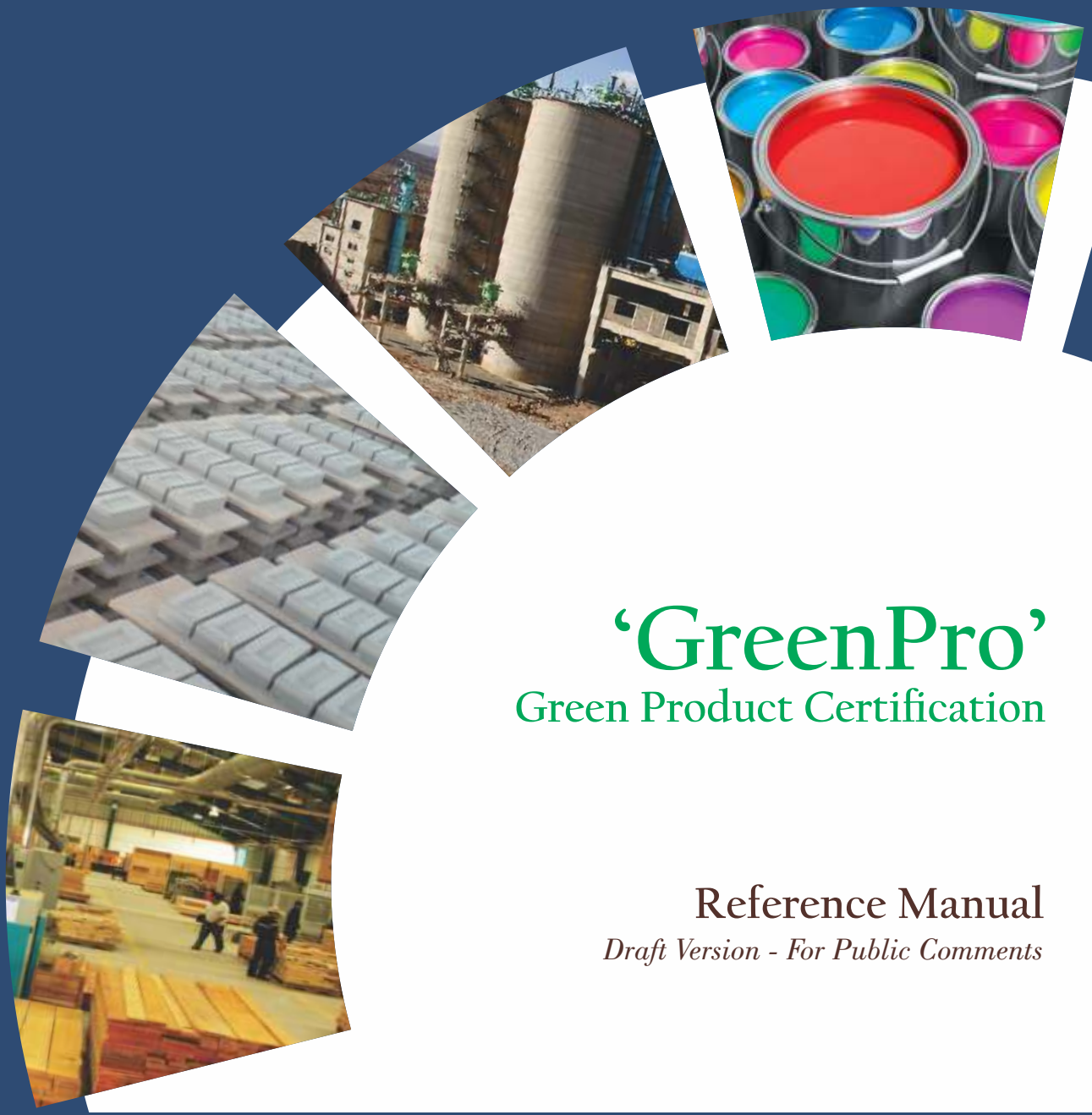
UNIDO

Confederation of Indian Industry

GreenPro



'GreenPro'

Green Product Certification

Reference Manual

Draft Version - For Public Comments

Supporting Council and programmes

Indian Green Building Council

Greenco

Knowledge Partner

UL

‘GreenPro’

Green Product Certification

Reference Manual

Draft Version - For Public Comments

Disclaimer

None of the parties involved in the creation of the GreenPro Reference Manual including Green Products & Services Council, its members, or the Indian government make any warranty (express or implied) or assume any liability or responsibility, to you or any third parties for the accuracy, completeness or use of, or reliance on, any information contained in the GreenPro Reference Manual, or for any injuries, losses or damages (including, without limitation, equitable relief) arising out of such use or reliance.

As a condition of use, you covenant not to sue and agree to waive and release the Green Products & Services Council, its members and the Indian government from any and all claims, demands and causes of action for any injuries, losses or damages (including, without limitation, equitable relief) that you may now or hereafter have a right to assert against such parties as a result of your use of, or reliance on, the Green Products Rating.

Confederation of Indian Industry
CII - Sohrabji Godrej Green Business Centre
Survey No. 64, Kothaguda Post
Hyderabad - 500 084
India

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

RECPnet

Message from UNIDO

The United Nations Industrial Development Organization (UNIDO) is the specialized agency of the United Nations that promotes Inclusive and Sustainable Industrial Development (ISID) to enable its member states to benefit from industrialization that creates shared prosperity and safeguards the environment.

This, amongst others, requires existing industries to continuously improve their environmental performance and resource use intensity, whilst in addition promoting new green industries to produce and deliver environmental goods and services - in short Green Industry. UNIDO initiated in 2012 at the global level the Green Industry Platform, which is a global, high-level, multi-stakeholder partnership and forum to catalyze, mobilize and mainstream action on Green Industry around the world (www.greenindustryplatform.org). It provides a framework to bring governmental, business and civil society leaders together to secure concrete commitments and action in support of the Green Industry agenda.

In 2015 UNIDO celebrates 20 years of cooperation and achievement with the United Nations Environment Programme (UNEP) in fostering adaptation and adoption of Resource Efficient and Cleaner Production (RECP) in developing, emerging and transition economies. The RECP programme is implemented in co-operation with a network of knowledge institutions and service providers globally, known as RECPnet, of which CII - Godrej GBC is a proud founding member.

Innovative green labelling standards provide one promising avenue for scaling up and mainstreaming RECP in industries. With regard to green standards, there are singular attempts and pilots of certification. First steps have been taken in the establishment of a rating system for green products as there is a lasting dependence on external rating systems from other countries that are not tailored to the industrial process and Regulations in India.

UNIDO is glad to note that CII-Godrej GBC has launched GreenPro - Green Product Certification with the objective of facilitating green product market transformation in the Country. We congratulate CII Godrej GBC on this initiative and wish them success in their endeavour.

We are pleased to know that UNIDO-CII joint initiative towards facilitating Green Product market transformation In India has led to this compilation. We look forward to many more interesting and value adding publications related to Green products from CII Godrej GBC.

Foreword

Today, going the green way is no longer a choice but an imperative for a sustainable tomorrow. Indian construction sector is playing a vital role in this direction. This sector has been one of the early adopters of green products and technologies for enhancing the performance of the Green Buildings.

Today, India with over 4.45 billion sq.ft stands number: 2 in terms of registered green building footprint. As a result of the spread and growth of green building movement, the demand for credible green products and technologies has increased many fold.

One of the key challenges before the construction industry is to identify and incorporate the right green products and technologies in the project. Further, stakeholders are also keen to know what exactly constitutes a green product ?.

To address this imperative, CII has established Green Products & Services Council. The Council in partnership with various National & international stakeholders has launched GreenPro - Green Product certification, a holistic mechanism which will assess how green is a product and certify. Underwriters Laboratory (UL) is our knowledge partner for developing the standards for GreenPro certification.

Today, GreenPro certification process is serving as an excellent guide to manufacturers to improve their green quotient.

In the past one year, over 110 products from more than 25 companies have achieved GreenPro certification and many are in the pipeline.

Moving ahead, Green Products & Services Council will look beyond buildings and focus on other sectors including- industrial products, technologies, consumer items, services.

Green Products & Services Council is pleased to partner with UNIDO in ushering in a GreenPro movement in the Country.

UNIDO's experiences and success stories will be suitably included into GreenPro certification and the process will become more robust and comprehensive.

We are sure, this Reference Manual will be of great value to you and will go a long way in enhancing your competitiveness and in the process enable to be world class green product / technology.

We warmly invite you to share your feedback / suggestions on the Reference Manual.

ParasuRaman R
Chairman, Green Products & Services Council
Founding Chairman, Indian Green Building Council

Acknowledgements

The GreenPro - Green Product Certification Reference Manual has been made possible through the efforts of many volunteers, members of Green Products and Services Council, representatives from manufacturing industry, product experts, conformity agencies and sustainable consultants. We extend our deepest gratitude to all these members.

United Nations Industrial Development Organisation (UNIDO) has extended technical and financial support for preparing the reference manual. We thank UNIDO for their support.

Our special thanks to the following technical committee Chairman for their participation and contribution in developing the product specific GreenPro standards and this reference Manual.

- Mr ParasuRaman R, Chairman, Green Products & Services Council and Founding Chair, IGBC
- Dr Prem C Jain, Chairman, Indian Green Building Council
- Mr V Suresh, Chairman, Policy and Advocacy committee, Indian Green Building Council
- Mr G Jayaraman, Chairman, Technical committee - Green Cement
- Dr L Ramakrishnan, Chairman, Technical Committee - Cleaning chemicals
- Ar B R Ajit, Chairman, Technical Committee - Paints and Construction Chemicals
- Dr Velan, Chairman, Technical committee - Construction blocks

We would also like to thank the following organizations for their participation and contribution in developing the GreenPro - certification standards and the reference manual.

- ACC Limited
- Aerolite Ceiling Systems
- Ahlada Engineers Pvt Ltd
- Eco-Care Building Products (P) Ltd
- Epitome Bamboo Flooring
- Featherlite
- Godrej & Boyce Mfg. Co. Ltd
- Godrej Interio
- Green Build Products Pvt Ltd
- Haylide Chemicals Pvt Ltd
- HIL Limited

- Hindustan Sanitaryware & Industries Limited
- Interface Flor India Pvt Ltd
- Intertek
- JK Lakshmi Cement
- JSW Cement Ltd
- KERAKOLL India Pvt. Ltd
- Lafarge India Pvt Ltd
- Lemmens Shardlow
- Manohar Constructions
- Nippon Paint (India) Limited
- Owens Corning Industries (India) Pvt Ltd
- Pidilite Industries Limited
- Richie Raffle Biotech Private Limited
- Roxul Rockwool Insulation Pvt Ltd
- Saint – Gobain Glass India Ltd
- SCS Global Services
- SGS India Pvt Ltd
- Sika India Pvt Ltd
- STP limited
- The Supreme Industries
- Thermatek
- Ultratech Cement Limited
- Underwriters Laboratories (UL)
- U.P. Twiga Fiberglass Limited
- Voltas Limited
- Wipro furniture
- Zuari Cement Ltd

Contents

Introduction

1. Introduction

The construction industry is one of the fastest growing sectors in India contributing significantly to economic growth. The rapid growth of the sector poses a host of challenges for preserving environment as well as keeping up the health of occupants. The green building movement spearheaded by Indian Green Building Council (IGBC) has enabled construction industry to incorporate green building concepts to enhance the environmental performance of buildings

Manufacturing and service sectors have also realized the impending impacts of their actions on environment. Several companies have taken proactive initiatives to minimize their environment impacts. One of the major initiatives by the companies is to procure green products, materials and technologies for manufacturing their products. Companies embracing 'green' concepts across construction, manufacturing and services sectors have created demand for green products. The demand is expected to grow exponentially in future.

Against this background, CII-Sohrabji Godrej Green Business Centre (CII-Godrej GBC) has launched Green Products and Services Council with the support of all the stake holders including product manufacturers, standard developers, conformity agencies, testing laboratories, consultants, end users, regulators, representatives from the concerned government departments etc.

The main objective of the council is to facilitate Green product market transformation in India through 'Green Product Certification'.

The GreenPro - Green Product Certification is a tool for facilitating Green Product market transformation in the country. GreenPro is expected to:

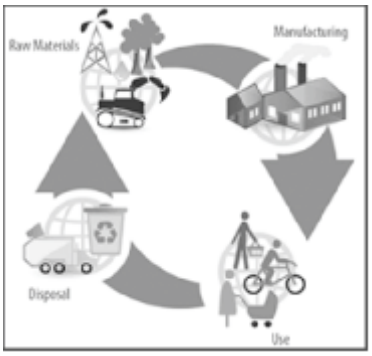
1. Enable the end users such as green building projects and manufacturing industry in selecting the right product and equipment
2. Increase the market demand for the Green products
3. Put a system in place for a product to be called 'Green'

GreenPro - Green Product Certification was launched in the year 2015. GreenPro certification programme focuses on certifying products, materials and technologies related to construction and manufacturing sectors.

This GreenPro reference manual aims at facilitating the product manufacturers to go through the certification process. The reference manual provides details on the criteria for certification, compliance options, suggested approach for implementing the compliance options and the case studies implemented by various product manufacturers that helped them to meet the GreenPro criteria.

2. 'GreenPro' - Life Cycle Approach

The GreenPro - Green Product Certification adopts a holistic approach based on the 'Life Cycle' of the product. The rating system encourages the product manufacturers to implement measures that would result in environmental, health and wellbeing benefits at the following stages of the life cycle of the products.



1. Raw materials
2. Manufacturing Process
3. Product Performance during use
4. Disposal / Recycling
5. Benefits

3. Benefits

The GreenPro - Green Product Certification benefits both the product manufacturers and the users. The benefits are both tangible and intangible.

For Product Manufacturers

Some of the benefits of adopting GreenPro for the product manufacturers are highlighted below:

1. Differentiates the Green product from the competition
2. Increases the market reach out with credible and precise information on the Green features of the products
3. Enables innovation in product manufacturing
4. Increases resource conservation through enhanced energy efficiency, water efficiency, use of renewable energy, minimization of waste etc during the manufacturing process and hence increase in profitability
5. Acts as a driver for achieving environment excellence
6. Complements National & International Green Building Rating systems

For Users

Use of certified Green products leads to significant tangible and intangible benefits for the end users.

Some of the benefits for the users are highlighted as below:

1. Time and effort in carrying out due diligence in selecting green product is saved
2. The user is assured of the performance of the product and equipment
3. Ensures Toxic and Carcinogen free products which in turn improve health benefits & wellbeing of the users
4. Improved product performance during use to reduce resource consumption and environmental impacts
5. Recognition and credits for achieving national and international rating for the buildings and companies

4. National Priorities addressed in Rating

GreenPro - Green Product Certification addresses the following which are priorities of the Government at the National level:

Water:

Water is a major concern in most part of the country. Implementation of water efficiency measures, rain water harvesting and achieving Zero Effluent Discharge are being encouraged to address the water related issues in the product manufacturing facilities.

Land:

Availability of land and increase in land pollution are major areas of concern. The certification demands for increased recycling of material after use which would result in reduction in landfills and hence reduction in land pollution.

Energy Efficiency:

The certification encourages the product manufacturers to adopt energy efficiency improvement measures and reduce their energy consumption which is in line with the National Mission on Enhanced Energy Efficiency.

