



MODEL FOR GREEN RESIDENTIAL BUILDING



বাংলাদেশ হাউজ বিল্ডিং ফাইন্যান্স কর্পোরেশন
Bangladesh House Building Finance Corporation

স্বপ্নের দিশে প্রতিশ্রুতির স্মারক

Model for 'Green Residential Building'

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Preface

Bangladesh is widely considered as one of the most climate-vulnerable countries in the world. Though its contribution to global warming is negligible (less than 0.47% of global emissions), the country is impacted by all the adversities of climate change. Enhanced adaptation and mitigation measures are required to reduce the adverse impacts of projected climate change.

The government of Bangladesh has taken various policies, plans and programs to address the climate change issue and environmental degradation of the country. As a state-owned financial institution, BHBFC is also aligned with respective policies, plans and programs. BHBFC has been financing to improve planned & quality housing since its inception. Now it is the time to contribute in green residential building to mitigate the emission of GHGs and conserve the country's resources and energy. In this purpose, BHBFC has developed a model for constructing a building that would be leveled as a green residential building.

Residential building emits a good amount of CO₂ in the atmosphere. This model intends to contribute in reducing GHGs in the atmosphere. Site management, energy, water and construction material efficiency are the main focus and concern of the model. This model would contribute to reduce environmental degradation and improve sustainable living in the country.

I would like to express my sincere thanks and gratitude to the Board of Directors, Bangladesh House Building Finance Corporation. I remember the technical observation and contribution come from **Mr. Mosleh Uddin Ahmed, Additional Chief Engineer, Public Works Department**, at present: Member (Engineering & Coordination), National Housing Authority, Dhaka and Director, Board of Directors, BHBFC to develop this model. The committee is indebted to him and delighted to express gratitude.

Finally, I would like to express my appreciation to our **Managing Director Mr Md. Abdul Mannan** and **Deputy Managing Director Mr. Arun Kumar Chowdhury** for providing continuous support and monitoring to wrap up the work as a viable model.



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Executive Summary

Climate change and environmental degradation is affecting the life and livelihood of people all over the world, where Bangladesh is one of the most vulnerable countries. Climate change is one of the consequences of an increase in the emission of greenhouse gases. Buildings emit 39% CO₂ in both construction and operation of total emissions from different sources. The necessity of addressing the environment becomes key issue in housing sector for reducing the GHGs emission. Therefore, ensuring the access to planned sustainable housing especially Green residential housing in Bangladesh is crucial for several reasons, considering the country's environmental, economic, and social context. Green building practice would be helpful in reducing the emissions. The demand for sustainable building construction has experienced significant growth. This is a design-based process which helps conserve resources and decrease the negative impacts of resource use on human health and the environment throughout a building's lifecycle including raw material selection for construction, operation, renovation or elimination of building.

The necessity of green building in Bangladesh stems from the need to address environmental challenges, enhance energy efficiency, promote resilience to climate change, and contribute to sustainable and healthier living conditions for its growing population. Government plans and policies also support in this regards. People of Bangladesh still are not adequately aware of environment preservation and energy-saving concepts.

Green building certifications is a way to ensure the high standard of sustainable and eco-friendly practices to construct and operate buildings. There are many green building certification systems and tools across the globe like LEED, BREEAM, IGBC, GRIHA, EDGE, DGNB, Energy Star Certified Buildings etc.





In Bangladesh, the Building Energy Efficiency & Environment Rating (BEEER) has been developed by Sustainable and Renewable Energy Development Authority (SREDA) to ensure the energy and resource efficiency in building to encourage sustainable practices in the construction industry. At present, BEEER is at drafting level, yet to be circulated. Housing parameter varies from region to region. Green residential building in Bangladesh should be in accordance with local housing condition. That's why to determine a viable model of green building in Bangladeshi housing condition considering global benchmark would be the most priority. The green building model should be user friendly, available, resource and energy efficient as well as affordable.

Although, this model is developed for financing to customers of BHBFC, it could also be a model for other banks and financial institutions. This model includes 06 major features such as **Suitable Site and Location Management, Building Construction Materials, Energy Conservation, Water Conservation, Indoor Environmental Quality and Awareness Development**. Some of the features are **mandatory** and some of the features are **optional**. **The total scoring number of the model is 100, where mandatory features have 70 and optional features have 30**. If a house achieves mandatory numbers, it will be qualified for certification.



Introduction

Global warming is one of the gravest global climate concerns. This phenomenon is mainly caused by the effluent emission of Green House Gases (GHGs). It is a growing concern for green house gas emission as buildings emit 28% CO₂ with an additional 11% from buildings construction¹ of total global energy-related emissions. Emission of Green House Gases (GHGs) plays a major impact in global climate change which produces various hazardous consequences and disaster. The necessity of addressing the environment becomes key issue in housing sector for reducing the GHG emission. Therefore, it is high time to devise fitting policy and programs to close the affordable housing gap on one side and at the same time, to manage the degradation on environment. Bangladesh is one of the developing countries of Asia which has been facing serious environmental deterioration and vulnerable to both disasters and climate change and ranked the seventh extreme disaster risk-prone country in the world as per the report from the Global Climate Risk Index 2021. Therefore ensuring the access to housing especially Green housing in Bangladesh are essential for several reasons, considering the country's environmental, economic, and social context.

What is Green Building?

To bring constructive developments through the construction industry in dealing with the issues of carbon emission, energy, water and other natural resource consumption, the green building emerges as an option which in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life are thus synonymously used as sustainable buildings.

