European Commission

Green City Accord

Clean and Healthy Cities for Europe

GCA Mandatory Indicators Guidebook

Version of 29 April 2022

Green City Accord

GCA Mandatory Indicators Guidebook

Contents

Introduction

The following guidebook provides further information on the 'mandatory' indicators for each of the five areas covered by the Green City Accord (GCA): air, water, nature & biodiversity, waste & circular economy, and noise.

Reporting as a core component of the Green City Accord

Signatory cities are required to report on their progress in each of the five different areas of the GCA mentioned above.

The main purpose of reporting is for cities to:

- Provide evidence on how they are progressing towards the five goals of the GCA;
- Enable them to benchmark their own progress against the progress of their fellow cities.

Mandatory indicators

An overview of the full set of mandatory indicators can be found on the next page.

A limited set of 15 mandatory indicators, three indicators per area have been selected. The indicators were tested with a group of interested cities.

Use of mandatory indicators

The mandatory indicators are to be used in:

- Establishing the baseline – covering both the starting point in each area as well as the targets to be achieved by 2030 - within two years after signing the GCA (For cities having signed in 2020 and 2021, the baseline report should be delivered in June 2023.)
- Reporting changes compared to the baseline every three years. (For cities having signed in 2020 and 2021, the first progress report will be due in June 2026.)

Overview of mandatory indicators

Air

- $PM_{2.5}$ concentration levels [highest annual mean observed at (sub) urban background stations]
- PM_{10} daily concentration levels [highest number of days exceeding the WHO recommendation of 45 µg/m³ per year, observed at any (sub) urban background or traffic station]
- NO_2 concentration levels (highest annual mean observed at traffic stations)

Water

- Household water consumption (litres/capita/day)
- Infrastructure Leakage Index (ILI)
- Percentage of urban wastewater meeting the requirements of the UWWTD (regarding collection and secondary treatment)

Nature & Biodiversity

- Percentage of protected natural areas, restored and naturalised areas on public land in municipality
- Percentage of tree canopy cover within the city
- Change in number of species of birds in urban area/built-up areas in the city

Waste & Circular Economy

- Municipal waste generated per capita (tons)
- Recycling rate of municipal waste (%)
- Percentage of municipal waste landfilled

Noise

- Percentage of the population exposed to average day-evening-night noise levels (Lden) ≥ 55 dB
- Percentage of the population exposed to night-time noise (Lnight) ≥ 50 dB
- Percentage of (adult) population with High Sleep Disturbance

1 Air

Green City Accord Goal: A significant improvement in air quality in our cities, moving us closer to respecting the World Health Organization's New Air Quality Guidelines[1], while ending exceedances of EU air quality standards as soon as possible.

Overview of Indicators

- **1.1 $PM_{2.5}$ concentration levels [highest annual mean observed at (sub) urban background stations]**
- **1.2 PM_{10} daily concentration levels [highest number of days exceeding the WHO recommendation of 45 µg/m³ per year, observed at any (sub) urban background or traffic station]**
- **1.3 NO_2 concentration levels [highest annual mean observed at traffic stations]**

1.1 $PM_{2.5}$ concentration levels [highest annual mean observed at (sub) urban background stations]

What does it measure?

The indicator '$PM_{2.5}$ concentration levels [highest annual mean observed at (sub) urban background stations]' was established according to existing air quality legislation and reflects ongoing local and national monitoring processes reported at the EU level. The indicator is provided by the EU Ambient Air Quality Directive (EUAAQ) (2008/50/EC and 2004/107/EC).

$PM_{2.5}$ represents the smaller fraction of particulate matter which contains particles with a maximum diameter of 2.5 micrometres (µm), also known as fine particulate patter ($PM_{2.5}$).

Did You Know?

According to the European Environmental Agency, in 2020, 96% of the urban population was exposed to concentrations of fine particulate matter (PM2.5) above the WHO guideline of 5 µg/m3.

