



IGBC Green Factory Building



®

IGBC Green Factory Building

Rating System

Version 1.0

Abridged Reference Guide

July 2009



Confederation of Indian Industry
CII-Sohrabji Godrej Green Business Centre

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Indian Green Building Council

C/o Confederation of Indian Industry
CII – Sohrabji Godrej Green Business Centre
Survey No. 64, Kothaguda Post
Near Kothaguda Cross Roads, R R Dist
Hyderabad – 500 032

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- ✓ Emerson Network Power (I) Pvt. Ltd.
- ✓ Environmental Design Solutions Pvt Ltd
- ✓ ETA Star Group of Companies
- ✓ Free Spanz
- ✓ G S B Forge Pvt. Ltd.
- ✓ General Cable Energy India Pvt Limited
- ✓ Godfrey Phillips India Ltd.
- ✓ Granules India Ltd.
- ✓ Hindalco Industries Ltd.
- ✓ I Enviro Com
- ✓ Infosys
- ✓ InterfaceFLOR India Pvt Ltd
- ✓ International Institute for Energy Conservation (IIEC)
- ✓ J K Paper Limited
- ✓ Johnson Controls India Pvt Limited
- ✓ K K Nag Ltd.
- ✓ Kermax Microsystems India Ltd.
- ✓ Kinetic Wudplas Pvt Ltd.
- ✓ Kingspan India Pvt Ltd
- ✓ Kirloskar Chillers Private Limited
- ✓ L R V Engineering Systems
- ✓ Larsen & Tubro Ltd.
- ✓ Manjeera Constructions Limited
- ✓ Mape Connoisseurs
- ✓ Masy Malladi Agro Systems Pvt Ltd.
- ✓ Mather & Platt Pumps Limited
- ✓ Milestone Ecofirst Advisory Services Pvt Ltd.
- ✓ National Remote Sensing Centre
- ✓ Organisation Development Consultants
- ✓ Powerdesk India Pvt Ltd.
- ✓ PSL Modular
- ✓ Reitz India Ltd
- ✓ Revac systems
- ✓ S S I D Consultants Pvt Ltd.
- ✓ Sai Enviro Engineers Pvt Ltd.
- ✓ Saint Gobain Glass India Limited
- ✓ Sauterrace
- ✓ Schrader Duncan Limited
- ✓ SGS India Pvt Ltd
- ✓ Siri Energy& Carbon Advisory Services Ltd
- ✓ Skyshade Daylights
- ✓ Sri Talasila Infrastructures (India) Pvt Ltd.
- ✓ Surbana International
- ✓ Surmount Energy Solutions Pvt. Ltd.
- ✓ Suzlon Infrastructure Ltd.(Synefra Engg and Construction Ltd)
- ✓ Systemair Fans Private Limited
- ✓ Taiba Engineering Consultants
- ✓ TATA BP Solar India Ltd.
- ✓ Wipro Ecoenergy
- ✓ Workspace Solutions
- ✓ Wysine Technologies Pvt Ltd



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Foreword from the IGBC

India is witnessing tremendous growth in infrastructure and construction development. The construction industry in India is one of the largest economic activities and is growing at an average rate of 9.5% as compared to the global average of 5%. As the sector is growing rapidly, preserving the environment poses a host of challenges. To enable the construction industry to be environmentally sensitive, CII-Sohrabji Godrej Green Business Centre has established the Indian Green Building Council (IGBC). IGBC is a consensus driven not-for-profit council representing the building industry, consisting of more than 600 committed members. The council encourages builders, developers and owners to build green to enhance the economic and environmental performance of buildings.

The Green Building Movement in India has been spearheaded by IGBC since 2001, by creating national awareness. The council's activities have enabled a market transformation with regard to Green Building concepts, materials and technologies.

IGBC continuously works to provide tools that facilitate the adoption of green building practices in India. The development of IGBC Green Factory Building Rating System is another important step in this direction.

IGBC Membership

IGBC draws its strength from its members who have been partners in facilitating the Green Building Movement in India. The local chapters led by individual champions and committed members have been instrumental in reaching out the vision of the IGBC at the regional levels. IGBC is today seen as a leader in spearheading the Indian green building movement. The council is member driven and consensus based.

Contact:

Indian Green Building Council

C/o Confederation of Indian Industry
CII – Sohrabji Godrej Green Business Centre
Survey No. 64, Kothaguda Post
Near Kothaguda Cross Roads, R R District
Hyderabad – 500 084, India
Ph: +91 40 23112971-74
Fax : +91 40 23112837
Email: igbc@cii.in
Web: www.igbc.in

I. Introduction

With the advancement of green building movement in India, many companies have evinced keen interest in having a holistic green design and construction framework for upcoming factory buildings. The national GDP expected to grow at about 7% and the contribution of the manufacturing sector to the national GDP being quite significant at 25%, more and more factories would be set up in the country. While the growth is imminent it is imperative that the development should happen in an environmentally sustainable manner. In this context the development and launch of a green rating programme for factory buildings would have far reaching impacts on saving natural resources, betterment of working conditions and enhanced productivity, thereby leading to substantial national benefits.

Green concepts and techniques in the industry can help address national issues like energy efficiency, conservation of natural resources, handling of consumer waste, water efficiency and reduction in fossil fuel use in commuting. Most importantly, these concepts can enhance occupant health, happiness and wellbeing. The concept of a rating would encourage designers to address these by design.

IGBC has set up the Green Factory Building Core Committee to develop the rating programme. This committee comprised of key stakeholders including corporate, architects, developers, manufacturers and institutions. The committee, with a diverse background and knowledge has enriched the rating system both in its content and process.

This rating system would address the factory buildings and not the processes. It would be applicable to all sectors of industry and for all climatic zones of India.

National Benefits:

The anticipated long term benefits, assuming a 200 green factory building stock erected in the next 5-6 years are the following:

- Ø Reduction in power demand by factory buildings
- Ø Reduction in GHG emissions
- Ø Reduction in potable water consumption
- Ø Increase of green cover in new factory premises, thereby reducing heat island effect
- Ø Recharge of aquifers with storm water
- Ø Enhanced indoor air quality leading to at least 1% productivity gains

II. Benefits of Green Factory Building

Green factory building can have tremendous benefits, both tangible and intangible. The most tangible benefits are the reduction in water and energy consumption right from day of occupancy. The energy savings could range from 30 – 40 % and water savings around 20 – 30%. Intangible benefits of green factory include enhanced indoor air quality, good daylighting, health, wellbeing and safety of the workmen.

National Priorities Addressed in the Rating System

Water Efficiency:

India is the second most populous nation in the world with a billion people. 70 percent of India's irrigation needs and 80 percent of its domestic needs are met by groundwater. According to World Bank estimates, by the year 2020 India is expected to experience severe water stress with the per capita availability of water projected to fall below 1000 cubic meters per year as compared to 2000 cubic meters per year in 1997. Water demand is expected to rise with the expanding urbanisation and industrialisation. Effective water management strategies need to address the crisis. The green factory building rating encourages use of water in a self - sustainable manner through reduce, recycle and reuse strategies.

Handling of Waste:

With expanding industrialisation and urbanisation, the quantity of waste generated is increasing. Several studies indicate about 25 million tons of municipal waste and 10 million tons of hazardous waste is generated annually. In the present waste management scenario almost 90% of the waste generated requires around 1200 hectares of land per year for disposal. The waste is either dumped or burnt, producing hazardous gases and leeching of toxins into the soil. Segregation of waste at source, diverting the material to the local recycling facilities and reuse of materials, thereby reducing waste dumped in the landfills are some of the strategies encouraged by the rating system.

Energy Efficiency:

Buildings consume significant amount of energy of which there is a potential to save 30 to 40%. This rating system mainly addresses the efficiency in the factory building energy consumption. Considering the tremendous knowledge and awareness levels amongst factory owners and designers, factory buildings are well positioned to embrace the latest trends and technologies in enhancing energy efficiency.

Reduced Use of Fossil Fuels:

Due to rise in standard of living economic activities are increasingly becoming energy and technology intensive. Fossil fuel consumption is increasing worldwide to keep up with the changing needs. The dependence on fossil fuels also raises the risk of climate change. Major contribution to atmospheric pollution and climate change are believed to be from carbon emissions produced from combustion of fossil fuels. The rising fossil fuel demand has evoked a fear of running out of fuel reserves in the future. To reduce the dependency on fossil fuels and the resultant air pollution, the rating system encourages the use of alternate fuels for transportation, public transportation, bio fuels for captive power generation, green power and onsite renewable energy generation.

Reduced Dependency on Virgin Materials:

Rising industrial needs demand greater use of materials for various activities. Use of non renewable, virgin materials would pose a risk of depleting the available natural resources. The rating system encourages projects to use recycled & reused material and discourages the use of virgin wood thereby addressing environmental impacts associated with extraction and processing of virgin materials.

