National Institute of Urban Affairs

Ministry of Housing and Urban Affairs
Government of India

Smart City
MISSION TRANSFORM-NATION

CLIMATESMART CITIES

Assessment Framework 2.0

- ENERGY & GREEN BUILDINGS
- URBAN PLANNING, GREEN COVER & BIODIVERSITY
- MOBILITY & AIR QUALITY
- WATER MANAGEMENT
- WASTE MANAGEMENT

DAY-NULM
Deendayal Antyodaya Yojana-National Urban Livelihoods Mission

HRIDAY

प्रधान मंत्री आवास योजना-शहरी
Pradhan Mantri Awas Yojana-Urban
Rejuvenating the Soul of Urban India

अमृत
Atal Mission for Rejuvenation and Urban Transformation

Urban Transport

स्वच्छ भारत
एक कदम स्वच्छता की ओर

CLIMATESMART CITIES

Assessment Framework 2.0

2020

Ministry of Housing and Urban Affairs
Government of India

ClimateSmart Cities Assessment Framework 2.0

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WRI INDIA

RESILIENT GLOBAL RESILIENT CITIES NETWORK

Core Team *(in alphabetical order)*
NIUA: Ms. Ankita Mandal, Ms. Ashali Bhandari, Mr. Empati Uday Kumar, Ms. Mohini Bhaisare, Ms. Pallavi Thool, Ms. Raina Singh, Ms. T Shravani, Ms. Uditi Agarwal, Dr. Umamaheshwaran Rajasekar, Ms. Vaishnavi Shankar
GIZ: Ms. Vaishali Nandan, Mr. Vibhor Sood
WRI India: Ms. Himanshi Kapoor, Ms. Prerna Vijaykumar Mehta

Design Team
NIUA Design Team

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Abbreviations

AF	Adaptation Fund
ADB	Asian Development Bank
AFDB	Africal Development Bank
AJAY	Atal Jyoti Yojana
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BEE	Bureau of Energy Efficiency
BEEP	Building Energy Efficient Programme
BIMS	Building Information Management System
BIS	Bureau of Indian Standards
CAF	Corporacion Andina de Fomento
CCFU	Climate Change Finance Unit
CCP	Corporation of City of Panaji
CDO	Chief Data Officer
CEO	Chief Executive Officer
CGDCR	Comprehensive General 0Development Control Regulation
CMP	City Mobility Plan
CNG	Compressed Natural Gas
CPCB	Central pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organisation
CPR	Centre for Policy Research
CSC-AF	Climate smart cities- Assessment Framework
CSR	Corporate Social Responsibility
CTF	Clean Technology Fund
CTTS	Comprehensive Traffic and Transportation Studies
DEA	Department of Economic Affairs
DMP	Disaster Management Plan
ECBC	Energy Conservation Building Codes
EESL	Energy Efficiency Services Limited
EIB	European Investment Bank
EPCO	Environmental Planning and Coordination Organisation
FAME	Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles
GBCI	Green Business Certification Inc.
GCF	Green Climate Fund
GEDA	Goa Energy Development Agency
GEF	Global Environment Facility
GHG	Green House Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GRIHA	Green Rating for Integrated Habitat Assessment
HRIDAY	Heritage City Development and Augmentation Yojana
HVAC	Heating, Ventilating and Air Conditioner
IADB	Inter-American Development Bank
ICCC	Integrated Command and Control Centre
ICLEI	International Council for Local Environmental Initiatives
IEA	International Energy Agency
IEC	Information, Education and Communication
IPSCDL	Imagine Panaji Smart City Development Limited
IUC	International Urban Cooperation
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management
JBIC	Japan Bank for International Cooperation
KFW	Kreditanstalt für Wiederaufbau, Germany
KwH	Kilowatt Hour
LCPM	Low Carbon Mobility Plan
LED	Light Emitting Diode
LPG	Liquefied Petroleum Gas

MEEP	Municipal Energy Efficiency Program
MLD	Million Litres per Day
MNRE	Ministry of New and Renewable Energy
MoHUA	Ministry of Housing and Urban Affairs
MPPKVVCL	Madhya Pradesh Paschim Kshetra Vidyut Vitran
MRF	Materials Recovery Facility
MuDSM	Municipal Demand Side Management
NAAQS	National Ambient Air Quality Standards
NABARD	National Bank for Agriculture and Rural Development
NAFCC	National Adaptation Fund for Climate Change
NAMA	Nationally Appropriate Mitigation Actions
NAPCC	National Action Plan on Climate Change
NBC	National Building Code
NCAP	National Clean Air Programme
NCRMP	National Cyclone Risk Mitigation Project
NDC	Nationally Determined Contribution
NDMA	National Disaster Management Authority
NEERI	National Environmental Engineering Research Institute
NHPC	National Hydro Power Corporation
NIUA	National Institute of Urban Affairs
NMT	Non-Motorised Transport
NRSC	National Remote Sensing Centre
NRW	Non-Revenue Water
NTPC	National Thermal Power Corporation
PGCIL	Power Grid Corporation of India Limited
PMUY	Pradhan Mantri Ujjwala Yojna
PPCR	Pilot Program for Climate Resilience
PPP	Public Private Partnership
PSU's	Public Sector Undertakings
PWD	Public Works Department
RA	Recycled Aggregates
RCA	Recycled Concrete Aggregates
RDF	Refuse Derived Fuel
RESCO	Renewable Energy Service Company
SBM-U	Swachh Bharat Mission- Urban
SCADA	Supervisory Control and Data Acquisition
SCCF	Special Climate Change Fund
SCM	Smart Cities Mission
SDG	Sustainable Development Goals
SECI	Solar Energy Corporation of India
SEDA	State Energy Development Agency
SEF	Sikkim Ecological Fund
SLF	Sanitary Landfill Facility
SLNP	Street Lighting National Program
SPCB	State Pollution Control Board
SPV	Special Purpose Vehicle
SRSA	State Remote Sensing Agency
UJALA	Unnat Jeevan by Affordable LED's and Appliances for All
UMTA	Unified Metropolitan Transport Authority
UNEP	United Nations Environment Programme
USD	US Dollars

1. Background

The Government of India has eight missions under the National Action Plan on Climate Change (NAPCC) to address the impact of climate change. The National Mission on Sustainable Habitat is one of the eight climate missions and aligning to the National Mission on Sustainable Habitat, the Smart Cities Mission under the Ministry of Housing and Urban Affairs (MoHUA) launched "ClimateSmart Cities Assessment Framework" in February 2019. This framework was first-of-its-kind city assessment framework on climate relevant parameters, including those of the recently launched National Clean Air Programme. The "ClimateSmart Cities Assessment Framework" serves as a tool for cities to assess their present situation and provides a roadmap for cities to adopt and implement relevant climate actions. In addition, the dissemination of best practices adopted by Indian cities has supported in setting contextual standards in green, sustainable and resilient urban development.

The objective of this framework is to provide a roadmap for Indian cities in combating climate change. The ClimateSmart Cities assessment framework consists of indicators across five categories namely; (i) Energy and Green Buildings, (ii) Urban Planning, Green Cover and Biodiversity, (iii) Mobility and Air Quality, (iv) Water Management and (v) Waste Management. The framework provides assessment of both, mitigation and adaptation measures. The indicators are progressive in nature to support cities in assessing where they stand and encourage them to adopt appropriate actions enabling them to improve their score in the future and consequently build climate resilience. To enable this progress, MoHUA aims to conduct the assessment on an annual basis.

In the first phase, the assessment had established a baseline for 96 cities that participated. The process was spread across a period of six months and involved more than 27 Government departments/organisations from three tier governance structure- National, State and City along with other stakeholders in providing inputs for more than 120 data sets. To facilitate cities to participate in the assessment, 8 cluster and 4 regional workshops were conducted in the months from April to July 2019 in which more than 300 State & City officials participated. Cities submitted data on the portal and these submissions were evaluated by an Expert Committee. With an intent to inform cities on their climate readiness, the first baseline assessment for each city was announced.

With the help of knowledge sharing platforms, it was observed that cities were learning from each other's experiences and were motivated to work towards combating climate change impacts collectively. The success stories, best practices, advisories and other reference material from the first assessment are currently available on SmartNet to help other cities in their endeavour.

The next phase of "ClimateSmart Cities Assessment Framework" aims to capture the progress made by cities since the previous year. Moving forward, the learnings and experience from phase-I, and the feedback received from cities have helped in improving the indicators, assessment methodology, scoring criteria and respective evidences that are to be captured to conduct a wholistic assessment. The subsequent sections elaborate the revised details of the assessment framework.

2. ClimateSmart Cities

2.1 Overview

ClimateSmart means anchoring of climate actions within activities catering to urban development. This includes municipal services such as water supply and solid waste management, but also infrastructure projects such as housing, planning and land development, etc. Climate smart development responds to the changing climatic conditions and fistering sustainable actions which could help in increasing the ease of living within cities.

As a first step, 100 Smart Cities under the Smart Cities Mission impacting more than 100 million people were encouraged to explore the ideas of low carbon development, rapid deployment of energy-efficient technologies, and investment in climate-resilient infrastructure at the local level. The objective was to enable cities assess their preparedness to tackle climate change and help them with a roadmap to achieve sustainable climate actions on the ground. The "ClimateSmart Cities Assessment Framework 2.0" will further allow cities to learn from their performance in the previous assessment and help them scale up contextual best practices. This will inturn help cities to improve their performance standards in accordance with some of the international guidelines in creating green, sustainable and resilient urban habitats.

2.2 Assessment Framework 2.0

The ClimateSmart Cities Assessment Framework has been revised considering the feedbacks provided by the cities, suggestions from sector experts and learnings from the first phase of assessment. The indicators have been revised after rigorous discussions and consultations with various sectoral experts in the fields of climate change and urban development. The Assessment Framework 2.0 is based on an integrated scoring system which could help evaluate cities across various sectors and intend to rank them in order of their performance.