Renewable Energy:

The certification advocates compliance with Renewable Purchase Obligation (RPO) and encourages product manufacturers to invest in renewable power generation. This is in line with Government of India's objective of increasing the contribution of renewable power sources.

5. 'GreenPro' Certification Standard

The certification programme applies product specific 'GreenPro Certification Standards' for evaluating the products. The product specific standards are developed with the support of respective product committees formed under the aegis of Green products and services council.

The product committee involves all major stake holders related to the respective product category including product manufacturers, standard setters, conformity agencies, Architects, users etc. The product committee is led by an expert who is also an unbiased specifier.

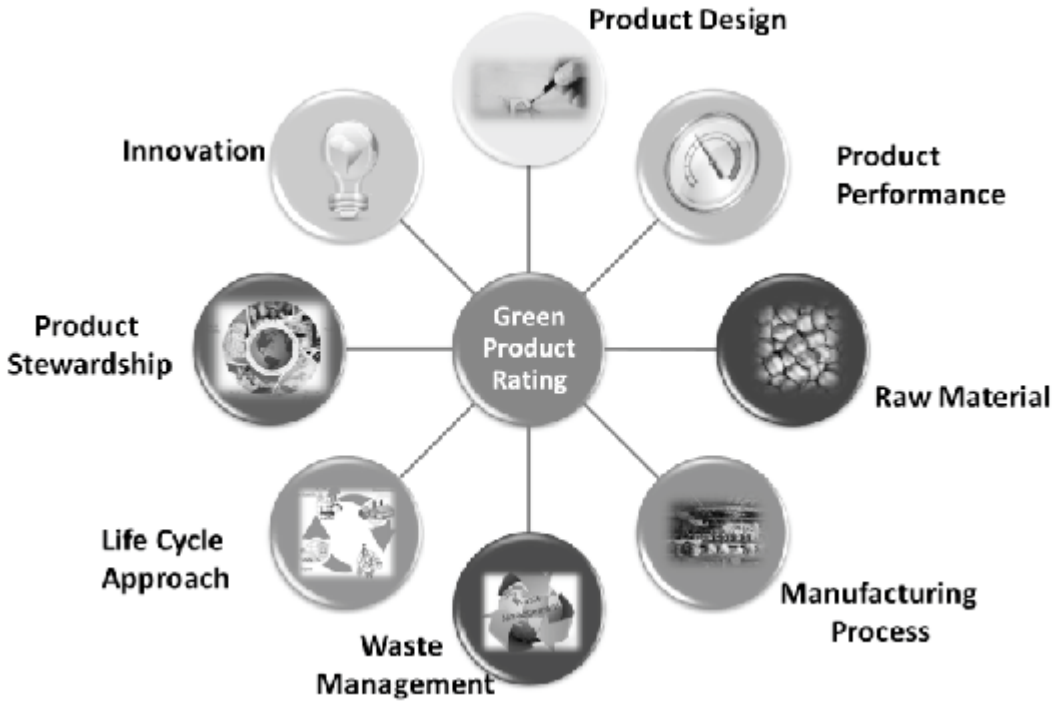
The certification standards are developed in line with the ISO 14020 Environmental Labels and Declarations - General principles. The principles adopted for the development of GreenPro certification include:

- Information / declarations provided shall be accurate, verifiable and relevant
- Certification procedures and requirements shall not create unnecessary obstacles to international trade
- Certification shall be comprehensive and based on scientific methodology to support the claim and the results are accurate and reproducible
- Information concerning procedure, methodology and any criteria supporting certification shall be available for all parties
- Certification shall consider all relevant aspects of life cycle of the product
- Certification shall not inhibit innovation
- Administrative requirements shall be limited to those necessary to establish conformance with standards
- Process of development shall be open and consensus based involving all relevant stakeholders
- Information on environment aspects of certified products and services shall be available to the purchasers / potential purchasers.

5.1 Features of GreenPro standard

GreenPro certification standard follows prescriptive as well as performance based approach for evaluating a product. The certification calls for demonstration of product performance through testing as per specified standards and implementation of measures at every stage of Life Cycle of the product, leading to clearly measurable environmental benefits.

GreenPro certification evaluates green features of products based on various performance parameters grouped under the following Credit Modules.



1. **Product Design:** The rating necessitates manufacturer to demonstrate its top management commitment towards environment performance improvement of the product.
2. **Product Performance:** The required performance parameters of the product need to be demonstrated through product testing as per the specified standards.
3. **Raw Materials:** The rating demands for efforts to bring down the use of virgin materials through recycling and elimination of toxic and hazardous content in the input materials for product manufacturing.
4. **Manufacturing Process:** GreenPro certification recognises the efforts taken by the product manufacturer to reduce the resource consumption during the manufacturing process
5. **Waste Management:** The rating calls for efforts to minimize the wastes or safer disposal of the wastes generated during manufacturing process other than the materials used for product manufacturing.
6. **Life Cycle Approach:** The rating encourages the product manufacturer to carryout Life cycle analysis for the products and implement measures based on the impact analysis.
7. **Product Stewardship:** The rating recognizes the measures implemented by the product manufacturers to reduce environmental impact in product transportation and recycling / product disposal
8. **Innovation:** The rating recognizes the innovative measures implemented by the product manufacturers which had resulted in substantial reduction in environment impact exceeding the threshold level specified in the rating standard.

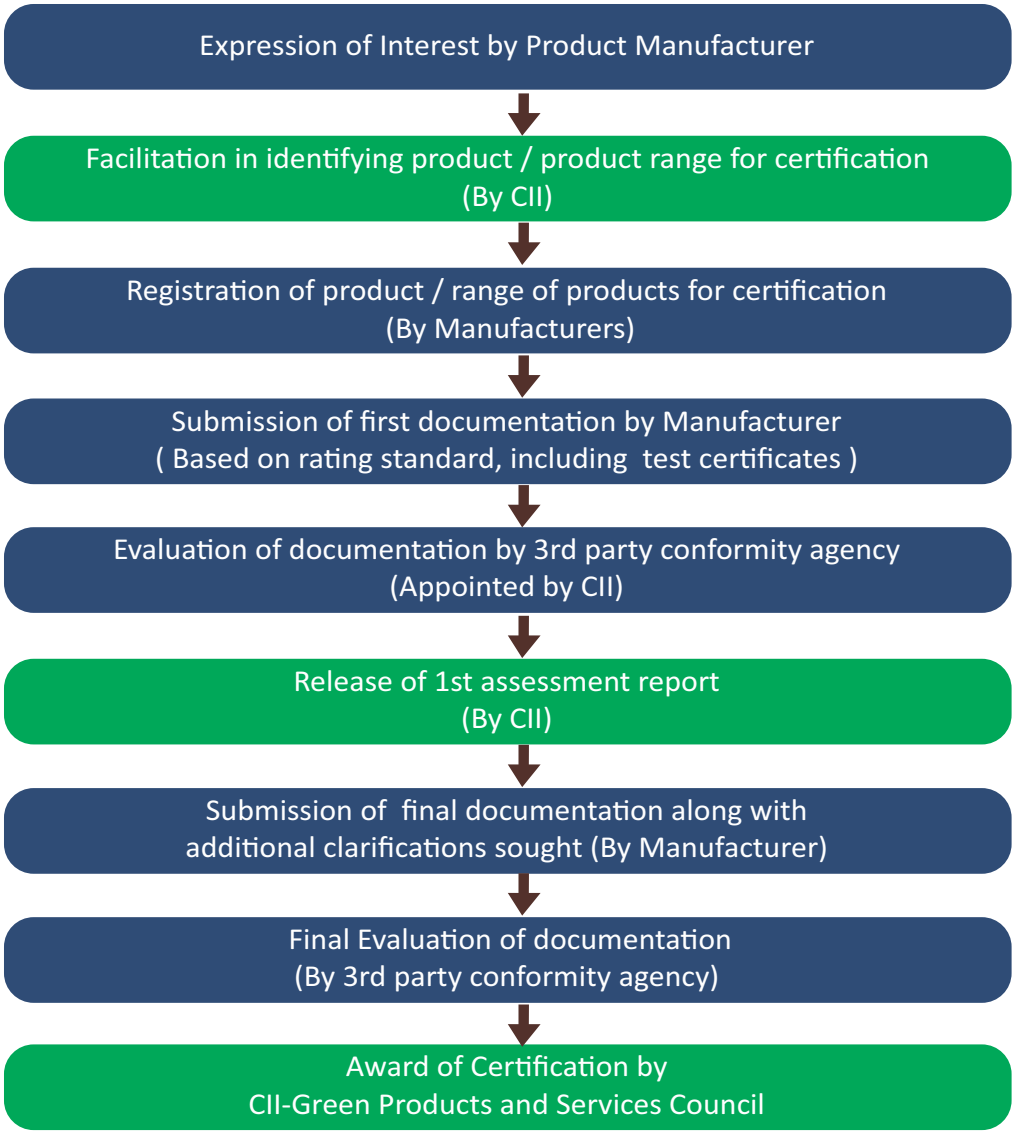
The approach and the Credit Modules for evaluation of products remain by and large the same for all the product categories. However, the credits as part of the individual Credit Modules and the weightage will vary depending upon the product categories and their significance.

A Product needs to comply with certain specified mandatory requirements and compliance to mandatory requirements is a pre-requisite. The mandatory requirements will vary depending upon the product category.

The threshold limit of all the credits is 100. The product manufacturers can apply for the Credits depending upon the applicability and gain credit points for the rating.

6. Methodology of Rating

The step by step methodology for the rating is mentioned below.



7. Product testing

The GreenPro calls for testing of select product parameters for the award of certification. The product parameters will vary depending upon product categories. Wherever testing of the products is specified, the GreenPro also specifies the testing standards and the requirements.

The product manufacturers can carry out the product testing in any of the Laboratories accredited by **National Accreditation Board for Testing and Calibration Laboratories (NABL)** according to the specified standards and produce the test certificates with the test results for further evaluation.

If the product testing has been already carried out in an NABL accredited laboratory owned by the product manufacturer, the product manufacturer has to submit the details of the test procedures & methodology for verification.

If the product testing need to be carried outside the country, the laboratory should have been accredited by the accrediting agency recognized by the Government of the respective country or an accrediting agency which is member of international bodies such as International Laboratory Accreditation Co-operation (ILAC) or Asia Pacific Laboratory Accreditation Co-operation (APLAC).

8. GreenPro Certification - Eligibility

A product will be certified depending upon the number of credit points achieved based on the evaluation of 3rd party conformity agency.

The maximum achievable credit points are 100. A product will be certified as 'Green Product' if it achieves 50 or more credit points in the evaluation.

9. Validity of the GreenPro Certificate

The Green product certificate is valid for 2 years from the date of award of the certification for the product / product range.

At the end of the validity period, the product manufacturer need to apply for the renewal of the GreenPro certification.

10. Upgradation of GreenPro standards

The Green Products and Services council's endeavor is to periodically upgrade the GreenPro certification standards and raise the bar.

The upgradation of the standards will be taken up with the support of product committee on consensus basis. Updates or addenda will be incorporated and formally communicated to the applicants.

Product Design

Background

A Green Product should have minimal environmental impact in its entire life cycle. This can be achieved better by focusing at the design stage. A product need to have an ecofriendly design to reduce environmental impact at every stage of its life cycle including raw materials, manufacturing process, performance of the product during use and end of life management. For example, a product 'Designed for Recycling' will facilitate easier recycling of the product at the end of its useful life and reduce the overall environmental impact.

The manufacturing process contributes significantly to the environment impact in the life cycle. Hence, there is a need for addressing the environment impact on a continuous basis at every stage of the manufacturing process from the raw material input to the product output.

Enhancing the environmental performance of the product by design and also during the manufacturing is a continuous process. This can be achieved better by involving all the employees in the organization and giving them a clear vision.

The organization, through their Eco Vision can demonstrate their commitment to environment, encourage and give clear direction to all their employees to contribute to environmental sustainability in their respective fields.

Vision is one of the key elements of an organization's strategic planning. This should be communicated to all their stakeholders including customers, suppliers, employees and society.

Credit 1.1: Eco vision

Intent

To design a product holistically considering all the environmental attributes, so as to minimize the associated impacts.

Compliance options

Eco vision:

The Company is recommended to have an Eco vision which demonstrates its commitment to design and manufacture environment friendly products. The Eco-Vision statement can be part of Environment or quality policy of the company.

The Eco vision is to inspire all the employees across the organization and encourage them to contribute significantly to holistically improve the environment performance of the products manufactured. Subsequent to the vision, the strategies for achieving the vision may also be articulated as part of the statement.

The statement should be signed by the head of the organization and made available in their website.

Strategies adopted:

The company should develop and adopt strategies for enhancing the environment performance of the product at every stage of its life cycle. In this process, the company should engage all the relevant stakeholders and allocate sufficient financial resource for implementation.

Upfront allocation of financial resources would minimize the gestation period between the identification of improvement opportunities and implementation. Having dedicated teams for incorporating measures for improving the environment performance during the design and manufacturing stage of the products yields the maximum benefits. The teams can be empowered to make use of allocated resources with specific guidelines on investment / Return on Investment (ROI) / payback period.

The company has to create awareness amongst all their employees about the Eco Vision and the strategies adopted through display of posters, programs, corporate communication etc.

This credit requirement is common for all the product categories. The breakup for credit point allocation for the credit 1.1 is as below.

Credits	Criteria	Credit Points
	Product design	
Credit 1.1	*Eco - Vision statement*	1
	Strategies adopted, resource allocation, stake holder engagement, Implemented measures & Impacts	
	- At design stage of the product	2
	- At manufacturing stage of the product	2

Documentation Required

1. Environmental vision statement of the company
2. Documents regarding allocation of resources, both manpower and financial, for environmental projects
3. List of strategies adopted by the company to improve environmental sustainability

Approach

In the case of environmental sustainability, being proactive is better than being reactive. The following steps are to be taken by the company in order to implement 'Green' measures at the design stage of the products and reap the maximum benefits.

Develop Eco Vision: The Company has to develop Eco Vision by involving members from all the key functions. The Eco Vision should demonstrate the company's commitment towards sustainability and in line with the business objectives.

Develop Strategies to achieve Eco Vision: The Company should also have strategies in place for achieving the Eco Vision. The strategies can be dynamic and change over a period of time for achieving the same Eco Vision.

The company should form a cross functional team to develop the strategies. The team can have representatives from various departments such as product development, production, maintenance, marketing, logistics, procurement etc.

The team should be led by a person from the senior management. The cross functional team should brainstorm and workout the strategies for achieving the Eco Vision.

Allocate resources: Once a policy is framed and strategies are in place, resources need to be allocated for implementation of strategies. Dedicated teams with clear targets for implementation of measures at various stages of product's life cycle including product design, procurement of raw materials, product manufacturing, product distribution etc. It is also recommended to have allocation of financial resources every year beginning with broader guidelines for utilization. This enables faster implementation of the measures.

Create Awareness: The Company should create awareness amongst all the employees about their Eco Vision and strategies through posters, awareness programs, corporate communications etc. This will encourage every employee to contribute for environmental sustainability in their respective operating areas.