Occupational Health:

Occupational Health is the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations which requires good health, adaptation to work and controlling risks. Occupational health is one of the major concerns in providing safety and good working conditions in the industrial sector to reduce the risk of problems related to work. The rating system addresses some of the issues related to occupational health such as avoiding the use of asbestos in construction, provision of breakout spaces etc.,

III. IGBC Green Factory Building Rating System

IGBC has set up the Core Committee to develop and maintain the ratings ongoing contemporary relevance to the industry. **The committee constitutes industry, academia, government, material manufacturers and institutions to provide strategic inputs and guidance.** The diversity in the professions and experience of the members brings in a holistic perspective in the process of developing the rating programme.

a. Evolution of the Rating System

IGBC, in its endeavor to extend green building concepts to all building types envisioned a rating programme for factory building in May 2008. A core committee was formed under the leadership of Mr. Pradeep Bhargava, Managing Director, Cummins Generator Technologies India Ltd. The committee drafted the pilot version of the programme which was launched in May 2009. The rating system is designed to suit Indian climate and construction practices.

After one year of implementation, feedback from pilot projects will be reviewed by the core committee and suggestions would be incorporated in the final rating system.

The rating system will be subject to review by the core committee, every 6 months, to ensure that it is updated and contemporary.

b. Features of IGBC Green Factory

IGBC Green Factory Building Rating System is a voluntary and consensus based programme. The rating system has been developed based on materials and technologies that are currently available. This rating system would facilitate the development of energy efficient, water efficient, healthy, more productive, environmentally friendly factories

The rating system evaluates certain credit points using a prescriptive approach and other credits on a performance based approach. The rating system is evolved so as to be comprehensive and at the same time user-friendly. The programme is fundamentally designed to address national priorities and quality of life for factory workmen.

The rating programme uses well accepted national standards and wherever local or national standards are not available, appropriate international benchmarks have been considered.

c. The Future of IGBC Green Factory Building

Many new green building materials, equipment and technologies are being introduced in the market. With continuous up-gradation and introduction of new green technologies and products, it is important that the rating programme also keeps pace with current standards and technologies. Therefore, the rating programme will also undergo periodic revisions to incorporate the latest advances and changes. It is important to note that project teams applying for IGBC Green Factory Building should register their projects with the latest version of the rating system. During the course of implementation, projects have an option to transit to the latest version of the rating system.

IGBC will highlight new developments on its website on a continuous basis at www.igbc.in

IV. IGBC Green Factory Building Process

The IGBC Green Factory Building addresses both the new and existing factory buildings.

The existing factory buildings should address the following measures (illustrative) before applying for certification:

- Ø Soil erosion control measures in future
- Ø Changes in design to accommodate requirements of differently abled people, like easy access to lifts, rest rooms etc.,
- Ø Change to low flow water fixtures
- Ø Rainwater harvesting
- Ø Limit turf areas
- Ø Have policy for use of green materials in future
- Ø Minimum fresh air ventilation
- Ø Comfort conditions
- Ø Use eco-friendly housekeeping materials

The rating system is valid for 3 years. On completion of 3 years, projects can validate / renew based on the prevailing latest version. The guidelines detailed under each credit enable the design and construction of green factory building of all sizes and types.

IGBC Green Factory Building rating addresses green features under the following categories:

- ✓ Site Selection and Planning
- ✓ Water Conservation
- ✓ Energy Conservation
- ✓ Material Conservation
- ✓ Indoor Environment Quality and Occupational Health
- ✓ Innovation & Design Process

Different levels of green building certification are awarded based on the total credits earned. However, every Green factory building should meet certain mandatory requirements, which are non-negotiable.

The various levels of rating awarded are:

- ✓ 'Certified' to recognise best practices
- ✓ 'Silver' to recognise outstanding performance
- ✓ 'Gold' to recognise national excellence
- ✓ 'Platinum' to recognise global leadership

a. IGBC Green Factory Building Registration

Project teams interested in IGBC Green Factory Building Certification for their project must first register with IGBC. Projects can be registered on IGBC website (www.igbc.in) under ‘IGBC Green Factory Building’. The website includes information on registration fee for IGBC member companies as well as non-members. Registration is the initial step which helps establish contact with IGBC and provides access to the required documents, templates, important communications and other necessary information.

Consult the web site for important details about IGBC Green Factory Building application as well as the certification review process, schedule and fee.

b. IGBC Green Factory Building Certification Levels

Certification Level	Points
Certified	51-60
Silver	61-70
Gold	71-80
Platinum	81-100

c. Documentation

The project team is expected to provide supporting documents at each stage of submission for all the mandatory requirements and the credits attempted. Supporting documents are those which provide specific proof of meeting the required performance level, such as, specifications, drawings (in native format only), cutsheets, manufacturer’s literature, purchase invoices and other documents. These details are mentioned in this guide, under each credit / mandatory requirement.

Documentation is submitted in two phases – design submittals and construction submittals:

- ✓ The design submission involves those credits which can be evaluated at the design stage. The reference guide provides the list of design and construction phase credits. After the design submission, review is done by third party assessors and review comments would be provided within 30 working days.
- ✓ The next phase involves submission of clarifications to design queries and construction document submittal. The construction document is submitted on completion of the project. This review will also be provided within 30 working days, after which the rating is awarded.

It is important to note that the credits earned at the design review are only considered as anticipated and are not awarded until the final construction documents are submitted along with additional documents showing implementation of design features. If there are changes for any design credit anticipated, these changes need to be documented and resubmitted during the construction review phase.

IGBC will recognise factory buildings that achieve one of the rating levels with a formal letter of certification and a mountable plaque.

d. Credit Interpretation Ruling

In some instances the design team can face certain challenges in applying or interpreting a mandatory requirement or a credit. It can also happen in cases where the project can opt to achieve the same goal through a different compliance route.

To resolve this IGBC uses the process of ‘Credit Interpretation Ruling’ (CIR) to ensure that rulings are consistent and applicable to other projects as well.

The following are the steps to be followed in case the project team faces a problem:

- ✓ Consult the Reference Guide for description of the credit goal, compliance options and calculations.
- ✓ Review the goal of the credit or mandatory requirement and self-evaluate whether the project satisfies the goal.
- ✓ Review the Credit Interpretation web page for previous CIR on the relevant credit or mandatory requirement. All projects registered under IGBC Green Factory will have access to this page.
- ✓ If a similar CIR has not been addressed or does not answer the question sufficiently, submit a credit interpretation request. Only registered projects are eligible to post CIRs. Two CIRs are answered without levying any fee and for any CIR beyond the first two CIRs, a fee is levied.

e. Appeal

Generally credits get denied due to misinterpretation of the goal. On receipt of the final review, the project team has the option to appeal to IGBC for reassessment of denied credits or mandatory requirements. The documentation for the mandatory requirements or credits seeking appeal may be resubmitted to IGBC along with necessary fee. IGBC will take 30 working days to review such documentation. These submissions would be reviewed by an assessor not involved in the earlier assessments. Documentation for appeals should include the following

- i. Documentation submitted for design submission
- ii. Documentation submitted for construction submission
- iii. Clarifications along with necessary drawings and calculations

V. Fee

Certification fee details can be found on IGBC website.

VI. Updates and Addenda

This is the first version of IGBC Green Factory Building Abridged Reference Guide. As the rating system continues to improve and evolve, updates and addenda to the reference guide will be made available through the website. These additions will be incorporated in the next version of the rating system.

IGBC Green Factory Building Check list		
Site Selection & Planning		Available points
Mandatory Requirement 1	Compliance with Local Regulations	
Mandatory Requirement 2	Soil Erosion Prevention & Control	
SS Credit 1	Contaminated Site Remediation	1
SS Credit 2	Access to Public Transport / Shuttle Services	3
SS Credit 3	Basic Amenities	2
SS Credit 4	Natural Topography and Landscape, 20%,30%	2
SS Credit 5	Heat Island Effect on Roof and Parking Areas	4
SS Credit 6	Non Fossil Fueling Facility for Vehicles	1
SS Credit 7	Design for Differently Abled	2
SS Credit 8	Night Sky Pollution Reduction	1
		16
Water Conservation		
Mandatory Requirement 1	Rainwater Harvesting, 50% Roof and non-roof Run-off	
Mandatory Requirement 2	Low Flow Water Fixtures	
WC Credit 1	Limit Turf Area, 20%, 30%, 40%	3
WC Credit 2	Drought Tolerant Species, 30%, 40%	2
WC Credit 3	Management of Irrigation System	2
WC Credit 4	Rainwater Harvesting, 75%,95%	6
WC Credit 5	Non-process Wastewater - Treatment, 75%, 95%	4
WC Credit 6	Water Use Reduction, 20%, 30%	4
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Energy Conservation		
Mandatory Requirement 1	CFC-Free Equipment	
Mandatory Requirement 2	Minimum Energy Performance	
EC Credit 1	HCFC Free / Low Impact HCFC Equipment	1
EC Credit 2	Optimise Energy Performance, 10%, 12.5%, 15%, 17.5%,	6
EC Credit 3	Metering	2
EC Credit 4	On-site Renewable Energy,5%,10%, 15%	6
EC Credit 5	Green Power, 50%, 75%, 100%	6
EC Credit 6	Eco-friendly Captive Power Generation for Factory Building Requirement	2
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Material Conservation		
Mandatory Requirement1	Handling of Non-process Waste (Post Occupancy)	
MC Credit 1	Waste Reduction During Construction, 50%, 75%	2
MC Credit 2	Materials with Recycled Content, 10%,20%	2
MC Credit 3	Local Materials, 50%,75%	4
MC Credit 4	Material Reuse, 5%,10%	4
MC Credit 5	Certified Wood/ Rapidly Renewable Building Materials and Furniture, 50%, 75%	4
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Indoor Environment Quality and Occupational Health		
Mandatory Requirement 1	Tobacco Smoke Control	
Mandatory Requirement 2	Minimum Fresh Air Requirements	
Mandatory Requirement 3	Avoid Use of Asbestos in the Building	
IEQ Credit 1	Improved Fresh Air Ventilation	4
IEQ Credit 2	Building Flush Out	2
IEQ Credit 3	Day Lighting 50%, 75%, 95%	6
IEQ Credit 4	Low VOC Materials	2
IEQ Credit 5	Reduction of Workmen Fatigue (Break out spaces)	2
IEQ Credit 6	Eco-friendly House-keeping Chemicals	1
IEQ Credit 7	Aerobic & Cardiovascular Gymnasium	2
		19
Innovation in Design		
ID Credit 1.1	Innovation in Design	1
ID Credit 1.2	Innovation in Design	1
ID Credit 1.3	Innovation in Design	1
ID Credit 1.4	Innovation in Design	1
ID Credit 1.5	IGBC AP	1
		5
Total Points		100