- Green building is also known as sustainable building. It expands and complements the building design concerns of economy, utility, durability, and comfort. It is the practice of increasing efficiency with which buildings use – energy, water and materials-while reducing building impacts on human health and the environment².
- The planning, design, construction, and operations of buildings with several central, foremost considerations: energy use, water use, indoor environmental quality, material selection and the building's effects on its site³.
- Green building refers to both a structure and the application of processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from planning to design, construction, operation, maintenance, renovation and demolition.

¹Global Alliance for Buildings and Construction

²World Green Building Council (WGBC)

³US Green Building Council





There are a number of features which can make a building 'Green'. These include:

- Efficient use of energy, water and other resources.
- Use of renewable energy, such as solar energy.
- Pollution and waste reduction measures, and the enabling of re-use and recycling.
- Good indoor environmental quality.
- Consideration of the environment in design, construction and operation.
- Consideration of the quality of life of occupants in design, construction and operation.
- A design that enables adaptation to a changing environment.



Necessity of Green Building in Bangladesh

The necessity of Green building in Bangladesh stems from the need to address environmental challenges, enhance energy efficiency, promote resilience to climate change and contribute to sustainable and healthier living conditions for its growing population. It aligns with global trends towards sustainable development and reflects a proactive approach to the challenges of the 21st century. Green building focuses on the following important area:

1. Environmental conservation.
2. Energy efficiency.
3. Resource conservation.
4. Climate resilience.
5. Health and wellbeing.
6. Government initiative towards sustainable development.
7. Economic benefits.





Strategic Alignment of Green Residential Building

Bangladesh has to tackle the impact of climate change in two broad ways. They are-

- **Adaptive measures** and
- **Mitigation measures.**

On the mitigation aspect, policymakers have to increase investment for reduction of greenhouse gas emissions in polluting sectors, including agriculture, manufacturing, transport and construction sectors. However, since climate change is a global challenge, Bangladesh will have to work together with the global community. Bangladesh will also have to demand for higher resources and technology transfer for tackling climate change related challenges more effectively.

- **National Housing Policy 2016:** The government motto is 'None Should be Homeless'. In order to address this multi-dimensional problem in a planned manner, the government took the initiative to formulate the housing policy of Bangladesh. The main goal of the housing policy of Bangladesh is to provide accessible, sustainable, and quality housing for all to ensure sustainable development and equity so that the rights of healthy and affordable housing are ensured to all citizens.

- **Sustainable Development Goal (SDG):** The Sustainable Development Goals are a global call to action to end poverty, protect the earth's environment and climate, and ensure that people everywhere can enjoy peace and prosperity. Along with other goals, Bangladesh upholds the right to proper housing and shelter for all. The following goals of SDG are strategically related to the green, sustainable and affordable housing.

SDG 7: Affordable and Clean Energy

SDG 11: Sustainable cities and Communities

SDG 12: Responsible Consumption and Production

SDG 13: Climate Action

- **National Adaptation Plan (NAP):** To reduce the negative impacts of climate change and promoting sustainable planning for future development routes, the Government of Bangladesh initiated the formulation of its NAP (2023-2050) under the Ministry of Environment, Forest and Climate Change (MoEFCC), aiming for a viable path to climate-resilient development and reduced climate risks and vulnerabilities. Among the 6 goal of NAP the 3rd goal is much related to this topic. **Goal 3: 'Develop climate-smart cities for improved urban environment and well-being'**. Through this goal, the NAP aims to develop climate-smart cities reinforced with **expand green infrastructure, renewable energy mechanisms, improve human health & WASH** and so on.





- Moreover, there are some other policies related to sustainable housing activities such as **Bangladesh Climate Change Strategy and Action Plan 2008, Perspective Plan 2041, Energy Efficiency and Conservation Master plan up to 2030.**
- **Bangladesh Bank in Sustainable financing:** Bangladesh Bank launched a comprehensive green banking initiative in 2011 to support and promote environmentally responsible financing; issuing guidance inter alia for environmental risk assessment of borrowing proposals and for greening of internal processes and practices within banks and FIs.
- Bangladesh Bank issued Green Banking Policy Guideline for Banks in 2012.
- Sustainable Finance Department was established on July 23, 2015.
- Green Transformation Fund (GTF)-2016 and guidance note on GTF in 2020;
- Guidelines on Environmental and Social Risk Management (ESRM) for Banks and FIs in Bangladesh.
- Sustainable Finance Policy for Banks and Financial Institutions, 2020 has been circulated.
- A comprehensive list of product/project/initiatives of Green Finance for banks and FIs has been circulated in 2023 (previous circular was in 2017, 2020 & 2022).
- **Definition of Affordable Green Housing by Bangladesh Bank:** Affordable green housing is defined as a certified green housing in Bangladesh with basic civic infrastructure which is afforded by Lower Income Group (LIG) and Middle Income Group (MIG). Development of eco-friendly homestead and climate resilient housing in the village area are also included within the scope of affordable green Housing.

The SFD circular no-02 of Bangladesh Bank has nicely pointed out the outline and features of green residential building. But it requires more robust detailing to catch up every corner of the ground. In this regard a suitable and viable model is needed for the bank and financial institution to provide financial assistance in green residential building.



Why BHBFC has developed a Green Building Model?