Resources:

1. GreenCo - Green Company Rating System - reference guide
2. Indian Green Building Council (IGBC) Green Building Rating system for New Buildings

Eco vision

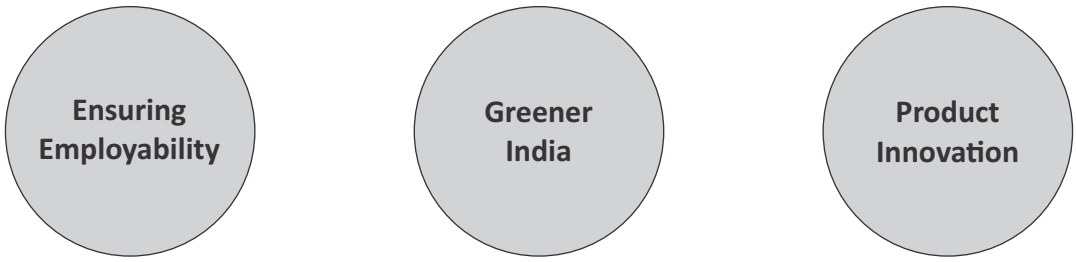
Case study 1:

Godrej & Boyce Mfg. Co. Ltd is one of the oldest business houses in India. Godrej being right in the middle of Mumbai, has an extra responsibility to effectively utilize resources so as to co-exist with one of the most populous cities in the world. True to its lineage, Godrej has adopted one of the most taxing environmental visions in Indian industry.

Called the 'Good & Green', Godrej envisions for a brighter living for all its stakeholders by creating a more inclusive and greener India. Some of the salient points of the “Good & Green” policy are as follows:

- By 2020, Godrej wants all its manufacturing locations to be carbon neutral, zero waste, water positive and energy efficient businesses
- To have one third of their income from green products and services

As part of Good & Green by 2020, as a group we will aspire to:



Train 1 million youth in skills that will enhance their earning potential

Achieve zero waste to landfill, carbon neutrality and a positive water balance, while reducing specific energy consumption and optimising the use of renewable energy

Generate a third of our portfolio revenues from ‘good’ and / or ‘green’ products

Strategies for environmental sustainability

Case study 2:

Hindustan Unilever Limited, part of Unilever Limited, is a large FMCG conglomerate. HUL is a company which has clearly understood the real impacts of its operation on environment and how environmental sustainability plays a vital role in the basic existence of a FMCG business. As a part of "Unilever Sustainable Living Plan", HUL has listed down various sustainability goals and strategies to achieve the goals.

One such strategy is conducting Life Cycle Analysis for its products in the design stage to produce a more environmental friendly product.

- LCA being used a strategy to formulate newer efficiency products. "Comfort One Rinse" is one such product which saves 2 buckets of water for rinsing
- Apart from applying LCA results for formulating new products, HUL also uses the results to compare existing products and thereby greening its portfolio
- LCA is therefore used as a tool to design environment friendly products

Case study 3:

Nippon paint, a leading paint manufacturer in Asia has a clear vision of developing their company into an eco-friendly company that helps in protecting the environment and reducing the resource consumption. Some of the key strategies adopted by Nippon Paint for achieving their Eco Vision are as below.

- Resource Efficiency: Reduce energy consumption for manufacturing of products (Eg: Reduce grinding time of the raw materials)
- Identification of Improvement Projects: Form Quality Circles and identify projects that lead to resource consumption reduction
- Volatile Organic Compound (VOC) Reduction: Design all the interior paint products with low VOC content
- Green Message: Promote Green concepts in all external communications
- Green Procurement Policy: Ensure all the purchased products for manufacturing of paints are ECO friendly

Product Performance

Background

Generally, the product selection is based on the quality parameters which are essential for meeting the functional requirements. The products need to comply with Bureau of Indian Standards (BIS) or relevant product standards for ensuring the quality or functional performance during their use.

In majority of the products, the environment impact caused by the emissions during the product use phase of the life cycle is very significant. The impact during the use phase is about 40-60% of the total life cycle impact. The emissions and the contaminants in the products also affect the human health during their use.

A Green product has to be superior in quality or functional performance complying to all the relevant standards, contribute significantly for reducing the environment impact and enhance the health of the end users during its use.

For an example, in case of construction blocks, generally, compression strength has been considered for selection. Thermal insulation ('U' Value in W/m^2K) property of blocks contributes significantly for reducing the heat gain in the building and hence reduces the energy consumption. A Green construction block need to have better thermal insulation property compared to conventional blocks apart from having adequate compression strength.

Similarly, in case of plywood and boards, generally, strength and water resistant properties are considered as quality parameters. These boards emit volatile organic compounds (VOCs) and formaldehyde during their use. These emissions significantly affect the human health. A Green Ply wood or board should have very low VOC and formaldehyde emissions apart from meeting the required strength and water resistant properties.

The performance parameters that contribute towards reducing the environment impact and enhancing the health vary depending upon the product categories and their use. These performance parameters of a Green product need to be tested as per internationally accepted standards such as ASTM, IS etc. and maintained well within the specified threshold limits. Refer the respective GreenPro standard for product categories for the details of specific performance parameters, threshold limits and testing standards.

Performance parameters that contribute for environment impact reduction and enhancement of health benefits, for various product categories are as below.

Product Category	**Performance Parameters**
Construction Blocks	Insulation - 'U' value ($W/m^2 K$)
Paints	Volatile Organic Compounds (VOCs)Glass U Value (W/m^2K), Solar Heat Gain Coefficient, Visual Light Transmittance
Furniture	Volatile Organic Compounds
Insulation	Thermal conductivity - K Value (W/mK)
Cleaning Chemical	Volatile Organic Compounds, Flammability, Elimination of Environmental pollutants
False Ceiling	Volatile Organic Compounds, Formaldehyde emissions
Cement	CO_2 Emission per ton of cement

Credit 2.1: Product performance

Intent

To enhance the performance of the product during its use thereby leading to environmental benefits

Compliance options

Carryout the testing of the product for the specified performance parameters as per the product specific GreenPro standard and produce the test certificates.

- The tests can be carried out in any of the laboratories accredited by National Accreditation Board for Testing and Calibration (NABL) as per the specified standards for testing or an equivalent internationally accepted standard.
- If the product testing has been already carried out in an NABL accredited laboratory owned by the product manufacturer, the product manufacturer has to submit the details of test procedures and methodology for verification.
- If the relevant testing facility is not available in India, the product can be tested in a foreign laboratory which is recognized by an international accreditation agency or their local government.
- If the product has already adopted any other internationally recognized Eco label and tested the relevant performance parameters, the testing need not be repeated again. The manufacturer has to produce the details of validity of the Ecolabel and the test certificates of performance parameters.

Point allocation

Credit points allotted for product performance will vary depending upon the product category. In majority of the product categories, the Product performance credit gains the maximum weightage and is about 25% of total credit points.

Refer the respective product category specific GreenPro certification standard for the allocation of credit points.

Documentation Required

1. Test carried out in a third party laboratory accredited by NABL
   a. Test certificate confirming to performance standards set by the GreenPro product standard
2. If the tests are carried out in a laboratory owned by the manufacturer
   a. Details of testing standards and procedures adopted
   b. NABL accreditation certificate of the laboratory
3. If other Ecolabels have been already adopted
   a. Details of Ecolabels and the validity period
   b. Test certificates of the performance parameters

Approach

This credit encourages the product manufacturers to improve the environmental performance of the product on a continuous basis. Product performance improvement calls for incorporation of improvement measures in product design, raw materials and in some cases the manufacturing process as well. Product manufacturer has to involve all the key functions of the business to bring in improvements in these areas.

The following step by step approach may be adopted to improve the product performance and comply with the requirements of GreenPro standard.

- Carryout product testing for the specified performance parameters as per the recommended testing standards.
- Compare the test results with the threshold limits specified by the GreenPro certification standard. The GreenPro certification standards are generally on par with international standards. Only in few cases the threshold limits have been made stringent / relaxed to suit Indian conditions.
- If the test results are not complying with GreenPro standards, develop a plan for improving the performance of the product involving all key functions of the business including product design, manufacturing, major suppliers of raw materials and marketing team to get the feedback from the end users. The improvement activity has to be led by product design team.
- Identify all possible measures for improving the product performance and work out the cost benefit analysis based on the life cycle costing.
- The manufacturer may choose the implementation measures for improving the product performance considering the market opportunities, business strategies, future regulations, cost benefit analysis etc.
- After implementation of the measures, test the product performance with the support of a third-party agency periodically (at least once in six months). This will enable the manufacturer to eliminate any deviation in raw materials or manufacturing process.

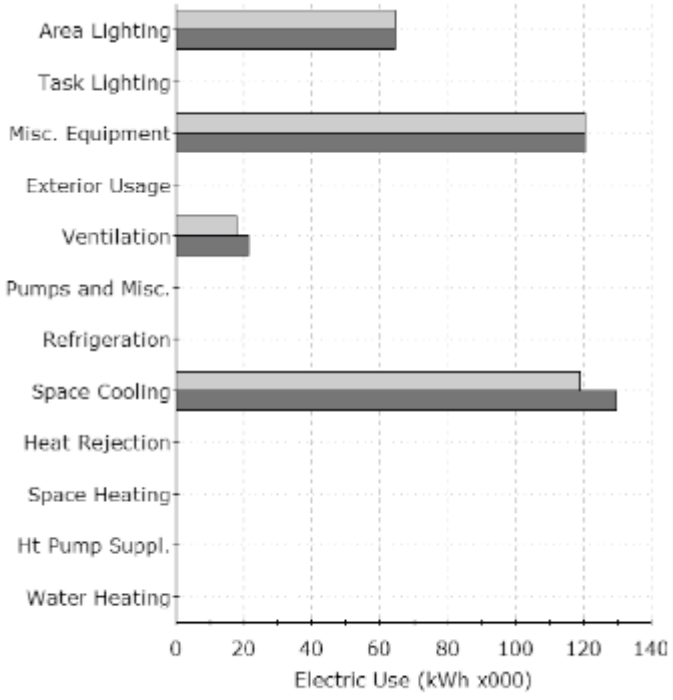
GreenPro certification standard will also be periodically upgraded to raise the bar. The manufacturer may adopt the same approach to improve the performance periodically and comply with the requirements.

Case study 4: Low 'U' value construction blocks for reducing the heat load

Thermal performance of a construction block significantly affects the overall heat load gained by a building through the walls. Lower is the 'U' value better is the insulation property and hence the heat gained by the building through the wall will be lower. This will lead to reduction in air conditioning load and hence reduction in energy consumption.

Conventional earthen bricks have 'U' value typically in the range of about 2.0-2.5 W/m2K. whereas the Autoclaved Aerated Concrete blocks have 'U' value in the range of about 0.7-0.8 W/m2K. The AAC blocks utilize fly ash as raw materials to the extent of about 70%. This in turn reduces soil erosion.

The case study given below compares the energy consumption pattern of a 20,000 Sqr ft. air conditioned building constructed with AAC blocks and a similar building constructed with conventional bricks.



The reduction in energy consumption for air conditioning is about 4.3% in case of the building constructed with AAC blocks compared to the other building constructed with conventional earthen bricks.

The comparison of other energy parameters for the buildings are tabulated below.

Sl. No.	Parameters	Conventional Block	AAC Block Blocks	% Savings
1	Energy Performance Index (kWh/m2/Yr)	186.2	173.1	7.03
2	Monthly peak demand in (KW)	1268.9	1183.1	6.7
3	Energy (Kwh*1000)	336140	321770	4.27
4	AC Capacity (TR)	56	47	9

The comparison has been made for a single-story building for which the heat gain through the wall is lower compared to roof. In case of multistoried buildings, the heat gain through the walls will be much more compared to the heat gain through the roof. Hence, the use of AAC blocks in a multistoried building will result in much more reduction in percentage of energy consumption compared to a single-story building.

Case study 5: Low VOC Products and materials for improved Indoor Environment Quality

Volatile Organic Compounds are solvents, other chemicals in paints, fabrics, carpets or any other indoor materials which evaporate during use. When VOCs are released into atmosphere they react with nitrogen oxide and produce Ozone which is a main contributor for air pollution, particularly summer time smog. VOCs directly impact human nervous system, blood and kidneys when exposed for a longer period of time.

Major sources of VOCs in an office building and the typical contribution by the sources are as below.

Materials	VOC in mg/m^3
Paint	2.43
Gypsum Ceiling	0.20
Carpet	3.32
Furniture	2.41

For a Green Building, the recommended threshold limits of TVOCs, Formaldehyde and total aldehydes for the products and materials such as Gypsum ceilings, Carpets, Furniture are as below.

Chemical Component	Emission Limits
TVOC	0.5 mg/m3
Formaldehyde	50 Parts Per Billion (Ppb)
Total aldehyde	100 Ppb

These chemical components can be tested using Chamber test method. In this test, the product is placed in a controlled environment within a chamber. Known quality of air is blown over the product at particular velocity over a period of time and the emission levels are measured at the exhaust. These measured emissions should be well within the above specified threshold limits.

Godrej and Boyce Ltd, one of the leading furniture manufacturers in India have tested their products such as furniture, Beds, Ward robes, kitchen cabinets etc. for their emission levels using chamber test. These products have confirmed to the requirements mentioned in the above table.

Use of the low emission products and materials improves the indoor environment quality and enhances the health and wellbeing of occupants.

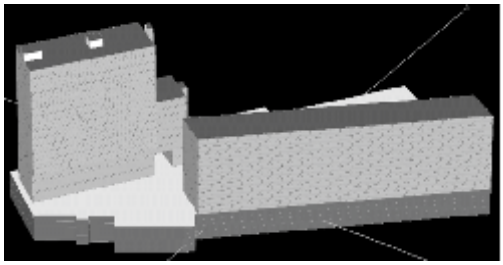
Case study 6: Reduce the heat load of Buildings by applying insulation

Building walls and roofs are the major sources of solar heat gain. The heat gain in the building can be reduced by applying roof and wall insulation. Variety of insulation materials such as glass wool, mineral wool, extruded polystyrene (XPS), Expanded Polystyrene (EPS), Polyurethane foam etc are available for wall and roof insulation.

Insulation materials are the materials with very low thermal conductivity of 0.03 - 0.04 W/mK. Insulation materials on the walls and roofs will reduce heat gain, air conditioning load and hence will result in reduction in energy consumption.

For meeting the Energy Conservation Building Code (ECBC) requirements, a building wall should have minimum 'U' value of 0.40 W/m^2K. A Green building need to improve the thermal performance significantly beyond the recommended values of ECBC. This can be achieved by insulating the walls with insulation having very low thermal conductivities can achieve the 'U' values as low as 0.05 W/m^2K.

The case study given below compares the energy consumption pattern of an air-conditioned building (i) Without insulation (ii) With glass wool as an Insulation material having 'K' value of 0.04 W/m K.