Site Selection & Planning

Compliance with Local Regulations

Design & Construction Submittal

Mandatory Requirement 1

Goal

To ensure that the factory building design complies with the required statutory and regulatory codes

Compliance options

The following steps need to be ensured

- ✓ Approval of the plan from the competent Government authority
- ✓ Approvals for all statutory requirements relating to construction of the project

Documentation Required

- ✓ Provide an approved plan and a fit for occupancy documents obtained from the competent Government authority.
- ✓ Provide photographs / as-built drawings of the completed factory building.
- ✓ Declare that no government clearance is pending.

Approach and Methodologies

Survey the statutory requirements in the area that the factory building is constructed. Ensure that these requirements are incorporated at the design stage.

Soil Erosion Prevention & Control

Construction Submittal

Mandatory Requirement 2

Goal

To control soil erosion and thereby reduce negative impacts to the site

Compliance options

Adopt all the measures listed below to control erosion:

- ✓ Ensure erosion control measures that confirm to the best management practices highlighted in the National Building Code of India.
- ✓ Ensure that fertile topsoil is stockpiled for reuse later.
- ✓ Develop appropriate measures to address soil erosion, post occupancy.

Documentation Required

Provide photographs to show stockpiling of topsoil. Submit a narrative describing the measures implemented or provide the erosion control plan adopted. Submit a post occupancy erosion control plan.

For Existing Factory Buildings:

For initial certification, provide a copy of organisational policy that meets the requirement of this mandatory requirement For recertification, provide documentation demonstrating the compliance.

Approach and Methodologies

Evolve strategies to stockpile top soil and reuse later for landscaping purpose. Stockpiled soil can be donated to other sites for landscaping purpose. Consider adopting measures such as temporary and permanent seeding, mulching, earth dikes, silt fencing, sediment traps, and sediment basins as appropriate. Open areas can be landscaped (e.g. grass, trees, shrubs, etc.). Paved areas can be installed with permeable paving. For impermeable surfaces, direct all run off towards storm water collection pits.

Contaminated Site Remediation

Design Submittal

SS Credit 1.0

Point: 1

Goal

Rehabilitate contaminated sites where development is complicated by environmental contamination.

Compliance options

Construct the factory building on a contaminated site after taking appropriate remediation measures.

Note: This credit is available for project sites where more than 50% of the site area is contaminated. Brownfield sites means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant (EPA).

Documentation Required

- ✓ Provide documentation demonstrating that the site is contaminated.
- ✓ Provide a narrative describing the remediation methods adopted to cleanup the site.

Approach and Methodologies

During the site selection process, give preference to contaminated sites. Adopt a site-remediation plan and cleanup the site using remediation strategies such as pump-and-treat, bioreactors, land farming and in-situ remediation.

Access to Public Transport / Shuttle Services

Design Submittal

SS Credit 2.0

Points: 3

Goal

Reduce air pollution and land development impacts from personal automobile use.

Requirement

Locate the factory within 1.0 km walking distance from an intra-city railway station or a bus stop within 0.5 km walking distance. Alternately, the factory can operate or have a contract in place for shuttle services to cover 40% of the employees. (1 point)

Provide housing to cater to 40% of employees within a walking distance of 2 km from the factory. (2 points)

Documentation Required

- ✓ Provide a site plan indicating the project site and highlighting the intra city railway station, sea port / air port and distance between them.
- ✓ Provide the percentage of regularly employed personnel utilizing the shuttle facility provided by the green factory.

Approach and Methodologies

Select sites near to public transits and household services that are accessible by safe and convenient pedestrian pathways. Initiate a dialogue with the government to setup public bus stops.

Basic Amenities

Design Submittal

SS Credit 3.0

Points: 2

Goal

To enhance the overall quality of life by providing amenities within and closer to the site

Compliance Options

Provide at least three amenities as listed in Exhibit A - Category 1, within a distance of 2 Km from the entrance of the factory (1 point)

AND

Provide at least three in-situ amenities as listed in category 2 (1 point)

Note: This point can be earned only if the amenities are available before or at the time of project completion.

Documentation Required

Provide an area map (to scale) indicating the path and distances from the proposed factory site to the amenities provided, with supporting photographs.

Approach and Methodologies:

Select sites which have access to basic public facilities like schools, hospitals, stores etc., Initiate a dialogue with the government and private agencies to develop such facilities. For the employees, provide basic amenities in-situ.

Exhibit A - List of Basic Amenities

Category 1: Within 2 km from the factory

- Ø Grocery / retail store
- Ø School
- Ø Bank / ATM
- Ø Restaurant
- Ø Multi-purpose halls
- Ø Fire Station
- Ø Medical clinic / hospital / Dental
- Ø Pharmacy
- Ø Post Office / Courier service
- Ø Electricity / water utility bills payment counter
- Ø Stationery

Category 2: Facilities provided in-situ

- Ø First Aid Medical Facility
- Ø Crèche
- Ø Lockers and showers
- Ø Canteen
- Ø Guest house
- Ø Cyber café (high speed internet access to employees, atleast 1 system for every 10 people)

Natural Topography and Landscape, 20%, 30%

Construction Submittal

SS Credit 4.0

Points: 2

Goal

Minimise disturbances to the factory building site so as to reduce long-term environmental impacts.

Compliance Options

Avoid site disturbance by retaining the natural topography of the site and / or landscape at least 20% of the site area or meet the local regulation, whichever is higher. Points are awarded as follows:

Points for retaining natural topography or landscaping

Percentage of site area with natural topography and / or landscaped area	Points
$\geq 20 \%$	1
$\geq 30 \%$	2

Notes:

- *Parking areas, walkways etc., are considered as site disturbances.*
- *Landscaped areas over built structures such as roofs, basement etc **cannot** be considered for the purpose of calculation of landscaped area.*
- *Potted plants will not be considered as landscape.*

Documentation Required

Provide drawings, calculations and photographs indicating the site area with natural topography (and / or) landscaped area.

Approach and Methodologies

Design the factory building with a minimal footprint (by limiting design needs and stacking floor plans). Consider retaining the natural landscapes in the site, to the extent possible. In sites which have fully grown trees, avoid destruction. Avoid developing paved surfaces on the site, as much as possible.

Heat Island Effect on Roof and Parking Area

Construction Submittal

SS Credit 5.0

Points: 4

Goal

Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimise impact on the microclimate.

Compliance Options

Roof

(2 Points)

Use high albedo roofing material or heat resistant paint or china mosaic or white cement tiles or any other highly reflective materials over the roof to cover atleast 50% of the exposed roof area.

OR

Provide vegetation to cover atleast 50% of the exposed roof area.

Note: Exposed roof area does not include areas occupied by equipment such as HVAC, solar water heater, photovoltaic etc.

Parking Areas

(2 Points)

Plant shade-giving trees to cover atleast 75% of the open parking areas (or) install permanent roof to cover 75% of the parking areas. In the event of installing a permanent roof, it should meet the requirements for heat island mitigation on the roof.

OR

Provide 75% of the parking spaces in a basement.

Documentation Required

- ✓ Provide roof drawings highlighting location and the extent of high reflective roof materials / green roof provided.
- ✓ Provide drawings and calculations showing parking areas and details of the proposed cover.

Approach and Methodologies

Consider installing heat resistant paint and vegetated roofs to reduce the heat island effect. Typical materials with high reflective properties include china mosaic, white cement tiles, paints with high Solar Reflective Index (SRI) values etc.,

Non-Fossil Fueling Facility for Vehicles

Design Submittal

SS Credit 6.0

Point: 1

Goal

To encourage the use of non-fossil fuel vehicles to reduce pollution from automobile use.

Compliance Options

Provide non-fossil fueling facility within the site to cater atleast 5% of the parking capacity.

Documentation Required

Provide parking plans showing provisions for non-fossil fueling facility. Provide calculations demonstrating that these facilities meet the credit criteria.

Approach and Methodologies

Survey the type of non-fossil fueled vehicles already plying on the roads and also survey the kind of vehicles which may come up in the future. Create facilities for refueling these types of vehicles. Consider having adequate number of refueling facilities based on the refuel time such that atleast 5% of vehicles parked can be serviced within one work-shift.

