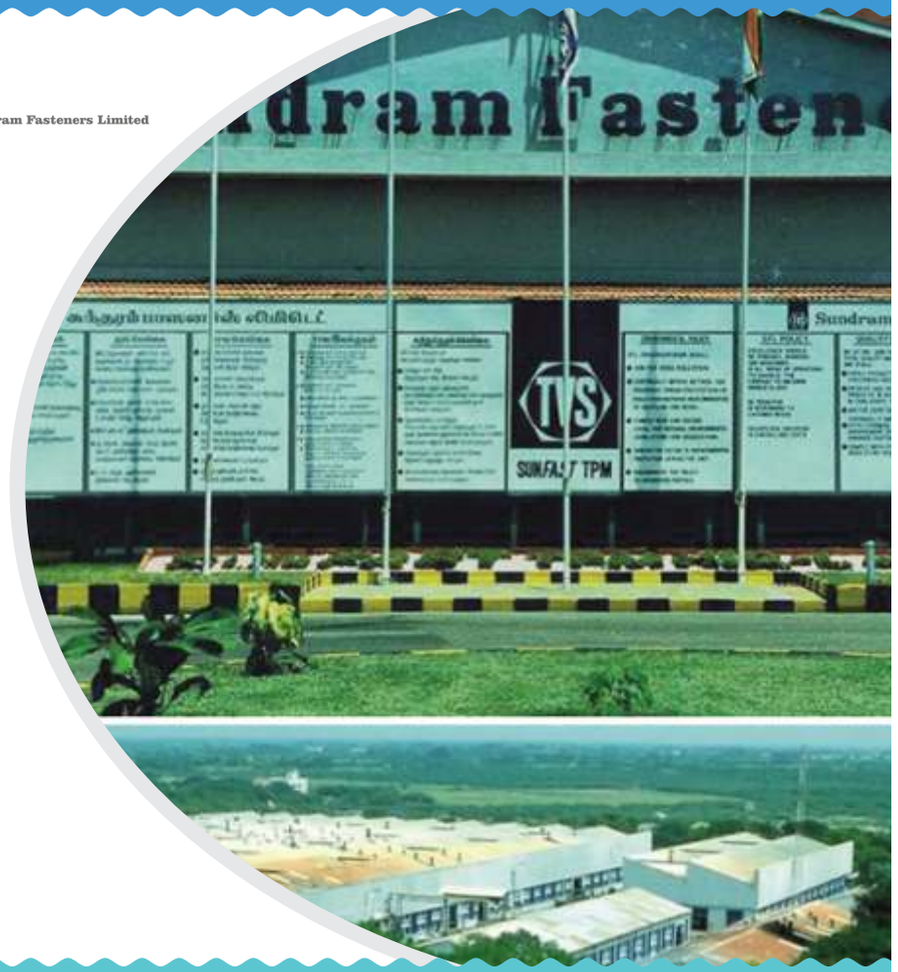
Sundram Fasteners Limited, Krishnapuram manufactures wide variety of products mainly high tensile fasteners like bolts, nuts, studs, screws and powder metallurgy parts.

The company's quality systems have been accredited with ISO: 9000 - 2001, QS-9000, ISOTS- 16949 and ISO-14001. SFL also holds first to set up reverse Osmosis plant in South India (1998) and it has eventually evolved itself into a zero discharge plant through its journey.

SFL is one of the signatory of CII Mission on Sustainable Growth under which SFL took voluntary commitments on reduction of energy, water consumption, increasing use of renewable energy, reduce consumption of natural resources.

Sundram Fasteners Limited, Krishnapuram has also achieved the distinction of becoming the first unit in the Auto Component manufacturing category to be rated GreenCo Gold.

Sundram Fasteners Limited



GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
GOLD
2014

GreenCo Gold

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Case Study 43

Electro Coagulation treatment of Chrome Waste Water in Effluent Treatment Plant

Project Background

Sundram Fasteners Limited, Krishnapuram metal finishing operations effluent has 3 different types of streams viz., Iron stream, hexavalent chrome stream and zinc stream. Conventional process of treating these streams is through chemical coagulation i.e heavy metals are precipitated to their hydroxides by raising the pH of the effluent from acidic to alkaline pH (9-10). The metal hydroxides settles and the clear effluent is adjusted to a pH of 7.0 by adding acid then total dissolved solids are removed in RO plant. During this process, there is a lot of chemical addition needed and also high volumes of sludge are generated.

The situation is more in a hexavalent stream since first pH is reduced by adding acid, followed by a reducing agent (typically sodium bi sulphite) to reduce hexavalent chrome to trivalent chrome. The pH of trivalent chrome effluent is then raised to a pH of 9.0 to aid precipitation of chrome to its hydroxide. The precipitated sludge is removed and the pH of clear effluent is reduced to 7.0 for further treatment. Thus the process involves use of acid at 2 stages, addition of a reducing agent, and soda lye or lime for precipitation of chrome to its hydroxide. This results in excessive use of chemicals and excessive sludge generation.

Electro coagulation process involves reduction of chrome to its trivalent state and also precipitates the chrome by electrolytic treatment of the effluent in electrochemical cell having iron as electrode. The iron reduces hexavalent chrome to trivalent and the water molecule in effluent breaks as H+ and OH- ions. These OH- ions combine with the Cr3+ ions and form chromium hydroxide. Thus the process involves negligible chemical addition. Chemical load is greatly reduced and as there are no chemicals involved and the sludge generated is also reduced to a greater extent.

Date of commencement	:	August 2013
Date of completion	:	December 2013

Uniqueness of the Project

Ease of change over from conventional method to new method and substantial reduction in chrome sludge generated

Replication Potential

Based on the nature of the effluent stream with metallic contents, pilot trials can be taken at plant and the project can be replicated. The project has high potential of replication in a similar industry.

Trigger of the Project

Elimination of chemical usage for effluent treatment and reduction in the sludge generation was the main trigger for the project. Savings were expected in Cost of chemical treatment and sludge disposal.