- **Need for a Model:** A green building model involves incorporating various sustainable design principles, construction techniques, and technologies to create structures that minimize their environmental impact and maximize resource efficiency. Here is a general outline of the components and considerations in a green building model such as **Site selection and planning, Energy Conservation, Water Conservation, Material and Resources, Indoor Environmental Quality, Awareness Development, Adaptability, Community and social consideration.** Bangladesh is one of the victims of climate change and global warming. Green House Gas (GHG) is responsible for this global warming which is emitted in housing construction a lot. Hence, the eco-friendly element of the program will be able to reduce this alarming gas and it will be a viable model for this sector which will create the largest positive impact on climate restoration in this climatically vulnerable country after the adoption of the model.
- **Green Residential Building in Bangladeshi Housing condition:** Green building or energy efficient building is a global concept. It is originated from developed countries. Due to climate change issue, sustainable housing has become more important sector worldwide to be addressed. Every country has its own kind of housing establishment in accordance with geographical and climatic position. Housing parameter varies from region to region. Green residential building in Bangladesh should be in accordance with local housing condition. That's why to determine a viable model of green building in Bangladeshi housing condition considering global benchmark would be the most priority. The Installation of green and energy-efficient technology is a must in the green building. Installing green and energy-efficient technologies like solar panel, rainwater harvesting equipment, wastewater filtration system; energy-efficient electric devices, efficient plumbing fixtures etc. are expensive in some extent than that of conventional technology. Moreover, People of Bangladesh still are not adequately aware of environment preservation and energy-saving concepts. Therefore, keeping the reality in mind, the green building model should be user friendly, available, resource efficient as well as affordable.
- **Residential-Exclusive and Adaptability:** Quality housing always provide standard habitat for living. This will ensure a healthful life, labor productivity, social dignity, asset-building up the opportunity, and ultimately a bigger up-gradation of living standards. BHBFC provides financial assistance only for residential building to the Lower and Middle Income Household (LMIH) group. Residential green building model will help to identify the right customer and contribute to reduce in GHG emission. That's why there is need for building an exclusive and adaptive green building model.





- **Affordability:** The specifications/criteria of a green building in existing global certification systems need to be adaptive in context of Bangladesh and affordable to lower-middle and middle-income groups who are the target customer of BHBFC. If the green building is not cost-effective to both customer and BHBFC, financing to implement the green building model would be challenging. This model will help to provide affordable and sustainable housing to the end beneficiaries with a proper guide.

- **Comprehensibility:** Another issue of green building model is the comprehensibility to general customer in Bangladesh. The idea for green residential building is relatively new and the transition from conventional building to green/environment-friendly/sustainable building is unfamiliar to most of the people. This model aims to illustrate the features/specifications of a green building very comprehensive and accessible to general people.

BHBFC and Green Building-Steering Financing towards Climate Sustainability:

As a statehood agency BHBFC is playing a pioneer role in providing low-cost long-term housing loans especially to the unattended lower socio-economic groups in the country. In an attempt to synchronize with government policy, BHBFC is also striving to develop a sustainable financing model in Bangladesh to contribute to the country's effort to reduce carbon emission and fight against climate change. BHBFC has already promoted this idea through several awareness development programs. The main purpose of the awareness development programs was to raise awareness among the existing and potential borrowers of BHBFC about renewable energy, alternative fuel, application of solar panel and bio-gas plant, rain water harvesting technology, saving cultivable agricultural land by vertical extension, eco-friendly and affordable housing technology and construction materials etc. Following the awareness, BHBFC has already initiated environmental friendly sustainable financing service as per the target included in Annual Performance Agreement (APA) with GoB synchronizing to the government sustainable policy for preservation of environment, natural resources and energy conservation adhere to the Sustainable Development Goals (SDGs). The current proposal is to provide a model for sustainable housing or green building that would be a well-designed initiative towards sustainable development and will move ahead the agenda as paradigm shift for next generation.

Area of providing financial assistance: BHBFC can provide financial assistance to the following section:

- Green Building Loan scheme:** This is the financing to a certified green building with eco-friendly building materials and technology. The flexibility will be endorsed in the model based on the certain benchmarks defined for the green building construction.
- Green Featuring Building Loan scheme:** This is the financing to the construction of those building which will incorporate certain eco-friendly features in the construction based on the benchmark items defined for those construction of eco-friendly house.





- iii) **Women Responsive Green Housing Loan scheme:** This scheme will promote women empowerment, increase ownership & participation of women in financial activity. There will be some special features of this scheme to women borrower such as lower interest rate and equity, larger period of repayment to facilitate the opportunity of including them.
- iv) **Green Housing Appliances Loan scheme:** This type of financing would be small in amount and short in term compared to the earlier schemes. This loan will cover the purchase of separate green equipment for housing purposes.

Review of Different Certification System of Green Building:

Green building certifications and standards have developed as a way to both showcase and evidence that a high standard of sustainable and eco-friendly practices was used to create and operate the building. There are many green building certification systems across the globe. Two of the most well-known certifications include BREEAM and LEED, which assess and award ratings based on the score received. The following international certification system of green building are most relevant to our model:

i. LEED (Leadership in Energy and Environmental Design)

LEED was developed by the U.S. Green Building Council (USGBC) to certify that buildings have achieved specific green building criteria, such as energy savings, water efficiency, and CO₂ emissions reductions. Higher points provide a higher rating, which can be Platinum, Gold, Silver, and Certified. The certification can be awarded to new builds as well as refurbishment works.

ii. BREEAM (Building Research Establishment Environmental Assessment Method)

This assessment method was launched in 1990 by the Building Research Establishment (BRE) suitable for both new developments and refurbishments; BREEAM assesses the environmental performance of buildings in nine categories. The assessment takes into consideration not just the design and construction of the building, but also how it was procured and how it is operated. The ratings allow environmental performance to be benchmarked and evaluated against other similar buildings, and include Outstanding, Excellent, Very Good, Good, Pass and Unclassified.