While considering such fueling facilities, ensure that all safety aspects have been addressed.

Design for Differently Abled

Design Submittal

SS Credit 7.0

Points: 2

Goal

To ensure that the factory building is user-friendly for differently abled people.

Compliance Options

The factory building design should incorporate the following provisions for differently abled people, as applicable:

- ✓ Appropriately designed preferred car parking spaces in areas which have easy access to the main entrance or closer to the lift (one parking space for every 400 personnel)
- ✓ Provision for easy access to the main entrance
- ✓ Uniformity in flooring level / ramps in the factory areas
- ✓ Rest rooms (toilets) designed for differently abled people

Documentation Required

Provide drawings showing design provisions for differently abled people. Also submit photographs highlighting the signages for easy location.

Approach and Methodologies

Identify all probable facilities required to cater to differently abled people. Design the factory building to ensure that certain basic minimum provisions for differently abled people are incorporated. For design strategies the guidelines as specified by NBC Annex D, Clause 12.21 is suggested.

Night Sky Pollution Reduction

Design Submittal

SS Credit 8.0

Points: 1

Goal

Reduce light pollution from exterior and façade lighting to increase night sky access and enhance nocturnal environment.

Compliance Option

The lighting power densities should not exceed 80% for exterior areas and 50% for factory building facades as indicated in ASHRAE/IESNA Standard 90.1-2004.

No external light should be upward looking.

Documentation Required

Provide lighting drawings indicating the location and type of fixtures used in the project.

Approach and Methodologies

Adopt site lighting criteria to maintain safe lighting levels while avoiding night sky pollution. Survey energy efficient lighting fixtures available in the market. Also consider the life of the lamps and evaluate the economic viability.

Water Conservation

Rainwater Harvesting, 50 % roof and non-roof run-off*Design Submittal***Mandatory Requirement 1****Goal**

To increase the ground water table or to reduce the usage of water through effective and appropriate rainwater management.

Compliance Options

Provide rainwater harvesting or storage system to capture atleast 50% of the runoff volumes from the roof and non roof surfaces.

In coastal areas where the groundwater table is shallow and water percolation is limited, collection tanks may be provided meeting the above requirement.

The storage volumes designed should cater to atleast 2-3 days of rainfall.

Runoff coefficients for Typical Surface Types

S.No	Surface Type	Runoff Coefficient
1	Cemented / tiled Roof	0.95
2	Roof Garden	0.30
3	Pavement, Asphalt	0.95
4	Pavement , Pervious	0.60
5	Vegetation, average (1-3 % slope)	0.20
6	Pavement, concrete	0.95

Note:

For normal rainfall, refer Meteorological Department data at <http://www.imd.gov.in>

Documentation Required

Provide drawings detailing rainwater harvesting system, specifically the capacity. Provide details of captured rainwater usage with quantity calculations.

Approach and Methodologies

Survey the water table in the area. Design appropriate harvesting system based on the sub-surface characteristics. Factors to be considered include weathering, fractures & joints for rocky sites and thickness of aquifer for sedimentary sites.

Capture rainwater from the roof and non roof for reuse. The design should also include flushing arrangement to let out impurities in the first few showers. Such pollutants and impurities include paper waste, leaves, bird droppings, dust, etc.

Low Flow Water Fixtures

Design Submittal

Mandatory Requirement 2

Goal

To minimise non-process water usage by installing efficient water fixtures.

Compliance Options

Select water fixtures whose flow rates are as indicated in the table below:

Baseline Flow Rates for Water Fixtures

S.No	Fixtures	Units	Baseline Flow Rates
1	Water Closets	LPF	6 / 3
2	Urinals	LPF	3.0
3	Showers	LPM	9.5*
4	Faucets	LPM	8.3*

** At a flowing water pressure of 5.5 bar*

Notes:

- The baseline flows can be demonstrated at flowing water pressure of 5.5 bar. Flowing water pressure of 5.5 bar does not mean that the water supply in the building is at 5.5 bar. The building fixtures can operate at lower pressures but to show compliance under this credit, the design flow rates are to be submitted at 5.5 bar.*
- Water fixtures do not include irrigation applications.*

Documentation Required:

Submit product manufacturer's data to confirm that conditions stated above have been satisfied for the specified fixtures.

Approach and Methodologies:

While selecting water fixtures, look for the flow-rates. The product catalogue or the brochure may detail the flow rates at various pressures. Fixtures are available with ultra high efficiency which can reduce water consumption substantially.

WATER CONSERVATION

Limit Turf Area, 20%, 30%, 40%

Design Submittal

WC Credit 1.0

Points: 3

Goal

To limit such landscapes which consume large quantities of water.

Compliance Options

Limit the use of turf on the site so as to conserve water. Points are awarded as specified below:

Points for Limited Use of Turf

Turf area as a percentage of total landscaped area	Points
≤ 20 %	3
≤ 30 %	2
≤ 40 %	1

Areas planted with turf should not exceed a slope of 25 percent (i.e., a 4 to 1 slope)

Note: This point is applicable only for those projects which have 20% of the site area landscaped.

Documentation Required

Provide a landscape plan specifying the species used. Provide photographs.

Approach and Methodologies

Landscape as much open area as possible. Select turf, plants, shrubs and trees which consume less water and are resilient to local climatic conditions.

Drought Tolerant Species, 30%, 40%

Design Submittal

WC Credit 2.0

Points: 2

Goal

Landscape to be designed to ensure minimum consumption of water.

Compliance Options:

Ensure that atleast 30% of the landscaped area is planted with drought tolerant species. Points are awarded as specified below:

Points for the use of drought tolerant species

Area of drought tolerant species as a percentage of total landscaped	Points
30 %	1
40 %	2

Notes:

- Ø This point is applicable only for those projects which have atleast 20% of the site / plot area landscaped.*
- Ø Drought tolerant species are those species that do not require supplemental irrigation. Generally accepted time frame for temporary irrigation is one to two years.*

Documentation Required:

Provide a landscape plan indicating the percentage of landscaped area which uses drought tolerant species. Also provide a list of the species used and highlight their drought tolerant nature.

Approach and Methodologies:

Select species that are well-adapted to the site. Consider drought tolerant species and xeriscaping as an approach for landscaping.

Management of Irrigation System

Design Submittal

WC Credit 3.0

Points: 2

Goal

Reduce the demand for irrigation water through water-efficient management techniques.

Compliance Options

(1 point for every two features)

Provide highly efficient irrigation systems incorporating features mentioned below:

- ✓ Provide a central shutoff valve for the irrigation system
- ✓ Provide a moisture sensor controller
- ✓ Turf and each type of bedding area must be segregated into independent zones based on watering needs
- ✓ Atleast 50% of landscape planting beds must be equipped with drip irrigation system to reduce evaporation
- ✓ Install time based controller for the valves such that the evaporation loss is minimum and plant health is ensured
- ✓ Use pressure regulating devices to maintain optimal pressure and prevent misting
- ✓ Any other innovative methods for watering

Documentation Required

Provide a detailed description about the management of installed irrigation systems. Provide landscape plans with the names of the species. Provide cut sheets and photographs of the systems installed.

Approach and Methodologies

The irrigation management system must be designed based on the requirements of the landscape plan, and installed as per the design. The designer and the installer must work together and ensure the design performance of the system.

Rainwater Harvesting, 75%, 95%*Design Submittal***WC Credit 4.0****Points: 6****Goal**

To increase the ground water table or to reduce the usage of water through effective and appropriate rainwater management.

Compliance Options:

Provide rainwater harvesting system to capture runoff water from roof area so as to utilise in landscape irrigation or indoor water usage.

In coastal areas where the groundwater table is shallow and water percolation is limited, collection tanks may be provided meeting the above requirement.

The storage volumes designed should cater to atleast 2-3 days of rainfall.

Runoff coefficients for Typical Surface Types

S.No.	Surface Type	Runoff Coefficient
1	Cemented / tiled Roof	0.95
2	Roof Garden	0.30
3	Pavement, Asphalt	0.95
4	Pavement , Pervious	0.60
5	Vegetation, average (1-3 % slope)	0.20
6	Pavement, concrete	0.95

Points are awarded as below:

Points for Rainwater Harvesting

Rainwater Harvesting System to capture / recharge	Points
≥ 75% runoff from roof area	3
≥ 95% runoff from roof area	6

Notes:

- Ø *In areas where recharging the aquifer is not feasible, collection and reuse may be considered.*
- Ø *For normal annual rainfall, refer Meteorological Department data at <http://www.imd.gov.in>*

WATER CONSERVATION

Documentation Required:

Provide details on the rainwater harvesting system specifying storage capacity and volume of water captured. Provide details of captured rainwater.

Approach and Methodologies

Survey the water table in the area. Design appropriate harvesting system based on the sub-surface characteristics. Factors to be considered include weathering, fractures & joints for rocky sites and thickness of aquifer for sedimentary sites.

Capture rainwater from the roof and non roof surfaces for reuse. The design should also include flushing arrangement to let out impurities in the first few showers. Such pollutants and impurities include paper waste, leaves, bird droppings, dust, etc.