2.3 Sectors

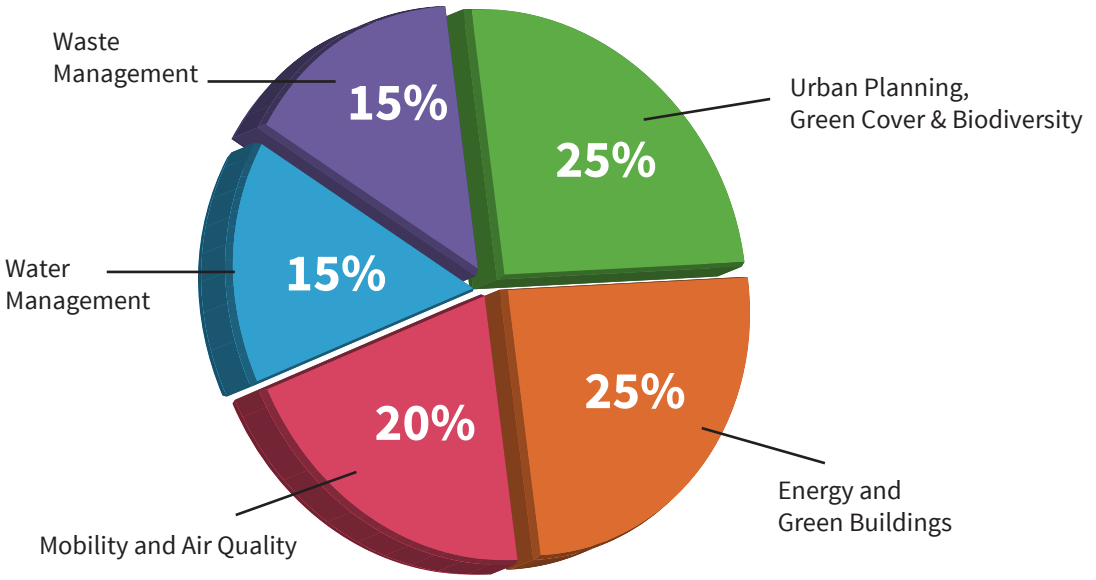
The ClimateSmart Cities Assessment Framework 2.0 is broadly categorised into 5 sectors with 28 indicators. Each of these indicators have a maximum of 5 levels representing different stage of development each with a corresponding weightage. The following sections give details of the sectors, indicators and levels included in the assessment framework.

CSCAF 2.0 consists of 28 diverse indicators across five sectors namely;

(i) Energy and Green Buildings,
(ii) Urban Planning, Green Cover and Biodiversity,
(iii) Mobility and Air Quality,
(iv) Water Management, and
(v) Waste Management.

The assessment framework 2.0 attempts to address both the mitigation and adaptation measures and the weightage for each sector has also been given in accordance with its relation to mitigation or adaptation potential. In terms of mitigation, sectors such as transportation, waste, energy consumption and green cover are most important while for adaptation, sectors such as water, biodiversity, urban planning and land-use play an important role.

Figure 2.1. Sector-wise weightage for ClimateSmart Cities Assessment 2.0



25% Energy and Green Building

25% Urban Planning, Green Cover & Biodiversity

15% Waste Management

15% Water Management

20% Mobility and Air Quality

The assessment framework 2.0 gives the highest weightage to "Energy and Green Buildings" and "Green Cover, Biodiversity and Urban Planning" categories- 25% each, considering the extent of impact that aspects of these sectors on mitigation and adaptation to tackle climate menace and so on to the remaining categories.

2.4 Indicators

The assessment framework 2.0 has 28 progressive revised indicators across 5 sectors, which are not only functional but also doable in the current context of Indian Smart Cities. As with other SMART indicators, this assessment framework 2.0 aims to be Specific, Measurable, Actionable, Relevant and Time-bound. In addition, each indicator has progressive levels from '1' to '5' to provide each city with a roadmap that they can chart their own progress and devise relevant actions to address the same.

The indicators formulated are progressive and aspirational in nature from Level 1 to Level 5. Each indicator not only assess but also provides guidance to progress and achieve the next highest levels. Cities will be assessed based on the existing situation and guidance will be provided for cities aspiring to achieve progress in the next phase of assessment.

Figure 2.2 Indicators of ClimateSmart Cities Assessment Framework 2.0

Table 2.1: List of Indicators across each sector

Energy & Green Buildings	Urban Planning, Green Cover, & Biodiversity	Mobility and Air Quality	Water Management	Waste Management
1. Electricity Consumption in the City	1. Rejuvenation & Conservation of Water Bodies & Open Areas	1. Clean Technologies Shared Vehicles	1. Water Resources Management	1. Waste minimization initiatives undertaken by the City
2. Total Electrical Energy in the City Derived from Renewable Sources	2. Proportion of Green Cover	2. Availability of Public Transport	2. Extent of Non-Revenue Water	2. Extent of dry waste recovered & recycled
3. Fossil Fuel Consumption in the City	3. Urban Biodiversity	3. Percentage of coverage of Non Motorized Transport network (pedestrian and bicycle) in the city	3. Wastewater Recycle and Reuse	3. Construction & Demolition (C&D) waste management
4. Energy efficient street lighting in the city	4. Disaster Resilience	4. Level of Air Pollution	4. Flood/ water stagnation risk management	4. Extent of Wet Waste Processed
5. Promotion of green buildings	5. City Climate Action Plan	5. Clean Air Action Plan (Planning and Implementation)	5. Energy efficient water supply system	5. Scientific Landfill availability & operations
6. Green Building Adoption			6. Energy efficient wastewater management system	6. Landfill/ dumpsite Scientific Remediation

3. Methodology

The set of 28 indicators that form the ClimateSmart Cities Assessment Framework 2.0 are a combination of metrics that are varied in nature and specifications. A series of steps have been followed to standardize data across all indicators. These steps have been outlined in this section.

3.1. Scoring Method

The nature of the indicator determines the nature of the data that is collected, and its units of measurement. This may vary considerably across categories. Each indicator will have a different scoring mechanism, the different data types used in this framework are elaborated within the subsequent subsections.

Percentage

Several indicators mark the performance of a city in terms of coverage of services or amenities provided or achieved or natural offsetting means available, marked against a larger total, e.g. the total population or per capita figures or total area. These indicators will, therefore, take the form of percentages.

Ratio

Similarly, to weigh the data for comparability, some indicators will be obtained in the form of ratios of one aspect against the other, and the higher the ratio, the better.

Binary Marking

Some indicators take the form of yes or no questions to the municipalities, and the levels go directly between 1 and 5. For e.g. has city conducted a water resource assessment or does the city have a storm water drainage plan.

Benchmarking

Some indicators fix an ideal or optimal value (either 100% or a certain unit of universal achievement) as benchmarking, while others take the best (or worst) performing city in the same tiers of comparison as a benchmark to be measured against. There are no indicators that use a deviation from mean as measurement, as they all have progressive marking across levels

Normalization

This is usually required to make the indicators comparable with each other, and to bring in standardisation or data aggregation across different units of measurement, which can enable a single ranking amongst cities. However, in the case of the Climate Smart Cities Assessment Framework 2.0, the value for each indicator is assigned on the selected criteria in terms of performance evaluation levels (level 1 to level 5), hence the issue of different units does not arise. The values of performance level ranges from 1-5, and the levels are defined such that there is no scope of outlier or extreme value, therefore, this exercise does not require the normalization process.

Aggregation

The aggregation methodology of the Climate Smart Cities Assessment Framework 2.0 is based on three elements namely category, indicators, and performance evaluation levels. The thematic sector wise score is calculated by adding the scores against each of its indicators. The thematic sector wise list of indicators and maximum score allocated is as per the Table 3.1 below.

ClimateSmart City Score

It is pertinent that the aggregated score presents the cities' efforts towards mitigating and adapting actions but does not represent the actual impact of such actions. Therefore, to negate this, a ClimateSmart City score is calculated based on each sector weightage and score. The sector wise score is calculated by summing the weighted scores against each indicator.

CSC Score: [(A X 0.042) + (B X 0.050) + (C X 0.040) + (D X 0.025) + (E X 0.025)]

Table 3.1: Score aggregation

Sector	Indicators	Maximum Assigned Score	Score Obtained	Aggregate Category Score
Energy and Green Buildings (600 Marks)	Electricity Consumption in the City	100	Z_1	$A=(Z_1+Z_2+Z_3+Z_4+Z_5+Z_6)$
	Total Electrical Energy in the City Derived from Renewable Sources	100	Z_2	
	Fossil Fuel Consumption in the City	100	Z_3	
	Energy Efficient Street Lighting in the City	100	Z_4	
	Promotion of green buildings	100	Z_5	
	Green Building Adoption	100	Z_6	
Urban Planning, Green Cover, and Biodiversity (500 Marks)	Rejuvenation & Conservation of Water Bodies & Open Areas	100	Z_7	$B= (Z_7+Z_8+Z_9+Z_{10}+Z_{11})$
	Proportion of Green Cover	100	Z_8	
	Urban Biodiversity	100	Z_9	
	Disaster Resilience	100	Z_{10}	
	City Climate Action Plan	100	Z_{11}	
Mobility and Air Quality (500 Marks)	Clean Technologies Shared Vehicles	100	Z_{12}	$C=(Z_{12}+Z_{13}+Z_{14}+Z_{15}+Z_{16})$
	Availability of Public Transport	100	Z_{13}	
	Percentage of coverage of Non-Motorized Transport network (pedestrian and bicycle) in the city	100	Z_{14}	
	Level of Air Pollution	100	Z_{15}	
	Clean Air Action Plan (Planning and Implementation)	100	Z_{16}	

Sector	Indicators	Maximum Assigned Score	Score Obtained	Aggregate Category Score
Water Management (600 Marks)	Water Resources Management	100	Z_{17}	$D=(Z_{17}+Z_{18}+Z_{19}+Z_{20}+Z_{21}+Z_{22})$
	Extent of Non-Revenue Water	100	Z_{18}	
	Wastewater Recycle and Reuse	100	Z_{19}	
	Flood/ water stagnation risk management	100	Z_{20}	
	Energy-efficient water supply system	100	Z_{21}	
	Energy-efficient wastewater management system	100	Z_{22}	
Waste Management (600 Marks)	Waste minimization initiatives undertaken by the City	140	Z_{23}	$E=(Z_{23}+Z_{24}+Z_{25}+Z_{26}+Z_{27}+Z_{28})$
	Extent of dry waste recovered & recycled	100	Z_{24}	
	Construction & Demolition (C&D) waste management	100	Z_{25}	
	Extent of Wet Waste Processed	100	Z_{26}	
	Scientific Landfill availability & operations	100	Z_{27}	
	Landfill/ dumpsite Scientific Remediation	60	Z_{28}	
Total Maximum Assigned Score		2800	Aggregated Score (A+B+C+D+E)	

3.2. Assessment Titles for Cities

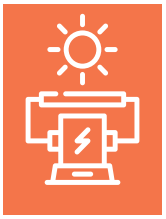
This section describes the assessment titles corresponding to the cities' performance in the CSCAF 2.0. The details are presented in Table 3.2. The logic of the ClimateSmart Cities Assessment Framework 2.0 is to provide cities with indicators to evaluate their own performance and facilitate peer to peer learning along with ranking on the basis of their performance. In addition to assessment and ranking, the framework 2.0 intends to help cities understand their current status regarding climate actions and make efforts to improve their efforts in specific sectors . Based on the overall scores, the cities shall be given the corresponding titles.