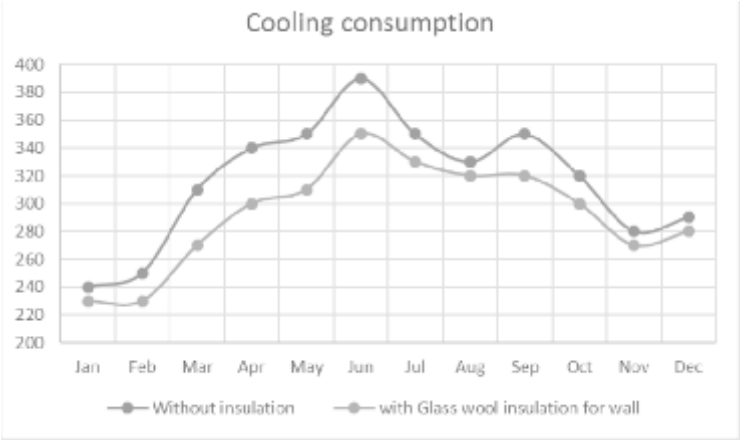
Building type	Office
Location	Hyderabad Composite climate
Area	Sqft
Air conditioning load	TR

Wall Description	**Thermal Conductivity of Insulation (W/mK)**	**'U' value of composite wall (W/m^2K)**
Only Brick Wall (Brick + Plaster on both sides)	-	1.98
Brick wall with Glass wool insulation of 6”	0.04	0.23

The reduction in 'U' value of the wall leads to reduction in heat load because of the thermal conduction and hence the corresponding reduction in energy consumption. Considering all other sources of heat load remain the same in both the cases, the reduction in energy consumption on account of insulation of walls is as below.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**	**Red**
Without insulation x 103 Kwh	240	250	310	340	350	390	350	330	350	320	280	290	**3800**	**-**
With Glass wool insulation x 103 kWh	230	230	270	300	310	350	330	320	320	300	270	280	**3510**	**7.63**

The cooling energy consumption will vary depending upon the climatic conditions and the graphical representation of the variation in cooling load is as below,



The reduction in energy consumption on account of Glass wool insulation for the wall is about 7.6%. Considering all the other energy consumption remain the same in the buildings, the overall reduction in energy consumption is about 2.5%, which will typically be paid back in about 2 years of time period.

Case study 7: Construction Chemicals for Green Building applications

Construction Chemicals are specialty products that are used in structures to increase their life, and also to impart additional protection from environmental hazards. Certain chemical products also help in minimizing the quantities of cement and water generally required during the construction.

Construction chemicals industry has a variety of products, ranging from concrete admixtures, waterproofing chemicals, flooring compounds, adhesives and sealants etc. Polymers are the most important group of raw materials and they are prevalent in every construction chemical formulation.

While significant efforts are made to enhance the performance, efforts are also being made to reduce the environmental impacts that the chemicals might cause. The key parameters evaluated to ensure that they are environment friendly are the low amounts of Volatile Organic Compounds (VOC) and absence of toxic or hazardous substances.

A GreenPro certified construction chemical not only ensures that the VOC levels are below the baseline levels but they are well within the prescribed levels.

A case in point:

Comparison of VOC levels between the baseline levels and 'GreenPro' certified products are as below

Construction Chemicals	Baseline	VOC (g/L)VOC levels of Green Construction Chemicals (g/L)
Multi-purpose construction adhesives	70	12
Architectural Sealant	250	53
Multi-purpose construction adhesives	70	51
Ceramic tile adhesives	65	11
Multi-purpose construction adhesives	70	20
Adhesives for metal	30	16
Architectural Sealant	250	65

Use of low VOC construction chemicals will lead to lower VOC emissions and contributes to improved indoor environment quality in the buildings.

Raw Materials

Background

Raw materials contribute significantly for the Green performance of a final product. When a manufacturer intends to manufacture Green products, it is important to utilize raw materials which are Green in terms of lower emissions to air, water & land and which do not cause ill effects on human health.

Toxic or Hazardous Substances

If the raw materials contain toxic or hazardous substances, the end product also is most likely to be toxic. Some of the hazardous substances which are commonly part of raw materials include heavy metals such as Mercury, Lead, Cadmium, Hexavalent Chromium, Arsenic etc.

Direct contact with these heavy metals or through inhalation leads to long term ill effects. Some of the ill effects on human health caused by these heavy metals are as below.

Mercury: Elemental mercury is toxic to the central and peripheral nervous system. The inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems, lungs, kidneys and may even be fatal.

Lead: Lead can affect almost every organ and system in human body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the immune system. The effects are the same whether it is inhaled or swallowed. As per World Health Organization (WHO) study there is no known lower limit of lead which will not be harmful to human health.

Cadmium: Breathing high levels of cadmium severely damages the lungs and can cause death.

Hexavalent Chromium: These metals are found to be carcinogenic. Commonly used preservative or adhesive is formaldehyde. It is a known carcinogenic substance and impacts human health.

Hence, elimination of the hazardous substances is imminent in a Green product to protect the health of the people who are exposed to the product. This requirement has been made mandatory for GreenPro certification of products.

Recycle Content (Or) Industrial Waste

Natural resources are scarce and utilization of only virgin materials for manufacturing of products leads to faster depletion of natural resources. At the end of the life typically the products are sent to landfills which again

leads to pollution of land and ground water.

Recycling of the products or utilizing any other waste materials can be utilized for minimizing the use of natural resources. Recycling of products will lead to both environmental and economic benefits.

Regional Materials

Transportation of raw materials from distant places to the manufacturing unit leads to emissions of Green House Gases which in turn leads to Global warming and climate change related issues.

GreenPro encourages sourcing of raw materials regionally which will reduce the emissions and also contribute to the local economy.

GreenPro certification standard specifies the following criteria as part of the Raw materials module depending upon the applicability to the specific product category.

1. Elimination of Hazardous substances
2. Recycled content / Utilization of Industrial waste
3. Utilization of Regional materials

Credit 3.1: Elimination of Hazardous substances

Intent

To eliminate the exposure to hazardous materials in the product that might lead to long term ill effects on health either through respiration / direct contact

Compliance options

In many products, the presence of hazardous substances is traced back to the raw materials used for manufacturing process. Presence of hazardous materials need to be eliminated at the raw materials stage. The type of hazardous substances will vary depending upon the products and the raw materials used. Product category specific GreenPro certification standard highlights details of the hazardous substances that need to be eliminated specific to the product category.

Some of the hazardous substances that need to be eliminated are:

- Heavy metals such as Mercury, Lead, Hexavalent Chromium, Cadmium and Arsenic
- Asbestos fiber
- Carcinogenic substances such as Formaldehyde
- Aromatic Hydrocarbons

The manufacturer can choose any of the following options to comply with the requirements of GreenPro certification:

1. Product testing

   Test the products as per the specified ASTM or equivalent standard and provide the test certificates indicating that there is no presence of hazardous substances in the product (or) the substances are present well within the specified limits as per the GreenPro certification standard. The details of testing standards for the hazardous substances are enclosed as Annexure.

2. Material Safety Data Sheet (MSDS)

   In case of Chemical products, provide the Material Safety Data Sheet (MSDS). The MSDS should have the following details:

   - Chemical Identify
   - Manufacturer's information
   - Hazardous ingredients / Identify information
   - Physical, Chemical characteristics
   - Fire and explosion hazard data
   - Reactivity data
   - Health hazard data
   - Precautions of safe handling and use
   - Control measures
   - Emergency and first air procedures

3. Test certificates of Raw materials

   Obtain the test certificates for the hazardous substances from the raw material suppliers for all the purchased raw materials.

Point allocation

Credit points allotted for Elimination of hazardous substances credit will vary depending upon the product category. Refer the respective product category specific GreenPro certification standard for the allocation of credit points.

Documentation Required

1) Test certificate as per the specified standard confirming the levels of heavy metals in the products (*OR*)
2) Material Safety Data Sheets (*OR*)
3) Test certificates for all raw materials obtained from the raw material suppliers

Approach:

Awareness amongst the end users about the ill effects of hazardous substances and the regulations which are becoming stringent, create demand for products and materials which are free from hazardous substances. The product manufacturers may adopt the following measures for eliminating the hazardous materials in the products and the process.

Elimination at the Design Stage: At the design stage of the product, sufficient care need to be taken to eliminate use of heavy metals and prohibited hazardous substances as raw materials. Apart from raw materials, these substances need to be eliminated in the manufacturing process also to prevent their entering into the final products.

In case of existing products, the manufacturer has to explore the possibility of gradually reducing the intensity by utilizing alternate raw materials so that presence of the prohibited substances can be maintained well within the allowable limits as per GreenPro standard. In many of the building related product categories, alternate raw materials are available for totally eliminating the prohibited substances.

Demand for Raw materials free from Hazardous substances: Product manufacturers have to demand for supply of raw materials which are free from the prohibited hazardous substances and also ask to produce test certificates from third party testing laboratories to ensure the same. This in turn will encourage the raw material suppliers to identify alternate materials and eliminate hazardous substances.

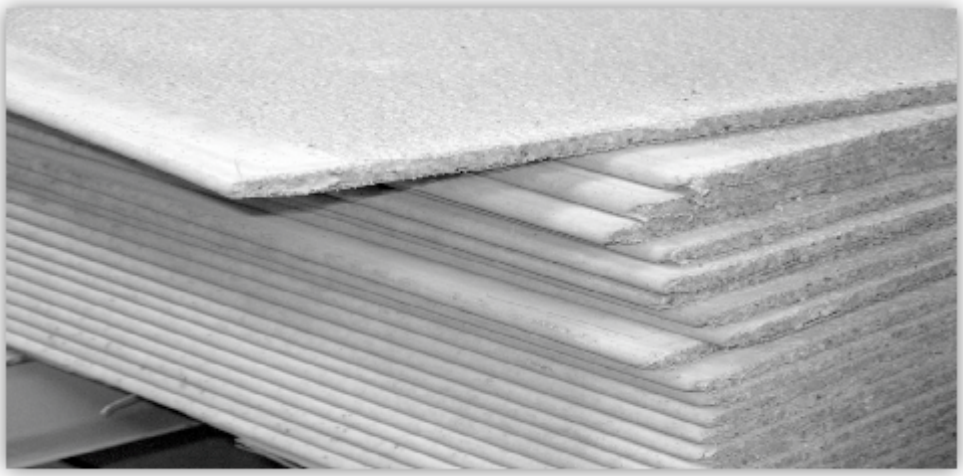
Involve 3rd party testing agencies: Engage 3rd party testing agencies to test and verify the presence of prohibited substances in the final products. This can be taken up atleast once in year.

Elimination of Hazardous materials

Case study 8: Replacement of asbestos with cellulose fiber

Visaka Industries Limited is one of the leaders in board & panel manufacturing in India. Back in the days, asbestos was a popular choice among manufacturers to manufacture cement boards. However, the scenario changed once the ill effects of asbestos dust came to be known.

Visaka Industries Ltd has changed their product portfolio from asbestos fiber cement boards to cellulose fiber cement board. Fiber cement boards are mainly made from cellulose fiber as a substitute for asbestos. Ordinary Portland Cement (OPC) and siliceous material as binder, certain additives and water are added to the mixture. In general, unbleached Kraft or bleached pulp and a limited quantity of waste paper is used as cellulose fiber. The above said mixture is then autoclaved to achieve the required strength and other properties.



They have further improved their product by utilizing recycled materials as raw materials. Earlier, when they moved from asbestos fiber based product to cellulose fiber based, imported virgin paper pulp was utilized.

Visaka Industries found that a cement board does not warrant such high quality virgin pulp. Therefore, they have again modified the production process to accommodate used cement paper bags. By doing so, the company has managed to use waste cement bags, which would have otherwise gone through down cycling / land fill.

Case study 9: Elimination of heavy metals in paints

Heavy metals are widely used for manufacturing of paints and paint products. In paints and paint products, bright colors are achieved by the use of heavy metals such as arsenic, chromium & cadmium in pigments.

Some of the commonly used heavy metals are:

- Lead
- Chromium
- Cadmium
- Mercury

Berger Paints, a leading paint manufacturer, has ensured that the heavy metals are eliminated in all their paint products or maintained well within the internationally accepted limits. The threshold limit for the heavy metal is sum of all the metal concentration shall not exceed 0.1% or 1000 ppm.

Their products were tested as per IS standard by a third party test laboratory and the details of heavy metals presence in one of their GreenPro certified products are as below.

S.No	Heavy metal	Concentration (%)
1	Lead	0.03
2	Cadmium	0.0007
3	Chromium	0.004
4	Mercury	Nil

Credit 3.2: Recycled Content / Utilization of wastes

Intent

Reduce virgin material consumption by increasing the recycled content or any other industrial / municipal wastes at the time of manufacturing of the products.

Compliance options

Virgin material consumption can be reduced by increasing the recycled content or any other industrial / municipal wastes as part of the raw materials without compromising the quality of the end product.

GreenPro encourages the manufacturers to utilize the pre consumer and post-consumer wastes for recycling.

- Pre consumer waste - it is a waste produced during the distribution and before the product is used by the end user.
- Post consumer waste - It is waste produced at the end of life of the product after being utilized by the end user.

The manufacturer may also explore the possibility of utilizing industrial or municipal wastes as part of the raw materials, which otherwise will go to the landfills.

To comply with the requirements of the credit, the manufacturer needs to produce the details of purchased raw materials, waste used for recycling and the total production of the end products. The percentage of recycled content in the final product will be ascertained based on mass balance.

Point allocation

Credit points are allotted based on the percentage of recycled content in final product. Point allocation and the threshold limits for the recycled content will vary depending upon the product category.

Refer the respective product category specific GreenPro certification standard for the allocation of credit points.

Documentation Required

1) Quantity of raw materials and waste materials purchased for recycling
2) Total production quantity

Approach:

In Industry, the feasibility of increasing the recycle content in the raw materials mix is affected by multiple factors. These include availability of recycled materials or industry wastes, supply chain to ensure uninterrupted supply, technological support for recycling, cost of recycled materials etc. Though increasing the recycled content is major challenge, it can contribute significant economic and environmental benefits. Industry to initiate the following to improve the recycled content in the final product.

Design the products for recycling: Improve the design of the products, services and processes to reduce the waste produced by the product at the end of its life cycle. The major portion of the products should be recyclable. The manufacturing unit can set a target to increase the percentage of recyclable components in the final products. It is unavoidable that some components or a percentage of product can become waste which can go for only down cycling.

Support Industrial Channel for waste recycling or recovery: The manufacturer to take initiative to create awareness amongst the product distributers, end users and the waste recyclers for recycling the products. The manufacturers should also work with the waste recyclers to process the waste and supply in such a way that it can be utilized as a raw material.

In some cases, the manufacturer may have to work with the authorities on policy issues to create an enabling environment for recycling.

Case study 10: Recycling of broken construction blocks

One of the biggest environmental concerns for Autoclaved Aerated Concrete (AAC) blocks industry is the disposal of broken blocks during the manufacturing stage. The broken blocks are usually sent to landfills. JVS Komatsco, a leading AAC block manufacturer has recycled the broken blocks for producing AAC blocks and reduced the consumption of cement and other raw materials.

They have commissioned a crusher unit which would crush the waste blocks into the desired size. The crushed blocks are added to the main mixture of cement, flyash and other raw materials. Quantity of crushed blocks added is about 16% of the total raw materials.

Initially, the addition of crushed blocks disturbed the whole manufacturing process and the company had to reformulate the process so as to accommodate the new ingredient. The company perfected the addition process over several trial and error processes.

Case study 11: Increase the Utilisation of Fly ash for manufacturing of Portland Pozzolana Cement (PPC)

Fly ash produced in thermal power plants is a major concern for environment. Majority of fly ash produced in power plants is sent to landfills. Fly ash is a very good pozzolanic material which can be utilized as an additive in manufacturing of cement. This leads to reduction in consumption of natural resources such as lime stone, coal etc.