iii. Energy Star Certified Buildings

ENERGY STAR is an energy rating system with strict energy performance standards. It compares a building's energy efficiency to the 2009 International Energy Conservation Code (IECC) and the building must gain a score of at least 75 out of 100 to earn the ENERGY STAR label. This must be verified during use rather than on predicted use at design stage and indicates that the building performs better than at least 75% of similar buildings – using at least 35% less energy and creating at least 35% fewer greenhouse gas emissions.





iv. The DGNB System

DGNB stands for 'Deutsche Gesellschaft für Nachhaltiges Bauen' (in English the German Sustainable Building Council). The DGNB System equally measures and evaluates a building's performance with respect to ecology, economy, and social aspects. As an incredibly advanced certification system, DGNB considers a wide range of criteria, including CO₂ generation from off-site sources and a life cycle assessment. The aims are to enable demonstrably better buildings to be built and managed, approaching sustainability as an integral part of every building project. Buildings can be rated as Platinum, Gold, Silver, or Bronze certified projects.

v. IGBC- Indian Green Building Council

IGBC, which stands for Indian Green Building Council, is an authority that promotes green building practices in India. An IGBC-Certified Green Home refers to a residential property that meets the stringent criteria set by IGBC which ensure energy efficiency, water conservation, and environmental responsibility. These IGBC-certified buildings in India are designed and constructed using eco-friendly materials, renewable energy systems and efficient waste management techniques.

vi. EDGE – Excellence in Design for Greater Efficiencies

EDGE is an online tool for determining cost-effective ways to build green, sustainable buildings, and has been shown to help planners to make energy efficiency savings of over 20% in new buildings. Designed by the International Finance Corporation (IFC), it can help city leaders in rapidly urbanizing areas keep development low-carbon, even in countries without regulations or standards set to drive energy-efficient green buildings.

vii. Local Rating System (at drafting level)

The Building Energy Efficiency & Environment Rating (BEEER) has been developed by Sustainable and Renewable Energy Development Authority (SREDA) to ensure the energy and resource efficiency in buildings and to encourage sustainable practices in the construction industry. SREDA acts as the implementation and executing body for BEEER which will be a voluntary rating system at the initial stage. It is based on certain baselines and calculation procedures to evaluate environmental, social and economic impacts of buildings. The rating system has been designed as a holistic approach to development of green buildings by taking the entire environmental footprint of buildings (e.g., water waste, resources) into account. In addition to this, aspects such as social standards, working conditions and safety are also evaluated. Through the consideration of social standards and working conditions, BEEER will help to counteract weak practices and improve the construction industry.

This model has adapted of its many important elements from BEEER, LEED, IGBC, BREEAM.



Description of the Model

BHBFC conducted roundtable discussion and workshop on green building model with expert professionals such as accredited professional from LEED, professionals from HBRI, SREDA and Bangladesh bank. Engineers from BHBFC also attended the program. Then a committee was formed with technical experts from BHBFC who reviewed the existing literature, rating system and went through several meetings. The model summary is provided below.

▪ Model summary

Section	Headline	Total		Mandatory		Optional	
		Number of inclusions/features	Marks	Number of inclusions/features	Marks	Number of inclusions/features	Marks
1	Sustainable Site & Location Management	10	30	6	25	4	5
2	Building Construction Materials	4	10	2	6	2	4
3	Energy Conservation	6	24	4	21	2	3
4	Water Conservation	6	21	3	11	3	10
5	Indoor Environmental Quality	5	11	3	7	2	4
6	Awareness Development	2	4	0	0	2	4
Total		33	100	18	70	15	30





Section-01: Sustainable Site & Location Management

	Total	Mandatory	Optional
Number of inclusions/features	10	6	4
Marks	30	25	5

SL.	Features	Details	Mandatory	Credit	Documentation /Means of Verification
1	2	3	4	5	6
1	Avoidance of Sensitive Land	Do not develop sites on that meet any of the followings: <ul style="list-style-type: none"> • Prime farmland • Parkland • Floodplain • Habitat of endangered animals/trees • Wetlands/Water bodies 	Mandatory	4	<ul style="list-style-type: none"> • Clearance certificate from authority/ mentioned in the site plan/mouza map. • Soil test report
2	Following Building Regulation	<ul style="list-style-type: none"> • Plans approved by urban local body/regulatory authority. • Construction according to the approved plan. 	Mandatory	8 (4+4)	<ul style="list-style-type: none"> • Approved Plan from authority (like RAJUK/ CDA/KDA/ Pourosova/ Upazilla Parishad etc.)
3	Access to Public Transit/ Transportation	The project site is located within 500 m walking distance to avail public transportation facilities like any of these followings: <ul style="list-style-type: none"> • Three-wheeler vehicle stoppage/hub • Local/intercity bus stoppage • Boat/Ferry Terminal • Train station/Metro-Rail station • Ride sharing accessibility 	Mandatory	3	<ul style="list-style-type: none"> • Google Map • Vehicle Road Permit list.
4	Reducing Heat Island Effect	<ul style="list-style-type: none"> • At least 02 (Two) native trees⁴ per katha are planted in the project site • Provide shade with solar photovoltaic panels (PV Panels) • Provide shade with architectural devices that have initial SRI value of 0.33 or higher • Rooftop gardening 	Mandatory	4	<ul style="list-style-type: none"> • Photograph of plants • Building layout • Manufacturer documentation that confirms SRI value of the materials/ SREDA





