

4. Indicator Description

4.1 Energy and Green Buildings



Indicator 1: Electricity Consumption in the City

Rationale: Growing urban areas and urban population increase electricity consumption in cities. Electricity generation is primarily dependent on fossil fuels, leading to higher GHG emissions. Controlling the per capita consumption of electricity will lead to lower GHG emissions.

Description: The indicator assesses the amount of electricity that is used by the city and encourages lower consumption in comparison to the best performing cities.

Methodology: Total electricity consumption (kWh) in the city is calculated. The population data of city is used for per capita calculations.

Formula:

$$\frac{\text{Total electricity consumption (in kWh) in the city for the assessment year}}{\text{Population of the city}}$$

Unit: kWh per capita

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 to 100.

Performance Evaluation Levels:
Table 4.1: Electricity Consumption in the City

	1	2	3	4	5
Progression Levels	> 10X compared to the city with lowest electricity consumption per capita	> 4X & < 10X as compared to the city with the lowest electricity consumption per capita	> 2X & < 4X as compared to the city with the lowest electricity consumption per capita	> 1.1 X & < 2X as compared to the city with the lowest electricity consumption per capita	Up to 1.1X as compared to the city with the lowest electricity consumption per capita
Evidence/ Data sources	<ul style="list-style-type: none"> Total electricity consumption of the city from DISCOMs Census of India population figures indexed with average annual growth rate for the year 2019 				
Responsible Department/ Agency	DISCOMs, ULB, SEDA				
Reference Document	Manual for the Development of Municipal Energy Efficiency Projects (BEE; 2008) - https://tinyurl.com/w6omgtt				
Score	0	25	50	75	100



Indicator 2: Total Electrical Energy in the City Derived from Renewable Sources

Rationale: Fossil fuels such as coal, natural gas and oil are the major sources of energy generation in our country. Production of energy from cleaner renewable energy sources (solar PV, solar thermal, wind energy, hybrid-hydel power, small hydro, geo-thermal energy, tidal energy, biogas, waste to energy) would minimize GHG emission.

Description: The indicator encourages the replacement of existing electricity generation from fossil fuels with cleaner renewable energy sources.

Methodology: Total electrical energy in the city is calculated by adding 80% of the ratio of total electrical energy consumption from all grid connected renewable energy sources (kWh) to total electricity consumption (in kWh) in the city and 20% of the ratio of installed capacity of off grid renewable energy sources for self-consumption (kW) to total connected load (kW) in the city.

Formula:

$$\left[\left(0.8 \times \frac{\text{Total electrical energy consumption (in kWh) from all on-grid renewable energy sources and is used in the city}}{\text{Total electricity consumption (in kWh) in the city}} \right) + \left(0.2 \times \frac{\text{Cumulative installed capacity (in kW) of off grid renewable energy sources for self consumption}}{\text{Total connected electrical load (in kW) in the city}} \right) \right] \times 100$$

Unit: %

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 to 100.

Performance Evaluation Levels:

Table 4.2: Total Electrical Energy in the City Derived from Renewable Sources

	1	2	3	4	5
Progression Levels	No electrical energy generated from renewable sources	Renewable Energy contribution of less than 5%	Renewable Energy contribution of 5- 10%	Renewable Energy contribution of 10-15%	Renewable Energy contribution of > 15%
Evidence/ Data sources	Data on electrical energy consumption from all grid connected renewable energy sources can be obtained from local power distribution companies (DISCOMs) <ul style="list-style-type: none"> Data on total electricity consumption and connected electrical load can be obtained from DISCOMs Data of installed capacity of all off-grid renewable energy sources used for self-consumption verified by State Energy Development Agencies (SEDA) - They may provide number based on the estimation of sale data, RE products, or RE proponents applying for subsidies. 				
Responsible Department/ Agency	DISCOMs, ULB, SEDA				
Reference Document	Energy Statistics (MOSPI; 2018) - http://mospi.nic.in/sites/default/files/publication_reports/Energy_Statistics_2018.pdf				
Score	0	25	50	75	100



Indicator 3: Fossil Fuel Consumption in the City

Rationale: Indicator aims to incentivize cities to lower their CO₂ emission per capita per area by encouraging them to switch to alternative cleaner fuel

Methodology: Total consumption of Diesel, Petrol, CNG, LPG and PNG are calculated in the city. The consumption of fossil fuel is converted to CO₂ emission using respective emission factors. Population of the city is used to assess per capita figures.

sources

Description: The indicator will assess the amount of fossil fuels (kL) i.e. Petrol, Diesel, CNG, LPG, PNG, utilized in the city

Formula:

$$\frac{\text{Total CO}_{2e} \text{ of fossil fuel consumption (diesel+petrol+LPG+CNG+PNG) by the city}}{\text{Population of the city}}$$

Where, total TCO_{2e} = Total diesel consumption (kL) x 2.62694 + Total petrol consumption (kL) X 2.20307 + Total LPG Consumption gkL) X 1.51906 + Total CNG Consumption (kL) X 0.48066 + Total PNG Consumption (kL) X 0.48066

*Emission factors are calculated based on stoichiometry

Unit: Tons CO₂ equivalent per capita

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 to 100.