Majority of cement manufacturers started producing fly ash based cements. However, the quantity of fly ash addition varies from manufacturer to manufacturer because of a variety of reasons.

As per Bureau of Indian standards the maximum and minimum percentage of fly ash that can be added in the cement are as below:

- Minimum level - 15%
- Maximum level - 35%

Dalmia Cement (Bharat) Limited, a leading cement manufacturer in the country has taken several measures to improve the absorption of fly ash in their cement. They have gradually improved the fly ash absorption over a period of time. The percentage of fly ash addition over a period in their PPC is as below.

Year	**2013-14**	**2014-15**	**2015-16**
PPC Production in Tonnes	1542275	1196226	1121487
Fly ash consumption in Tonnes	465683	381246	381937
% of Fly ash addition	30.2	31.9	34.1

Case study 12: Low Density Aggregate (LDA) Pellets

Indian Metals & Ferro Alloys (IMFA), a leading Ferro alloy manufacturer has a captive power plant to cater to their power requirement. During the process of power generation, significant amount of fly ash is generated. Fly ash disposal is a major environmental concern and typically disposed as land fill.

IMFA has utilised the fly ash generated from the captive power plant for manufacturing of Low Density Aggregate which is an alternate for conventional aggregate utilised in concrete making.

The manufacturing process of LDA from fly ash involves following steps:

- Fly ash collected from power plant ash silos are mixed with binder (1-2%), coal and water.
- The mixers send the slurry to 'pelletiser' to form globules of varying size of 4 to 16 mm.
- Globules deviating from required size are recycled back to the pelletiser.
- Globules are sent to the sintering section where the coal present in the pellets burns and produces the aggregate.

Green Features:

- Utilizes over 90% of fly ash as raw material
- Replacement of natural stone chips to be used as part of concrete thereby reducing the impacts of quarrying
- Avoids transport related emissions since more than 90% of the raw materials are sourced locally

Credit 3.3: Utilization of Regional materials

Intent

Encourage the use of raw materials that are extracted or manufactured locally to reduce the use of fossil fuels for transportation, thereby reducing associated environmental impacts.

Compliance Options

Explore the possibility of increased use of locally available products or materials as raw materials. This will minimize the local transport requirement and hence the associated Green House Gas emissions due to transportation.

Utilization of local materials will increase the local employment and boost the local economy.

Typically, GreenPro encourages the manufacturers to source the materials within the 400 kms of the product manufacturing unit. It is on par with the practices followed internationally.

In some of the product categories, the suggested limits are even lower. For example: In case of construction blocks, since it is not economically viable to source the raw materials beyond 150 Kilometers, it is recommended to source well within that distance.

Point allocation

Credit points are allotted based on the percentage of raw materials sourced regionally by weight. Point allocation will vary depending upon the product category.

Refer the respective product category specific GreenPro certification standard for the allocation of credit points.

Documentation Required

1) Details of the raw materials and their sources
2) Distance between the source(s) and the manufacturing unit

Manufacturing Process

Background

In a product life cycle, the manufacturing process demands for consumption of major resources such as energy, water, materials etc. This resource consumption contributes significantly for emissions during the manufacturing stage and the related foot print.

Manufacturing of the building products like Cement, Glass, Aluminum, Tiles, Paints etc. are highly resource intensive. Any marginal improvement for reducing the resource consumption contributes significantly for reducing the emissions and the foot print.

Some of the products may not be resource intensive while manufacturing. However, the availability of all the resources are becoming scarce and the prices are also always on increasing trend. Focusing on resource consumption reduction helps in reducing the manufacturing cost and enhancing the competitiveness. Hence, focus on resource consumption reduction is equally important in manufacturing of all products.

Resource consumption reduction is not a onetime activity. A systematic approach is required for taking up this on a continuous basis. Advent of latest technologies and processes always create opportunities for continuous improvement and reduce resource consumption.

GreenPro encourages the manufacturers to focus on the following areas to reduce the emissions during the product manufacturing process:

- Energy efficiency
- Water efficiency
- Use of Renewable Energy sources

Energy efficiency

Background

Energy efficiency is not a new concept for Indian Industry. Many Industries have improved energy efficiency on a continuous basis and achieved world class standards. For example, the specific energy consumption of Indian cement industry is the lowest in the world. At the same time, the Indian manufacturing sector offers enormous opportunities for energy efficiency improvement. As per the recent report of International Energy Agency (IEA), the energy saving potential, with the best available technology is about 17 Mtoe per year which is about 11% of the Industrial energy consumption in India.

Government policies encourage Indian industry to adopt energy efficiency measures. Bureau of Energy Efficiency (BEE) a nodal agency spear heading energy efficiency improvement in India, has launched Perform, Achieve and Trade programme for facilitating energy efficiency improvement in Indian Industry. Under this programme targets are set for reducing the energy consumption for the individual companies. Companies bettering the target are allowed to gain ECERTs and sell those in the market. Companies failing to achieve the target need to compensate by purchasing the ECERTs. There is financial incentive for companies improving energy efficiency and disincentive for those who are failing to improve. Presently, the PAT scheme covers 8 energy intensive industrial sectors. BEE is gradually widening the focus and planning to cover all the manufacturing industry under the PAT programme.

Energy efficiency has been considered as fourth fuel for the manufacturing industry. Irrespective of the regulatory requirements, the companies have to voluntarily improve energy efficiency on a continuous basis and reduce energy consumption. Apart from the environment and economic benefits for the individual companies, adopting energy efficiency, contribute significantly for national benefits such as lower fossil fuel dependency, reducing Green House Gas emissions and meeting the country's commitment at international level, reduced investment for the energy infrastructure and ultimately improvement in economy.

Though there are multiple benefits, GreenPro encourages the product manufacturers to adopt energy efficiency primarily to reduce the fossil fuel consumption and the associated environment impacts.

Credit 4.1: Energy efficiency

Intent

Enhance energy efficiency in the manufacturing process of the product, to reduce the associated environmental impacts.

Compliance options

Companies may adopt the following options for meeting the requirements of this credit.

1. Reduction in specific energy consumption

   - Establish Specific Energy Consumption (SEC) for both electrical and thermal energy consumption of the manufacturing unit.

$$SEC = \frac{\text{Total Electrical (KWh) / Thermal Energy (Kcal) consumption}}{\text{Total Production (Tonne (or) Number of Products)}}$$

   - Set short, medium and long term targets for achieving SECs
   - Identify and implement energy saving projects for reducing the specific energy consumption.

   In case of multiple products, the SEC figures need to be established for the individual products (or) for an equivalent product. For evaluation purpose, weighted average of specific energy consumption will be considered for a product, if an organization has multiple manufacturing units for the same products.

2. National / International Benchmarking

   Benchmark the specific energy consumption with National / International best operating plants. The benchmarking will help the companies to set the target for reducing the specific energy consumption.

   In case the National / International benchmarking figures are not available, the companies may carryout internal benchmarking based on the past performance.

Points allocation

Typically, the credit allocation of Energy Efficiency remains the same for majority of the product categories. Credit points are awarded based on the percentage reduction in specific energy consumption. The details of credit allocation are as below.

Credits	Criteria	Credit Points
	Manufacturing Process	
Credit 4.1	**Energy Efficiency**	
	Reduction in specific energy consumption ⩾ 5%	1
	Reduction in specific energy consumption ⩾ 10%	2
	Reduction in specific energy consumption ⩾ 15%	3
	Reduction in specific energy consumption ⩾ 20%	5
	Reduction in specific energy consumption ⩾ 25%	7
	(OR)	
	Benchmarking	
	National Benchmarking - Among top 5 Companies	5
	International Benchmarking - Among top 10 Companies	7

In case of the best performing plants, achieving increased percentage reduction in specific energy consumption may not be possible due to economic reasons or availability of technology. In that case, credit points will be allocated only based on the benchmarking of the company at National or international level.

Documentation Required

1) Details of annual production, energy consumption & specific energy consumption for the preceding 3 years
2) Details of National Benchmark & International Benchmark data with comparisons
3) Details of implementation of energy efficiency improvement measures with actual benefits achieved

Approach:

Companies have to adopt a systematic approach for implementing energy efficiency measures on a continuous basis. The following step by step approach may be adopted for reducing the energy consumption.

Energy management cell: a large energy intensive company has to set up an energy management cell with qualified energy managers / auditors. In case of a small company, a cross functional team can be set up involving key personnel from production, electrical and mechanical maintenance, instrumentation etc. The energy management cell should be headed by a senior person from the management.

Specific Energy Consumption: Establish the specific energy consumption figures product wise for both electrical and thermal energy consumption. In some cases, the company may arrive at the figure by converting electrical energy into an equivalent thermal energy.

Benchmarking and Target setting: The organization may set the short, medium and long term target for reducing the specific energy consumption. The target can be set based on the national or international benchmarking. If the benchmarking figures are not available, the company may set the target based on the internal benchmarking.

Allocate resources: allocate resources at the year beginning for implementing the energy efficiency measures. Broad guidelines given for utilization of the resources by the middle management. This will minimize the time taken for implementation of the projects.

Identify energy efficiency improvement projects: The energy management cell or the cross functional team has to identify improvement projects for implementation. The company many engage a third-party agency for carrying out energy audit once in 3 years to identify specific energy saving projects. While identifying the improvement opportunities, the following options can be considered.

- Capacity utilization - Increase the production and utilize the excess capacity available in the plant / individual equipment. The increase in capacity utilization will result in reduction in specific energy consumption
- Fine tuning - Excess margins are built into the equipment during the design stage. Due to various reasons,

there is always a deviation between the design and operating condition. This deviation leads to increase in energy consumption. Equipment fine tuning such as reduction in speed, resizing of the parts etc can be explored to reduce the energy consumption.

- Technology Upgradation - Advent of technologies always create opportunities for reducing the energy consumption. Utilize latest technologies as a retrofit or replacement for the maximum benefits.

Monitoring and Verification: After implementation of the energy saving projects, monitor and verify the benefits project by project. If there is a reduction in actual benefits vis-à-vis the anticipated, identify the reasons for the deviation and undertake the corrective measures.

Water Efficiency

Background

Availability of fresh water is only about 2.5% of the total water on the earth. Out of the available fresh water, only 0.4% is fit for human consumption. Of the balance 97.5%, about 30% is ground water and rest is in the form of ice in glaciers. The ground water level is also deteriorating day by day. On the other hand, water consumption on all fronts - Agriculture, Domestic and Industry is on increasing trend.

In India, the present industrial water consumption is about 45 billion cubic meter which is expected to increase about four-fold by the year 2050. Industry is also only dependent on the common water resources and ground water for meeting their water requirement. This leads to a situation where in industry has to compete with society for their water requirement, which is unsustainable. The cost of municipal water supply to industry and water treatment cost is also on increasing trend. The increase in water consumption also adds to increase in waste water generation and hence the cost of waste water treatment. All these significantly contribute to the increase in operation cost of the Industry.

Hence there is a need for industry to explore all the options to reduce the water consumption in the plant. Apart from reducing their own consumption, industry need to be proactive in harvesting the rainwater and recharge the aquifer for improving the water table. They also need to go beyond their fence, create access to potable water for the society. These will create a conducive atmosphere for the industry and society to coexist without competing for the water.

Hence, GreenPro encourages Industry to focus on the following:

1. Reduce water consumption
2. Rain water harvesting
3. Beyond the fence initiatives

Credit 4.2: Water Efficiency

Intent

Incorporate water efficiency measures in the manufacturing process to reduce potable water consumption and implement measures to benefit the society at large.

Compliance Options

1. Reduce Specific water consumption
   - Establish Specific water consumption for the products manufactured.
     - o Specific water consumption = $\frac{\text{Total water consumption}}{\text{Total Production}}$
   - Set short, medium and long term targets for achieving reduction in specific water consumption
   - Implement water efficient measures & technologies and recycle waste water generated from the plant to reduce the specific water consumption.

   In case of multiple products, the specific water consumption figures need to be established for the individual products (or) for an equivalent product. For evaluation purpose, weighted average of specific water consumption will be considered, if an organization has multiple manufacturing units for the same products.

   - National / International Benchmarking
   - Benchmark the specific water consumption figures with National / International best operating plants. The benchmarking will help the companies to set the target for reducing the specific water consumption.
   - In case the National / International benchmarking figures are not available, the companies may carryout internal benchmarking based on the past performance.
2. Harvest or Capture minimum of 95% of rain water runoff from roof & non-roof areas of the manufacturing facility
3. Implement measures for improving the availability of portable water beyond the fence for the benefit of the local community

Points allocation

Typically, the points allocation for Water Efficiency credit remains the same for majority of the product categories. Credit points are awarded based on the percentage reduction in specific energy consumption. The details of credit allocation are as below.

Credits	Criteria	Credit Points
	Manufacturing Process	
Credit 4.2	**Water Efficiency**	
	Reduction in specific water consumption	
	Reduction in specific water consumption ⩾ 5%	1
	Reduction in specific water consumption ⩾ 10%	2
	Reduction in specific water consumption ⩾ 15%	3
	Reduction in specific water consumption ⩾ 20%	4
	(OR)	
	Benchmarking	
	- Among top 5 units National level	3
	- Among top 5 units International level	4
	Rain water Harvesting - Harvest 95% rainwater run-off from Roof & Non-Roof areas	1
	Beyond the fence initiatives	1

In case of the best performing plants, achieving increased percentage reduction in specific water consumption may not be possible due to economic reasons or availability of technology. In that case, credit points will be allocated only based on the benchmarking of the company at National or international level.

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation, if the facility achieves the status of “Zero effluent Discharge”

Documentation Required:

1. Details of annual water consumption & Specific water consumption for 3 years
2. Details of National Benchmark & International Benchmark data with comparisons
3. Rain water harvesting system installed and quantity of water harvested annually
4. Details of the beyond the fence initiatives and the benefits

Approach:

Water Efficiency

Companies may adopt a step by step approach for reducing the water consumption within their plant. The objective should be to reduce the intake of fresh water and ultimately achieve 'Zero effluent Discharge' status. This can be achieved by adopting '3R - Reduce, Reuse and Recycle' principle at every stage of water consumption. This will lead to reduction in water intake and at the same time reduce the quantity of waste water discharge.

- **Reduce** - Adopt water efficiency measures and technologies to reduce the water consumption at the end user level. The water efficiency measures include elimination of water leakage in the process, losses on account drift, windage etc. The companies may explore utilization of latest technologies such as low flow fixtures, water less urinals etc for reducing domestic water consumption.
- **Reuse** - In manufacturing industry, quality of water discharged from one process may be sufficient to meet the requirement of subsequent or another process. Map the quality and quantity of water requirements in various processes and explore the possibility of reusing the water discharged from one process in another process. Reuse will reduce the overall freshwater consumption.
- **Recycling** - Treat the waste water discharged from the plant appropriately to meet the quality requirements and utilize the same in the process.

By adopting the 3R principle, explore the possibility of reducing the quantity of water discharged to zero or to the bare minimum level. After achieving the bare minimum level, at the end of the waste water treatment, natural or mechanical evaporation may be adopted for achieving the status of '**Zero Effluent Discharge**' plant.

Rain water Harvesting

Companies may adopt either or combination of the following approaches for implementing rain water harvesting within their plant premises.