(EEA, 2020)

[1] The WHO New Air Quality Guidelines released in September 2021 recommend new air quality levels for 6 pollutants, where evidence has advanced the most on health effects from exposure: particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and carbon monoxide (CO).

The $PM_{2.5}$ concentration indicator allows cities to monitor whether or not they have met the EUAAQ Directives or the World Health Organization (WHO) New Air Quality Guidelines, in addition to helping them assess exposure levels.

The minimum requirements set by the EU and WHO are:

- EU limit value: 25 µg/ m^3
- WHO New Air Quality Guidelines: 5 µg/ m^3

How do you calculate it?

This indicator corresponds to the highest annual mean of $PM_{2.5}$ concentration recorded in a particular year at stations in urban and suburban background locations.

Data can be obtained:

1) From air quality monitoring reports in different stations on a municipal or regional level and
2) Based on measurements made in urban and suburban background locations established for this purpose.

Did You Know?

According to the European Environmental Agency, in 2020, 11% of urban citizens were still exposed to PM_{10} above the EU daily limit value.

(EEA, 2022)

When a city is not able to report this value due to the non-existence of monitoring stations within city boundaries, they may report $PM_{2.5}$ values from the closest regional/national station where concentration values are available.

1.2 PM_{10} daily concentration levels [highest number of days exceeding the WHO recommendation of 45 µg/m³ per year, observed at any (sub) urban background or traffic station]

What does it measure?

The indicator PM_{10} daily concentration levels [highest number of days exceeding the WHO recommendation of 45 µg/m³ per year, observed at any (sub) urban background or traffic station]' was established considering the specifications of the EU Ambient Air Quality Directive (EUAAQ) (2008/50/EC and 2004/107/EC) and the new WHO Air Quality Guidelines.

Coarse particulate matter (PM_{10}) is an air pollutant consisting of small particles with an aerodynamic diameter less than or equal to a nominal 10 micrometres (µm).

The PM_{10} daily observed concentration indicator, allows cities to monitor if they meet the EUAAQ Directives or the WHO New Air Quality Guidelines.

The minimum requirements set by the EU and WHO for observed daily concentrations are:

- EU limit value: 50 µg/ m^3
- WHO New Air Quality Guidelines: 45 µg/ m^3 24-hour mean

How do you calculate it?

This air quality management indicator, corresponds to the highest number of days in a year where the PM_{10} concentration level recorded at stations in urban and suburban background locations has exceeded the WHO recommendation of 45 µg/ m^3. It refers to the number of days on the monitoring station that measured the most days in exceedance of the WHO recommendation of 45 µg/m^3.

Data can be obtained from:

1) Air quality monitoring reports in different stations on a municipal or regional level; and
2) Based on measurements made in urban and suburban background locations established for this purpose.

1.3 NO_2 concentration levels (highest annual mean observed at traffic stations)

What does it measure?

The indicator 'NO_2 concentration levels (highest annual mean observed at traffic stations)' was established according to existing air quality legislation and reflects ongoing local and national monitoring processes reported at the EU level. The indicator is provided by the EU Ambient Air Quality Directive (2008/50/EC and 2004/107/EC).

In some cities, nitrogen dioxide (NO2) and nitrogen oxide (NOx) emission concentrations are recognised as indicators that have the potential to help assess the effectiveness of sustainable transport measures on a local level. In this sense, the evaluation of NO2 concentrations at traffic stations is useful.

- EU limit value: is: 40 µg/m3
- WHO New Air Quality Guidelines: 10 µg/ m3

How do you calculate it?

This indicator corresponds to the highest value of the annual mean of nitrogen dioxide (NO_2) concentrations recorded in a particular year at stations with the highest traffic locations.

Data can be obtained:

- From air quality monitoring reports in different stations on a municipal and regional level; and
- Based on measurements made in urban and suburban background locations established for this purpose.

2 Water

Green City Accord Goal: Important progress in improving the quality of water bodies and the efficiency of water use.