SL.	Features	Details	Mandatory	Credit	Documentation /Means of Verification
1	2	3	4	5	6
5	Open Space Management	<ul style="list-style-type: none"> Keep open space area according to the applicable local regulation (by RAJUK/CDA/KDA/RDA/City Corporation/Pouroshova/Upazila Parishad etc.) 50% of total open space must be vegetated/having tree. 	Mandatory	3	<ul style="list-style-type: none"> Building layout Photograph of vegetated area.
6	Community Services	<p>At least 8 (eight) basic social service facilities of these followings within 1 km walking distance from the project site:</p> <ul style="list-style-type: none"> Supermarket Food retail store/confectionary/ Restaurant/Café Clothing store/showroom/tailor shop Grocery store (Mudi dokan/Bazar) Farmer's market (kacha bazar) Fruit stand Pharmacy Hardware store Commercial banks/ATM booth Mobile Financial Service agent (BKash/Nagad/Rocket etc.) Hair Care (Barber shop)/ Woman beauty parlor Laundry/dry cleaner Religious place for worship Educational facilities (School/college/Madrassa/University etc.) Post office/courier services Hospital/medical clinic/community health services Public parks/recreation center Community center Police/fire station 	Mandatory	3	<ul style="list-style-type: none"> Google Map Detail Area Plan (DAP)/ Housing map
Total				25	





SL.	Features	Details	Optional	Credit	Documentation/ Means of Verification
1	2	3	4	5	6
7	South/South-east Facing (Favorable building orientation)	In context of geographic location of the country and to avail the sunlight and monsoon wind coming from south, project site can be located in south facing plot/south-east facing plot or corner plot.	Optional	1	<ul style="list-style-type: none">• Approved Plan
8	Compact Development	There are at least 80 dwelling units within 1 acre land of the project site area. (To ensure the site is located in a previously developed urban area) [Following regulation in BNBC 2020 and FAR]	Optional	1	<ul style="list-style-type: none">• Approved Plan from authority (like RAJUK/ CDA/KDA/ Pourosova/ Upazilla Parishad etc.)
9	Parking facilities	<ul style="list-style-type: none">• Provide parking facilities following minimum requirements set out in BNBC 2020, Dhaka Imarat Bidhimala-2008 or other applicable government regulations.• Installation of a bicycle stand in the garage.	Optional	2	<ul style="list-style-type: none">• Approved Plan• Photograph of parking facilities
10	Design for physically challenged and senior citizen	Provide ramps with handrails on at least one side the building to enter/park/move with easy access for differently able and senior citizen residents/visitors.	Optional	1	<ul style="list-style-type: none">• Approved Plan
Total				05	





Section-02: Building Construction Materials

	Total	Mandatory	Optional
Number of inclusions/features	4	2	2
Marks	10	6	4

SL.	Features	Details	Mandatory	Credit	Documentation /Means of Verification
1	2	3	4	5	6
1	Alternative construction materials	<ul style="list-style-type: none"> Avoid use of burnt brick for construction of super structure wall and use concrete hollow blocks / autoclaved aerated concrete block/ interlocking Concrete Block/ lightweight Cellular Concrete and similar eco-friendly material for outer and partition wall (At least 50% of total Masonry wall should be made from Block). 	Mandatory	3	<ul style="list-style-type: none"> Description of the product (packaging/ memo/ warranty card/manual etc.)
2	Use of Local and eco-friendly materials	<ul style="list-style-type: none"> Use at least 60% local/regional construction materials which are extracted, manufactured and assembled within Bangladesh. Use at least 70% of electro mechanical equipment in the construction which is locally produced. Avoid timber & wood and use processed engineered wood. 	Mandatory	3	<ul style="list-style-type: none"> Description of the product (packaging/ memo/ warranty card/manual etc.)
Total				06	

SL.	Features	Details	Optional	Credit	Documentation /Means of Verification
1	2	3	4	5	6
3	Reuse and Re-cycling of building materials	Use new construction materials with recycled content that contributes to at least 10% of the total construction materials.	Optional	2	<ul style="list-style-type: none"> Description of the product (packaging/ memo/ warranty card/ manual etc.)
4	Use certified building materials	<p>At least 3 of the following main construction materials should come from the factory that have environmental compliance report or the factory should have energy audit report from national⁵ / International Certifying agency:</p> <ul style="list-style-type: none"> Bricks/Block Tiles Cement Readymade concrete Steel Particle board and Glass 	Optional	2	<ul style="list-style-type: none"> Description of the product (packaging/ memo/ warranty card/ manual etc.)
Total				04	





Section-03: Energy Conservation

	Total	Mandatory	Optional
Number of inclusions/features	6	4	2
Marks	24	21	3

SL.	Features	Details	Mandatory	Credit	Documentation/ Means of Verification
1	2	3	4	5	6
1	Energy Metering	<ul style="list-style-type: none"> • Install electricity meters to monitor whole building energy consumption for building-level/tenant-level/unit-level. • Install a whole building gas meter to monitor use of supplied gas. Or Store data of quarterly usage of LPG cylinder for each dwelling unit. 	Mandatory	4	<ul style="list-style-type: none"> • Quarterly use of Gas cylinder • Data sheet of energy use
2	Energy saving appliances	<p>At least two of the following electrical appliances having energy-star rating or energy efficiency level tag approved from BSTI shall be accepted:</p> <ul style="list-style-type: none"> • Refrigerator • Ceiling fan • Pumps and motors • Television • Oven • Washing machine 	Mandatory	4	<ul style="list-style-type: none"> • Description of the product (packaging/memo/warranty card/manual etc.) • Energy Star rating for energy efficiency from BSTI/recognized institution
3	Efficient lighting	<ul style="list-style-type: none"> ▪ Access to Daylight: Daylight spaces have been shown to improve people's ability to perform visual tasks, increase productivity and reduce illness. • Building fenestration should be designed to optimize day lighting and reduce the need for electric lighting. • Orient the building to minimize building exposure to the east and west and maximize glazing on the south and north exposures. • Daylight strategies do not save energy unless electric lights are turned off or dimmed appropriately. ▪ Use energy saving lighting appliances like LED bulb, CFL bulb etc. as following: • For interior lighting ensure average Lighting Power Density (LPD) of 7 W/m² • For exterior lighting (common space, parking space, pathway etc.) ensure average Lighting Power Density (LPD) of 2.5 W/m² ▪ Light with sensor. 	Mandatory	8	<ul style="list-style-type: none"> • Description of the product (packaging/memo/warranty card/manual etc.) • Photographs of installation.