Performance Evaluation Levels:

Table 4.3: Fossil Fuel Consumption in the City

	1	2	3	4	5
Progression Levels	> 10X compared to the city with lowest electricity consumption per capita	> 4X & < 10X as compared to the city with the lowest electricity consumption per capita	> 2X & < 4X as compared to the city with the lowest electricity consumption per capita	> 1.1 X & < 2X as compared to the city with the lowest electricity consumption per capita	Up to 1.1X as compared to the city with the lowest electricity consumption per capita
Evidence/ Data sources	The data on the consumption of petroleum products can be collected by reaching out to the petroleum products distribution companies (e.g. BPCL, IOCL, HPCL and SHELL, etc.) Census of India population figures indexed with average annual growth rate for the year 2019 as per SCP				
Responsible Department/ Agency	BPCL, IOCL, HPCL and SHELL, etc.				
Reference Document	Draft National Energy Policy (NITI Aayog; 2017) https://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017.pdf				
Score	0	25	50	75	100



Indicator 4: Energy Efficient Street Lighting in the City

Rationale: Street lighting is a major contributor to the city's electricity consumption. Energy efficient and renewable energy operated street lighting systems will reduce the dependence on electricity from fossil fuels thus indirectly reduce GHG emissions in the city.

Description: The indicator will assess the extent to which cities have adopted use of energy efficient and

renewable energy operated streetlights. Energy efficient streetlights should have lamps with luminous efficacy of more than 85 lumens per watt (e.g. LED, Sodium vapor lamps etc.)

Methodology: Ratio is calculated for the total number of energy efficient and renewable energy operated streetlights in the city to total number of streetlights in the city

Formula:

$$\frac{\text{Total number of energy efficient street lights + renewable energy operated street lights in the city}}{\text{Total number of street lights in the city}} \times 100$$

*Double counting of the streetlight should be avoided

Unit: %

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 to 100.

Performance Evaluation Levels:

Table 4.4: Energy Efficient Street Lighting in the City

	1	2	3	4	5
Progression Levels	No streetlights in the city is energy efficient	Up to 25% streets lights in the city are energy efficient or renewable energy operated	Up to 50% streets lights in the city are energy efficient or renewable energy operated	Up to 75% streets lights in the city are energy efficient or renewable energy operated	All streets lights in the city are energy efficient or renewable energy operated
Evidence/ Data sources	Total number of streetlights in the city can be obtained from ULB records. <ul style="list-style-type: none"> Municipal records/documentary evidence for the number of streetlights with energy efficient lamps Municipal records/documentary evidence for the number of streetlights operated with renewable energy Map of all streetlights in the city as .kml files (point geometry with optional attributes for energy efficient lamps) 				
Responsible Department/ Agency	ULB				
Reference Document	Energy Efficient Street Lighting (BEE; 2010) https://tinyurl.com/sorzgrz				
Score	0	25	50	75	100



Indicator 5: Promotion of green buildings

Rationale: Buildings, throughout their life cycles, are one of the prime contributors of GHG emissions in the city. In order to encourage the construction and use of green and energy efficient buildings, national building code 2016 and energy conservation of building codes are developed and notified by the Government. There are number of compliances, implementation procedures and stakeholder co-operation that needs to be in place from the city's side for effective adoption of green buildings. This indicator checks the readiness of the city regarding the compliance procedures, penalty/reward schemes and stakeholder co-operation for subsequent promotion of new and existing green and energy efficient buildings.

Description: Compliance and implementation procedures for various green building norms at city level requires integration of these provisions in the General

Development Control Regulations (GDCRs), building byelaws/rules, formation of green building cells/equivalent in ULBs etc. Green buildings are defined by established rating systems including Bureau of Energy Efficiency (BEE), Leadership in Energy & Environmental Design (LEED), Excellence in Design for Greater Efficiencies (EDGE), Green Rating for Integrated Habitat Assessment (GRIHA), Indian Green Building Council (IGBC), Green and Eco-friendly Movement (GEM).

Methodology: Compliance procedures are only available at state level. Assessment will be on the basis of inclusion of latest provisions of codes, regulations for green buildings at city level, formation of green building cell within city ULBs, availability of promotional/penalty schemes to spur demand for green buildings, and formation of city level green building committee/equivalent for stakeholder co-operation.

Formula:

Nil

Unit: Nil

Maximum Score: Total score for the indicator is 100. Cities will be marked based on the evidence provided for the number of measures implemented. Cities will be marked in 5 levels with scores ranging from 0 to 100.