Environmental Benefits

- Elimination of HCL acid use
- Reduction in consumption of Soda lye : 60%
- Total reduction in use of chemicals : 80%
- Reduction in chrome sludge generation : >50%

Cost Economics

- Investment : ₹ 3 Millions
- Annual savings : ₹ 1.8 Millions
- Payback period : 1.7 years

Shree Cement Limited
Beawar

SCL is one of the leading Indian cement companies and has made a remarkable presence in the cement industry of India through its sustainable growth philosophies. Approach for transforming risk into opportunities has bestowed it with many low hanging fruits. With a cement production capacity of 25.6 million tonnes per annum, it has become the third largest cement company of India.

It has manufacturing facilities spread over North and East India, in the states of Rajasthan, Uttarakhand, Bihar, Chhattisgarh, Haryana and Uttar Pradesh. It sells its product under highly recognized brands of Shree Jung Rodhak, Bangur Cement and Rockstrong.

SCL has its presence in the power sector with a power generation capacity of 612 MW. It is accredited with 111 MW WHR power plant, which is the largest in the world after China. It has established WHR based power plants at its Beawar, Ras & Raipur locations. Despite high installation costs of WHR installation, SCL has committed to establish WHR based power plants in all of its future projects.

Sustainable development is one of the fundamental pillars of SCL's philosophy. SCL embodies sustainability since its inception. It is an ISO 9001, ISO 14001, OHSAS 18001, Energy management 50001 and SA 8000 certified company and pursues best practices in Manufacturing, Energy Conservation and Environment Management.

The unit was rated GreenCo Gold in 2014

SHREE CEMENT LIMITED

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
GOLD
2014

GreenCo Gold

Contact Person
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Efficiency Enhancement of Waste Heat Recovery (WHR)

Project Background

The basic idea of the WHR based power plants is to capture the heat which is being released into the environment as waste and generate power. SCL has made a commitment to incorporate WHR based power plants in all of its upcoming projects. WHR comes with many low hanging fruits. It has also supplemented the efforts towards combating climate change and the eventual goal of sustainable development.

Concept of WHR Power Plant

In cement manufacturing, pyro-processing / clinkerization is one of the most energy intensive processes. Clinkerization process takes place at a temperature of about 14,000-14,500C. The overall efficiency of the process is about 55 % and the remaining energy i.e. about 45% is released as flue gases into the environment. These hot exit gases are released into atmosphere from two ends - one from the Pre-Heater (PH) and another at Air Quenched Coolers (AQC).These hot gases are trapped and the thermal energy which they contain is used to generate power. The thermal energy of these gases is used to operate the turbine which ultimately results in power generation. The project activity involves implementation of new and innovative technology of recovering waste heat from the exit gases of the six- stage pre-heater and clinker cooler.

Before

After

Date of completion : March, 2014

Uniqueness of the Project

It is common to see waste heat recovery system in 4 or 5 stage pre-heater cement manufacturing set up which offers high temperature range (400 - 450 Degree C) of exit gases. SCL took an initiative to install this system on 6 stage pre-heater set up where the exit gas temperature is approximately 200 – 300 Degree Celsius. Rigorous optimization of the waste heat recovery system in 6 stage pre-heater set up resulted similar benefits to those in 4 stage pre-heaters, which was innovative.

Replication Potential

According to a report released by Institute for Industrial Productivity & International Finance Corporation, there is potential of 500MW to 900 MW WHR based power generation for the Indian cement industry. Since WHR is all about the process optimization, there lies a huge potential for WHR based power plants. WHR viability will vary in each specific cement plant.

Trigger of the Project

SCL has been proactive in adopting strategies for combating climate change and works under the maxim of "clean and green is profitable". SCL considers global warming to be a priority management issue and implement measures to reduce CO_2 emissions. Therefore SCL committed installation of WHR based power plants with an objective to green its power generation.

Environmental Benefits

- Reduction in GHG emission : 504376 MT
- Annual water savings : 6527 kL
- Reduction in coal consumption : 26290 MT
- Reduction in SOx emissions : 154040 Kg
- Reduction in NOx emissions : 49079 Kg

Cost Economics

Investment made : ₹100 Millions

Tamil Nadu Newsprint and Papers Limited
Kagithapuram

Tamil Nadu Newsprint and Papers Limited (TNPL) was promoted by the Government of Tamil Nadu in the year 1979 to produce Newsprint and Printing & Writing Papers (PWP) using bagasse as the primary raw material. TNPL produces 4 lakh tonnes of uncoated Printing & Writing Paper per annu m, approximately 10% of the total production of Printing and Writing Papers (PWP) in the country. TNPL is the largest producer of paper from bagasse and uses about 1 million tonnes of depithed bagasse for producing the Printing & Writing Paper.

TNPL's own farm forestry and captive plantation programs are covered by FSC which guarantees that the wood used for the production of paper come from the plantations which are managed in a socially and environmentally responsible way. TNPL has installed and commissioned a state of-the-art de-inking plant of capacity to produce pulp from wastepaper. The mill has implemented various water conservation projects and has reduced water consumption to 42 kL/ ton of paper which is one of the lowest in paper industry. TNPL stepped into an innovative way of making cement from inorganic solid waste generated from chemical recovery cycle and fly ash from power boilers.

Towards greening the surrounding areas, the company has planted about 12500 trees in and around the mill. TNPL has established a unique world class state of art Clonal Propagation and Research Centre (CPRC) to produce clonal plants with minimum area for mother plants (Clonal Mini gardens) without any rooting hormones.

Tamil Nadu Newsprint & Papers Limited, Kagithapuram has attained the distinction of being 1st Agro based Paper Manufacturing Company in India" to receive the prestigious GreenCo Rating.