Overview of Indicators

- **2.1 Household water consumption (litres/capita/day)**
- **2.2 Infrastructure Leakage Index (ILI)**
- **2.3 Percentage of urban wastewater meeting the requirements of the Urban Waste Water Treatment Directive (UWWTD) (regarding collection and secondary treatment)**

2.1 Household water consumption (litres/capita/day)

What does it measure?

The indicator 'Household water consumption (litres/capita/day)' measures the average consumption of water (in litres) per day per person, for all domestic uses (excluding the industrial one).

How do you calculate it?

The household water use can be determined based on the measured supplied water volume. Records on volume of water supplied, consumed and, ultimately, paid by the domestic end-users, can be requested from the main entities responsible for supplying households, including industries, associations, enterprises and organisations, or the local public administration bodies. The 'Household water consumption (litres/capita/day)' indicator will be calculated by dividing the water volume supplied to the household by the total number of persons in the sample households.[2]

Did You Know?

According to the European Environmental Agency, in 2018, Europeans have an average household water consumption of 144 litres of freshwater per person per day, representing almost three times the standard for basic human needs.

(EEA, 2018)

2 Note: This calculation is more precise if done for individual households first, and, then averaged for the total number of houses sampled.

The supplied water volume is expressed per day by all households in the sample, considering that a day is a 24-hour period. All adults and children in the household are counted, and the collected amount equals the used volume. Note: A common mistake for the calculation of this value, has been to consider the aggregate of all types of water use, whereas this value only accounts for the domestic water usage though.

Another input to consider for the calculation of the supplied water volume is water usage by the population that is not supplied by the aforementioned entities. This value needs to be calculated based on estimations of 'per capita water use by households supplied by self-supply'.

2.2 Infrastructure Leakage Index (ILI)

What does it measure?

The International Water Association (IWA) uses the Infrastructure Leakage Index (ILI) as a performance indicator for water leakage. The ILI adjusts the measured loss, taking into account the service pressure and length of the network.

ILI measures how effectively infrastructure activities - such as repairs, active leakage control, and pipeline/assets management - are being managed at current operating pressure. As a ratio,[3] the ILI has no units and thus facilitates comparisons between utilities and countries that use different measurement units.

Aware of the wide diversity of water balance formats and methods, practitioners have identified an urgent requirement for a common international terminology. ILI is seen as a helpful water loss performance indicator, because it accommodates the fact that real loss will always exist, even in the very best and well managed distribution system. It gives the most rational technical basis for comparisons of water loss between utilities, which can be used by the operators to measure their attempt in water loss reduction. The IWA workgroup suggests that the ILI indicator should be around 1.0 for systems with very low water loss and could go above 5.0 for high leaking systems. It also tells us about the technical state of the network. The number of new leaks arising each year is influenced primarily by long-term pipeline management.[4]

[3] As a ratio the ILI is less sensitive to fluctuations in consumption than non-revenue water expressed in percentage.
[4] Replacing an old main pipeline with a new installation will undoubtedly reduce leakage from the main. However, unless the service connections are also renewed, the benefit may not be as great as first estimated. Reducing the time it takes to repair a leak will also reduce the volume of leakage. The average duration of the leaks is limited by the speed and quality of repairs, and the active leakage control strategy controls how long unreported leaks run before they are located.

How do you calculate it?

The Infrastructure Leakage Index (ILI) is the ratio of the Current Annual Real Losses (CARL in m3/year) to the Unavoidable Annual Real Losses (UARL in m3/year):

ILI=CARL/UARL

URAL, i.e. those losses whose removal is economically unjustified, is calculated by summing up the following three components:

- Leaks unavoidable on main lines and lines without connections, expressed as 18 dm3/km/day/m of pressure;
- Leaks unavoidable at connections to edge of street, expressed as 0.8 dm3/connection/day/m of pressure;
- Leaks unavoidable at edge of street to customer meter, expressed as 25 dm3/km/da/m of pressure.