**Performance Evaluation Levels:
Table 4.5: Promotion of green buildings**

	1	2	3	4	5
Progression Levels	No measures implemented	One measure implemented	Two measures implemented	Three measures implemented	All four measures implemented
Evidence/ Data sources	<p>MEASURE 1: Inclusion of Part 11 of National Building Code (NBC 2016) and/or Energy Conservation Building Codes (ECBC 2017) for commercial buildings & Eco-Niwas Samhita 2018 for residential buildings and/ or minimum level of green building rating systems notified in City Development Control Regulations (DCRs/GDCRs) and building rules/bye laws</p> <p>MEASURE 2: Functioning of green building cell in ULB for the purpose of knowledge dissemination, creating public awareness, empaneling green building vendors, designing green building schemes and their promotions, verification and faster approvals for green buildings in the city.</p> <p>MEASURE 3: Promotional/ Penalty schemes available for code compliance, pre- certification, certification of green buildings.</p> <p>MEASURE 4: Functioning of high-level Green Building Committee/ equivalent comprising of ULB's Commissioner and representatives of ULB green building cell, SPV, PMC, UDD, Town Planner, PWD, Green Building Certification agencies, Developers and Building Professional Associations. The committee will provide strategic advice for the promotion and adoption of energy efficient and green buildings in the city.</p>				
Responsible Department / Agency	<p>MEASURE 1: Latest version of NBC 2016 and or ECBC 2017 Compliance procedures available at city level</p> <p>MEASURE 2, 3 & 4: ULB records, Gazette notifications, Government Orders, Office Circulars, Public notices, Departmental Orders, Internal circulars, Communications, meeting notices, meeting minutes, public awareness campaigns (English, Hindi and regional languages), training programs conducted, updating green homes and buildings curriculum in schools and colleges and/or other relevant documents as data and evidences.</p>				
Reference Document	<p>NATIONAL BUILDING CODE (BIS; 2016) https://ukfireservices.com/uttarakhand_fire/wp-content/uploads/2018/04/NBC-2016-VOL.1-Part-4-Fire-and-Life-Saftey.pdf</p>				
Score	0	25	50	75	100



Indicator 6: Green Building Adoption

Rationale: In continuation with the previous indicators, this indicator encourages the design and construction of new buildings as per the energy efficient and green building norms.

Description: Indicator incentivizes the city for promoting green building with respect to the total number of buildings approved for construction and occupancy in the city for the assessment year. Green buildings are defined by established rating systems including Bureau of Energy Efficiency (BEE), Leadership in Energy & Environmental Design (LEED), Excellence in Design for Greater Efficiencies (EDGE), Green Rating for Integrated Habitat Assessment (GRIHA), Indian Green Building Council (IGBC), Green and Eco-friendly Movement (GEM).

Methodology: The city has to calculate i) total number of ECBC/ENS compliant buildings for construction approval or pre-certified green buildings for the assessment year (financial year for June assessment, October – September for December assessment, ii) total number of buildings approved for construction for the assessment year (financial year for June assessment, October-September for December assessment), iii) BUA of ECBC/ENS compliant buildings for occupancy approval or green buildings certified for the assessment year (financial year for June assessment, October-September for December assessment), iv) BUA of all buildings approved for occupancy during the assessment year (financial year for June assessment, October-September for December assessment)

Formula:

$$\left(0.2 \times \frac{\text{Total number of ECBC/ENS compliant buildings obtained construction approval + pre-certified green buildings for the assessment period}}{\text{Total number of buildings approved for construction for the assessment period}} + 0.8 \times \frac{\text{BUA of ECBC/ENS compliant buildings obtained occupancy approval + green buildings certified for the assessment period}}{\text{BUA of all buildings approved for occupancy for the assessment period}} \right) \times 100$$

*Double counting of code compliance and green building certified buildings should be avoided

Unit: %

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 to 100.

**Performance Evaluation Levels:
Table 4.6: Green Building Adoption**

	1	2	3	4	5
Progression Levels	No green buildings certified in the assessment period	Up to 10% Green Building Adoption in the assessment period	Up to 40% Green Building Adoption in the assessment period	Up to 60% Green Building Adoption in the assessment period	100% Green Building Adoption in the assessment period
Evidence/ Data sources	<ul style="list-style-type: none"> • List of ECBC/ENS compliant buildings obtained construction approval • List of pre-certified green buildings • List of all buildings approved for construction • List of ECBC/ENS compliant buildings obtained occupancy approval along with BUA • List of buildings certified with green building certificate and obtained occupancy approval along with BUA • List of all buildings approved for occupancy with BUA 				
Responsible Department/ Agency	ULB, Town Planning Dept., Green Building agencies.				
Reference Document	Certifying A Green Building (CERC & ENVIS; 2014) http://cercenviis.nic.in/PDF/jul_sep_2014.pdf				
Score	0	25	50	75	100