The unit was rated GreenCo Gold in 2015.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GOLD
2015

GreenCo Gold

Contact Person
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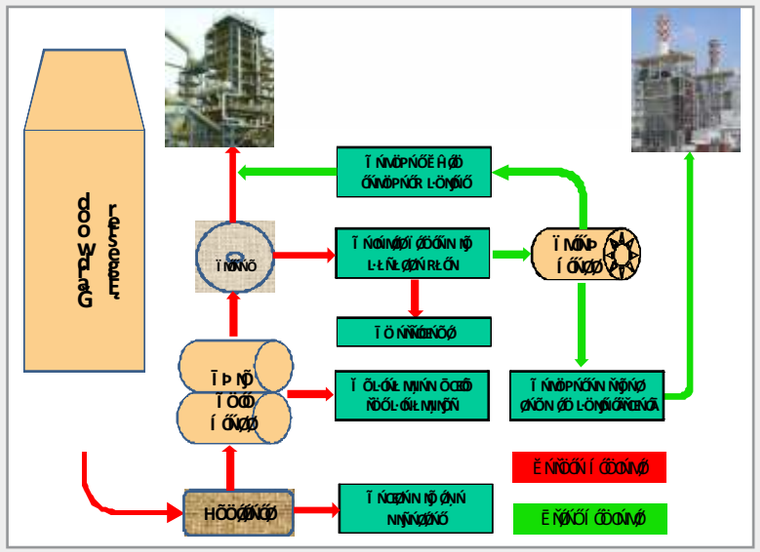
Reduction in Black liquor content in Hardwood Fine rejects and utilizing it as a fuel in Power Boilers

Project Background

Wood chips are used as raw material to produce paper pulp. Wood chips are cooked in the digester to remove lignin and extractive to make unbleached pulp. After bleaching the pulp along with other additives and fillers, paper is manufactured. The separated lignin and extractive, along with cooking chemical, are fired in the power boiler to recover chemicals and to produce energy. The rejects from the unbleached pulp contains high level of black liquor (sodium and sulphate). Disposal, handling and management of this waste was a major issue faced by the mill.

TNPL conceived the idea of installing screw press to remove the black liquor (sodium and sulphate) from the rejects. After washing, the black liquor filtrate is collected and sent back to soda recovery plant for steam generation and chemical recovery. The washed fine rejects are used as a fuel in boiler.



Date of completion : November 2013

Uniqueness of the Project

The project is designed and implemented internally to reduce the pollution load and to generate energy and conserve resources.

Replication Potential

The project can be replicated in all the wood based integrated pulp and Paper Industry

Trigger of the Project

Reduction of and effective management and disposal solid waste (Hard wood rejects with black liquor content) under the concept of waste to energy is the major thrust in initiating this project

Environmental Benefits

- Utilization of fine rejects in the boiler as a fuel-1116 Metric Tonnes /yr
- Annual thermal energy savings : 7704 GJ /yr
- Alkali reused : 82814 Kg / yr
- Annual savings in Black liquor : 9900m^3 / yr
- Annual GHG emission reduction : 1619 tCO_2/ yr

Cost Economics

- Investment made : ₹ 1.5 Millions
- Annual savings : ₹ 5.65 Millions
- Payback : 3 months

Conservation of Natural Resource through improvement in First pass ash retention

Project Background

Resource conservation or resource efficiency in the manufacturing sector is essential to ensure sustainable operation and to reduce environmental footprint. Producing more with less material by increasing resource efficiency, meets human needs while respecting the ecological carrying capacity of the earth. Resource conservation and efficiency generate fewer wastes and more products or by-products ensure the waste elimination gives environmental and economic benefits to manufactures.

To minimize the impact on the environment and conserve the natural resources, the mill has made efforts to conserve fiber & filler resources by improving first pass ash retention in the paper machine. The data on improvement in fist pass retention are presented in the table below.

Particulars	Unit	2011-12	2012-13	2013-14	2014-15
Basis weight	GSM	63.6	64.8	64.6	65.0
Machine Speed	Mt/min	818.6	840.2	837.2	818.4
Moisture	%	5.9	5.8	6.0	6.0
Ash content	%	13.5	14.6	15.2	17.5
First Pass Retention	%	74	74.3	76.2	76.7
First Pass Ash Retention	%	37.7	39.4	43.9	47.7
Fibre loss	%	1.39	1.38	1.27	1.17

Date of completion : April 2012

Uniqueness of the Project

Conservation of filler as well fiber is the unique nature of this project and will help sustainable operations.

Replication Potential

The project can be implemented in all kinds of paper industry and beneficial to all.

Trigger of the Project

Conservation of natural fiber and filler resources by reducing waste and by enhanced resource efficiency are the major thrust/reason behind initiating the project

Environmental Benefits

- Reduction in consumption of bagasse and wood
- Reduction in use of fillers : 5968 MT in 2014

Cost Economics

- Investment made : Nil
- Annual savings : ₹ 52.3 Millions

Lime Sludge and Fly Ash Management system LSFM, Waste to Wealth

Project Background

TNPL conceived the idea of converting the first stage lime sludge and fly ash into high grade cement and installed 600 TPD mini cement manufacturing plant. The commercial production of the project was started during Jan 2013 and first of its kind in the world of pulp and paper industry. This project is a beacon for other mills, in the direction of converting waste into wealth besides addressing the concerns being faced in the disposal of solid wastes.

- Reduction of inorganic waste quantity and disposal,
- Conservation of natural resources thereby avoiding the depletion of natural resources.

The lime sludge generated from the first stage caustisizing of pulping chemical recovery cycle and the fly ash generated from the power boilers are major issues of concern in inorganic solid waste management and disposal in the agro-based pulp and paper industry. Conversion of this waste into useful products will have duel benefit

Date of completion : March 2016

Uniqueness of the Project

Various raw materials, such as, agro, wood and waste paper is being used to manufacture paper. Among all the raw materials, agro based raw material contains relatively high silica content when compared to wood and wastepaper. Silica being one of the major non process element in the pulping and chemical recovery cycle create various issues, such as, high viscosity, corrosion, low energy generation, evaporator & boiler tube plugging and scaling in the chemical recovery process. Hence, two stage caustizing processes is necessary to purge part of silica entering the chemical recovery cycle from the agro based raw materials like bagasse to avoid silica build-up in the system. In the two stage caustisizing process, about 30% of the lime is used in the first stage and generated lime sludge which is purged as inorganic solid waste. Disposal and management of this inorganic solid waste is major issue for the integrated agro based pulp and paper mill. Remaining 70% lime is used in the second stage and generated second stage lime sludge is recycled back to system through lime kiln. However, in the wood based mill there is no purging required and only single stage caustisizing is followed and entire lime sludge is reused.