SL.	Features	Details	Mandatory	Credit	Documentation/ Means of Verification
1	2	3	4	5	6
4	Use of Renewable energy/ Install PV panel (Solar)	<ul style="list-style-type: none"> ▪ Installation of equipment's generating renewable energy such as: <ul style="list-style-type: none"> • Solar PV panel • Solar water heater system ▪ 3% renewable energy use is Mandatory (BNBC-2020). ▪ On grid solar panel. 	Mandatory	5	<ul style="list-style-type: none"> • Description of the product (packaging/ memo/ warranty card/manual etc.) • Photographs of installation. • Size, capacity and total consumption • Power load capacity certification/cal culation of the building from concerned authority
Total				21	

SL.	Features	Details	Optional	Credit	Documentation/ Means of Verification
1	2	3	4	5	6
5	Air Conditioning System	Installation of energy efficient (environment-friendly) Air Conditioning system for residential unit. Energy efficiency level tag approved from BSTI shall be accepted.	Optional	2	<ul style="list-style-type: none"> • Description of the product (packaging /memo/warranty card/manual etc.) • Photographs of installation.
6	Lift	<p>All lifts shall be equipped with necessary sensors and controls to reduce energy usage. For this purpose, following features shall be included in the lift system:</p> <ul style="list-style-type: none"> • AC Variable-Voltage and Variable-Frequency (ACVVVF) drives for the car and door shall be used. • Energy efficient lamps shall be used inside the car and for displays. • The lifts shall operate in standby mode during off-peak periods. • The power side of the lift controller and other operating equipment such as car lights, display lights and ventilation fans shall be switched off when the lift has been inactive for more than five minutes.(BNBC-2020) 	Optional	1	<ul style="list-style-type: none"> • Product description • Photograph
Total				03	





Section-04: Water Conservation

	Total	Mandatory	Optional
Number of inclusions/features	6	3	3
Marks	21	11	10

SL.	Features	Details	Mandatory	Credit	Documentation/ Means of Verification
1	2	3	4	5	6
1	Availability of potable water	Provide piped potable water supply and storage system, considering 120 liters of water per person per day.	Mandatory	4	<ul style="list-style-type: none"> Description with capacity & photographs of the storage system
2	Installation of water meter	Install prepaid/postpaid water meter (for whole building) /sub meter (for each individual unit) for the building.	Mandatory	6	<ul style="list-style-type: none"> Description & photographs of the meter(s)
3	Outdoor water use reduction	Use native drought prone plants and trees that do not require regular watering. (once established to cover at least 50% of the landscaping area)	Mandatory	1	<ul style="list-style-type: none"> List of trees and photographs
Total				11	

SL.	Features	Details	Optional	Credit	Documentation/M eans of Verification															
1	2	3	4	5	6															
4	Water use reduction by Water efficient plumbing fixture	<ul style="list-style-type: none"> At least 20% reduction shall be achieved only with fixture efficiency, without using alternative water sources. Use of efficient plumbing fixtures, sensors, auto control valves, aerators, flow control and pressure-reducing devices can result in significant reduction in water consumption. <table border="1" style="width: 100%; margin-top: 10px; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Type of fixtures</th> <th>Quantity</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>Water closets</td> <td>Dual Flush (6/4)</td> <td>liters/flushing cycle (full/low)</td> </tr> <tr> <td>Shower</td> <td>9.5</td> <td>liters/min at 551 kPa</td> </tr> <tr> <td>Hand wash taps</td> <td>6</td> <td>liters/min at 417.7 kPa</td> </tr> <tr> <td>Kitchen/pa ntry faucets</td> <td>6</td> <td>liters/min at 417.7 kPa</td> </tr> </tbody> </table> <p style="text-align: right; margin-top: 5px;">(BNBC-2020)</p>	Type of fixtures	Quantity	Unit	Water closets	Dual Flush (6/4)	liters/flushing cycle (full/low)	Shower	9.5	liters/min at 551 kPa	Hand wash taps	6	liters/min at 417.7 kPa	Kitchen/pa ntry faucets	6	liters/min at 417.7 kPa	Optional	5	<ul style="list-style-type: none"> Description & photographs of the plumbing fixtures Manufacturers cut sheet/ brochure/ letters indicating flow/flush rates.
Type of fixtures	Quantity	Unit																		
Water closets	Dual Flush (6/4)	liters/flushing cycle (full/low)																		
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Kitchen/pa ntry faucets	6	liters/min at 417.7 kPa																		
5	Reuse of water	<ul style="list-style-type: none"> Re-use the filtrated waste water from wash basin on the following application: <ul style="list-style-type: none"> Flushing Landscaping (irrigation) Use Sewerage Treatment Plant (STP). 	Optional	2 (1+1)	<ul style="list-style-type: none"> Tentative daily and annual water balance of the residence. Description & photographs showing the on-site waste-water treatment system installed. 															