1. If sufficient storage facility is available, capture the rain water, store and utilize the same for internal consumption (OR)
2. Recharge the ground and augment the water table

Capture the rain water from roof and paved non-roof areas. The maximum quantity of rain that can be captured is dependent upon the catchment area, run off coefficient and the average rain fall in that area.

Annual water harvesting potential = Catchment area x Run off coefficient x Average annual rain fall.

The average annual rain fall data can be obtained from the meteorological department. The run off coefficient value will vary depending upon the surface area. Typical runoff coefficients of some of the surfaces are as below.

Surface type	**Runoff Coefficient**
Cemented / Tiled Roof	0.95
Turf - Flat to steep	0.25 - 0.45
Concrete Pavement	0.95
Gravel Pavement	0.75
Mixed vegetation - Flat to steep	0.1-0.3

Before the storage or recharging, the rain water need to be filtered. In case of storage, harvested rain water has to pass through a filter chamber with filtering media such as fiber, coarse sand and gravel layers to remove debris and dirt. Charcoal can be used for additional filtration. Selection of filter depends upon the quality of run-off water. Settlement tanks are used for removing silt or any floating impurities before sending the harvested rain to recharge pit.

Beyond the fence Initiatives

Companies have to involve the local community for addressing their water requirements. Company may support the local community by providing potable water or creating access to potable water. This may involve creating water storage systems, developing nala bunds, check dams, rain water harvesting systems for augmenting ground water level etc.

Renewable Energy

Background

Use of renewable energy sources addresses the challenges of the energy security and climate change simultaneously. Due to various reasons, such as advent of latest renewable technologies, increase in volume and subsidies from the government the cost of renewable sources and hence renewable power cost have come down significantly over a period of time and become competitive. India, with a huge potential for renewable power generating sources offer enormous opportunities for Indian industry to substitute fossil fuels with renewable power.

Manufacturing industries have invested in renewable sources such as Wind, Solar, Biomass etc. or engaged in power purchase agreement with renewable power generators for purchasing the renewable power. The generated / purchased power is wheeled through state grids for their own consumption. This has significantly reduced their energy bill and also resulted in reduction in GHG emissions. Small manufacturing units have come together and formed consortiums for purchasing power from the renewable power generators.

Apart from the offsite power generating sources, companies can also explore the possibility of utilizing their own premises for installing renewable power sources such as solar panels, micro wind turbines etc. The generated power can be stored in batteries and utilized for their internal consumption or exported to grid. 'Net' or 'Gross' metering facilitates the companies to export power to the Grid whenever there is less internal consumption.

Utilization of renewable energy for product manufacturing significantly reduces the emissions in the overall life cycle of the product. Hence, GreenPro encourages the manufacturers to adopt both 'Offsite' and 'Onsite' renewable sources to replace the power generated by the fossil fuel.

Credit 4.3: Renewable Power

Intent:

Encourage the use of on-site & off site renewable energy sources to reduce the dependence on fossil fuels and their associated environmental impacts.

Compliance Options

Offsite renewable energy sources

Invest in Off-site renewable energy sources such as Wind, Solar PV, Biomass based power generation etc. or enter into a power purchase agreement with a renewable power producer for purchasing of renewable power. Utilize the generated or purchased renewable power through wheeling.

Onsite renewable energy sources

Install onsite renewable energy sources such as Solar PV or micro wind turbine within the plant premises and substitute the renewable for the grid power. Explore the possibility of exporting the power when there is no internal consumption, if 'Net' or 'Gross' metering facility is available.

Points allocation

Typically, the points allocation for Renewable Energy credit remains the same for majority of the product categories. Credit points are awarded based on the percentage of substitution for the grid power by the renewable power. The details of credit allocation are as below.

Credits	Criteria	Credit Points
	Manufacturing Process	
Credit 4.3	**Renewable Energy**	
	On-site renewable energy generation (Both electrical & thermal)	
	⩾2.5% ⩽ 5% of total annual energy consumption	1
	> 5% of total annual energy consumption	2
	Off-site Renewable Power	
	⩾10% of total annual power consumption	1
	⩾20% of total annual power consumption	3
	⩾30% of total annual power consumption	5

A company is eligible for claiming the allotted points to the threshold level of 5 Credits if they have done exceedingly in either on-site or Off site renewable energy generation.

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation Credit, if the contribution from the renewable energy sources is more than 40% of the annual energy requirement of the manufacturing facility

Documentation Required:

1. Details of installation of onsite and offsite renewable power generating sources including the technology, installed capacity and location with photographs of installations.
2. Details of total power consumption in the manufacturing facility and renewable power produced in kWh

Approach

Companies may explore the possibilities of both 'Onsite' and 'Offsite' renewable power generating sources for substituting the grid power or power generated through fossil fuels.

Onsite renewable sources

The following may be taken up before implementing onsite renewable power generation sources.

1. Assess the potential and opportunities - As a first step, companies to assess the potential for renewable power generation such as Solar PVs, Micro wind turbine etc based on the available land, solar radiation in case of solar PV and wind velocity in case of micro turbine etc.
2. Study the possibilities of utilization - Explore the possibilities for going of 'Net' or 'Gross' metering. If 'Net' or 'Gross' metering facilities are offered by the state utility, the company may adopt the same for exporting the power generated to the grind whenever, there is low internal consumption or excess power generation.
3. If such facilities or not offered by the local utilities, explore the possibility of storage and utilization. For an example, to start with, the lighting - both factory and exterior lighting can be converted into solar PV based lighting.
4. Based on the 'onsite' renewable power generation potential, requirement and the cost benefit analysis, set the target for increasing the renewable sources within the factory premises.

Off site renewable sources

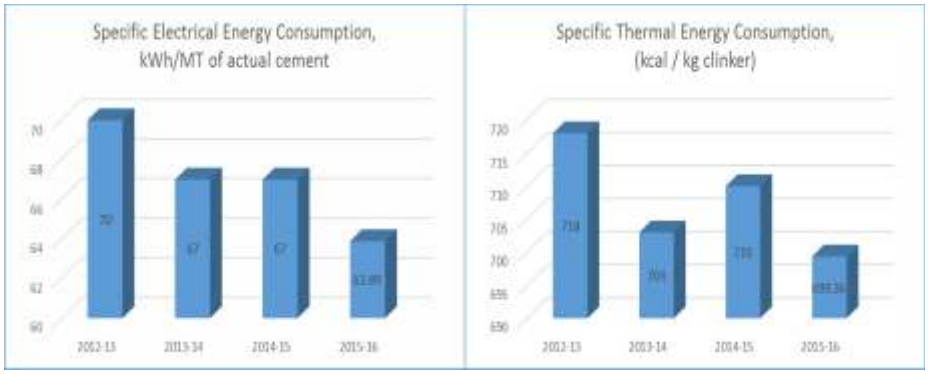
The following may be considered by the companies while exploring the possibilities of utilizing off grid renewable power:

1. In case of large scale industries, where power requirement for manufacturing process is in MWh, the company can explore the possibility of investing in renewable power sources and wheel the power through grid for their utilization. This may call for huge investment, however, since the reduction in energy cost is significant, it will be financially beneficial in the long run for the organization.
2. Apart from financial analysis, the companies need to consider the local government policies related to renewable power export, wheeling etc. and the grid conditions while investing in off grid renewable sources.
3. The companies may also explore the possibilities of engaging in power purchasing agreement with renewable power generators. The purchased power can be wheeled through the local grid. This will not require initial investment. In this case, since the purchased power cost will be comparatively higher, the company may gain only marginal financial benefits.
4. In case of small and medium scale industries, where power requirement for manufacturing process is lower, the company may join the Green Power Market Development programme of CII. The Green Power Market Development programme aggregates multiple smaller renewable power purchasers and facilitate them to purchase power at a competitive price from large renewable power producer. this creates a 'win-win' situation for renewable power purchasers and producers.

Case study 13: Reduction in Specific Energy consumption in a Cement Manufacturing Unit

A leading cement manufacturing company has reduced the specific electrical and thermal energy consumption on a continuous basis by implementing various energy saving measures. They have achieved 9% reduction in specific electrical energy consumption and 3% reduction in specific thermal energy consumption in the past 3 years.

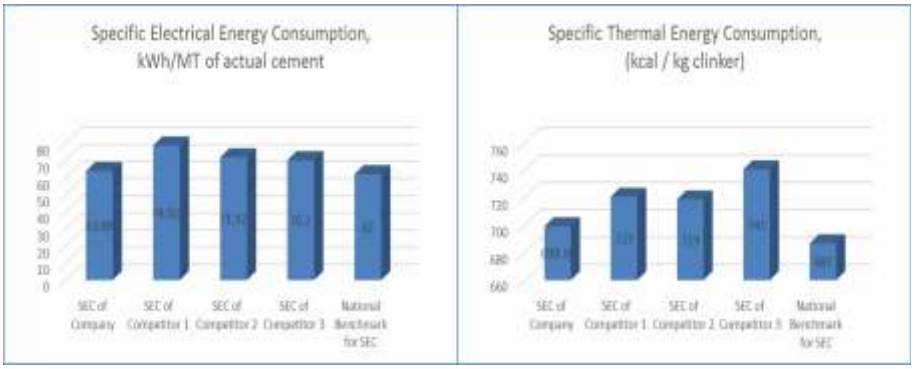
The plant has a target to achieve 61 kWh/MT of cement and 692 kcal / kg clinker by 2016-17.



Following are some of the initiatives implemented by the plant in the last 3 years:

- Reduction of specific power and fuel consumption in pyro section. Achieved savings of 7.6 lakh kWh per year
- Re-design of CVRM internals and modification of material handling circuit resulting in 11.6 Lakh kWh annual savings
- RVRM internal dam ring and scatter ring modification resulting in 9.3 Lakh kWh savings
- In-house modification of raw mill hot gas inlet duct resulting in 5.1 Lakh kWh savings

The plant has also benchmarked themselves against the other best performing plants in India. Based on the benchmarking they have set the target to become the plant with lowest specific energy consumption.



Waste Management

Background

Industries produce variety of wastes during the manufacturing process. These include both hazardous and non-hazardous wastes. Improper waste management leads to unhygienic and hazardous conditions in the workplace and the surroundings. According to a report by Indian Network for climate change assessment, waste management contributes to about 3% of global GHG emissions.

Waste management gains significant importance due to variety of reasons and waste is treated as wealth. Some of the reasons include:

1. Increase in cost of raw materials
2. Increase in cost of waste disposal
3. Stringent regulations from the government and the regulatory authorities
4. Potential risk of opposition from the local community etc.

Life cycle thinking helps the manufacturer to adopt all the possible options to reduce the waste and produce green products. This facilitates sending the waste generated during the manufacturing process back to the life cycle of the product as much as possible. Only a minimal quantity of waste which cannot be recycled is sent to land fill or disposed in an environment friendly manner through authorized agencies.

Meeting all regulations of government and local authorities related to waste management is a mandatory requirement. Apart from meeting the mandatory requirement, GreenPro encourages the manufacturers to adopt life cycle thinking in waste management and explore all possible options to reduce the quantum of hazardous and non-hazardous wastes sent to landfill or for disposal.

Mandatory requirements

Compliance to local regulations on solid, liquid and gaseous wastes discharged from the manufacturing location.

Intent

To ensure that the solid, liquid & gaseous wastes discharged from the plant comply with all local regulations.

Compliance options

Compliance certificate from State Pollution Control Board

Credit 5.1: Waste Utilization & Disposal

Intent:

Encourage appropriate handling and disposal of waste during manufacturing, thereby reducing environmental impacts and enhance health & wellbeing of the society.

Compliance Options:

- Segregate Hazardous and Non-Hazardous wastes. Further, within Non-hazardous wastes segregate them into recyclable, non-recyclable dry wastes and wet wastes.
- Establish specific waste produced in each category based on the quantity of waste generated and the production.
- Minimize wastes by implementing measures based on 'reduce, reuse and recycle' techniques.
- Reduce the quantity of waste sent for disposal or landfill

Award of Points

Credit points are awarded based on the percentage reduction in quantity of Non-hazardous and hazardous wastes sent for disposal or landfill

Credits	Criteria	Credit Points
	Waste Management	
Credit 5.1	Waste Utilization & Disposal	
	Non-Hazardous waste	
	10% reduction in disposal of waste per unit of production	1
	15% reduction in disposal of waste per unit of production	2
	20% reduction in disposal of waste per unit of production	3
	25% reduction in disposal of waste per unit of production	4
	Hazardous Waste	
	> 5%reduction in waste going to landfill	1
	> 10%reduction in waste going to landfill	2
	> 15%reduction in waste going to landfill	3
	> 20% reduction in waste going to landfill	4

Exemplary Performance:

This credit is eligible for exemplary performance under Innovation Credit, if 100% of the waste generated is utilized through innovative ways and means with higher value addition.

Documentation Required:

Details of the following for the preceding 1 year:

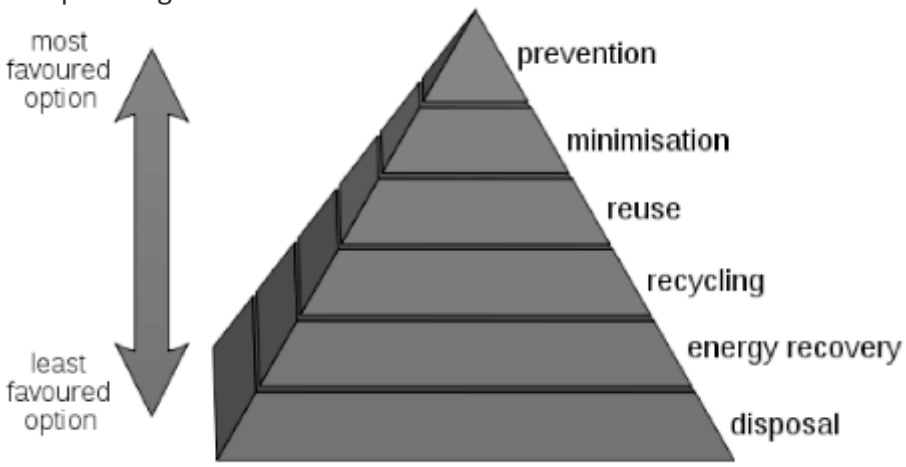
1. Details of waste generated and their quantity by weight or volume
2. Details of utilization of the wastes and the process of utilization
3. Details of the wastes handed over to Approved Common Hazardous Wastes Treatment Storage and Disposal Facility (TSDF) for past 3 years

Approach

Waste management requires life cycle thinking and an integrated approach for eliminating the waste generation during the manufacturing process. The following approach may be adopted for minimizing the waste generated during the manufacturing process.

1. First step towards the sustainable waste management is segregation of wastes and inventorisation. Segregate the wastes generated into hazardous and non-hazardous wastes. Further classify the non-hazardous wastes into recyclables solid wastes, non-recyclable wastes, wet wastes etc. Classify the hazardous wastes as per the schedule 1, 2 and 4 of hazardous waste (Management, Handling and Transboundary movement) rule 2008 and E Waste management and handling rule 2010.
2. After the segregation, quantify the wastes in each category and store in properly designed, designated area. The storage of hazardous wastes should be as per hazardous waste management rule 2011 by Ministry of Environment and Forest. The quantification of waste may be based on absolute quantities in terms of Kgs, Liters etc. or based on specific waste generation i.e. quantity of waste generated per unit quantity of product produced.
3. Prevention and minimization of the wastes at source are the most preferred options. Once the wastes are generated explore the possibility of reuse or recycle through appropriate mechanisms. If reuse / recycling is not feasible and if the waste has good calorific value, energy recovery can be explored. Finally, if none of the options are feasible then the wastes can be sent for landfill or disposal.