Replication Potential

All the agro based integrated pulp and paper industry will have similar issue of silica build-up in the chemical recovery cycle and generation of inorganic solid waste from the first stage. To avoid silica built-up and solid waste issue and to utilize the fly ash they can adopt this innovative approach.

Trigger of the Project

Environmentally and economically effective disposal and management of lime sludge and fly ash is the major motive behind initiating this project

Environmental Benefits

S.No.	Parameter	Unit	Value
1	Cement Production	MT	196572
2	Solid waste elimination due to reuse of Lime sludge	MT	78570
3	Solid waste elimination due to reuse of flyash	MT	45074
4	Conserved Lime Stone	MT	50704
5	GHG emission reduction due to lime stone conservation	MT	22310
6	GHG emission reduction due to logistic reduction of lime sludge	t CO_2 e	589
7	GHG emission reduction due to logistic reduction of fly ash	t CO_2 e	121
8	Reduction fuel saving due to logistics reduction	KL	236.8
9	**Total GHG emission reduction due to LSFM**	**t CO_2 e**	**23020***

Cost Economics

- Investment made : ₹ 1660 Millions
- Annual savings : ₹ 400 Millions
- Payback : 4 years

Tata Motors Limited
Jamshedpur

Tata Motors Limited is India's largest automobile company and leader in commercial vehicles. It is also the world's fourth largest truck and second largest bus manufacturer.

The Jamshedpur facility, Tata Motors' first, was established in 1945 to manufacture steam locomotives. It led the company's foray into commercial vehicles in 1954. It has been modernized through the decades, with a particularly intense scale in the last 10 years and has led the company's evolution into a manufacturer of global repute.

This world-class facility in Jamshedpur is equipped with:

- State-of-the-art technology, equipment and facilities that produce a truck every 5 minutes
- World class assembly lines for assembly of over 200 models, ranging from multi-axle trucks, tractor-trailers, tippers, mixers and special application vehicles, catering to civilian and defense requirements.
- Vehicle assembly line supported by the frame factory which has a world class press shop & CED facility for painting the long members, which are then assembled as frames for the entire range of models
- World class engine assembly shop, completely equipped for manufacturing naturally aspirated and turbo charged engines confirming to latest emission & efficiency standards etc.

The Plant manufacturing operations are supported by other functions such as Planning, Quality Assurance, Materials & ADD, Capital Equipment Manufacturing, Utility Services, Finance, Human Resources, Personnel & IR, Legal, Safety, Medical Services, and Administration.

The unit was rated GreenCo Gold in 2015.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GOLD
2015

GreenCo Gold

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Utilization of Hazardous Incineration Ash for manufacturing of Non-Hazardous Pavement Blocks

Project Background

Various processes of vehicle manufacturing generates different types of hazardous and non-hazardous waste. As part of conventional waste treatment process, TML Jamshedpur used to incinerate hazardous wastes through captive incinerator (250kg/hr). The residual ash was stored in the captive ash pond due to non availability of secured landfill in Jharkhand.

The environment team of TML, Jamshedpur conducted a comprehensive study of industrial incinerator with ash collection system and was studied that accumulation of non-hazardous ash in the ash pond can be mitigated by two eco-friendly methods i.e. manufacturing of paver blocks or co processing.

Over a period of time, paver blocks have evolved as a significant method for converting hazardous incineration ash to non-hazardous element. TML Jamshedpur converts the hazardous incineration ash to non- hazardous paver blocks and has been manufacturing more than one lakhs paver blocks every year. The paver blocks are used in construction of footpaths and pathways.

Date of commencement : 2014.

Uniqueness of the Project

Treatment of hazardous incineration ash by manufacturing of paver blocks is first of its kind project in Jharkhand and has high replication potential in the sectors.

Replication Potential

Conversion of hazardous incineration ash to nonhazardous paver blocks can be replicated in automobile or other sectors.

Trigger of the Project

- Adherence to guiding principles of environmental policy – Minimizing waste generation, maximizing resource efficiency, recycling of materials, improving greenery and developing eco- friendly waste disposal practices etc.
- Unavailability of secured landfill for hazardous waste disposal

Environmental Benefits

- Annual reduction in GHG emission : 200 tCO_2e per year
- Direct material cost saving : 40%

Cost Economics

- Investment : NIL
- Annual Savings : ₹ 2.5 Millions

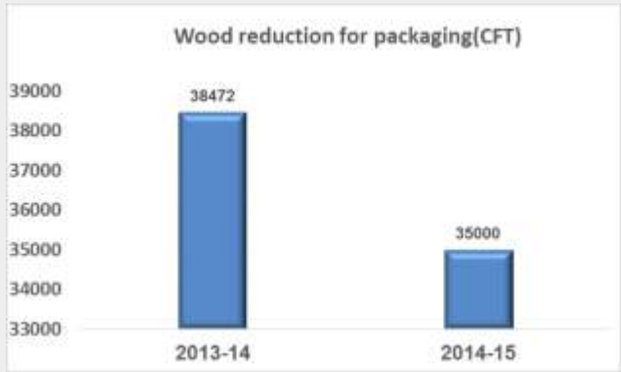
Utilization of reusable metallic pallets for packaging vehicle aggregates

Project Background

With continuous development in customers' requirements in commercial vehicle segment, TML has increased its vendor base beyond the boundaries of Jamshedpur. Previously, the large vendor base managed by TML, use to send the vehicle components and aggregates in wooden packaging or boxes from their respective manufacturing plants to TML Jamshedpur.

With constant focus on environmental sustainability, the Supply Chain Management & Environment team of TML-JSR has conducted sessions at vendor's end on removing reducing wood packaging from logistics movement and to find an eco-friendly alternative.

Based on the findings and consensus from the supply chain partners, it was established that, re-usable Metallic Pallets will be used in majority as an alternative packaging material in place of wood.