SL.	Features	Details	Optional	Credit	Documentation/Means of Verification
1	2	3	4	5	6
6	Rain Water harvesting	<ul style="list-style-type: none"> • Design the rainwater harvesting system to collect runoff from the roof area of the building. • Use collected rainwater for end-users such as toilet flushing, gardening, firefighting water storage. • Excess rainwater shall be recharged to below ground with filtration. • Rainwater Storage capacity shall be calculated based on size of the roof area using calculation referred in BEEER by SREDA. (Annexure-1) 	Optional	3	<ul style="list-style-type: none"> • Rainwater Harvesting and Recharging Calculation • Plumbing drawing indicating the rainwater collection and use in buildings • Rainwater filtration system and/or treatment system design • Layout plan and design of recharge well/rainwater storage tank
Total				10	





Section-05: Indoor environmental quality

	Total	Mandatory	Optional
Number of inclusions/features	5	3	2
Marks	11	7	4

SL.	Features	Details	Mandatory	Credit	Documentation/ Means of Verification
1	2	3	4	5	6
1	Ventilation	<ul style="list-style-type: none"> Window to wall ratio shall not exceed 40%. Adequately ventilate all living spaces by mechanical or natural means. and Cross ventilation should be available. 	Mandatory	3	<ul style="list-style-type: none"> Architectural floor plan. Window to wall ratio calculation. Natural/mechanical ventilation calculation.
2	Exhaust system	<ul style="list-style-type: none"> Kitchen and Bathroom should have exhaust system (i.e: Exhaust fan); and/or Install Kitchen hood. 	Mandatory	2	<ul style="list-style-type: none"> Photographs of exhaust system.
3	Waste management	Install three different dustbins/containers for Compostable, Recyclable and hazardous wastes in ground floor.	Mandatory	2	<ul style="list-style-type: none"> Photographs of dustbins/containers
Total				07	

SL.	Features	Details	Optional	Credit	Documentation /Means of Verification
1	2	3	4	5	6
4	Low emitting materials	<ul style="list-style-type: none"> Interior paints and coatings shall comply with the VOC levels specified in Annexure-2. Adhesive and Sealants shall comply with VOC levels specified in Annexure-2. All products must have the VOC level certification from ISO or similar recognized accredited organization. Veneer wood, particle boards and all types of composite wood products shall not contain added Urea Formaldehyde. Use of low emitting glass. 	Optional	2	<ul style="list-style-type: none"> VOC level certification from ISO or BSTI or similar recognized accredited organization. Description of the product (packaging/memo/warranty card/manual etc.)
5	Tobacco smoke control	<ul style="list-style-type: none"> Prohibit smoking in common space of the building Prevent tobacco smoke leaking in to the common areas from the residential units. 	Optional	2	<ul style="list-style-type: none"> Photograph of Sticker prohibiting smoking.
Total				04	





Section-06: Awareness Development

	Total	Mandatory	Optional
Number of inclusions/features	2	0	2
Marks	4	0	4

SL.	Features	Details	Optional	Credit	Documentation/ Means of Verification
1	2	3	4	5	6
1	Awareness for home owner	<ul style="list-style-type: none"> Participation in environment-related awareness program (Seminar/ Workshop/ Webinar) arranged by BHBFC. or Participation in environment-related awareness program (Seminar/ Workshop/ Webinar) arranged by any local/ national/ international organization. or Participation in any environment-related motivational event arranged by any local/ national/ international organization. 	Optional	2	<ul style="list-style-type: none"> Certificate issued by organizer. Attendance list/ Photograph of the program. Reward/award/ waiver from any formal organization regarding environmental work.
2	Occupant wellbeing	<ul style="list-style-type: none"> Quarterly meeting of building residents promoting awareness of sustainable living. Common space for common sitting space/ yoga room/children playground/ prayer room. 	Optional	2	<ul style="list-style-type: none"> Photographs of the facilities.
Total				04	





Challenges for the Implementation of This Model

• Awareness and Education

Despite the growing interest, there's a need for widespread awareness about the benefits and methodologies of green building practices among stakeholders, including constructor/developers, designer/architects and consumers.

• Cost Implications

Initial costs of implementing green technologies often deter constructors/developers, as they might perceive higher costs compared to traditional construction methods. However, long-term operational savings and reduced environmental impact often offset these costs.

• Regulatory Framework and Compliance

While there's progress in creating regulatory frameworks that incentivize green building construction, ensuring compliance across all regions and implementing consistent standards remains a challenge.

• Availability of Skilled Workforce

The lack of trained professional's adept in green construction practices poses a significant obstacle. Skilled labor is crucial for the successful implementation of green building initiatives.

• Readiness of Market

The market for green building materials is not ready in Bangladesh. Some companies are importing machines for preparing concrete/hollow blocks, branding their electronic appliances with energy performance/saving ratings. But the housing market and sub-sector are not ready for adopting green building measures.

• Non-performance of maintenance

Even green buildings that pass the initial performance tests and are successfully commissioned can present problems later on if the owner and occupants fail to perform proper maintenance.