Table 3.2. Criteria for assigning Climate Smart Cities Assessment Titles

Assessment titles	CSC Score
Climate Champions	81 - 100
Climate Leaders	61 - 80
Climate Trendsetters	41 - 60
Climate Explorers	21 - 40
Climate Warriors	0 - 20

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	• 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:

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

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) • 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 sources

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

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.

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 TCO2e = Total diesel consumption (kL) x 2.62694 + Total petrol consumption (kL) X 2.20307 + Total LPG Consumption 9kL) 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 CO_2 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. • 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	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 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. MEASURE 3: Promotional/ Penalty schemes available for code compliance, pre- certification, certification of green buildings. 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.				
Responsible Department / Agency	MEASURE 1: Latest version of NBC 2016 and or ECBC 2017 Compliance procedures available at city level 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.				
Reference Document	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				
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	• 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://cercenvis.nic.in/PDF/jul_sep_2014.pdf				
Score	0	25	50	75	100

4.2 Urban Planning, Green Cover and Biodiversity

Indicator 1: Rejuvenation & Conservation of Water Bodies & Open Areas

Rationale: Urban Environment consists of many aspects including water bodies, open spaces and built-up area. From climate adaptation and mitigation perspective all three aspects play a critical role. Rejuvenation of water bodies is significant to combat water crises. Water bodies are essential as reservoirs for drinking, as retention basins for groundwater recharge, for protection in case of floods and for maintaining biodiversity. Having local sources of fresh water decreases the dependence on energy for pumping purposes. Open spaces, namely recreational spaces, planned greens and green buffer zones (as per URDPFI Guidelines 2014) in any city play a critical role in terms of climate mitigation and adaptation aspects by decreasing local temperature and help recharge groundwater. Increase in build-up areas and decrease of water bodies and open spaces lead to an increase in the local temperature within a city

Description: Is the city undertaking rejuvenation and conservation of water bodies & open areas thus trying to combat the heat-island effect.

Methodology:

The information concerning the current extent and status of water bodies and open areas can be mapped using data sourced from concerned department/ agencies. The area within the municipal boundary has to be considered. This figure has to be compared with the existing masterplan (percentage and area). For this indicator the definitions of water bodies and open areas are given as follows:

Water Bodies: All natural and manmade water bodies bound on all sides, listed under Census of Water body and 6th MI Census of Ministry of Water Resources, urban & peri-urban lakes under NCLP and wetlands identified as per Wetland Management Conservation Rules 2017 will be considered for the purpose of this indicator. For water quality, CPCB guidelines for water quality monitoring to be referred.

Open Areas: Open areas are defined as recreational spaces, planned greens and green buffer zones as per URDPFI Guidelines, 2014.

An urban heat island is an urban area or metropolitan area that is significantly warmer than its surrounding areas/ rural areas due to human activities. Developing an urban heat island map along with the informed actions taken by the ULBs/Planning authorities for combating urban heat island, and for increasing rejuvenated and conserved water bodies and open areas, will be useful in assessing the implementation status of such projects and its effectiveness.

Formula:

NA

Unit: NA

Maximum Score: Total score for the indicator is 100. Cities are marked in 5 levels with scores ranging from 0-100. In this indicator the level 3 and 4 have been merged taking into consideration the initiation of rejuvenation work and allocation of budget that goes hand in hand. Out of the total 50 marks allocated, cities will receive incremental scores ranging from 1-25 based on the evidence(s) provided for actions initiated. Similarly, for evidence(s) provided on fund allocation and expenditure for the actions, cities will receive another 1-25 marks. Finally, cities scoring a total of >25 and >50 marks will be considered in level 3 and level 4 respectively.

Performance Evaluation Levels:
Table 4.7: Rejuvenation & Conservation of Water Bodies & Open Areas

	1	2	3/4	5
Progression Levels	No Action Initiated	Assessment of urban water bodies and open areas	Allocation of Budget and Implementation	Monitoring, Review & Maintenance
Evidence/ Data sources	No Action Initiated	• Mapping of water bodies which includes their location, area, depth, volume and current status (ownership, encroachment, protected/ conserved/ maintained as per prescribed guidelines) has been carried out for the current year. • Mapping of open areas (planned greens) with details of current status (including ownership, encroachment, protected/ conserved/ maintained as per prescribed guidelines) has been carried out for the current year. • Urban heat island map for the city has been prepared	• Informed actions for rejuvenation and conservation of water bodies and open areas have been initiated (with supporting documents: photographs, proof of contracts, etc.) based on mapping and assessments conducted at level 2. • Proof of fund allocation and expenditure for conservation and rejuvenation	• Monitoring, review & maintenance mechanisms in place for long-term sustainability of rejuvenation & conservation actions • Evidence on change/ improvement in status and quality of open areas and water bodies. as per relevant guidelines • Map of rejuvenated & conserved water bodies & open areas as a .kml file (polygon geometry)
Responsible Department/ Agency	ULB, Development Authority, Town Planning Department, National Remote Sensing Agency, State Remote Sensing Agency, Horticulture department', Environment officer			
Reference	Lake Rejuvenation in Udaipur http://smartnet.niua.org/sites/default/files/resources/22.pdf URDPFI Guidelines, 2014 http://mohua.gov.in/upload/uploadfiles/files/URDPFI%20Guidelines%20Vol%20I.pdf http://mohua.gov.in/upload/uploadfiles/files/URDPFI%20Guidelines%20IIA-IIB(1).pdf Manual for Data Collection for Census of Water bodies http://mowr.gov.in/sites/default/files/Instruction%20Manual%20for%20Census%20of%20Water%20Bodies.pdf Wetland Management Conservation Rules 2017 https://yamuna-revival.nic.in/wp-content/uploads/2019/02/Wetlands-Conservation-Management-Rules-2017.pdf Guidelines for National Lake Conservation Plan https://smartnet.niua.org/sites/default/files/resources/NLCP_guideline_0.pdf CPCB guidelines for water quality monitoring 2017 https://cpcb.nic.in/wqm/Guidelines_Water_Quality_Monitoring_2017.pdf Advisory on Conservation and Restoration of Water Bodies in Urban Areas http://mohua.gov.in/upload/uploadfiles/files/Advisory%20on%20Urban%20Water%20Bodies.pdf Water Conservation Measures Guidelines of MoHUA under Jal Shakti Abhiyan http://mohua.gov.in/upload/uploadfiles/files/Guidelines%20for%20Urban%20Water%20conservation%20Jal%20Shakti%20Abhiyan.pdf			
Score	0	25	75	100

Indicator 2: Proportion of Green Cover

Rationale: Sufficiently large and protected greenspaces reduce the impact of human activities on climate. The ecosystem services provided by the urban greenspaces help the city in general and its citizens to adapt to the adverse effects of climate change and disasters

Description: To what extent is the city developing and increasing its green cover. Green Cover, defined as natural or planted vegetation covering a certain area of terrain, functioning as protection against soil erosion, protecting the fauna, and balancing the temperature. For the purpose of this indicator, green areas are defined as man-made city level and zonal/ district level greens; and reserved/ protected areas as per MoHUA's Urban Green Guidelines, 2014 and protected areas under the Wildlife Protection Act, 1972.

Methodology: Data available on area of urban greens can be analysed from satellite imagery. Recent imagery can be procured from the state or National Remote Sensing Centre (NRSC). Baseline year: 2019. Comparative analysis using the formula given below on a yearly basis will help to understand the increase/decrease over time. This data is also being reported by cities for the Ease of Living Index (Indicator 3.2.1) and may be sourced from there.

Formula:

$$\frac{\text{Green Cover in sq.km}}{\text{Municipal area in sq.km}} \times 100$$

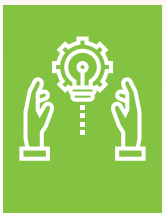
Unit: %

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 – 100. In this indicator, certain bonus marks will be provided for cities that are taking additional desirable measures towards protection of green cover.

1. Additional 10 marks for reporting on additional qualitative data – list of native tree species, tree density, and tree canopy density. (Applicable for levels 1 to 4)
2. Additional 10 marks for developing the strategy for increasing Green Cover in the city in line with the National Clean Air Plan (NCAP). (Applicable for levels 1 to 4)
3. Additional 5 marks for providing evidence on action initiated for points 1 and 2 above. (Applicable for levels 1 to 4)

Performance Evaluation Levels:
Table 4.8: Green cover

	1	2	3	4	5
Progression Levels	0% to <5% Green Cover	5% to < 9% Green Cover	9% to < 12% Green Cover	12% to < 18% Green Cover	≥ 18% Green Cover
Evidence/ Data sources	• Map of green cover within municipal boundary for this year as a .kml file (polygon geometry)				
Responsible Department/ Agency	National Remote Sensing Centre, State Remote Sensing Centre, Urban Planning or Development Authority, Forest Department				
Reference	Advisory on Urban Green Cover and Biodiversity, WWF, 2019 https://tinyurl.com/v4b7tln Water Conservation Measures Guidelines of MoHUA under Jal Shakti Abhiyan http://mohua.gov.in/upload/uploadfiles/files/Guidelines%20for%20Urban%20Water%20conservation%20Jal%20Shakti%20Abhiyan.pdf Urban Green Guidelines 2014, Town and Country Planning Organisation, MoHUA http://mohua.gov.in/upload/uploadfiles/files/G%20G%202014(2).pdf				
Score	0	25	50	75	100



Indicator 3: Urban Biodiversity

Rationale: Urban biodiversity provides significant ecosystem services contributing to climate change mitigation and adaptation, such as carbon sequestration, air and water purification, mitigation of impacts of environmental pollution, noise reduction, and regulation of microclimate. High biodiversity increases the resilience of the city

Description: To what extent is the city acting for protection, conservation and management of urban biodiversity

Methodology: Data on biodiversity can be obtained from the Biodiversity Management Committee and the people's Biodiversity register (instituted as per on the Biological Diversity Act, 2002). City Biodiversity Index is a self-assessment tool for cities to evaluate and monitor the progress of their biodiversity conservation efforts against their own individual baselines.