Uniqueness of the Project

Utilization of re-usable metallic pallets is a unique concept, because of its various challenges.
The implementation phase needs increased awareness among vendors and supporting them to execute the project. It was also important to maintain the product quality with re-useable metallic pallets.

Replication Potential

Replicable in all engineering and automobile industry

Trigger of the Project

- Adherence to guiding principles of TML Environment Procurement Policy: "Mitigate impact of logistics and packaging in supply chain"

Environmental Benefits

- Fuel (Diesel) Saving : 6500 Litres
- Reduction in GHG emission : 17 tCO_2

Cost Economics

- Investment : ₹ 0.7 Millions
- Annual Savings : ₹ 0.4 Millions
- Payback period : 2 years (approx.)

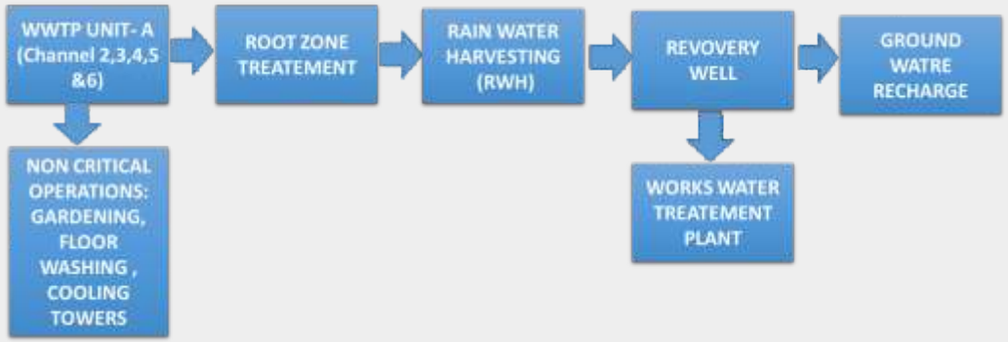
Achievement of Zero Liquid Discharge by Waste Water Treatment, Root-Zone Treatment and Rain Water Harvesting

Project Background

TML, JSR used to discharge treated effluent / sewage (effluent quality within the CPCB permissible limit) out of the TML boundary wall, through the storm water drain.

At present, outflow waste water from five outlet drains has been diverted near rain water harvesting, where it is treated & polished for use in non-critical operations and ground water recharge.

Potable water quality achieved through natural treatment process i.e. Root zone Treatment using Vetiver grass roots meets IS 10500: 2012 (Drinking water quality standards) and is being diverted to RWH pond.



Uniqueness of the Project

Proactive initiatives towards achieving Zero Liquid Discharge (ZLD) to maximize the recycle, reuse, recharge of natural resource to attain environmental & social sustainability.

Replication Potential

Replicable across all manufacturing as well as service sector industries

Trigger of the Project

- TML, JSR solely depends on river source - not a sustainable solution
- Fast urbanization of Jamshedpur and surrounding areas increases the demand of water
- Developing a domestic source of water has become an imperative necessity for TML

Environmental Benefits

- Reduction in water consumption : 57%
- Reduction in usage of fresh water : 20.69 lakh m^3

Cost Economics

- Investment : ₹ 1.50 Millions
- Annual Savings : ₹ 2.1 Millions

Tata Motors Limited
Pantnagar

Tata Motors Limited is India's largest automobile company. It is the leader in commercial vehicles in each segment, and among the top in passenger vehicles with winning products in the compact, midsize car and utility vehicle segments. Tata Motors Ltd. has been the pioneer in launching new products in the Indian as well as the International market.

Tata Motors Ltd. is equally focused on environment friendly technologies in emissions and alternative fuels. It has developed electric and hybrid vehicles both for personal and public transportation. It has also been implementing several environment-friendly technologies in manufacturing processes, significantly enhancing resource conservation. The goal of environment protection is achieved through tree plantation, conserving water and creating new water bodies and last but not the least, by introducing appropriate technologies in vehicles and operations for constantly enhancing environment care.

Tata Motors Ltd., Pantnagar has an annual production of 166,461 eq. vehicle. It has won several prestigious awards such as Srishti's Awards for Good Green Governance, Uttarakhand Energy Conservation Award, INSSAN National Creativity Award and many more.

The unit was awarded GreenCo Gold in 2015.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GreenCo
GOLD
2015

GreenCo Gold

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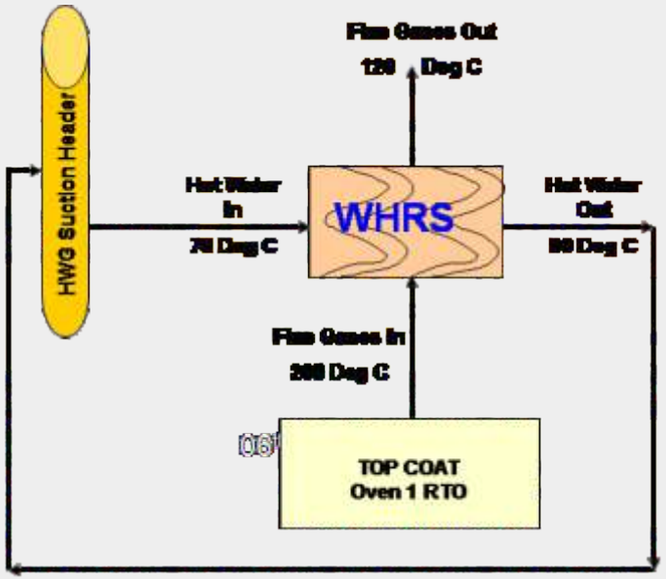
Waste Heat Recovery System (WHRS) for top coat oven 1 RTO – Paint Shop

Project Background

Regenerative Thermal Oxidizer (RTO) are typically used in paint shop to destroy Hazardous Air Pollutants (HAPs) and Volatile Organic Compounds (VOCs) from paint shop oven exhaust. The temperature inside RTO is maintained in the range of 800-850 Deg. Celsius. The flue gas temperature at the exhaust of RTO unit is 200-225 Deg. Celsius.