	Helpful	Harmful
Internal	<ul style="list-style-type: none"> Guidelines and frameworks are established Technologies and methods for Bangladesh context exist Local and eco-friendly materials commonly used 	<ul style="list-style-type: none"> Lack of knowledge among stakeholders, need for capacity building and training of experts and sensitization of the populace Lack of coordination and collaboration among organizations Green Financing frameworks are in formative stages
External	<ul style="list-style-type: none"> Increasing national awareness of GB Decreasing costs for GB Availability of foreign investors and development opportunities Knowledge sharing 	<ul style="list-style-type: none"> Dominance of conventional construction techniques Reluctance of housing sector to change Increasing frequency of occurrence of natural disasters/calamities

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Annexure-1

Calculation for Rainwater Harvesting

Eligibility Criteria:

- Design the rain water harvesting system to collect run off from the roof area of the building.
- Rain water storage capacity shall be calculated based on size of the roof area using following calculation.

$$T = \sum A_i p_i \times I \times C$$

Where,

A_i = Roof Area

T - Tank capacity (m^3)

p_i = Roof Area Percentage

p - Percentage roof area

I - daily average rainfall (m); Where, I = Annual rain fall \div Number of rainy days per annum

C - Roof run-off coefficient (shall be considered as 90%)

A - Roof area excluding green roofs (m^2)

Roof Area (A_i)	Roof Area Percentage (P_i)
First 5000 sq ft	10%
From 5000 up to 10,000 sq ft	5%
From 10,000 up to 50,000 sq ft	2%
From 50,000 up to 100,000 sq ft	1%
Above 100,000 sq ft	0.5%

- Use collect drain water for end use such as toilet flushing, gardening, firefighting water storage.
- Excess rain water shall be recharged to below ground with filtration or grease/oil trapping system.





Annexure-2

Table-1: Maximum Allowable VOC levels for Paints and Coatings

Coating	VOC (g/ltr)	Coating	VOC (g/ltr)
Bond breakers	350	Mastic coatings	500
Clear Wood finishes	275	Metallic Pigmented coatings	500
Varnish/Lacquer	275	Multi color coatings	250
Sanding Sealers	275	Non flat coatings	50
Clear brushing lacquer	275	Non flat high gloss	50
Concrete-curing compounds	100	Pigmented lacquer	275
Dry-fog coatings	150	Pre-treatments wash primers	420
Fire-retardant coatings		Primers, sealers, under coats	100
Clear	650	Quick-dry enamels	50
Pigmented	350	Quick-dry primers, sealers, undercoats	100
Flats	50	Rust: preventive coatings	100
Floor coatings	50	Shellac	
Graphic arts (sign) coatings	500	Repair	650
Industrial maintenance (im) coatings	100	Clear	340
High temperature (im) coatings	420	Stains-Interior	100
Zinc-rich (im) primers	100	Swimming pool coatings	340
Japan/faux finishing coatings	450	Waterproofing sealers	100
Magnesite cement coatings	300	Water proofing concrete, masonry sealers	100





Table-2: Maximum Allowable VOC levels for Adhesives and Sealants

Architectural Applications	VOC(g/l) Less Water	Specialty Applications	VOC(g/l) Less Water
Indoor carpet adhesives	50	PVC welding	510
Carpet pad adhesives	50	CPVC welding	490
Wood flooring adhesives	100	ABS welding	325
Rubber floor adhesives	60	Plastic cement welding	250
Sub floor adhesives	50	Adhesive primer for plastic	550
Ceramic tile adhesives	65	Contact adhesive	80
VCT and asphalt adhesives	50	Special purpose contact adhesive	250
Dry wall and panel adhesives	50	Structural wood member adhesive	140
Cove base adhesives	50	Sheet applied rubber lining operations	850
Multipurpose construction adhesives	70	Top and trim adhesive	250
Structural glazing adhesives	100		

Substrate Specific Applications	VOC (g/l) Less Water	Sealants	VOC (g/l) Less Water
Metal to metal	30	Architectural	250
Plastic foams	50	Non membrane roof	300
Porous material(except wood)	50	Roadway	250
Wood	30	Single-ply roof membrane	45
Fiberglass	80	Other	420

Sealant Primers	VOC (g/l) Less Water
Architectural, nonporous	250
Architectural, porous	775





Abbreviation

BB	Bangladesh Bank
BEEER	Building Energy Efficiency and Environment Rating
BHBFC	Bangladesh House Building Finance Corporation
BNBC	Bangladesh National Building Code
BREEAM	Building Research Establishment Environmental Assessment Method
BSTI	Bangladesh Standards and Testing Institution
CDA	Chattogram Development Authority
GB	Green Building
ISO	International Organization for Standardization
KDA	Khulna Development Authority
kPa	Kilopascal
LEED	Leadership in Energy and Environmental Design
PVC	Polyvinyl Chloride
RAJUK	Rajdhani Unnayan Kartipakkha
SFD	Sustainable Finance Department
SREDA	Sustainable and Renewable Energy Development Authority
USGBC	United States Green Building Council
VOC	Volatile Organic Compound





Round table discussion on the Affordable Green Housing Finance.



Workshop on Affordable Green Housing Finance.





Workshop on Affordable Green Housing Finance.



Committee Meeting on Green Residential Building Model Preparation.





The Green Residential Building Model was approved at board meeting on January 17, 2024





Meeting at the Financial Institutions Division (FID) on Green Residential Building Model and Affordable Finance.



A Few Photographs BHBFC Financed Eco-Friendly Houses



KISHORGANJ



GOPALGANJ



UTTARA, DHAKA



BARISHAL





BHBFC Financed Eco-Friendly Houses



MIRPUR DOHS, DHAKA





বাংলাদেশ হাউজ বিল্ডিং ফাইন্যান্স কর্পোরেশন
Bangladesh House Building Finance Corporation

সুস্থায়নের দিগন্তে প্রতিশ্রুতির স্মারক

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