The hierarchy of waste management techniques in the order of most preferred option to the least preferred option is given below.



Case study 14: Minimization of Waste within the factory and in the Supply Chain by a furniture manufacturer

One of the top furniture manufacturer in India has reduced the waste disposed to landfill through efficient usage of resources. They have involved their vendor network to reduce the waste generation by appropriately modifying the size of raw material supplied for furniture manufacturing. In this process, they have also facilitated their suppliers to reduce material wastes at their end. This has created a win - win situation for the raw material supplier and the product manufacturer.

The company has taken a target to reduce the resource intensity by 25% in 3 years when compared to 2014-15 baseline.

Parameter	2014-15	2015-16	2016-17	2017-18
Material conservation and waste reduction	Baseline	15% on previous year	5% on previous year	3% on previous year

To achieve the target, the company has taken up the following initiatives:

1. Identify vendors who have the potential for 'High Influence, High Impact'.
2. The vendor cluster is trained on resource efficiency, material conservation, waste management etc. by industry experts.

3. On-site training programs are conducted by industry experts and senior management and opportunities for reduction are identified

Following are some of the opportunities identified by the vendor cluster and implemented w.r.t. waste reduction:

- Changing the sheet size for achieving better optimization (yield improvement)
- Material Size optimization (wooden boards) from size 8X6 & 9X6 to size 7X6 & 9X5
- Product mix production planning for better material utilization
- Reusing the scrap generated in process as raw materials for new product
- Recycling of EPS waste generated in the plant
- Recycling of thermocole waste generated in the plant

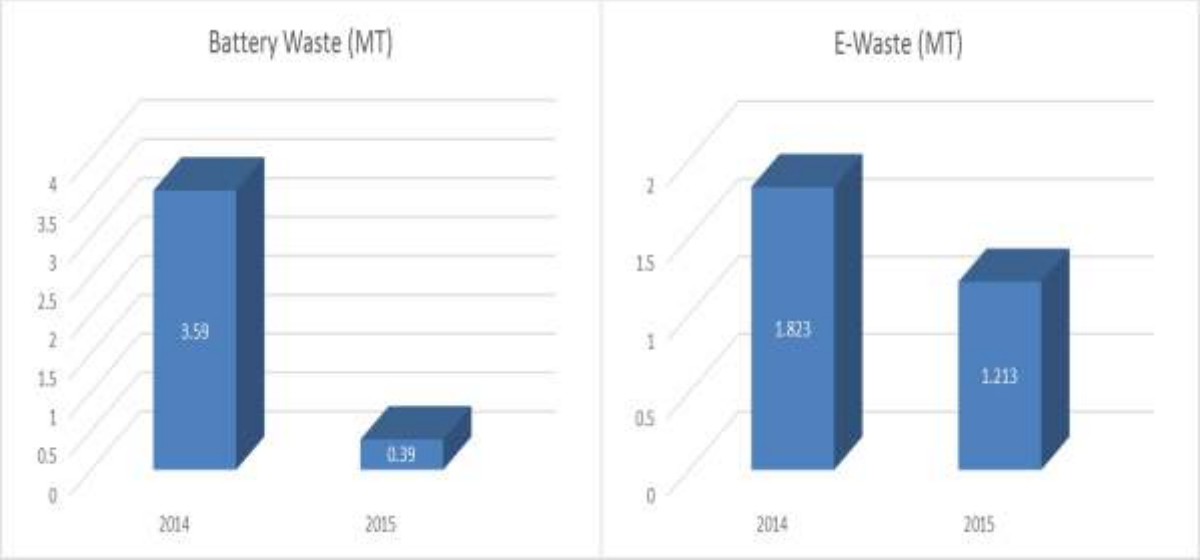
While the overall resource intensity is reduced by 13.65%, over 50 projects are identified for waste reduction and a saving of 12% per project is achieved in 2015 - 16.

Case study 15: Hazardous waste management in a leading cement manufacturing unit

A leading cement manufacturer has adopted efficient waste management practices and reduced the related environment impacts. Through various internal programs, the unit has optimized its processes and reduced the quantity of waste generated. The waste disposal plan includes segregation, inventorization and disposal mechanism of each type of waste generated.

Key programs implemented by the manufacturing unit are as follows:

- Reduction in used batteries generation through 'Waste Batteries Reduction Program' which recommends
  - Use of latest generation batteries with longer life
  - Use of maintenance free batteries
  - Intermittent charging during non-use period etc.



- **E Waste Reduction Program mandating**
  - Regular inspection at scheduled intervals
  - Use and upgrading with latest generation electronic panels with higher life
- **Reduction in lubricant consumption by 6.3%**
  - By identifying & arresting leakages
  - Through periodical testing and monitoring of line filtration by Electrostatic Liquid Cleaners (ELC) to increase the life of lubricants
  - Equipment with no/low lubrication requirement are selected

Life Cycle Assessment

Background

Life Cycle Assessment (LCA) is the most comprehensive method to assess the environmental impacts of a product, process or activity throughout its life cycle; from the extraction of raw materials through to product manufacturing, transport & distribution, use and disposal.

Earlier, the life cycle approach was used as a tool only to compare products for the environment impacts during the life time. Presently LCA finds many applications in the areas of

- Marketing - To highlight how the product has lower environment impact compared to other products in the market.
- Purchasing - To procure products with lower environment impact
- Product Design - To identify measures to incorporate in the product design to reduce the environment impact.
- Benchmarking - To understand the present status in comparison to national / international scenario and set target to improve the performance
- Policy - To bring in policy measures to encourage low carbon economy

LCA for a product will give important inputs on where the major environmental impacts occur in the life cycle of the product. The environmental impacts include Climate change, Acidification, Eutrophication, Photochemical smog, Fossil fuel depletion, Ecotoxicity, Ozone Depletion, Human toxicity etc. These major impacts can be either in the supply chain, in the processes owned by the company, or in the use or end of-life of the product.

With this knowledge, a company can formulate its environmental strategy aiming to improve their product's life cycle to reduce the overall impacts associated with the product. Measures implemented to reduce the environment impact at any stage contribute significantly towards optimizing the resource inputs. This in turn leads to reduction in operating cost and ultimately in improving the sustainability of the business and the bottom line.

GreenPro encourages manufacturers to carryout Life Cycle Analysis for their products and implement measures to reduce the overall environmental impacts.

Credit 6.1 Life Cycle Analysis

Intent:

Identify environmental impact at every stage of the life cycle of the product and initiate measures to reduce such impacts

Compliance Options

- Carry out Life cycle analysis of the product for the boundary conditions of Cradle to Cradle i.e. from the raw material sourcing to recycling / disposal of the manufactured products.
- The product manufacturer can carry out the life cycle analysis with the support of external service provider or with internal expertise using a LCA software tool.
- Based on the Life Cycle impact analysis, implement measures for reducing the environmental impacts.

Award of Points

Credit points are awarded for carrying out Life cycle analysis and implementation of the measures for reducing the environmental impact. The details are as below.

Credits	Criteria	Credit Points
	Life Cycle Approach	
Credit 6.1	Life Cycle Analysis	6
	Measures taken & Quantification of benefits achieved	
	- Implementation of at least one initiative	1
	- 2% impact reduction	2
	- 4% impact reduction	3
	- 6% impact reduction	4
	- 8% impact reduction	5
	- 10% impact reduction	6

Exemplary Performance:

This credit is eligible for exemplary performance if the implemented measure is innovative and addresses any of the measure that has not been covered as part of the rating system

Documentation Required:

1. LCA study report with the details of the study conducted and impact analysis
2. Details of the measures implemented based on the impact analysis of LCA study and the benefits achieved

Approach

Life cycle analysis of a product, involves the following step by step approach.

- Goal and Scope Definition - The purpose of taking up the LCA study and scope of the work need to be defined clearly. The first step also involves definition of the boundary conditions or the functional unit which would be considered for the study.
- Life cycle Inventory - This involves collection and estimation of data related to materials, energy, water, waste, emissions etc. at each stage of the life cycle of the product.
- Impact Assessment - This involves application of science based models for estimating the potential environment impact.
- Interpretations - This involves analysis of results and conclusions.

The above steps are outlined in International Organization for Standardization (ISO) standard ISO 14040, which is part of the ISO 14000 series on environmental management. ISO 14040 provides an internationally accepted framework for conducting LCA.

Based on the analysis of results, the company has to form a cross functional team involving personnel from all major departments to explore the possibility of reducing the life cycle impact through the following. In this process, the company may engage an external LCA expert for facilitating the process.

1. Identify the areas of focus for reducing the environment impact. If focus areas are beyond the manufacturing process, involve the relevant stakeholders in the subsequent process.
2. Identify measures for reducing the impact
3. Allocate resources and implement the measures
4. Repeat the LCA exercise to assess and monitor the impact reduction.

Case study 16: Life Cycle Analysis for Furniture

Goal

- To provide comprehensive view of the environmental profile of the product
- To identify opportunities for impact reduction and provide approaches for future products

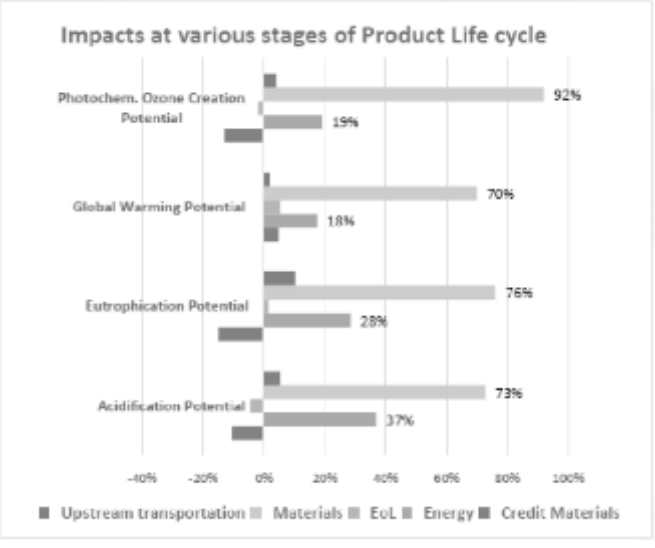
Scope

- 'Cradle to Grave' approach for assessment of product includes evaluation of environment impact of all activities associated with extraction of raw materials, transportation of raw materials, packaging, sale of product, use of product and disposal at the end.

Functional Unit

- 1 Square meter of WISH workstation.

Results of the study

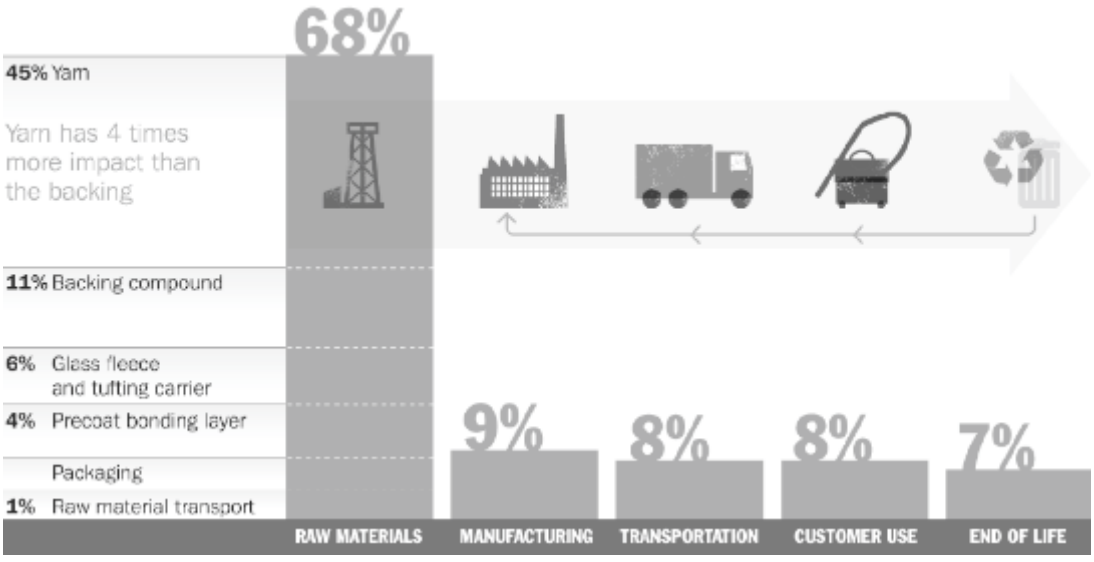


Observations:

- The major contribution to primary energy demand is related to the production of materials (86%), energy (16%) used in the WISH workstation. The key contributor is Aluminum extrusion (42%), pedestal (28%), Tile (11%).
- The major contribution to human toxicity is due to aluminum extrusion (47%) and tile (19%).
- Reduction in Al consumption by 10% resulted in 3% reduction in overall GWP.
- Reduction of energy consumption (electricity & natural gas) results in reduction of 1.7% reduction of GWP.
- 10% reduction in steel weight results in reduction of GWP by 3%.
- Increase in recycling of various materials such as wood, aluminum, steel may further lead to reduction in overall GWP.
- Use of selective plastic components may further reduce the GWP impact significantly.
- The plant has taken significant efforts to reduce material consumption by reducing the height of the frame, height of the lower metal tile, trims to flat trim.

Case study 17: Life Cycle Analysis for a Carpet Tile

A leading carpet tile manufacturer conducted LCA to be able to communicate the benefits of their product to consumers and also be able to identify opportunities for improvement.



LCA showed that 68% of the environmental impacts were caused in the raw material extraction stage. Manufacturing had just 9% impact while transportation had 8% impact on the environment with respect to the entire life cycle. Customer use and end of life also had a low 7-8% impact on the environment when compared to raw material extraction. In the raw material stage, about 45% of the environmental load was caused by yarn production. This therefore helped the company gain direction for future sustainability initiatives.

The above LCA results helped the company determine three ways of improving the environmental impact of a carpet tile:

- Reduce the amount of yarn
- Increase yarn recycled content
- Create a smarter yarn

Product Stewardship

Background

Product stewardship means being responsible for all phases of a product's lifecycle - from design to end of life and places the primarily responsibility with the producer. This is a paradigm shift from current practices that places the burden on end users, municipalities and local governments for handling end of life (EOL) waste and its disposal. Product stewardship has been advocated to the manufacturers for their own benefit and society at large to reduce the adverse health, safety and environmental impacts of products.

Product Stewardship principle requires that the producer takes primary responsibility for ensuring:

1. Proper and safe use of the product, which includes effective communication of the safe use of the products and their disposal

   It is the responsibility of the product manufacturers to educate all the stake holders involved after the product dispatch including the product distributors, vendors, end users etc regarding the safe use of the products and their disposal at the end of life of the product. This can be taken up through advertisements, awareness programs, product user manuals, information on the product packaging etc. Product manufacturer has to aim at covering hundred percent of stake holders over a period of time.

2. Extended Producer Responsibility - End -of- life (EOL) take-back and recycling of the product

   This implies that producers assume their fair share of post consumption system management responsibilities. The responsibility can be financial, operational, even technical, and must render producers answerable to and accountable for results. Producers independently or jointly should develop and put a system in place to take product back at the end of its life and recycle either in their own manufacturing facility or facilitate recycling through authorized recyclers.