The temperature of exhaust flue gases from top coat oven-1 RTO is approx 200 Deg Celsius and mass flow rate of 14000 Kg/Hr, which carry considerable amount of heat (6 Lacs Kcal/Hr. approx), and rejected in to atmosphere. There is a possibility of recovering a significant amount of this heat (up to 2.85 Lacs Kcal /Hr) which can be pumped to raise the temperature of inlet water of hot water generator system in paint shop.

Waste Heat Recovery System (WHRS) of capacity 2.85 Lacs KCal/Hr, was installed at the outlet of RTO unit of top coat oven-1 for energy recovery and re-use from waste flue gases of RTO Unit which is pumped back to pre-heat the inlet water of hot water generator system in paint shop, thus reducing the heat load on it and resulting in saving of fuel (Propane).



Date of completion: : Feb 2016

Uniqueness of the Project

The WHRS project is unique because of following parameters
- *Safety:* Hot work inside paint shop where highly flammable materials like paint, thinner etc. are present. This project was completed without any reportable incidence during execution.
- *Time and stakeholders:* Multiple agencies Co-ordination like Safety & Fire team, Paint Shop Mfg., Planning, Contractor (Mech. & Electrical) etc.
- *Space constraint for execution:* Space constraints for lifting, shifting and positioning of WHR equipment at mezzanine (1st floor) since the area was preoccupied by existing paint shop equipments and very limited space was available for installation and movement during execution.
- *Cleanliness during execution:* Paint shop is a dust free shop hence the cleanliness was maintained as per standards while executing the project work during off days and working days.

Replication Potential

This can be easily replicated in other automobile plants.

Trigger of the Project

Continuous rise in specific fuel consumption and stiff target for reduction of variable conversion cost of fuel (5% reduction over best performed year) and reduction in carbon emission were major concerns. After observing the stack monitoring reports in paint shop, the temperature of RTO exhausts were found to be 205 -215 Deg. Celsius. This Triggered the possibility of heat recovery to utilize in processes and reduce fuel consumption.

Environmental Benefits

- Propane Fuel Saving : 150 MT/year
- Reduction in GHG emission : 435 tCO_2e/year

Cost Economics

- Investment made : ₹ 4.1 Millions
- Annual savings Potential : ₹ 5.9 Millions
- Payback : 8 Months

UltraTech Cement Limited
Reddipalayam Cement Works

UltraTech Cement Limited with 12 composite plants, 13 grinding units, 1 white cement plant, 1 WallCare putty plant and 5 bulk terminals, is one of India's large manufacturer and exporter of cement. Most of the plants have ISO 9001, ISO 14001 and OHSAS 18001 certification. In addition, two plants have received ISO 27001 certification and four have received SA 8000 certification. UltraTech's products include Ordinary Portland cement, Portland Pozzolana cement and Portland blast-furnace slag cement.

UltraTech Cement Limited, Reddipalayam Cement Works (RDCW), the group's state of the art cement manufacturing facility, is located in Ariyalur District of Tamil Nadu. Spanning across an area of 157 acres and operating with an employee strength of 300, RDCW has an annual production capacity of 1.4 MTPA. RDCW manufactures Ordinary Portland Cement (OPC) 43 & 53 grade, Portland Pozzolana Cement (PPC) for the Indian market and Export Grade Cement for Sri Lanka and Myanmar.

The trade segment is a retail selling process established through appointment of dealers and retailers after which the product reaches the end users. The non-trade segment is the segment wherein bulk consumption takes place which includes builders, contractors, cement pipe manufacturers, tile manufacturers, etc. Technical Services to Customers (TS) with wide network of qualified and experienced Civil Engineers operate all over the country to help customers in producing the best concrete and mortar at site.

The unit was rated GreenCo Gold in December 2015.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GOLD
2015

GreenCo Gold

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Case Study 52

Co-processing of ETP Sludge as an Alternate Raw Material

Project Background

Reddipalayam Cement Works (RDCW) promotes the use of alternate fuel and raw material. The ETP sludge generated from Common Effluent Treatment Plants (CETPs) of textile dyeing wastewater is a major challenge because of the volume, toxicity and limitation on land disposal. Huge quantities of sludge is dumped in the treatment plant premises. Also, an extensive characterization for all physico-chemical parameters and heavy metals needs to be done to select the suitable disposal method.

The hazardous waste with defined characteristics, utilized as alternate fuel or raw material for clinker in cement kilns i.e. "co-processing of hazardous wastes in cement kilns" is a proven, legally acceptable and environmentally safe procedure for destruction of hazardous wastes. In addition to serving as a suitable technique in handling hazardous waste from industries, co-processing reduces the over use of natural resources and the overall environmental footprint through the use of alternate materials replacing traditional raw materials.

RDCW carried out discussions with the textile industries in Tamil Nadu state and TNPCB. It was agreed that disposal of CETP/IETP sludge from textile industries by co-processing at Reddipalayam Cement Works of UltraTech Cement Limited is an environmentally friendly method.

ETP Sludge Feeding System

A dump hopper with a capacity of 4 MT was fabricated and installed on the belt conveyor for feeding ETP sludge pay loader. An interlock was also provided to the conveyor that will run only when the stacker and its belt conveyor is in running condition. The new conveyor was designed for 200 TPH Capacity, with an installed power of 15 KW. The discharge of the belt conveyor directly fed on the stacker belt.

Date of commencement of the project – The unit conducted trial runs successfully in the presence of CPCB and TNPCB. Permission from CPCB was obtained in October 2013 and TNPCB permission was obtained in January 2014 for regular co-processing of ETP sludge.

Uniqueness of the Project

The project helps to reduce consumption of natural resources and extend the life of the quarries. Use of hazardous waste in cement industry replaces raw materials such as silica, iron, etc.

Replication Potential

The project is replicable. ETP sludge can be used as an alternate raw material in cement industries.