Formula:

NA

Unit: NA

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 – 100. For levels 4 and 5, cities will receive incremental scores ranging from 1-25 based on the measures undertaken and evidence(s) provided.

Performance Evaluation Levels:
Table 4.9: Urban Biodiversity

	1	2	3	4	5
Progression Levels	No Action Initiated	Institutional Set-Up	Baseline Assessment	Urban Biodiversity Improvement Measures	Implementation of Actions
Evidence/ Data sources	No action initiated	• Establishment of City Level Biodiversity Management Committee (as per Biological Diversity Act, 2002; City council resolution; announcement to State Biodiversity Board)	• People's Biodiversity Register (based on the Biological Diversity Act, 2002, Letter of State Biodiversity Board validating register) • Inventory of urban ecosystems and species (including International Union for Conservation of Nature, IUCN listed species)	• Funds/ Municipal Budget allocated • Identification of measures to increase biodiversity within master plan/ greening plans/ rejuvenation plans	• Calculation of City Biodiversity Index (Report with the calculated index) • Evidence on implementation of measures identified in level 4 • Evidence on change/ improvement in species diversity (species list of various taxa) • Map of areas where measures to increase biodiversity have been taken as .kml files (polygon geometry) wherever applicable
Responsible Department/ Agency	State Horticulture Department, State Forest Department, ULB, Environment Department; Biodiversity Management Committee, State Horticulture Department, State Forest Department, TCPO, ULB, Development Authority				
Reference	Advisory on Urban Green Cover and Biodiversity, WWF, 2019 https://tinyurl.com/v4b7tln The Biological Diversity Act, 2002 http://moef.gov.in/environment/biodiversity/ User's Manual on the Singapore Index on Cities ' Biodiversity (https://www.cbd.int/authorities/doc/Singapore-Index-User-Manual-20140730-en.pdf)				
Score	0	25	50	75	100

Indicator 4: Disaster Resilience

Rationale: In urban areas the brunt of any kind of disaster (human or nature induced) is borne by the urban inhabitants and also by the urban infrastructure. As effects of climate variability leading to extreme events are becoming more severe and frequent, the incidents of damage to urban infrastructure are also increasing. Therefore, it is important that all cities, especially Smart Cities, should not only be able to identify their potential hazards, vulnerabilities and risk but also be prepared for prompt response during disaster situation as well as have robust plans in place to "Build Back Better" including recovery, reconstruction and rehabilitation.

Description: To what extent the city is prepared and resilient to tackle natural and manmade disasters and if it aligns with the Sendai Framework for DRR, NDMA Guidelines (2010, 2014, 2019) and MoHUA's SOP on Urban Flooding (2017).

Methodology

Disaster Management Plan: The National Disaster Management Act, 2005, the National Policy on Disaster Management 2009 (NPDM) and the National Disaster Management Authority (NDMA) provide direction and a framework to the government agencies at all levels (National, State and Local) to prepare for all phases of disaster management cycle i.e. a) mitigation (prevention and risk reduction), b) preparedness, c) response and d) recovery (immediate restoration to long term betterment reconstruction). In accordance with the provisions of the Disaster Management Act and the policy a National Disaster Management Plan (NDMP) is prepared, which is a dynamic document and needs to be periodically updated. Similarly, each State, District / City level plans has to be prepared in line with the NDMA guidelines (2014) issued by the National Disaster Management Authority.

Ward-level Hazard Risk, Vulnerability and Capacity Assessment: The municipal administration along with the ward level officers shall initiate a participatory process among the community groups and the representatives of ULBs to assess the vulnerabilities and risks to various hazards in their respective areas. Wherever possible the disaster management (DM) teams shall be involved in the process. Please refer to the National Policy Guidelines, National Disaster Management Authority.

Early Warning Systems An effective Early warning System needs to be end-to-end, people-centred, across sectors and multiple levels with a continuous feedback mechanism for improvement.

Formula:

NA

Unit: NA

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 – 100. For levels 3, 4 and 5, cities will receive incremental scores ranging from 1-25 based on the measures undertaken and evidence(s) provided.

Performance Evaluation Levels:
Table 4.10: Disaster Resilience

	1	2	3	4	5
Progression Levels	Disaster and Risk Reduction is yet to be prioritized	Institutional Mechanism Established	Disaster Management Plan	Plan Implementation	Monitoring, Updating Mainstreaming
Evidence/ Data sources	City level plan not initiated	• City level loss and damage data has been collated and documented (last 5 years) • Institutionalizing and establishing of dedicated Disaster Management Cell/ Emergency Operation Centre (EOC) within ULB (based on NDMA Guidelines, 2010) • First responders/ volunteers for disaster response identified. Training and mock drills conducted.	• Ward-level Hazard Risk (hydromet, geophysical and public health), Vulnerability and Capacity Assessment prepared for the current year in a participatory manner (based on NDMA Guidelines, 2010) • Map of ward wise hazard, vulnerability and capacity information as a .kml file (polygon geometry) • City Level Disaster Management Plan, prepared as per NDMA Guidelines and vetted by State Disaster Management Authority	• Establishment of Early warning systems for priority risks incl. helpline and early warning systems along Weather Forecasting System are linked to Integrated Command and Control Centers (ICCC) for regular monitoring and managing emergency situations • Map of alert systems across the city as a .kml file (point or polygon geometry with attribute: type of alert)	• Regular monitoring and review of City level Disaster Management Plan conducted • Mainstreaming disaster risk reduction in departmental plans within the ULB • The States/ City level Building Bylaws/ Development Controls/ Codes address hazard and vulnerability identified at level 2
Responsible Department/ Agency	ULB in coordination with District administration, State Disaster Management Authority, State Revenue Department; State Irrigation Department				
Reference	Greater Chennai City Disaster Management Plan, 2018 - https://www.chennaicorporation.gov.in/images/CDMP%20Book%20Wrapper%20Full%20Book%20(%20English).pdf Ahmedabad Heat Action Plan, 2019 - https://www.nrdc.org/sites/default/files/ahmedabad-heat-action-plan-2018.pdf NDMA Guidelines, 2010, 2014, 2019 (https://ndma.gov.in/en/ndma-guidelines.html) SOP on Urban Flooding, 2017 (https://smartnet.niua.org/content/55ad7139-2d37-4831-a74a-d228720ce584)				
Score	0	25	50	75	100

Indicator 5: City Climate Action Plan

Rationale: As part of the Paris Agreement on climate change (2015), many nations committed to take immediate action to keep the global temperature rise below 2°C of pre-industrial levels. In 2016 India ratified the Paris Agreement and committed under its 'nationally determined contributions' (NDCs) among others to reduce the emission intensity of its GDP by 33-35% from 2005 level by 2030; to achieve about 40% cumulative electric power installed from non-fossil fuel based energy resources by 2030 and to create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030. With much of India's development dependent on cities, consistent with the objectives of the Paris Agreement, cities urgently need to plan and implement climate actions in an integrated and inclusive way through the following measures: mitigation of greenhouse gas emissions and adaptation to climate change impacts to foster wider social, cultural, economic and environmental benefits.

Description: Climate Action Plan (mitigation and adaptation) has to be prepared and implemented by the city. It should be developed in a comprehensive manner covering all sectors, including waste management, integrated water management, mobility and air pollution, energy and green buildings; biodiversity, green cover, disaster risk preparedness and urban planning. The plan has to propose actions for both climate change mitigation and adaptation based on a GHG emissions inventory and a climate change vulnerability assessment respectively, addressing all sectors listed above. Regular monitoring, reporting and verification (MRV) of the plan is essential to qualify and quantify the measures implemented for achieving accountability, and improved impact.

Methodology:

Climate Change Mitigation: GHG emission inventory to be prepared for all sectors on the basis of the Global Protocol for Community Scale GHG Emissions (GPC). Other detailed GHG emission assessments using any other tools based on the IPCC global protocol will also be considered.

Climate Change Adaptation: Vulnerability Assessment for the city.: The Intergovernmental Panel on Climate Change (IPCC) identifies three components of climate change vulnerability: exposure, sensitivity and adaptive capacity. Manifold toolboxes and collections of methods to evaluate impacts, vulnerability and adaptation to climate change exist. It is recommended that a comprehensive vulnerability assessment and identification of gaps is undertaken based on the United Nations Framework Convention on Climate Change (UNFCCC) methodology.

Climate Action Plan: based on the GHG inventory as well as on the vulnerability assessment, a Climate Action Plan for the city addressing all issues of mitigation and adaptation has to be developed. The Guiding Principles for City Climate Action Planning from UN-HABITAT and the National Mission on Sustainable Habitat could be referred to, however the sectors to be covered under the plan should at least include all sectors as covered under the ClimateSmart Cities Assessment Framework.

Formula:

NA

Unit: NA

Maximum Score: Total score for this indicator is 100. Cities will be marked in 4 levels with scores ranging from 0 – 100. For level 2, cities will receive incremental scores ranging from 1-50 based on the measures undertaken and evidence(s) provided. For levels 3 and 4, cities will receive incremental scores ranging from 1-25 based on the measures undertaken and evidence(s) provided.