WATER CONSERVATION

Non-process Wastewater – Treatment, 75 %, 95%

Design Submittal

WC Credit 5.0

Points: 4

Goal

Treat non-process wastewater either in-situ or in a common effluent treatment plant.

Compliance Options

Provide an on-site wastewater treatment system to treat atleast 75% of wastewater generated in the factory building, to standards suitable for flushing and landscaping purposes. The points are awarded as follows:

Treatment of non-process water	Points
≥ 75 %	2
≥ 95 %	4

AND

The treated wastewater for reuse must confirm to the quality standards as prescribed by the Central Pollution Control Board (CPCB).

Documentation Required

Provide a detailed description of the on-site or common wastewater treatment system. Attach photographs / specifications of the treatment system. Submit a detailed water balance for the project. Provide details of the usage of treated wastewater within the factory building.

Approach and Methodologies

Calculate the wastewater volumes generated in the factory building. Design appropriately the capacity of the on-site wastewater treatment system. While designing the treatment system, ensure that the treated wastewater meets the required quality standards based on its purpose of application. Have signages around the factory building to caution occupants and housekeeping staff that this water is not potable.

WATER CONSERVATION

Water use reduction 20%, 30%

Design Submittal

WC Credit 6.0

Points: 4

Goal

Reduce the demand for potable water through water-efficient management techniques.

Compliance Options

Select water fixtures whose flow rates are efficient than the baselines indicated in the table below:

Baseline Flow Rates / Capacity for Water Fixtures

S.No	Fixtures	Units	Baseline Flow Rates
1	Water Closets	LPF	6 / 3
2	Urinals	LPF	3.0
3	Showers	LPM	9.5*
4	Faucets	LPM	8.3*

** At a flowing water pressure of 5.5 bar*

The points are awarded as specified as below:

Percentage of Potable Water Savings over Baseline	Points
≥ 20 %	2
≥ 30 %	4

Note:

- *The baseline flows can be demonstrated at flowing water pressure of 5.5 bar. Flowing water pressure of 5.5 bar does not mean that the water supply in the building is at 5.5 bar. The building fixtures can operate at lower pressures but to show compliance under this credit, the design flow rates are to be submitted at 5.5 bar.*
- *Water fixtures do not include irrigation applications.*

Documentation Required

Provide calculations indicating the reduction in total water consumption by at least 20% using the desired water efficient fixtures.

Approach and Methodologies:

While selecting water fixtures, look for the flow-rates. The product catalogue or the brochure may detail the flow rates at various pressures. Fixtures are available with ultra high efficiency which can reduce water consumption substantially.

Energy Conservation

CFC-Free Equipment

Design Submittal

Mandatory Requirement 1

Goal

To avoid the use of CFC based refrigerants and ozone layer depleting gases which negatively impact the environment.

Compliance Options

Refrigerants used in building Heating, Ventilation & Air-conditioning (HVAC) equipment and unitary air-conditioners installed must be CFC-free.

Documentation Required

Provide a declaration signed by a responsible party declaring that the factory building HVAC systems do not use CFC based refrigerants.

Approach and Methodologies

Survey the market for all CFC-free HVAC systems. Such systems are also available in smaller capacities. Install HVAC equipment which does not use CFC based refrigerant.

Mandatory Requirement 2

Design Submittal

Minimum Energy Performance

Goal

Optimise energy efficiency for non-process use in the factory building to reduce environmental impacts from excessive energy consumption.

Compliance Options

OPTION 1: WHOLE FACTORY BUILDING ENERGY SIMULATION

Demonstrate compliance of the proposed factory building performance as per ECBC / ASHRAE 90.1-2004 standards by a whole factory building simulation.

Simulation is to be carried out for achieving comfort temperatures of 28 ± 2 deg C.

Note:

All the process loads are to be factored in both the base and proposed case. However, process loads can be excluded while reporting the building energy savings.

Conditioned areas will be simulated as conditioned spaces. Non conditioned areas will be simulated as non conditioned spaces

OPTION 2: - PRESCRIPTIVE APPROACH

The project should meet the applicable criteria as established in prescriptive measures of ECBC 2007 / ASHRAE 90.1-2004, for each of the following:

- Ø SHGC for glazing areas
- Ø Lighting Power Densities
- Ø Chiller efficiency (for air conditioned buildings)

Documentation Required

For buildings adopting the performance approach, submit the results of energy simulation. For buildings adopting the prescriptive measures, submit a narrative of the measures adopted.

Approach and Methodologies:

Consider a holistic energy efficiency approach to include the factory building orientation, envelope, systems, lighting and other equipment. Identify the materials and equipment available in the market and their properties with regard to energy performance. While selecting these material and equipment, consider their associated environmental impacts.

Decision making with respect to selection of materials can be based on the life cycle assessment approach rather than the initial cost. Determine the applications where automatic controls can help in energy savings. Obtain details of the controls and ensure proper installation.

HCFC Free / Low Impact HCFC Equipment

Design Submittal

EC Credit 1.0

Points: 1

Goal

To avoid the use of HCFC based refrigerants and ozone layer depleting gases which negatively impact the environment.

Compliance Options

OPTION 1

Refrigerants used in Heating, Ventilation & Air-conditioning (HVAC) equipment and unitary air-conditioners installed, for non process equipment must be HCFC free.

OR

OPTION 2

Install HVAC and refrigeration equipment that uses refrigerants that comply with the following requirement:

$$LCGWP + LCODP \times 100,000 \leq 100$$

Where:

$$LCODP = [ODPr \times (Lr \times Life + Mr) \times Rc] / Life$$

$$LCGWP = [GWPr \times (Lr \times Life + Mr) \times Rc] / Life$$

LCODP: Lifecycle Ozone Depletion Potential (lbCFC11/Ton-Year)

LCGWP: Lifecycle Direct Global Warming Potential (lbCO2/Ton-Year)

GWPr: Global Warming Potential of Refrigerant ($0 < GWPr < 12,000$ lbCO2/lbr)

ODPr: Ozone Depletion Potential of Refrigerant ($0 < ODPr < 0.2$ lbCFC11/lbr)

Lr: Refrigerant Leakage Rate (% of charge per year) ($0.5\% < Lr < 3\%$ /Year)

Mr: End-of-life Refrigerant Loss (% of charge) ($2\% < Mr < 10\%$)

Rc: Refrigerant Charge (lbs refrigerant per Ton of cooling capacity) ($0.9 < Rc < 3.3$)

Life: Equipment Life (Years) ($10 < Life < 35$ Years)

For projects with multiple units of base building level HVAC and refrigeration equipment, a weighted average of all base building level HVAC and refrigeration equipment shall be applied to the formula above:

$$[\text{SUM} (LCGWP + LCODP \times 10^5) \times Q \text{ unit}] / Q \text{ total} \leq 100$$

Where:

Q unit = Cooling capacity of an individual HVAC or refrigeration unit (Tons)

Q total = Total cooling capacity of all HVAC or refrigeration equipment (Tons)

ENERGY CONSERVATION

AND

Install fire suppression systems that do not contain ozone depleting substances - CFCs, HFCs, HCFCs or Halons.

Documentation Required

- ✓ Provide a declaration signed by a responsible party declaring that the factory building HVAC systems do not use CFC / HCFC based refrigerants.
- ✓ For projects using HCFC based refrigerants for HVAC systems, submit calculations to show the compliance requirement under option 2.

Approach and Methodologies

Survey the market for all CFC / HCFC free HVAC systems. Such systems are also available in smaller capacities. Install HVAC equipment which does not use CFC / HCFC based refrigerants.

ENERGY CONSERVATION

Optimise Energy Performance, 10%, 12.5%, 15%, 17.5% *Design Submittal*

EC Credit 2.0

Points: 6

Goal

Optimise energy efficiency for non-process use in the factory building to reduce environmental impacts from excessive energy consumption.

Compliance Options

OPTION 1: WHOLE FACTORY BUILDING ENERGY SIMULATION (6 points)

Demonstrate a percentage improvement in the proposed factory building performance compared to the baseline factory building performance as per ECBC / ASHRAE 90.1-2004 Standards by a whole factory building simulation.

Simulation is to be carried out for achieving comfort temperatures of 28 ± 2 deg C. Points are awarded as follows:

Minimum Energy Cost Savings

New Buildings	Points
10%	3
12.5 %	4
15%	5
17.5%	6

Note:

All the process loads are to be factored in both the base and proposed case. However, process loads can be excluded while reporting the building energy savings.

Conditioned areas will be simulated as conditioned spaces. Non conditioned areas will be simulated as non conditioned spaces

OPTION 2: PRESCRIPTIVE APPROACH (3 Points)

The project should exceed the applicable criteria by 10% over those established in prescriptive measures of ECBC 2007 / ASHRAE 90.1-2004, for each of the following:

- Ø SHGC for glazing areas
- Ø Lighting Power Densities
- Ø Chiller efficiency (for air conditioned buildings)

Documentation Required

For buildings adopting the performance approach, submit the results of energy and lighting simulation. For buildings adopting the prescriptive measures, submit a narrative of the measures adopted.

ENERGY CONSERVATION

Approach and Methodologies:

Consider a holistic energy efficiency approach to include the factory building orientation, envelope, systems, lighting and other equipment. Identify the materials and equipment available in the market and their properties with regard to energy performance. While selecting these material and equipment, consider their associated environmental impacts.