Trigger of the Project

Enhancement of mines' life through reduced limestone usage was the trigger of the project

Environmental Benefits

- Annual GHG emission reduction : 23 MT CO_2
- Annual savings in limestone : 2% (25,707 MT)

Cost Economics

- Investment made : ₹ 2.4 Millions
- Annual savings achieved : ₹ 8.5 Millions
- Payback - 3.5 Months

Co-processing of Industrial Waste as an Alternate Fuel

Project Background

The major cost drivers in cement manufacturing are raw material, fuel and power. Fuel constitutes 24% of the total cost of production and is the highest. Due to increasing prices of Anthracite coal, the primary fuel until 2001, was replaced with a petroleum refinery by-product known as petroleum coke available at cheaper price. Equipment modification and operating conditions were modified to handle issues such as clogging at kiln inlet and riser duct due to high ignition temperature and high sulphur content. The plant operates on 100% pet coke since 2004.

Due to increasing cost on fuel, it was imperative to focus on innovative measures and once such initiative was the tailor-made pre-processing (handling & feeding) and co-processing system. Availability of huge quantity of hazardous material and necessity of reducing fuel cost, enabled the unit to install a system that would handle all types of waste material that has heating value and can be utilized without affecting the cement process or product quality.

Long term targets and aesthetics of the plant were considered while designing the layout and storage of the co-processing system. Owing to the high heterogeneity of waste, maintenance of kiln stability was a challenge that was overcome due to several initiatives.

Details of the pre-processing & co-processing system -

- Three sheds with allotted space for different types of waste in closed yard of sizes 25X36 square meters
- Shredding machine to handle material with size more than 50 mm
- Loader to mix material of different calorific value in different proportions to achieve an overall calorific value of 3500 to 4000 kcal/kg
- Belt conveyor fitted with magnetic separator connected to the bucket elevator
- Kiln riser duct at about 20 m above the kiln inlet
- Discharge chute with two hydraulic flap and two pneumatic gate below the hydraulic flap to avoid back fire and false air ingress during operation
- VFD fitted conveyor belts looped with pre calciner outlet temperature for better control of calciner temperature and to avoid CO generation at kiln inlet
- Vertical hopper eliminating issues on flowability at the hopper discharge chute due to bigger size and high moisture content of material

Uniqueness of the Project

Various types of industrial waste with a certain amount of calorific value can be processed and used as alternate fuel.

Replication Potential

Similar projects can be undertaken in other cement plants.

Trigger of the Project

The cost of fuel at RDCW was very high compared to other cement plants because of its location and high logistics cost. Besides a gradual increase in pet coke price, continuous reduction in availability made the option economically not very feasible. Hence, there was a need to develop a system to sustain low fuel cost for a longer period of time.

Environmental Benefits

- Annual GHG emission reduction : 1,247 tCO_2
- Annual savings in fossil fuels : 2,886 MT

Cost Economics

- Investment made : ₹ 7.7 Millions
- Annual savings achieved : ₹ 19.8 Millions
- Payback : 4 Months

Ultra Tech Cements – Andhra Pradesh Cement Works Tadipathri

UltraTech's parent company, the Aditya Birla Group, is in the league of Fortune 500 companies. It employs a diverse workforce comprising of 120,000 employees, belonging to 42 different nationalities across 36 countries. The Group has been ranked number 4 in the global 'Top Companies for Leaders' survey and ranked number 1 in Asia Pacific for 2011. 'Top Companies for Leaders' is the most comprehensive study of organizational leadership in the world conducted by Aon Hewitt, Fortune Magazine and RBL (a strategic HR and Leadership Advisory firm).

Andhra Pradesh Cement Works produces Ordinary Portland Cement (OPC) of grade 43 and 53 (57%), Portland Pozzolana Cement (PPC) (40%) and Portland Slag Cement (PSC) (3%). ARCW produces OPC, PPC, and PSC with PPC being its main product. In addition to these, on the demand of Tamil Nadu state government, ARCW produces Amma Cement. GICW had its initial setup to produce PSC, later on to meet the customer requirements it has been transformed to the production of OPC and PPC.SBT being a bulk terminal effectively caters cement to the northern Andhra Pradesh market. SBT gets clinker from the group unit Rajashree Cement Works for logistic benefit. It sets a unique example for supply chain Management.

In addition, it also manufactures "tailor-made" cement of desired specifications for larger customers. As the plant is located closer to major markets, cement transport is predominantly done through road & rail in bulk and packed bags to reach its customers.

The unit was rated GreenCo Gold in May 2016.

GREEN COMPANY RATING SYSTEM
CII - SOHRABJI GODREJ GREEN BUSINESS CENTRE INDIA
GOLD
2016

GreenCo Gold 16

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Case Study 54

Evaporation Loss Reduction from Water Storage

Project Background

The Evaloc® SRP Emulsion spreads over water surface through SRP (Sustained Release Package) the proven Application Methods & Package, MPDT (Multi Point Dispensing Technique) in an integrated manner with the help of special design SFMDA (Stationary Floating Marked Dispensing Apparatus) on 24/7 basis. The fatty acid molecules form the ultra-thin layer on water surface preventing escape of surface water molecules into an unlimited open atmosphere and thus, continuous natural process of evaporation is reduced to some extent.

The Evaporation column is measured by installing Class 'A' Type Pans at site. The actual evaporation loss and saving achieved is calculated by applying standard input data involving necessary figures like levels, contents, water spread, utilization and other losses etc. The calculations provide near accurate picture about evaporation loss and saving achieved. The savings have been in the range of 35- 45% of evaporation column.

The product being Biodegradable gets accepted in nature's food chain also the product does not cause any disturbance in water treatment plants.

Four Evaloc SRP Bags are attached through side clips. Uniform Spreading of Evaloc SRP provides instant evaporation retarding film coverage, which continues for entire intended period of operation.

Uniqueness of the Project

The product being Biodegradable is accepted in nature's food chain, and does not cause any disturbance in water treatment plants.

Replication Potential

The project can be implemented in any industry to reduce water evaporation losses where water is stored in ponds.

Trigger of the Project

The unit is located at Tadipatri in Rayalaseema region which faces high water crisis, and is totally dependent on rain water.