Performance Evaluation Levels:
Table 4.11: City Climate Action Plan

	1	2	3	4
Progression **Levels**	Climate Action Plan not considered	Institutional Mechanism Established and Plan prepared	Implementation	Regular Monitoring & Streamlining
Evidence/ Data sources	Climate Action Plan not initiated	• ULB Level Climate coordination cell established • City Level Stakeholder Committee constituted and consulted regularly • City level climate assessments - GHG Inventory or Vulnerability Assessment (as per indicator 4) - have been conducted • Mitigation and/or Adaptation Areas have been assessed for the city • Climate Action Plan (including mitigation and adaptation strategies) prepared for the city in a participatory manner	• Funds/ Municipal Budget of last financial year shows allocation • Implementation of measures initiated (with supporting evidence)	• Monitoring Reporting and Verification (MRV) system prepared and implemented • Relevant recommendations from the Climate Action Plan is incorporated in master plan
Responsible Department/ Agency	Municipal Corporation / Smart City SPV / Chief Climate or Resilience Officer's office; Environment Officer; Town Planning Department, Development Authority, State/ City Transport Department			
Reference	Surat Resilience Strategy http://scct-surat.in/download/pdf/11.pdf Rajkot: Climate Resilient City Action Plan https://tinyurl.com/ts48gsd (Video Link : https://www.youtube.com/watch?v=Yy3duEaOqkk) National Mission on Sustainable Habitat https://smartnet.niua.org/csc/assets/pdf/key-documents/phase-2/Up-GreenC-and-BIO/National-Mission-on-Sustainable-Habitat.pdf UN Habitat Guiding Principles https://smartnet.niua.org/csc/assets/pdf/RepositoryData/UP_Green_Cover/UNHabitat_Planning_for_Climate_Change.pdf			
Score	0	50	75	100

4.3 Mobility and Air Quality

Indicator 1: Clean Technologies Shared Vehicles

Rationale: Conventional fuel burning vehicles release an enormous amount of toxicants to atmosphere, cities must put efforts to introduce a cleaner fuel based shared vehicles.

Description: The indicator assesses the percentage of shared vehicles that operate on clean fuels like CNG, LPG, biofuels or are hybrid or electric vehicles.

Methodology: The city has to calculate the ratio of annual number of clean technologies shared vehicles to total shared vehicles.

Formula:

$$\frac{\text{Total number of shared vehicles on clean technologies}}{\text{Total number of shared vehicles in the city}} \times 100$$

*Note: *Clean technology shared vehicles consists of vehicles that operate on clean fuels like CNG, LPG, biofuels or are hybrid or electric vehicles*

Unit: %

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

Performance Evaluation Levels:
Table 4.12: Clean Technologies Shared Vehicles

	1	2	3	4	5
Progression Levels	No clean technology shared vehicles available	Clean technology shared vehicles <5%	Clean technology shared vehicles 5% to <15%	Clean technology shared vehicles 15% to <25%	Clean technology shared vehicles >25%
Evidence/ Data sources	• Registration data from regional transport office by type of fuel				
Responsible Department/ Agency	State/ Municipal Corporation, SPV's – Public Transport companies, City Development Authority, Smart City SPV's, Regional Transport offices				
Reference Document	Open Government Data Platform https://tinyurl.com/vn7fsg6 Moving Forward Together Enabling Shared Mobility in India (NITI Aayog; 2018) https://niti.gov.in/writereaddata/files/document_publication/Shared-mobility.pdf				
Score	0	25	50	75	100

Indicator 2: Availability of Public Transport

Rationale: Under Smart City initiatives, most of the cities are planning for organized public transport system. Increase in extent of supply availability of public transport can be a key factor to evaluate the modal shift from private transport to public transport. In turn helps tremendously to reduce emissions by the transport sector.

Description: The population growth had put forth a tremendous demand for infrastructure and mismatch between demand and supply of transport infrastructure resulted in delays, fuel loss, air and noise pollution, accidents and loss of productive time and energy. Extent of supply availability of public transport is one of the service level performance benchmarks.

Methodology: The city has to calculate the Public Transport Unit (PTU) of total available public transport (which includes fleet size of bus, Metro coach, suburban rail coach and ferries) per 1000 population. Estimated existing population of the city should be considered. Data could either be taken through previous studies, secondary sources or captured through specific primary surveys. Data collected from the primary and secondary sources need to be collated and analyzed.

Formula:

$$\frac{\text{Fleet size of PT (bus+metro coach+suburban rail coach+ferries)} \times 1000}{\text{Estimated existing population of the city}}$$

Where, 1 metro coach or train coach or ferry = 3 Public Transport Unit (PTU),

Note: Since the capacity of non-bus systems may vary from city to city. Please note the following conversion unit:

- *1 Public Transport Unit (PTU)= 1 standard size bus having capacity 65 passengers*
- *Midi bus (capacity-45)= 0.7 PTU*
- *Mini bus (capacity-35)=0.55 PTU*

Unit: Availability of Public Transport Unit (PTU) per 1000 population

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

Performance Evaluation Levels:
Table 4.13: Availability of Public Transport

	1	2	3	4	5
Progression Levels	Public Transport is not available	Availability of Public Transport (<0.2)*	Availability of Public Transport (0.2-0.4)*	Availability of Public Transport (0.4-0.6)*	Availability of Public Transport (≥0.6)*
Evidence/ Data sources	• Annual data from public transport Authorities companies • Census of India population figures indexed with average annual growth rate for the year 2019 as per SCP				
Responsible Department/ Agency	State/ Municipal Corporation, SPV's – Public Transport companies, City Development Authority, Smart City SPV's, Regional Transport offices				
Reference Document	Service Level Benchmarks for Urban Transport (MoHUA, 2010) https://smartnet.niua.org/csc/assets/pdf/key-documents/phase-2/Mobility-Air/Service-Level-Benchmarks-for-Urban-Transport-MoHUA-2010.pdf				
Score	0	25	50	75	100

*Note: *the decimal figure represents, Public Transport Unit (PTU) per 1000 population*

Indicator 3: Percentage of coverage of Non-Motorized Transport network (pedestrian and bicycle) in the city

Rationale: Developing the Non-Motorized Transport (NMT) network in a city addresses the problems related to the high consumption of non-renewable energies. Thus addressing air pollution and GHG emission production. Furthermore, it promotes aspects like health, user safety, traffic congestion and equal mobility-options for all income brackets.

Description: This indicator assesses the network length for dedicated cycle lanes/ tracks and footpath in the city on major road network (all arterial, sub-arterial roads and public transport corridors).

Methodology: The city has to calculate the total length of footpath and cycle lanes/tracks. Footpath minimum width and cycle lane/track minimum width should be as per the street design guidelines of MoHUA. In case of narrow roads, width of cycle track and footpath can be combined.

Formula:

$$\frac{\text{Total length of NMT (length of footpath + length of cycle lane/track network)}}{\text{Total road network length}} \times 100$$

Unit: %

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

Performance Evaluation Levels:
Table 4.14: Percentage of coverage of Non-Motorized Transport network (pedestrian and bicycle) in the city

	1	2	3	4	5
Progression Levels	NMT Coverage: Less than 15%	NMT Coverage: 15% to <25%	NMT Coverage: 25% to < 35%	NMT Coverage: 35% to < 50%	NMT Coverage: ≥ 50%
Evidence/ Data sources	• NMT Network plan of city • Annual completed list of NMT and Pedestrian projects of Public Works department and Municipal Corporations • Bicycle lanes constructed in the city • Map of NMT network in the city as a .kml file (line geometry with optional attribute: width of lanes) • Map of bicycle lanes constructed in the city as a .kml file (line geometry with optional attribute: width of lanes)				
Responsible Department/ Agency	State/ Municipal Corporation, SPV's – Public Transport companies, City Development Authority, Smart City SPV's, Regional Transport offices				
Reference Document	Promoting Non-Motorized Transport in Asian Cities: Policymakers' Toolbox (UN-Habitat and Shakti Sustainable Energy Foundation; 2013) https://tinyurl.com/wbjd5b3 Urban cycling design guidelines (UCDG) https://pmc.gov.in/sites/default/files/urban-cycling-design-guidelines.pdf				
Score	0	25	50	75	100

Indicator 4: Level of Air Pollution

Rationale: Climate and air pollutants including CO2 emissions have a common origin- the current energy model. Both are worsened by the burning of fuel and increase the CO2 emissions. Sound urban planning and clean technologies are now recognised as solutions to air pollution. The smart cities present a unique opportunity to adapt to advanced air-quality-monitoring technologies. Cities are encouraged to adopt affordable technologies by introducing low-cost air-quality sensors and linking the latter to the Integrated Command and Control Centres. This approach can complement the Pollution Control Board's existing monitoring system to provide further data on localised areas, hot spots and help generate real-time information for cities to take corrective action as well as gauge improvements. Air pollution data will not only help the government in framing policies and measures but allow citizens to make informed decisions that can improve the quality of their lives.

Description: A city level air-quality monitoring grid is important to generate holistic data, helps to assess the risks, implements control measures and assesses other climate smart strategies adopted by the city. The city is encouraged to assess to what extent it has achieved National Ambient Air Quality Standards (NAAQS),2009. The National Clean Air Programme sets a target of 20 -30 percent reduction of air pollution levels with 2017 as the base year. A city level air-quality monitoring grid is important to generate holistic data, helps to assess the risks, implements control measures and assesses other climate smart strategies adopted by the city.

Methodology: The indicator assesses the existing city-level air quality monitoring mechanism, its strengthening requirements and availability of air quality data on public domain. City will be assessed on its additional pollutants monitoring, its reduction strategies, its implementation and compliance to the National Standards.