Decision making with respect to selection of materials can be based on the life cycle assessment approach rather than the initial cost. Determine the applications where automatic controls can help in energy savings. Obtain details of the controls and ensure proper installation.

ENERGY CONSERVATION

Metering

Design Submittal

EC Credit 3.0

Points: 2

Goal

To encourage continuous monitoring and enhance the performance of factory buildings.

Compliance Options

Have separate meters for process and non process loads

AND

Provide meters for any four of the following: (1 point for every two meters)

- ✓ Energy meter for air-conditioning
- ✓ Energy meter for internal lighting
- ✓ Energy meter for external lighting
- ✓ Btu Meter for chilled water consumption
- ✓ Energy meter for municipal water pumping
- ✓ Energy meter for grey water pumping
- ✓ Energy meter for water pumping for landscaping

Documentation Required

Describe the metering equipment installed. Provide cut sheets for the meters installed.

Approach and Methodologies

Identify all the major energy and water consuming equipment and install systems to monitor their consumption. Develop and implement a measurement and verification plan to compare the predicted savings and actual energy performance.

ENERGY CONSERVATION

On-Site Renewable Energy, 5%, 10%, 15%

Design Submittal

EC Credit: 4.0

Points: 6

Goal

Promote self sufficiency in energy through renewable technologies for on-site power generation and use within the factory building.

Compliance Options

Install renewable energy systems to meet atleast 5% of annual energy consumption of the factory building (excluding the process load). Points are awarded as below.

Renewable Energy Power

Percentage of annual non-process energy consumption	Points
≥ 5 %	2
≥ 10 %	4
≥ 15 %	6

Documentation required

Submit documents detailing the installation and design for the renewable energy source. Submit manufacturers cut sheets and the purchase invoice.

Approach and Methodologies

Take into consideration the renewable energy feasibility while determining the power requirement from the local utility. The sources of renewable energy that can be considered under this credit include Solar energy, Wind energy, Biomass, Biogas etc.

ENERGY CONSERVATION

Green Power: 50%, 75%, 100%

Design Submittal

EC Credit 5.0

Points: 6

Goal

Encourage investments in off-site renewable energy technologies to be supported to the grid.

Compliance Options

Demonstrate that the company has installed off-site green power and wheeled to the building

Points are awarded as below:

Green Power

Percentage of annual non-process energy consumption	Points
50 %	2
75%	4
100 %	6

Documentation Required

Provide documents indicating the green power provider with the contract details. Total annual energy consumption and total annual green power purchase need to be provided. The energy consumption values should be expressed in kWh.

Approach and Methodologies

Estimate the energy needs (non process loads) of the factory building on annual basis. Install green power plants which meets non-process energy requirement of the factory building. Green power can be sourced from solar, wind, biomass or low-impact hydro sources.

**Eco-Friendly Captive Power Generation for
Factory Building Requirement**

Design Submittal

EC Credit: 6.0

Points: 2

Goal

To reduce emission levels and their impacts on environment through the use of low emitting fuels or better equipment.

Compliance Options

Provide generator sets to meet the following criteria, as applicable:

- ✓ Use bio fuels or non edible oils or any other non-fossil based fuel for captive power generation.
- ✓ Use diesel generator sets which are certified by Central Pollution Control Board (CPCB) for emissions and noise compliance
- ✓ Use ISI rated generator sets

Note:

Projects can apply for this credit if the capacity of the Generator set caters to 50% of the non process load

Documentation Required

Provide manufacturer's cut sheets and purchase invoice of the generator sets used in the project.

Submit details on the alternative fuels used for captive power generation or provide details on the noise and emission levels of the non-fossil fuel generator sets along with the CPCB certification.

Approach and Methodologies

Survey the market for available captive power generators which operate on bio-fuels or non-edible oils and generator sets which are CPCB certified for emissions and noise. Also consider availability of fuel on a sustained basis and the economic viability.

Material Conservation

Handling of Non-process Waste (Post Occupancy)

Design Submittal

Mandatory Requirement 1

Goal

To ensure effective non-process waste management, post occupancy for recycling and safe disposal.

Compliance Options

Have a facility to segregate atleast five of the following non process waste generated in the factory.

- ✓ Organic waste
- ✓ Plastic
- ✓ Paper, Paperboard
- ✓ Glass
- ✓ Metals
- ✓ 'e' waste
- ✓ Lamps
- ✓ Batteries

Documentation Required

Submit detailed drawings of waste storage area and their location within the building.

Approach and Methodologies

Calculate the quantum of waste generated in the factory building. Design the waste treatment plant with suitable capacity to efficiently manage the waste and recover resources.

MATERIAL CONSERVATION

Waste Reduction during Construction, 50%, 75%

Construction Submittal

MC Credit 1.0

Points: 2

Goal

Minimise construction waste being sent to landfills.

Compliance Options

Waste Reduction

Avoid atleast 50% of the waste generated during construction being sent to landfills and incinerators. Calculate percentage using either weight or volume.

Points for Construction Waste Reduction

Percentage of Construction Waste Diverted	Points
≥ 50 %	1
≥ 75 %	2

Documentation Required

Submit records tabulating the total waste material generated and the quantities which were diverted from landfills.

For Existing Factory Buildings:

For initial certification, provide a copy of organisational policy that meets the requirement of this credit. For recertification, provide documentation demonstrating the credit compliance.

Approach and Methodologies

Collect all construction debris generated on site. Segregate these waste based on their utility. Evaluate means of disposing such waste to manufacturing units which use them as raw materials. Typical construction debris in factory projects could be broken bricks, steel bars, broken tiles, glass, wood waste, paint cans, cement bags, packing materials etc.,

MATERIAL CONSERVATION

Materials with Recycled Content, 10%, 20%

Construction Submittal

MC Credit 2.0

Points: 2

Goal

To encourage the use of products (materials other than plant machinery) which contain recycled materials to reduce environmental impacts associated with the use of virgin materials.

Compliance Options

Use materials with recycled content such that the total recycled content constitutes at least 10% of the total cost of the materials used in the project. Points are awarded as below.

Points for Recycled Content

Percentage of Recycled content	Points
≥ 10 %	1
≥ 20 %	2

Notes:

- ✓ *Material Cost = Total Cost – (Labour Cost + Installation Cost)*
- ✓ *If Labour and Installation cost is not known, the default material cost can be considered as 60% of the total cost of the component*
- ✓ *Cost of equipment, systems, lighting fixtures, appliances, movable furniture need not be considered in the total material cost*

Documentation Required

Provide details of all materials used in the project with the material cost. Specify recycled content in the materials used. Submit letters from manufacturers specifying the recycled content.

For Existing Factory Buildings:

For initial certification, provide a copy of organisational policy that meets the requirement of this credit. For recertification, provide documentation demonstrating the credit compliance.

Approach and Methodologies

Survey the materials with recycled content and locate such local suppliers. Some of the materials with recycled content are Fly ash blocks, Tiles, Steel, Glass, Cement, False Ceiling, Aluminium and Composite Wood.

MATERIAL CONSERVATION

Local Materials, 50%, 75%

Construction Submittal

MC Credit 3.0

Points: 4

Goal

Encourage the use of factory building materials available locally thereby minimising the associated environmental impacts.

Compliance Options

Ensure that atleast 50% of the total factory building materials by cost used in the factory building are manufactured within a radius of 500 Km. Points are awarded as follows:

Points for Local Materials

Percentage of local materials	Points
$\geq 50\%$	2
$\geq 75\%$	4

Documentation Required

Provide calculations demonstrating that, the project uses the required percentage of local materials in terms of cost. Provide letters from the manufacturers / vendors indicating the distance between place of manufacture and the project site.

For Existing Factory Buildings:

For initial certification, provide a copy of organisational policy that meets the requirement of this credit. For recertification, provide documentation demonstrating the credit compliance.

Approach and Methodologies

Set a project goal for utilisation of locally sourced materials from identified suppliers. During construction, ensure that the specified local materials are utilised and quantify the total percentage of local materials used.

MATERIAL CONSERVATION

Material Reuse, 5%, 10%

Construction Submittal

MC Credit 4.0

Points: 4

Goal

Encourage the use of salvaged building materials and products to reduce the demand for virgin materials thereby minimising the impacts associated with extraction and processing of virgin materials.

Compliance Options

Ensure at least 5% of the total cost of the building materials is salvaged, refurbished and reused. Points are awarded as follows:

Points for Reuse of Salvaged Materials

Percentage of Materials Salvaged	Points
$\geq 5\%$	2
$\geq 10\%$	4

Documentation Required

Provide calculations demonstrating that the project uses the required percentage of salvaged materials in terms of cost. Provide sources of such salvaged materials.

For Existing Factory Buildings:

For initial certification, provide a copy of organisational policy that meets the requirement of this credit. For recertification, provide documentation demonstrating the credit compliance.

Approach and Methodologies

Identify opportunities to incorporate salvaged materials in the factory building design and research potential material suppliers. Consider salvaged materials such as flooring, paneling, doors, frames, furniture, brick etc. Loose furniture like tables, chairs cannot be used under the credit.