Environmental Benefits

- Reduction in evaporation loss : 45% (19000 m^3)
- No impact on fish cultivation
- Improved the biodiversity
- Eco friendly product

Cost Economics

- Investment made : ₹ 0.65 Million

Case Study 55

Reduction in GHG emission-CM3 Classifier modification

Project Background

Vertical Roller Mills are used for clinker grinding and cement mills supplied by M/s Loesche are used. The specific power of the mill was at 30.5kWH/MT of material which had to be reduced. Fish bone analysis to arrive at the root cause were :

- Hydraulic disturbances generated high vibrations in mill
- The clinker mill was supplied with individual hydraulic packs for each
- Roller (3 no's) instead of conventional hydraulic pack (one power pack for all 3 rollers)
- Improper feed material distribution beneath master rollers
- Improper water spray on the grinding table
- More fines in reject from separator

Assembly of New classifier LSVS 92Cs

Before going with the modifications, the assembling of the LSVS classifier was carried out. The assembly of the classifier includes:

- Grit Funnel Assembly, Alignment and Welding
- Liners and Tiles fixed to Grit Funnel
- Classifier Frame Assembly and Alignment
- Fixing of Upper Housing on Assembled Classifier Frame
- Alignment and welding of Classifier upper Housing and frame
- Assembly and Alignment of classifier Lower housing
- Liner Fixing to Mill Feed Chute

Modification of hydro-pneumatic spring system

The hydro-pneumatic spring system has been replaced with conventional hydraulic system to avoid the hydraulic disturbances.

Replacement of LSKS classifier with LSVS Classifier

To reduce the more fines in reject from Separator, the classifier was replaced with new LSVS classifier due to which the rejects reduced and the air flow inside the duct improved that enhanced the output of the mill.

Modification of classifier static vanes gap

Further to reduce the rejects and increase the output, the velocity was to be increased. For this the gap between static vanes and rotor of the classifier was reduced from 330 mm to 230 mm.

Uniqueness of the Project

The Project is unique since this is a joint improvement project with the supplier and is the first experiment across the globe. After the success design modifications are done in the suppliers new installation across the globe.

Replication Potential

The project is a very successful experiment and is already replicated in all other Mills. The same can be replicated in any VRM with proper study and correct Engineering.

Trigger of the Project

The major thrust behind initiating the project as mentioned is the effective utilization of total limestone deposit and it was a major challenge due to high sulphur in petcoke. With the changing business scenario, it was the need of the hour to use petcoke for competitive advantage and on the other hand to maximize the utilization of material exploring all the alternatives.

Environmental Benefits

- Reduction in power consumption : 5.83 kWH / tonne material
- Reduction in GHG emission : 3983 tonnes of CO_2 eq
- Elimination fuel consumption(earlier HFO fired and presently cooler hot gases are diverted to Cement Mills)

Cost Economics

- Investment made : ₹ 6 Millions
- Annual savings achieved : ₹ 34 Millions
- Payback : 2.5 Months

CII Godrej GBC has developed the GreenCo Rating System the "first of its kind in the World". The objective is to define and assess "How Green is your company", and highlight the way forward to facilitate world class competitiveness through Green strategies. The assessment provides significant value addition and direction to businesses in terms of Resource Conservation, Greener Value chain, superior Ecological performance and an enhanced Corporate Green Image. The framework adopts a cradle to cradle life-cycle approach to evaluate the activities of the company on the ecological front.

GreenCo Rating process

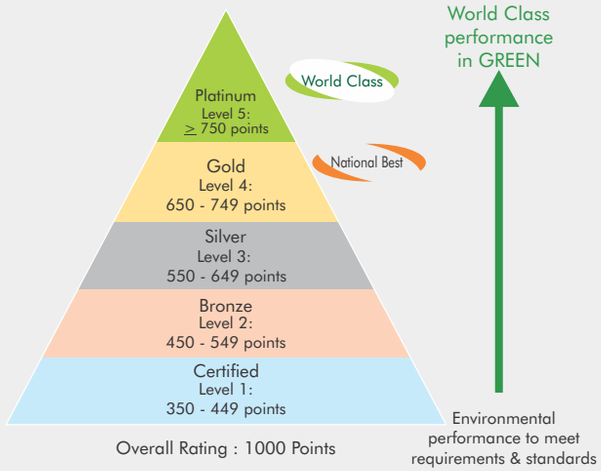
- Online Registration
- Training Program & Handholding
- Document Submission
- Pre-Assessment
- Site visit Assessment
- Award of Rating & Feedback Report

GreenCo Rating parameters:

Holistic, Performance based and life cycle approach

1. Energy Efficiency
2. Water Conservation
3. Renewable Energy
4. Green House Gas Mitigation
5. Material Conservation, Recycling & Recyclability
6. Waste Management
7. Green Supply Chain
8. Product Stewardship
9. Life Cycle Assessment
10. Eco-friendly environment, biodiversity & innovation

GreenCo Rating *l*evels



Who should apply ?

GreenCo rating is applicable for both Manufacturing & Service Sector

Manufacturing Sector

- Automobile & Engineering
- Cement
- Fertilizers
- FMCG
- Foundry
- Glass
- Iron, Steel & Non Ferrous
- Metals
- Pharmaceutical & Chemicals
- Pulp & Paper
- Refineries & Petrochemicals
- Textile
- Tyre

Service Sector

- Airports
- Corporate offices
- Hospitals
- Hotels
- IT Services
- Logistics

Individual plants/facilities which are in operation for minimum 3 years
New plants /facilities with minimum 2 years of operational data

NOTES :

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Confederation of Indian Industry

ABOUT US

Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India´s development process. Founded in 1895, India's premier business association has over 7900 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 200,000 enterprises from around 240 national and regional sectoral industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

CII – Sohrabji Godrej Green Business Centre (CII – Godrej GBC), a division of Confederation of Indian Industry (CII) is India's premier developmental institution, offering advisory services to the industry on environmental aspects and works in the areas of Green Buildings, Energy Efficiency, Water Management, Renewable Energy, Green Business Incubation and Climate Change activities. CII-Godrej GBC works closely with the stakeholders in facilitating India emerge as one of the global leaders in Green Business by the year 2022.

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