Formula:

Nil

Unit: According to National Ambient Air Quality Standard by CPCB

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

Performance Evaluation Levels:
Table 4.15: Level of Air Pollution

	1	2	3	4	5
Progression Levels	No Consideration	Basic Monitoring	Availability of Data in Public Domain	Air Pollution Reduction Trend	Achievement of National Air Quality Standards
Evidence/ Data sources		• Capture levels of - PM10 PM2.5, NO x, SO x (as per Central Pollution Control Board Guidelines) • Additional pollutants monitored (like CO, NH3, Pb and O3 etc. as per NAAQS)	• Daily AQI levels are published and available to public through display boards/ SAFAR/ Sameer App/ any other app	• Reduction Air Pollution level based on previous year reading if available • Reduction trend / incremental improvement in compliance to National Clean Air Programme, • NCAP target (base year 2017)	• National ambient air quality standard for PM10, PM2.5, NOx and SOx has been met.
Responsible Department/ Agency	CPCB, SPCB				
Reference Document	National Ambient Air Quality Standards (NAAQS) (CPCB; 2009) https://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf Central Control Room for Air Quality Management, Delhi NCR https://app.cpcbccr.com/ccr/#/caaqm-dashboard-all/caaqm-landing				
Score	0	25	50	75	100

Indicator 5: Clean Air Action Plan (Planning and Implementation)

Rationale: Unsustainable urban planning, lack of proper waste management, poor technology in industries and increased urban transport have all led to rise in air pollution in cities in India. According to the Health Organisation (WHO), seven million people die prematurely from health risks every year owing to air pollution. The Smart city Mission sets out to bring in its fold the urban policy design of public transit oriented urban mobility, smart parking, intelligent traffic management and integrated multi-modal transport, prioritising non-motorised transport, digitalisation of public services, and waste management e.g. reduction of C&D (construction and demolition) waste, all of which are good practices for better air quality. These are also actions that need to be emulated in the entire city.

Description: Cities should take onus for providing healthy air quality to the citizens. Clean Air Action Plans mandated by the National Clean Air Programme (2019) of Government of India integrate the cumulative city level actions for better air quality. For a city to be climate smart it should be able to address the issues of reducing air and climate pollutants since both air and climate pollutants arise from similar sources and addressing one has a direct co benefit to the other. Clean Air is integral for achieving climate smartness by a city.

Methodology: Indicator assesses to what extent the city has made efforts to improve the air quality, through clean air action planning and proper air quality management strategy in cities. To generate data and identify sources through scientific methods and subsequently to develop and implement sectoral strategies and projects that are components of the clean air action plan. This has to be done in close co-ordination with the State Level monitoring authorities and other stakeholder departments. The clean air action plan needs to be reviewed and monitored to assess improvements in air quality.

Formula:

Nil

Unit: Nil

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

Performance Evaluation Levels:
Table 4.16: Clean Air Action Plan (Planning and Implementation)

	1	2	3	4	5
Progression Levels	No Air Pollutant Monitoring Clean Air Action Plan in the city	Air Pollutant Monitoring	Clean Air Action Plan and Pollutants Source Identification	Implementation of Clean Air Action Plan	Assessing impacts of Clean Air Action Plan implementation
Evidence/ Data sources		• Monitoring Stations for measuring Ambient Air Quality (please indicate number of stations, differentiate between manual stations /continuous ambient air quality monitoring stations (CAAQMS) / continuous emission monitoring system (CEMS) / • Air Quality Monitoring mechanism linked with ICCC/ Sensors based monitoring systems • Map of monitoring stations in the city as .kml files (point or polygon geometry) • Map of air pollution sensors in the city as .kml files (point geometry)	• Clean Air Action Plan prepared by SPCB based on CPCB guidelines as per National Clean Air Programme, (NCAP) developed • Any other Clean Air Action Plan developed by Municipal Authority / Smart City Mission in case of other cities • Scientific study based on CPCB / SPCB led Source Apportionment Studies and Emissions Inventories • Any other available government validated studies for identifying source/EIs	• Implementation of at least 2 measures under the domain of the ULB as specified in Clean Air Action Plan	• Impact assessment for implementation of Clean Air Action Plan measures with evidence of improvements in air quality
Responsible Department/ Agency	CPCB, SPCB				
Reference Document	National Clean Air Programme (MoEF & CC; 2019) http://moef.gov.in/wp-content/uploads/2019/05/NCAP_Report.pdf				
Score	0	25	50	75	100

4.4 Water Management

Indicator 1: Water Resources Management

Rationale: Climate change is expected to impact the water resources and subsequently the water availability. It is, therefore, important to take stock of the water availability and demand equation and in the context of climate change so that adequate action can be taken if required.

Description: This indicator is to assess whether the city is on course to meet the future water demand. The indicator requires an assessment of both current and future water availability; and corresponding current and future water demand. Given that many cities depend significantly on ground water resources to augment piped water supply, it is expected that both surface and groundwater assessments would have been conducted.

Methodology: The water resource assessment should look at both surface and groundwater, wherever required, and quantify both availability and demand using scientific techniques. Various sectors for water allocation are domestic, Industrial and agriculture. The city preparing a new water resource management plan shall include the climate change factors.

Formula: NA

Unit: NA

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 to 100. In this indicator the level 4 and 5 have been merged taking into consideration the actions initiated, actions implemented and WRM plan revised based on climate change factors. Cities will be marked based on the evidence provided for actions initiated and implemented from 1 – 15 marks each, and up to 20 marks for providing evidence for revised WRM plan considering climate change factors. Any city scoring above 50 and 75 marks in total will be in level 4 and 5 respectively.

Performance Evaluation Levels:
Table 4.17: Water Resource Management

	1	2	3	4/5
Progression Levels	No water resource assessment has been carried out	Assessment of current water resources along with future demand and water availability for at least five years	Water Resource Management (WRM) Plan is prepared with Short, Medium- and Long-Term Actions	Actions for Water Resource Management
Evidence/ Data sources		• A Report/study that indicates stock of existing water resources with projections, its uses for various sectors; projected future water demand water availability and water quality for at least five years. The Report/study shall include: • Main water resources of the city including ground water / surface water • Quantum of water available at source • Details of water allocation for domestic, industry and agriculture purposes • Water quality test report at source and after treatment. • Map of major (catering to 5% of more of the city's water needs) ground & surface water sources as .kml file (additional evidence) * Report/study older than 5 years will not be considered	• A Report/ study/ plan that estimates future water availability. The Report/study/plan shall include: • Demand management Plan for best utilization of available water resources • Augmentation of existing water resource through recharge, rejuvenation and storage (includes rain-water harvesting) * Report / study older than 5 years will not be considered	• Actions initiated for execution of works specified in the water resource management plan • The city has reviewed and revised the Water resource Management Plan to include climate change factors.
Responsible Department/ Agency	ULB/ Water Utility/Water Boards/Flood and Irrigation Department / Ground Water Department / Industries Department/ Industrial Corporations / Any SPV and or any other relevant implementation agency, IMD.			
Reference	Technical Material for Water Resources Assessment, World Meteorological Organization (2012) http://www.wmo.int/pages/prog/hwrp/publications/Technical_report_series/1095_en_4_Web.pdf Strengthening Water Security in Asia and the Pacific, Asian Water Development Outlook, ADB (2016) https://www.adb.org/sites/default/files/publication/189411/awdo-2016.pdf			
Score	0	25	50	100

Indicator 2: Extent of Non-Revenue Water

Rationale: Reducing Non-Revenue Water (NRW) is a powerful demand management instrument, which decreases the stress on existing water resources. Given that climate change is expected to create an additional pressure on the existing water resources, reducing NRW is considered as a robust climate smart solution. Reduction in NRW will enhance resilience by reducing both the water losses as well as demand for electricity required for pumping, thereby mitigating GHG emissions.

Description: This indicator highlights the extent of water produced which does not earn the utility any revenue. Non-revenue water is the difference between the volume of water put into a water distribution system and the volume that is billed to customers. NRW comprises - a) Consumption which is authorized but not billed, such as public stand posts; b) Apparent losses such as illegal water connections, water theft and metering inaccuracies; c) Real losses which are leakages in the transmission and distribution networks. Benefits of NRW reduction, in particular of leakage reduction, include:

- financial gains from increased water sales or reduced water production, including possibly the delay of costly capacity expansion;
- increased knowledge about the distribution system;
- increased firefighting capability due to increased pressure;
- reduced risk of contamination.
- More stabilized water pressure throughout the system

Methodology: NRW is computed as - Difference between total water produced and put into transmission and distribution system, and total water sold expressed as a percentage of total water produced. The city also conducts NRW study considering each distribution network and followed by adopting measures to reduce the extent of NRW.

Formula:

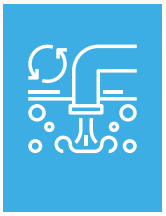
$$\frac{\text{(Total water produced and put into the transmission and distribution system - Total water sold)}}{\text{Total water produced and put into the transmission and distribution system}} \times 100$$

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 4.18: Extent of Non-Revenue Water

	1	2	3	4	5
Progression **Levels**	NRW study is not conducted by city	NRW study is conducted by the city and the most recent NRW of the city during 2016-20 is >40%	Most recent NRW of the city during 2016-20 is >30% to 40%	Most recent NRW of the city during 2016-20 is ≥20% to 30%	Most recent NRW of the city during 2016-20 is <20%
Evidence/ Data sources		• Non-Revenue Water (NRW) report (2016-20) • Map of ward wise NRW as a .kml file (polygon geometry with attribute: percentage of NRW) (additional evidence)			
Responsible Department/ Agency	ULB/ Water Utility/ Water Boards/ Flood and Irrigation Department/ Any SPV and or any other relevant implementation agency.				
Reference	Designing an Effective Leakage Reduction and Management Program (WSP; 2008) http://documents1.worldbank.org/curated/en/479201468316169165/pdf/441260WSP0BOX31e0reduction01PUBLIC1.pdf The Issues and Challenges of Reducing Non-Revenue Water (ADB; 2010) https://www.adb.org/sites/default/files/publication/27473/reducing-nonrevenue-water.pdf				
Score	0	25	50	75	100



Indicator 3: Wastewater Recycle and Reuse

Rationale: Recycling and reuse of wastewater reduces the stress on the existing water resources, which are expected to be impacted by climate change.

Description: The percentage of wastewater received at the treatment plant that is recycled or reused after appropriate treatment for various purposes. This should only consider water that is directly conveyed for recycling or reuse, such as use in gardens and parks, use for irrigation, etc. Water that is discharged into water bodies, which is subsequently used for a variety of purposes, should not be included in this quantum. Reuse may be in diverse avenues such as non-potable domestic use; horticulture, agricultural, power plants, industries among others. The indicator emphasises to reduce the consumption/ utilization of clear water.

Methodology: This indicator highlights what percentage of the wastewater generated is being recycled and reused. It is important that the wastewater treatment meets the approved CPCB standards.