3. Absence of toxic substances in the product and efficient manufacturing of the product, avoiding toxic substances in the process

   This is an essential element of product stewardship. This need to be taken up at the product design stage, selection

of raw materials free from toxic/hazardous and prohibited substances. Elimination of toxic substances has been already addressed in GreenPro in the Raw Materials and Product Performance modules.

4. Quality management system to reduce rejection rate after product dispatch

   Generally, the scope of the product quality management system adopted by manufacturers is limited to their factory premises. Products may get rejected before their use due to physical damages or deterioration in quality. These can happen because of improper handling of products or lack of quality management system in place during product transportation, distribution and storage. GreenPro encourages the product manufacturers to institute a quality management system at every stage after the dispatch of products before the end use to ensure that the end users achieve the intended benefits of a green product. In the Green Product Certification, Product Stewardship credit focuses on the following:

   - Education for the Stake holders on Green Products for reaping the intended benefits fully
   - Quality management system for minimizing the rejection rate after product dispatch
   - Extended producer responsibility increasing the recycling or safer disposal

Depending upon the applicability to the product category, the above criteria has been finetuned and adopted in the product specific GreenPro certification standard.

Credit 7.1: Education

Intent:

Educate those involved in handling the product at every stage post-dispatch, so as to reap the intended environmental benefits of the green product fully.

Compliance Options

Companies to develop and implement stake holder specific awareness and information sharing programmes for reaping the benefits of Green products at every stage after dispatch of the product.

Award of Points

Credit points are awarded based on the efforts taken by the product manufacturers for creating awareness and the percentage of stakeholders covered. Typically, Education credit accounts for 2 credit points and the points are awarded as below.

Credits	Criteria	Credit Points
7	Product Stewardship Credit	
7.1	Education	
	> 10% of people involved in handling the product after dispatch and users	1
	> 20% of people involved in handling the product after dispatch and users	1

Exemplary Performance:

This credit is not eligible for exemplary performance under innovation criteria.

Documentation Required:

- Details of the stake holders' specific awareness or information dissemination programmes about the Green Products, its features and their roles to reap the intended benefits
- Estimation of % of stake holders covered

Credit 7.2: Quality management system after dispatch of the product

Intent:

Intent of quality management system is to reduce rejection & waste during dispatch & storage

Compliance Options

Establish a quality management system for monitoring the quality of the product after dispatch till the use.

Award of Points

	Product Stewardship	
Credit 7.2	Quality management system after dispatch of the product	1

Exemplary Performance:

This credit is not eligible for exemplary performance under innovation criteria.

Documentation Required:

- Details of in place to oversee the quality of the product during distribution up to the user end.

7.3 Extended Producer Responsibility

Intent

To encourage manufacturers to institute a mechanism for product take-back for recycling or safe disposal at the end of useful life.

Compliance options:

The company is encouraged to have a mechanism for product take back which would involve:

- Collection
- Environmentally sound treatment of collected product
- Use of product & materials in the form of reuse or recycling

The company has to employ an environmentally friendly procedure or method to disposed off products that cannot be reused or recycled. The disposal method to comply with the Law of the country.

Credits	**Criteria**	**Credit Points**
	Product Stewardship	
Credit 7.3	Extended Producer Responsibility : Institute a system for product take-back for recycling or safe disposal	1
	Reduction in product take back	1

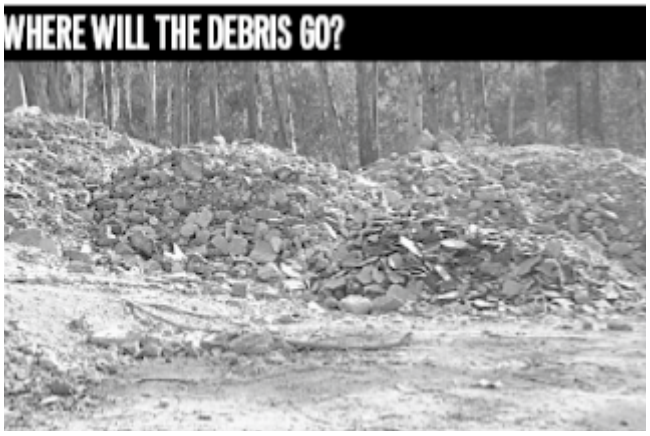
Exemplary Performance:

This credit is not eligible for exemplary performance under innovation criteria.

Documentation Required:

- Details of the mechanism in place for product take back
- Quantity of reduction in product take back.

Case Study 18: End of Life Management - Product Stewardship initiative for Recycling of Concrete.



Rooftops Canada has been supporting an unusual project in Mumbai, India. The CIDCO-YUVA Building Centre is a joint initiative set up by Rooftops Canada's partner, Youth for Unity and Voluntary Action (YUVA), and the City Industrial Development Corporation (CIDCO). The Centre recycles construction waste - reclaiming what was seemingly useless debris in a cost-effective and sustainable program.

The CIDCO-YUVA Building Centre has been successfully picking up construction waste - including brick, mortar, masonry and ceramic tiles - for a small fee. The debris is sorted, crushed and turned into new paving stones, bricks and mortar. **The Centre has created jobs in its recycling of old debris from construction sites and building demolitions and renovations, and its success has led to recognition by the City**.

The Indian brick industry, which is the second largest producer in the world next to China, consumes more than 24 million tons of coal annually. While the government has been emphasizing the use of more efficient kilns to reduce the industry's greenhouse gas emissions, it

also realizes that efficiency alone will not solve the problem. In response, the Municipal Corporation of Greater Mumbai (MCGM) has extended a call to the international engineering community to design, construct and manage a **500-ton per day construction and demolition (C&D)** waste recycling facility for the city. **The ultimate goal of the project is to substitute a portion of clay brick production with recycled material collected from the overwhelming amounts of C&D waste produced in the city each day**.

The CIDCO-YUVA Building Centre has been approached by the City to help in this ambitious undertaking. A plant of this size has never been constructed in the country and will also require the experience of international partners to carry it out effectively. The Indian construction industry remains unconvinced about recycling technology. This project is therefore an important opportunity to demonstrate that alternative methods not only function just as well as traditional practices but offer significant benefits for the environment and people of India. With an estimated one year remaining until landfill space in Mumbai is completely gone, the new large-scale recycling facility is urgently needed.

Case Study 19: Product Stewardship at Design stage - Development of Energy Efficient Air Conditioners & Refrigerators by a leading appliance manufacturing company

India is a signatory to the accelerated phase out plan for HCFC's (Montreal Protocol). Hence the need to select an alternative refrigerant which is CFC/HFC/HCFC free. The alternatives:

- HFC 407c
- HFC 410a
- HC 290

Approach to get best refrigerant:

- Evaluation of alternate refrigerants.
- Easy for the manufacturing of split and window type air-conditioner.
- Environmental/ Climate friendly.
- Safe in design, energy-efficient and cost-effective.
- 100 % ROHS compliance

ODP & GWP comparison -

Refrigerant	Ozone Depleting Potential	Global warming Potential
Chlorodifluoromethane (R22)	0.05	1810
Difluoromethane + Pentafluoroethane (R410a)	0	2090
Difluoromethane (R32)	0	675
Propane (R290)	**0**	**<3**
Carbon Dioxide (R744)	0	1

Benefits of the project carried out by the equipment manufacturing company:

- One production line produces around 1,80,000 HCFC-free, energy-efficient units per year. The direct emissions saved by these units, compared to earlier models using fluorinated gas refrigerants, as well as the savings in indirect emissions related to energy consumption, amount to about one million tonnes CO2 (based on a product lifetime of ten years).
- Air Conditioners with an Energy Efficiency Ratio (EER) of 3.7; higher than the currently applicable '5 star' threshold of 3.3
- Lowest power consumption (1350W for 1.5 Ton and 912W for 1.0 Ton) in respective capacity categories.
- Air Conditioners with zero Ozone Depleting Potential (ODP) and the lowest Global Warming Potential (GWP).
- Highest EER and lowest power consumption in the competition.

Most Energy Efficient Product -

India's most energy efficient Direct Cool Refrigerator -

1. Expanded poly styrene (EPS) support material replaced by pulp tray which is recyclable in direct cool refrigerator packing.

2. Achieve ROHS compliance from 75% to 100 % for all products

3. CFC/HCFC free Product

4. Hydrocarbon as a blowing agent in place of R12

5. 6-star performance of DC refrigerator

Comparison of the environment impact of the refrigerant adopted by the company and their peers is as below.

Criteria	Case study	Company 1	Company 2	Company 3
Refrigerant	Isobutene	R134a	R134a	R134a
ODS	0	0	0	0
GWP	3	1600	1600	1600

Innovation and Development

Background

Product manufacturers who have embraced green practices for quite some time have already implemented most of the conventional practices to improve sustainable performance of the products and reduce the resource consumption during the manufacturing process. Any further improvement may call for adoption of latest technologies and capital investment.

Companies need to be innovative and incorporate measures to economically reduce the emissions. Innovation can be in any of the following forms:

1. Adoption of latest techniques or practices

   The latest techniques or practices are those which are totally new to the industry / sector and not commonly practiced in India for reducing the emissions. The manufacturer could have either developed the practice on their own or borrowed from international practices.

2. Application of a known concept differently to yield the maximum benefits

   In this case, the application may be unique to concerned manufacturing unit. For example, 'Recycling' is a known concept. However, if the manufacturer has utilized the recycling concept in such way that he could achieve significant reduction in raw material consumption in spite of all the limitations generally the industry encounters for recycling, then the initiative may be considered as innovation.

3. Implementation based on learning from other industrial sectors.

4. Implementation of latest technologies that lead to significant emission reduction.

For each of the above options, the product manufacturer has to justify how the measure implemented is innovative from their point of view.

Credit 8.1 Product Innovation

Intent:

Recognize initiatives that are not addressed in this Certification system but have a profound impact in protecting the environment.

Compliance options:

1. As part of the credit, the product manufacturer can apply for four innovative measures. If the implemented measures meet any one of the following criteria mentioned below can be considered as an innovative measure.
    - Any environmental measure not covered in the Certification but addressed by the manufacturer
    - Any measure surpassing the credit threshold of any of the credits included as part of this Certification
2. Receipt of Eco labels, Awards & accolades

The points for innovative measures are as follows:

Credits	Criteria	Credit Points
	Innovation	
Credit 8.1	Innovation : Each innovative measure implemented at any stage of Life cycle will gain 1 Credit Point	4
	Other Credentials, Awards and Accolades	1

Documentation Required:

1. Details of the innovative measures highlighting the Intent and the measured Impacts
2. Copy of the certificates for the details of Eco-labels, Awards & accolades obtained

Annexures

Annexure -1

Details of Performance Parameters to be tested and suggested Testing Standards

S.No	Product	Parameters to be tested	Testing Standard
1	**Paint**	Volatile Organic Compounds	ASTM D 6886
		Longivity	Sunshine whetherometer test / QUV test
		Heavy metals Mercury Lead Cadmium Hexavalent Chromium	 ISO 3856-7 or ASTM D 3624 ISO 3856-1 or ASTM D 3335 ISO 3856-4 or ASTM D 3335 ISO 3856-5
		Halogenated Hydrocarbon	ASTM D4457
2	**AAC block**	U' Value	ASTM C 55
		Radio activity	
3	**Housekeeping chemicals**	Volatile Organic Compounds	ASTM D-6886 or USEPA method - 24
		Flammability - Flash Point	IS 1448
		Effect on Effluents	Test Methods as prescribed by the current "Guide Manual: Water and Waste Water Analysis" by CPCB, India, Or APHA – "Standard methods for the examination of water and waste water", shall be followed for each of the parameters
		Suspended Solids (mg/l)	
		Bio-chemical oxygen demand (BOD, 3 days at 27^{o} C) (mg/l)	
		Chemical Oxygen Demand (mg/l)	
		Phenolic compounds	
		pH	
		Toxicity	
		Total residual chlorine (mg/l)	
		Arsenic (mg/l)	
		Selenium (mg/l)	
		Cyanide (mg/l)	
		Bio-Assay test	
		Heavy Metals	
		Mercury (mg/l)	
		Lead (mg/l)	
		Cadmium (mg/l)	
		Chromium (VI) (mg/l)	
		Total Chromium (mg/l)	
		Copper (mg/l)	
		Zinc (mg/l)	
		Nickel (mg/l)	
		Manganese (mg/l)	

		Iron (mg/l)	Test Methods as prescribed by the current "Guide Manual: Water and Waste Water Analysis" by CPCB, India, Or APHA – "Standard methods for the examination of water and waste water", shall be followed for each of the parameters
		Vanadium (mg/l)	
		Eutrophicatior	
		Ammoniacal Nitrogen (as N) (mg/l)	
		Total Kjeldahl Nitrogen (as NH $_3$) (mg/l)	
		Free Ammonia (as NH $_3$) (mg/l)	
		Phosphates (mg/l)	
		Others	
		Fluoride (mg/l)	
		Sulphide (mg/l)	
		Nitrate (mg/l)	
4	**SRI Paints**	**Heavy metals** Mercury Lead Cadmium Hexavalent Chromium	 ISO 3856-7 or ASTM D 3624 ISO 3856-1 or ASTM D 3335 ISO 3856-4 or ASTM D 3335 ISO 3856-5
		Solar Reflective Index	ASTM E 1980
5	**Glass**	U Value	ASTM C 1363
		Solar Heat Gain Coefficient	NFRC 201-2010 Calorimetry Hot box method
		Visual Light Transmittance	ASTM E 792 or ANSI / ASHRAE 74 standard 74-73
6	**False ceilings**	Volatile Organic Compound	ISO 16000-6
		Formaldehyde	ISO 16000-3
7	**Roof tiles**	Thermal conductivity	ASTM C 1363-11
		SRI value	ASTM E 1980
8	**Insulation**	R Value	ASTM C 1363-11
9	**Furniture**	TVOC	Chamber test method - ASTM D 5116 and D 6670
		Formaldehyde	
		Total Aldehyde	
		4 Phenylcyclehexene (PCH)	
10	**Plumbing fixtures**	Water flow rate	Uniform Plumbing Code - India

About CII

The 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 8000 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.

About UNIDO

UNIDO is the specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability.

The mission of the United Nations Industrial Development Organization (UNIDO), as described in the Lima Declaration adopted at the fifteenth session of the UNIDO General Conference in 2013, is to promote and accelerate inclusive and sustainable industrial development (ISID) in developing countries and economies in transition.

The relevance of ISID as an integrated approach to all three pillars of sustainable development is recognized by the recently adopted 2030 Agenda for Sustainable Development and the related Sustainable Development Goals (SDGs), which will frame United Nations and country efforts towards sustainable development in the next fifteen years. UNIDO's mandate is fully recognized in SDG-9, which calls to "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". The relevance of ISID, however, applies in greater or lesser extent to all SDGs.

For further details, please contact:

Confederation of Indian Industry
CII-Sohrabji Godrej Green Business Centre
Survey No 64, Kothaguda Post, R.R. Dist., Near HITEC City, Hyderabad - 500 084
Tel: +91 40 44185111 Fax: +91 40 44185189

S Karthikeyan
+91 98400 02983