MATERIAL CONSERVATION

Certified Wood / Rapidly Renewable Building Materials and Furniture, 50%, 75%

Construction Submittal

MC Credit 5.0

Points: 4

Goal:

To minimise the usage of virgin wood thereby encouraging responsible forest management.

Compliance Options:

Ensure atleast 50% (by cost) of all wood based products used in the building will be FSC (Forest Stewardship Council) or the local Forest Department certified wood or rapidly renewable based products. Points are awarded as below:

Points for use of FSC / Forest Department certified wood / rapidly renewable

Percentage of FSC / Forest Department certified wood / Rapidly renewable	Points
$\geq 50 \%$	2
$\geq 75\%$	4

Note: For assemblies, consider the value of only wood based materials

Documentation Required:

Provide details showing the total cost of wood based products procured for the building. Provide details on the FSC / Forest Department certified wood or rapidly renewable products used. Also show the percentage calculations of the certified wood / rapidly renewable materials used to the total cost of new wood used for doors, windows, furniture etc.

For Existing Factory Buildings:

For initial certification, provide a copy of organisational policy that meets the requirement of this credit. For recertification, provide documentation demonstrating the credit compliance.

Approach and Methodologies:

Ascertain wood based applications in the factory building. Substitute the use of virgin wood with FSC or Forest Department certified wood or rapidly renewable products.

**Indoor Environment Quality and
Occupational Health**

Tobacco Smoke Control

Design Submittal

Mandatory Requirement 1

Goal

Minimise exposure of non-smokers to the adverse health impacts arising due to passive smoking, post occupancy.

Compliance Options

Smoking should be prohibited inside the factory.

AND

If the local law permits, locate specifically assigned outdoor smoking areas at a minimum of 7.6 meters (25 feet) from entrance doors, window openings and outdoor air intakes.

Documentation Required

Provide details on how the building complies with the requirement. Also provide details on how this would be implemented.

Approach and Methodologies

Prohibit smoking in common areas like corridors, lobby, lifts etc., Design the building to eliminate or minimise tobacco smoke pollution in the common areas. Occupant guidelines can specify that smokers should ensure that tobacco smoke does not enter common areas. Signages can be placed at several places in the building campus to educate occupants and visitors.

Minimum Fresh Air Requirements

Design Submittal

Mandatory Requirement 2

Goal

To provide better ventilation to ensure good indoor environment.

Compliance Options

Install fresh air delivery systems in all the occupied spaces of the factory building to meet the criteria below:

For Air conditioned factory buildings, comply with the following fresh air requirements:

Minimum Fresh air Flow Requirements

Location	Minimum Airflow
Factory area	20 cfm per person + 0.12 cfm per sq ft
Office Area	5 cfm per person + 0.06 cfm per sq ft
Cafeteria	7.5 cfm per person + 0.18 cfm per sq ft
Day care	10 cfm per person + 0.18 cfm per sq ft
Classrooms	10 cfm per person + 0.12 cfm per sq ft
Wood / Metal shop	10 cfm per person + 0.18 cfm per sq ft
Conference / Meeting rooms	5 cfm per person + 0.06 cfm per sq ft
Storage rooms	0.06 cfm per sq ft
Computer Lab	10 cfm per person + 0.18 cfm per sq ft
Warehouse / Stores	0.06 cfm per sq ft

For naturally conditioned factory buildings, provide openings such that the ratio of openings to carpet area is atleast 2%

INDOOR ENVIRONMENT QUALITY AND OCCUPATIONAL HEALTH

For buildings with forced ventilation, comply with the following minimum air change requirements (the list is only illustrative, not exhaustive):

Location	Air Changes per Hour (ACH)*	Location	Air Changes per Hour (ACH)*
Assembly Rooms	4	Engine rooms	15
Boiler Rooms	15	Factories and workshops	8
Canteens	8	Foundries	15
Compressor rooms	10	Gymnasium	6
Conference rooms	8	Offices	6
Dye works	20	Stores and Ware houses	3
Electro plating shops	10	Welding shops	15

* In areas not addressed in the above table, provide atleast 8 air changes per hour

** Volume measured at 4.25 meters height from the floor.

Documentation Required

- ❖ Provide a design narrative describing the project's ventilation system design.
- ❖ For Air conditioned buildings, include specific information regarding the fresh air intake volume for each occupied zone to demonstrate that the design meets minimum fresh air requirements.

Approach and Methodologies

Fresh air ventilation in factory is vital since it has both process heat loads and normal loads. Having adequate fresh air will impact the indoor air conditions and quality.

Naturally conditioned factory buildings may consider having window openings to bring in the fresh air. In case of forced ventilation systems, fresh air can be pumped into the spaces. In areas where the fresh air temperatures are either too high or too low, consider treating such air using systems like geo-thermal, wind towers, earth tunnel cooling, direct / indirect evaporative cooling etc.,

Avoid use of Asbestos in the Building

Design submittal

Mandatory Requirement 3

Goal

To encourage factory design that eliminates the risk of major health effects associated with asbestos exposure.

Compliance Options

Eliminate the use of asbestos in new factory building design.

In case of existing buildings, if asbestos is already being used, have a phase-out plan in place.

Documentation Required

Provide details on how the building complies with the requirement.

For Existing Factory Buildings:

For initial certification, provide a copy of organisational policy that meets the requirement of this prerequisite. For recertification, provide documentation demonstrating the prerequisite compliance.

Approach and Methodologies

By design, avoid use of building materials which are asbestos based. In case of existing buildings, have a strategy in place to phase out such materials.

Improved Fresh Air Ventilation

Design Submittal

IEQ Credit: 1.0

Points: 4

Goal

To provide increased ventilation to ensure good indoor environment.

Compliance Options

Install fresh air delivery systems in all the occupied spaces of the factory building to meet the criteria below:

For Air conditioned factory buildings, provide ventilation rates higher than those mentioned in IEQ mandatory requirement 2.

The points are awarded as specified below:

Percentage Improvement over Minimum Fresh Air Requirements	Points
≥ 20 %	2
≥ 30 %	4

For naturally conditioned factory buildings, comply with the following requirement:

Openings to Carpet Area ratio	Points
3 %	2
4 %	4

For buildings with forced ventilation, provide increased Air Changes per Hour (ACH) than those mentioned in IEQ mandatory requirement 2.

Points for providing increased ACH in the occupied spaces

Percentage Improvement over Minimum Air Changes per Hour*	Points
≥ 20 %	2
≥ 30 %	4

** For other occupied areas not addressed in the minimum ACH table, 2 points and 4 points will be awarded for providing 10 ACH and 12 ACH respectively.*

*** Volume measured at 4.25 meters height from the floor.*

Documentation Required

- ❖ Provide a design narrative describing the project’s ventilation system design.
- ❖ Include specific information regarding the fresh air intake volume for each occupied zone to demonstrate that the design exceeds minimum fresh air requirements.

Approach and Methodologies

Fresh air ventilation in factory is vital since it has both process heat loads and normal loads. Having adequate fresh air will impact the indoor air conditions and quality.

Naturally conditioned factory buildings may consider having window openings to bring in the fresh air. In case of forced ventilation systems, fresh air can be pumped into the spaces. In areas where the fresh air temperatures are either too high or too low, consider treating such air using systems like geo-thermal, wind towers, earth tunnel cooling, direct / indirect evaporative cooling etc.,

Building Flush Out

Design Submittal

IEQ Credit 2.0

Points: 2

Goal

To avoid occupant’s exposure to indoor airborne contaminants before occupying the premises.

Compliance Options

Before the building is occupied and after paints, adhesives and sealants have been used, a building flush out needs to be carried out for ten days by keeping all windows open.

OR

If the building prefers to carry out the flush out using forced ventilation systems, the flush out can be carried out for five days.

OR

AIR QUALITY TESTING

Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols such that the maximum contaminant concentrations listed below should not be exceeded:

Contaminant	Maximum Concentration
Formaldehyde	50 parts per billion
Particulates (PM10)	50 micrograms per cubic meter
Total Volatile Organic Compounds (TVOC)	500 micrograms per cubic meter
* 4-Phenylcyclohexene (4-PCH)	6.5 micrograms per cubic meter
Carbon Monoxide (CO)	9 parts per million and no greater than 2 parts per million above outdoor levels
<i>* This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.</i>	

For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to comply with the requirement. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from the same locations as in the first test.

INDOOR ENVIRONMENT QUALITY AND OCCUPATIONAL HEALTH

The air sample testing shall be conducted as follows:

- All air sample testing measurements to be conducted before occupancy and during normal occupied hours. The ventilation system should be operational starting at the normal start time operated at minimum outside air flow rate under the occupied mode.
- Prior to testing the building shall have all interior finishes installed.
- The number of sampling locations will vary depending upon the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq.ft. OR For each contiguous floor area, whichever is larger, and include areas with the least ventilation and greatest presumed source strength.
- Air samples shall be collected between 3 feet and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

Documentation Required

Provide a narrative describing the flush out procedure implemented.

For Existing Factory Buildings:

For initial certification, provide a copy of organisational policy that meets the requirement of this credit. For recertification, provide documentation demonstrating the credit compliance.

Approach and Methodologies

Building flush out needs to be carried out just before occupancy. Once the facility is ready including the interiors, flushing will be effective to washout the pollutants in the building materials.