Formula:

$$\frac{\text{Treated wastewater recycled and reused in Million litres per day (or) month}}{\text{0.80 X water supplied to the city in Million litres per day (or) month}} \times 100$$

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 4.19: Wastewater Recycle and Reuse

	1	2	3	4	5
Progression levels	No reuse	< 5% treated wastewater recycled and reused	5 to <10%Treated Wastewater recycled and reused	10 to <20%Treated Wastewater recycled and reused	≥20% Treated Wastewater recycled and reused
Evidence/ Data sources	• Water supply records for last twelve months • Records for treated water reuse for last twelve months				
Responsible Department/ Agency	ULB/ Water Utility/ Water Boards/ Flood and Irrigation Department/ Any SPV and or any other relevant implementation agency, CPHEEO.				
Reference	Handbook of Service Level Benchmarking(CPHEEO; 2008) http://cpheeo.gov.in/upload/uploadfiles/files/Handbook.pdf Chapter 7: Part A: Engineering, Recycling and Reuse of Sewage, Manual on Sewerage and Sewage Treatment Systems (CPHEEO; 2013) http://cpheeo.gov.in/upload/uploadfiles/files/engineering_chapter7.pdf				
Score	0	25	50	75	100

Indicator 4: Flood/ water stagnation risk management

Rationale: With increased urbanization and high densities, cities are inherently vulnerable to flooding and water stagnation events. Climate change will only intensify the problem and increase the frequency of such risks. A flood risk assessment is the first step in developing robust flood management strategies and plans.

Description: Urban flood is defined as 'the submergence of usually dry area by a large amount of water that comes from sudden excessive rainfall, an overflowing river or lake, melting snow or an exceptionally high tide'. This indicator assesses the preparedness of the city to address the risk of flooding and water stagnation. Here, water stagnant for more than four hours of a depth more than six inches is considered as water stagnation.

Methodology: There are generally two types of flood risk assessment. First is a rapid flood risk assessment that uses simple techniques to determine the likely impacts of a flooding event. Second is comprehensive flood risk assessment that is expressed as a function of vulnerability and hazard.

Formula: NA

Unit: NA

Maximum Score: Total score for the indicator is 100. Cities will be marked in 5 levels with scores ranging from 0 to 100. In this indicator, levels 4 and 5 have been merged taking into consideration the various stages on implementation. Cities will be marked based on the evidence provided for the implementation of measures recommended in the flood management plan and urban flood management SOP form 1 – 20 marks each, and 1-10 marks for establishing flood alert and early warning system. Any city scoring above 50 and 75 marks in total will be in level 4 and 5 respectively.

Performance Evaluation Levels:
Table 4.20: Flood/ water stagnation risk management

	1	2	3	4/5
Progression levels	Flood/water stagnation risk assessment not conducted	Rapid flood/ water stagnation risk assessment	Detailed flood risk assessment and preparation of management plan	Implementation of actions for flood/ water stagnation management
Evidence/ Data sources		Rapid flood risk assessment report prepared which shall include: Reasons of flooding/ water stagnation Flooding/ water stagnation Hotspots in city (including the number of incidences) Flood/ water stagnation Levels and frequency Map of flooding/ stagnation hotspots in the city as a .kml file (additional evidence) * Report/study older than 5 years will not be considered	Detailed flood risk assessment for various return period (5 years, 10 years and 50 years) Flood management plans including structural and non -structural strategies (as per NDMA guidelines for urban flood management, 2010) Mechanisms for implementing SOPs (as per MoHUA/ state guidelines) in place. Map of detailed flood risk assessment (scale 1:5000) as a .kml file (additional evidence)	Implementation of measures recommended in the flood management plan (20 points) Implementation of urban flood management SOP (as per MoHUA/state guidelines) (20 points) Urban flood alert and early warning systems established (10 points) Map of drainage and storm water networks in the city as a .kml file (additional evidence)
Responsible Department/ Agency	ULB/ Water Utility/ Water Boards/ Flood and Irrigation Department/ Any SPV and or any other relevant implementation agency			
Reference	Management of Floods, National Disaster Management Guidelines (NDMA; 2008) https://ndma.gov.in/images/guidelines/flood.pdf Flood Risk Management, A Strategic Approach (Asian Development Bank, GIWP, UNESCO, and WWF-UK; 2013) https://www.adb.org/sites/default/files/publication/30246/flood-risk-management.pdf NDMA guideline for urban flood management - https://ndma.gov.in/images/guidelines/management_urban_flooding.pdf SOP for urban flood management as per MoHUA guideline - http://mohua.gov.in/upload/uploadfiles/files/SOP%20Urban%20flooding_5%20May%202017.pdf			
Score	0	25	50	100

Indicator 5: Energy-efficient water supply system

Rationale: Energy efficient equipment for water supply in the city leads to reduction in GHG emissions (CO_2 emissions) per KwH of electricity consumed, thereby contributing to climate change mitigation.

Description: Water Supply System is defined as the water collected from the source, treated, stored and supplied to the end user i.e. entire chain from source to the user with a number of equipment that use energy in a water supply system. Hence, the use of different methods, type of pumps/ equipment and solutions can reduce the use of energy in entire system. The main objective is to explore various possibilities for energy conservation. An energy audit is an assessment and analysis of energy flows in a process or system, aimed at reducing the amount of energy input into the system without negatively affecting the output(s). An energy audit requires a thorough and detailed study of every aspect of the system, through the performance of various tests and measurement. Steps in energy audit report are:

- Collect and analyse historical energy usage.
- Study pumping systems and their operational characteristics.
- Identify potential modification that will reduce the energy usage and or cost
- Perform an engineering and economic analysis of potential modifications.
- Prepare a rank-ordered list of appropriate modifications

These are considered here to be a representative of energy efficient water supply system.

Methodology: This indicator aims to quantify the use and reduction of energy (per MLD of water supplied to the city) by using different options and solution used/ implemented by the city.

Formula:
Trend of reduction in energy consumption per MLD

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 4.21: Energy-efficient Water Supply System

	1	2	3	4	5
Progression Levels	City has not conducted the Energy Audit including for pumping stations and treatment plants	City has conducted the Energy Audit and the most recent energy reduction reported per MLD by the city during 2016-20 is <10% of baseline data	Most recent energy reduction reported per MLD by the city during 2016-20 is >10% to 15% of baseline data	Most recent energy reduction reported per MLD by the city during 2016-20 is >15% to 20% of baseline data	≥Most recent energy reduction reported per MLD by the city during 2016-20 is >20% of baseline data
Evidence/ Data sources		Energy Audit Report (2016-20)			
Responsible Department/ Agency	ULB/ Water Utility/ Water Boards/ Flood and Irrigation Department/ Any SPV and or any other relevant implementation agency				
Reference	Manual for the Development of Municipal Energy Efficiency Projects. BEE (2008) https://tinyurl.com/w6omgtt A Primer on Energy Efficiency for Municipal Water and Wastewater Utilities (ESMAP; 2012) https://tinyurl.com/sw6qja5				
Score	0	25	50	75	100

Indicator 6: Energy-efficient wastewater management system

Rationale: Energy efficient equipment for wastewater pumping in the city leads to reduction in GHG emissions (CO_2 emissions) per KwH of electricity consumed, thereby contributing to climate change mitigation.

Description: Wastewater Management System is defined here as the collection of wastewaters from the stakeholders of the city and its treatment. Reuse system is not be considered in this analysis and or assessment. There are number of equipment that use energy in a wastewater management system. However, wastewater pumps account for the maximum usage of energy. There are different methods, type of pumps/ equipment and solutions that can reduce the use of energy in entire wastewater management system. Energy Audit is an assessment and analysis of energy flows in a process or system, aimed at reducing the amount of energy input into the system without negatively affecting the output(s). The main objective is to explore various possibilities for energy conservation. An energy audit requires a thorough and detailed study of every aspect of the system, through the performance of various tests and measurement. Steps in energy audit report are:

- Collect and analyse historical energy usage.
- Study pumping systems and their operational characteristics.
- Identify potential modification that will reduce the energy usage and or cost
- Perform an engineering and economic analysis of potential modifications.
- Prepare a rank-ordered list of appropriate modifications

These are considered here to be a representative of energy efficient Wastewater Management system.

Methodology: This indicator aims to quantify the use and reduction of energy (per MLD of wastewater generation and treatment) by using different options and solution used/implemented by the city.

Formula:
Trend of reduction in energy consumption per MLD

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 4.24: Energy-efficient wastewater management system

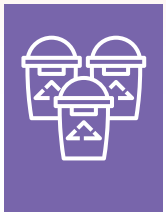
	1	2	3	4	5
Progression levels	Energy audit for wastewater pumping stations and treatment plants not conducted	City has conducted energy audit for wastewater pumping stations and treatment plants. Most recent energy reduction reported per MLD by the city during 2016-20 is <10% of baseline dat	Most recent energy reduction reported per MLD by the city during 2016-20 is >10% to 15% of baseline data	Most recent energy reduction reported per MLD by the city during 2016-20 is >15% to 20% of baseline data	Most recent energy reduction reported per MLD by the city during 2016-20 is >20% of baseline data
Evidence/ Data sources		Energy Audit Report (2016-20)			
Responsible Department/ Agency	ULB/ Water Utility/ Water Boards/ Flood and Irrigation Department/ Any SPV and or any other relevant implementation agency				
Reference	Manual for the Development of Municipal Energy Efficiency Projects. BEE (2008) https://tinyurl.com/w6omgtt A Primer on Energy Efficiency for Municipal Water and Wastewater Utilities (ESMAP; 2012) https://tinyurl.com/sw6qja5				
Score	0	25	50	75	100

4.5 Waste Management

Waste management indicators have been revised to align with Swach Survekshan 2020. This revision is based on the experience of CSCAF assessment cycle I and intend to avoid repetition of data collected across various frameworks initiated by MoHUA. The 6 indicators under CSCAF have been mapped with the relevant 12 service level indicators of Swach Survekshan. Cities will be assessed based on their Swach Survekshan score for the identified service level indicators. While the total Swach Survekshan score of the identified 12 service level indicators is 715 for one quarter, the average scores of each of these 12 mapped indicators in the quarters assessed under the Swachh Survekshan 2020 will be normalized to a score of 600 for the waste management theme under CSCAF.

Mapping of indicators with score between CSCAF 2.0 and Swach Survekshan

CSCAF 2.0 Waste Management	Swach Survekshan 2020 Service Level Indicators	Swach Survekshan Total marks of Mapped indicators	CSCAF 2.0 Score
Indicator 1	5 Service Level Indicators	215	140
Indicator 2	2 Service Level Indicators	135	100
Indicator 3	1 Service Level Indicator	100	100
Indicator 4	1 Service Level Indicator	100	100
Indicator 5	2 Service Level Indicators	105	100
Indicator 6	1 Service Level Indicator	60	60
	Total score	**715**	**600**



Indicator 1: Waste minimization initiatives undertaken by the City

Rationale: The relationship between solid waste and Greenhouse Gases (GHG) emission is well established. GHGs can be avoided though scientific management of waste. The first principle of the Integrated waste management hierarchy is reduction of waste at source. On the contrary, "increase in waste generation with urbanisation" is an accepted phenomenon and in case of urbanizing cities with increasing economic-ability and liveability aspects, this increase is expected to be more as compared to the other urban centres of the country. Therefore, it is important for cities to prioritise certain actions for waste reduction and accordingly plan their future waste management operations and infrastructure requirements. The intent of this indicator is to encourage cities to take actions in order to manage problems associated with increased waste generation. As generation and consumption patterns of waste vary across cities, all cities are encouraged to assess their generation/consumption patterns and characteristics and evolve city specific actions to reduce increasing loads to the existing SWM infrastructure.

Description: This indicator highlights the interventions made to minimize waste generation per-capita through various methods and incentives to reduce the waste generation at source. Aligning to the Swach Survekshan the indicator focuses on capturing the measures adopted in implementing Plastic Waste Management Rules 2016, initiatives taken to reduce dry/wet waste, treatment of domestic hazard waste, on-site wet waste processing by non-bulk waste generators, and measured taken by bulk waste generators to treat dry and process wet waste. This will include the efforts made by the citizens on one hand in reducing generation of waste at source and efforts by the Municipal Authorities in promoting decentralized & centralized processing of waste and setting up MRF facilities for salvaging recyclable & combustible waste. All these efforts will ultimately result in less quantity of waste going to landfill.

Performance evaluation

Table 4.23: Waste minimization initiatives undertaken by the City

Swach Survekshan Indicator	Title	Swach Survekhsan Marks
1.6	Ban on the use, sale and storage of non-bio degradable plastic bags/ plastic products less than 50 microns, in compliance with Plastic Waste Management Rules 2016	30
1.7	3R Principles: Whether initiatives taken in 2019 still working or new initiative taken to reduce generation of Dry/Wet Waste? If yes, share details	50
2.5	Percentage of total domestic hazardous waste (mensural waste and baby/adult diapers and others*) collected (either collected separately at source or received from MRF Centre) is treated, either by ULB or through third party managing bio medical waste. Hazardous waste from Hospitals, Nursing homes/clinics/Labs etc. not considered	60
2.10	On-site wet waste processing by non-bulk waste generators	30
2.11	Bulk Waste Generators (i) doing onsite processing of wet waste generated, including kitchen and garden waste or organic waste or getting wet waste collected and processed by private parties authorized by ULB. (ii) Handing over segregated dry waste to authorized waste pickers or waste collectors.	45
	Overall Swach Survekshan Marks	**215**
	CSCAF score	**140**

Indicator 2: Extent of dry waste recovered & recycled

Rationale: Reuse and recycle are the next levels of waste management hierarchy after reduce, cumulatively known as 3R's. This addresses the GHGs mitigation aspects due to resource efficiency. Waste recovery and recycling systems are yet to be 100% formalized by Cities and mostly informal sector takes care of the resource recovery for SWM value chain and its recycling operations. The intend of the indicator is to encourage cities to set up Material Recovery Facility (MRF) with provision for sorting recyclables and facility for producing SCF/ RDF are available and operational in cities as per SWM Rules, 2016.

Description: The indicator assesses the efficiency of city's waste management systems based on the extent of recyclables recovered from the city's total dry waste and further processed by the authorized recycling units. Aligning to the Swach Survekshan, the focus in on assessing the capacity of dry waste processing facilities and the quantity of dry waste processed MRF, RDF or Waste To Energy plants etc.

Performance evaluation

Table 4.24: Extent of dry waste recovered and recycled

Swach Survekshan Indicator	Title	Swach Survekshan Marks
2.3	Whether capacity of dry waste processing facility /facilities in the city is matching with the total dry waste collected in the city ?	60
2.4	Dry waste being processed out of total dry waste collected (excluding domestic hazardous waste) through MRF, RDF or Waste To Energy plants etc.	75
	Overall Swach Survekshan Marks	**135**
	CSCAF score	**100**

Indicator 3: Construction & Demolition (C&D) waste management

Rationale: The Construction and Demolition (C&D) waste is a major component of city waste and to reduce the pressure on the exploitation of natural resources, cities need to focus on finding greener ways to produce concrete, encouraging the reuse of recycled materials to replace virgin materials. The Greenhouse Gases (GHG) mitigation increases with an improved Construction and Demolition (C&D) Waste recycling and utilization is also captured here. The indicator intends that C&D Waste Management facilities are available and operational in cities as per C&D Waste Management Rules 2016.

Description: This indicator assesses the extent of decentralized management of C&D waste generated and the extent of its utilization. Aligning to the Swach Survekshan the focus is on capturing the mechanism in place to collect and process/ reuse C&D waste.

Performance evaluation

Table 4.25: Construction & Demolition (C&D) waste management

Swach Survekshan Indicator	Title	Swach Survekshan Marks
2.6	Any mechanism in place to collect and process/reuse Construction & Demolition (C&D) waste as per C&D Waste Management Rule, 2016?	100
	Overall Swach Survekshan Marks	**100**
	CSCAF Score	**100**

Indicator 4: Extent of Wet Waste Processed

Rationale: The contribution of wet waste toward increasing GHG emissions is well established. Cities need to manage wet waste through adequate processing facilities and by following scientifically operated systems in order to avoid GHG emissions resulting from waste processing in the city as per Solid Waste Management Rules, 2016

Description: Aligning to the Swach Survekshan, this indicator input on wet waste processing can be further used to calculate avoided GHG emissions based on the wet waste processed in a scientific manner.

Performance evaluation

Table 4.26: Extent of Wet Waste Processed

Swach Survekshan Indicator	Title	Swach Survekshan Marks
2.2	Percentage of wet waste being processed (out of total wet waste collected)	100
	Overall Swach Survekshan Marks	**100**
	CSCAF Score	**100**

Indicator 5: Scientific Landfill availability & operations

Rationale: In order to avoid GHG emissions from a waste disposal facility, cities need to scientifically operate and manage their landfills as per Solid Waste Management Rules, 2016 . This indicator assesses cities on conformity scientific landfill as per the SWM Rules, 2016 and guidance given in the Municipal Solid Waste Management (MSWM) Manual, 2016 (CPHEEO, 2016) and any other updated criteria published by CPCB/ State PCB for Solid Waste Disposal Facilities.

Description: Aligning to the Swach Survekshan, this indicator focuses on capturing the amount of collectable waste going to the landfill and the details of the landfill if it follows the set guidelines for operations and management.

Performance evaluation

Table 4.27: Scientific Landfill availability & operations

Swach Survekshan Indicator	Title	Swach Survekshan Marks
2.7	Percentage of collectable waste (process rejects/ unprocessed) going to the landfill	75
2.8	Is the landfill in the city a sanitary landfill ? Or landfill not required/ Zero landfill city	30
	Overall Swach Survekshan Marks	**105**
	CSCAF Score	**100**

Indicator 6: Landfill/ dumpsite Scientific Remediation

Rationale: Landfill gas (LFG) is a natural by-product of the decomposition of organic material in landfills. LFG is composed of roughly 50 percent methane (the primary component of natural gas), 50 percent carbon dioxide (CO2) and a small amount of non-methane organic compounds. Methane is a greenhouse gas which has 21 times more potential than CO2 for trapping heat in the atmosphere over a 100-year period, hence it is important to mitigate Landfill gases through scientific remediation. The indicator encourages cities to adopt the scientific remediation/closure of engineered landfills and dumpsites to avoid significant GHG emissions.

Description: Aligning to the Swach Survekshan, this indicator assesses the city's readiness/efforts to scientifically manage/close landfills and identified dump sites as a step towards reducing GHG emission.

Performance evaluation

Table 4.28: Landfill/ dumpsite Scientific Remediation

Swach Survekshan Indicator	Title	Swach Survekshan Marks
2.9	Remediation of all identified dumpsites, no legacy waste (dumpsite)/Zero landfill city	60
	Overall Swach Survekshan Marks	**60**
	CSCAF Score	**60**

5. Support for Data Collection

In order to facilitate data collection for CSCAF 2.0, there are various resources compiled on the website https://smartnet.niua.org/csc/index.html. These include data inputs, evidence templates, reference documents and Frequently Asked Questions (FAQs), details of which are given below:

Evidence Templates

Cities can use these ready-made templates to upload their data on the portal for the assessment framework. These templates allow cities to provide information in a standard format and include web-links for evidences that are greater than 20MB in size. The templates are arranged for different indicators for all thematic areas of the framework and can be accessed at https://smartnet.niua.org/csc/evidence-templates.html

Reference Documents

These documents are a compilation of relevant policies, manuals and legislations, along with best practices exhibited through case studies. It is arranged indicator wise along the 5 sectors aiming to create a repository of innovative and successful initiatives related to the five sectors that have been undertaken by various cities across the nation. It also helps one to understand the current status and implications of different policies across all sectors. They can be accessed at https://smartnet.niua.org/csc/knowledge-repository.html

Frequently Asked Questions (FAQs)

The FAQs are compiled as General FAQs and sector specific FAQs which can be accessed in case of any queries arising while filling out the assessment form in the portal. They can be accessed at https://smartnet.niua.org/csc/faqs.html

Training videos

Training videos illustrating the ways to navigate the portal for filling data and reading the technical document is available at: https://smartnet.niua.org/csc/general-faqs.html

Help-desk

Apart from the above resources, there is a national help-desk which will be operational throughout the assessment period. You can reach us at: **011-411-86699** from Monday to Friday, 9am to 5pm. Cities can also email climate-smartcities@gov.in for support.

Ministry of Housing and Urban Affairs

Government of India