Day Lighting, 50%, 75%, 95%

Design Submittal

IEQ Credit 3.0

Points: 6

Goal

To ensure connectivity between the interior and exterior environment, by providing good day lighting.

Compliance Options

Achieve a minimum average daylight factor of 2% for atleast 50% of the total floor area of all regularly occupied spaces.

Points for Day Light for regularly occupied Spaces

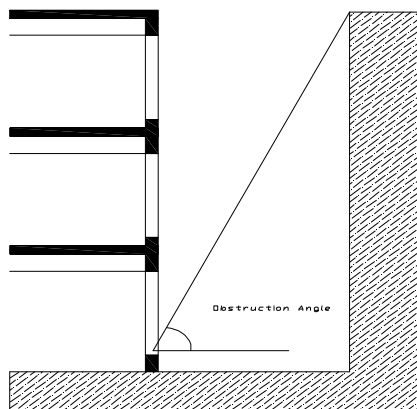
Percentage of Lighting	Points
≥ 50%	2
≥ 75%	4
≥ 95%	6

Average daylight factor can be calculated using the formula given below:

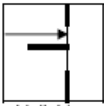
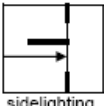
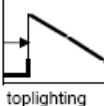
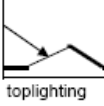
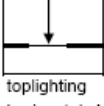
$$\text{Daylight Factor} = \frac{\text{Window Area [SF]} \times \text{Window Geometry} \times \text{Actual Visible transmittance}}{\text{Floor Area [SF]} \times \text{Minimum Visible transmittance}} \times \text{Height Factor}$$

Notes:

- ❖ *Window openings which are less than 0.76 meters (2.5 feet) above the floor are not considered for day lighting calculations*
- ❖ *Window openings where the angle of obstruction of objects obscuring the sky dome is greater than 70 deg. from the horizontal shall not be considered for daylight calculations*



Daylight Design Criteria

Window Type	Geometry Factor	Minimum Tvis	Height Factor
 sidelight daylighting glazing	0.1	0.7	1.4
 sidelighting vertical monitor	0.1	0.4	0.8
 toplighting vertical monitor	0.2	0.4	1
 toplighting sawtooth monitor	0.33	0.4	1
 toplighting horizontal skylights	0.5	0.4	1

Source: LEED India for New Construction

Notes:

- ❖ Sidelight daylight glazing is selected for window openings which are 2.1 meters (7 feet) above the floor
- ❖ Sidelighting vertical monitor is selected for window openings which are 0.76 to 2.1 meters (2.5 feet to 7 feet) above the floor

Documentation Required

Provide calculation of daylight for occupied areas like workstations etc., Sum up all areas which achieve 2% or higher day light factor. This aggregate area as a percentage of the total work area should be more than 50%.

Approach and Methodologies

Ensure that daylighting is considered at the design by appropriate orientation. The orientation of the building can be such that maximum daylighting to all the spaces is achieved for most part of the day.

Low VOC Materials

Construction Submittal

IEQ Credit 4.0

Points: 2

Goal

To encourage the use of materials with low emissions so as to reduce adverse health impacts for building occupants.

Compliance Options

Use paints with low or no VOC content to the extent of 100% of interior wall surface area. (1 point)

AND

For other VOC emitting materials like adhesives and sealants used within the interiors ensure that the VOC content does not exceed the limits as specified in the table below. (1 point)

VOC Limits for Materials

Type of material	VOC Limit
Paints:	
Non-flat paints	150 g/L
Flat (Mat) paints	50 g/L
Anti-corrosive / anti-rust paints	250 g/L
Varnish	350 g/L
Adhesives:	
Wood flooring Adhesive	100 g/L
Tile adhesives	65 g/L
Indoor carpet adhesives	50 g/L
Wood	30 g/L

Documentation Required

Provide (letter / brochure) from the manufacturer indicating the VOC limit of the paints and adhesives used **or** provide purchase invoices and supporting photographs of paint containers specifying VOC content.

For Existing Factory Buildings:

For initial certification, provide a copy of organisational policy that meets the requirement of this credit. For recertification, provide documentation demonstrating the credit compliance.

Approach and Methodologies

Develop a project outline specification and include low or no VOC materials as a criterion for interior material selection. List down all possible interior materials which can have high VOC content. Research and specify no or low VOC materials based on durability, performance and environmental characteristics.

Reduction of Workmen Fatigue (Break out spaces)

Design Submittal

IEQ Credit: 5.0

Points: 2

Goal

Provide facilities for the workmen to minimise work related fatigue.

Compliance Options

Provide outdoor break out spaces within the factory campus to cater to 5% of the regular employees per shift. The spaces should be located within a walkable distance of 0.3 km from the shop floor.

Documentation Required

Submit plans of the breakout spaces provided. Also include facilities provided in the breakout spaces.

Approach and Methodologies

Break out spaces may be provided within the factory premises. These spaces should be such that workmen can get away from their work areas and rejuvenate themselves.

Eco-Friendly House-Keeping Chemicals

Design Submittal

IEQ Credit: 6.0

Points: 1

Goal

To encourage the use of eco friendly house keeping chemicals which are less toxic so as to reduce adverse health impacts for factory occupants.

Compliance Options

Use products that meet green seal standard (GS-37) or equivalent or use products which comply with the specified emission limits

Documentation Required

Provide MSDS cut-sheets / specifications for all cleaning products used.

Approach and Methodologies

Adopt eco -friendly house keeping practices during maintenance / housekeeping activities by using bio-degradable chemicals, which address health, hygiene and well-being of maintenance staff & building occupants. Eco-friendly house keeping chemicals may be used for cleaning of floors, walls, glazing surfaces, restrooms etc.

Aerobic & Cardiovascular Gymnasium

Design Submittal

IEQ Credit: 7.0

Points: 2

Goal

To enhance occupational health of the factory occupants

Compliance Options

Provide an adequately sized gymnasium to cater to atleast 2 % of occupants in the factory campus.

Documentation Required

Provide plans to indicate the location of the gymnasium and the types of equipment installed

Approach and Methodologies

The gymnasium should house cardiovascular training related equipment for the purpose of physical exercise. Personal trainers may be appointed to monitor and train the members. The other facilities in the gymnasium may include workout sessions, cardio areas, group exercise classes etc.,

Innovation in Design

Innovation in Design

Design / Construction Submittal

ID Credit 1.1 – 1.4

Points: 4

Goal

To provide design teams and projects the opportunity to be awarded points for exceptional performance above requirements set by the IGBC Green Factory Building rating system and / or innovative performance in Green Factory Building categories not specifically addressed by the rating system.

Compliance Options

Some of the points that can be earned under this credit are as follows

Credit 1.1: Innovation

Identify the intent of the proposed innovation credit, the proposed requirement for compliance, and the proposed documentation to demonstrate compliance, and the design approach used to meet the required elements.

Credit 1.2: Innovation

Same as credit 1.1

Credit 1.3: Innovation

Same as credit 1.1

Credit 1.4: Innovation

Same as credit 1.1

Documentation Required

Provide a narrative highlighting the goal, compliance options and documentation of the innovation measure.

Approach and Methodologies

The following can be considered for credit points under innovation:

- ✓ Exemplary performance under any of the credits. The compliance should significantly exceed the credit threshold.
- ✓ Strategies or measures not covered by rating system such as adoption of passive architecture techniques, exemplary energy, water and material savings in process, green education etc.,

IGBC AP

Design Submittal

ID Credit 1.5

Point: 1

Goal

To support and encourage the involvement of IGBC AP accredited professionals in the green factory building project.

Compliance Options

Atleast one principal participant of the project team shall be an IGBC AP.

Note: The project team can apply for an additional innovation till the IGBC Accredited Professional Exam is launched.

Documentation Required

Submit the IGBC AP certificate.

Approach and Methodologies

Educate the project team members about the Green factory building design & construction and application of the rating system at the design stage of the project.

GLOSSARY

Abbreviations

ARI

Air-conditioning and Refrigeration Institute

ASHRAE

The American Society of Heating, Refrigerating and Air-conditioning Engineers

BEE

Bureau of Energy Efficiency

CFM

Cubic Feet per Minute

COP

Coefficient of Performance

CRI

Carpet and Rug Institute

ECBC

Energy Conservation Building Code

EER

Energy Efficiency Ratio

FSC

Forest Stewardship Council

HDD

Heating Degree Days

HVAC

Heating Ventilation and Air-conditioning

IPLV

Integrated Part Load Value

LPD

Lighting Power Density

LPF

Liters per Flush

GLOSSARY

LPM

Liters per Minute

MSDS

Material Safety Data Sheet

NA

Not Applicable

NBC

National Building Code

PTHP

Packaged Terminal Heat Pumps

SHGC

Solar Heat Gain Coefficient

SRI

Solar Reflective Index

VOC

Volatile Organic Compound



Confederation of Indian Industry
CII - Sohrabji Godrej Green Business Centre

Address for Communication

Confederation of Indian Industry
CII – Sohrabji Godrej Green Business Centre
Kothaguda Post, Near HITEC City
HYDERABAD - 500 084
Tel: 91-40-2311 2971 - 73; Fax: 91-40-2311 2837;
Email: igbc@cii.in; Web: www.igbc.in