The UARL indicator is determined by the formula:

UARL=(18×(Lm+Lr)+0.80×Np+25×Lp)×P×0.365 (m3/rok)

Whereas, given the formula above:

- Lm is the length of the mains pipelines (km);
- Lr is the length of the connection pipelines (km);
- Lp is the total length in km of underground connection pipes measured from the edge of the street to the customer (km);
- Np is the number of service connections;
- P is the average operating pressure of the system, and 0.365 is the conversion factor (m^3/year).

Did You Know?

According to the European Environmental Agency, a 3 millimetre-wide hole in a pipe can lead to a loss of 340 litres of water per day — roughly equivalent to a household's consumption!

(EEA, 2018)

2.3 Percentage of urban wastewater meeting the requirements of the Urban Waste Water Treatment Directive (UWWTD) (regarding collection and secondary treatment)

What does it measure?

The Urban Waste Water Treatment Directive (UWWTD, 91/271/EEC) establishes the minimum requirements for urban waste water[5] collection and treatment in Europe.

The indicator 'Percentage of urban wastewater meeting the requirements of the UWWTD (regarding collection[6] and secondary treatment[7])' measures a city's capacity to comply with the existing requirements of the UWWTD regarding collection (Article 3) and secondary treatment (Article 4).

The UWWTD has a role to play in steering the EU toward the zero-pollution ambition as enshrined in the European Green Deal. The treatment of urban waste water from homes and workplaces is fundamental to ensuring public health and environmental quality. The main objective of the UWWTD is to protect the environment, specifically surface waters, from the adverse effects of waste water discharges — such as oxygen-consuming organic pollution, which degrades aquatic life — and microbiological contamination with pathogens. This is achieved through the collection and treatment of waste water in settlements and areas where population and economic activity are sufficiently concentrated (agglomerations) with the polluting load generated expressed as a population equivalent (p.e.). The UWWTD covers agglomerations over 2,000 p.e.

Did You Know?

As following the 2nd River Basin Management Plans (RBMP), performed since 2015, only 40% of the European Union's surface water bodies achieved good ecological status.

(EC, 2022; CIRCABC, 2015)

In most cases, it stipulates that waste water must be subject to biological treatment (secondary treatment), but in catchments with particularly sensitive waters - such as

[5] **Urban waste water** means domestic waste water or the mixture of domestic waste water with industrial waste water and/or run-off rain water.
Domestic waste water means waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities Article 2(3).
Industrial waste water means any waste water which is discharged from premises used for carrying on any trade or industry, other than domestic waste water and run-off rain water.
[6] The UWWTD defines **Collection System** as a system of conduits which collects and conducts urban waste water.
[7] The UWWTD defines **Secondary treatment** as the treatment of urban waste water by a process generally involving biological treatment with a secondary settlement. Secondary treatment, also known as biological treatment, removes the remaining organic matter, suspended solids and some of the bacteria, viruses and parasites, and to some extent nutrients and chemical substances.

those suffering from eutrophication - more stringent (tertiary) waste water treatment may be required to substantially reduce nitrogen and phosphorus pollution.

The installation of waste water treatment facilities first requires the set-up of a sewage collecting system, followed by the provision of facilities to treat the collected waste water.

The UWWTD also has an important role to play in the circular economy, through the reuse of treated waste water and sewage sludge, the production of renewable energy, and the recycling of nutrients.

How do you calculate it?

This indicator is calculated by taking the percentage of wastewater load compliant with the requirements of the Urban Waste Water Treatment Directive (UWWTD) regarding collection (Article 3 of UWWTD) and secondary treatment (Article 4 of UWWTD).

3 Nature & Biodiversity

Green City Accord Goal: *Considerable progress in conserving and enhancing urban biodiversity, including through an increase in the extent and quality of green areas in cities, and by halting the loss of and restoring urban ecosystems.*

Overview of Indicators

- **3.1 Percentage of protected natural areas, restored and naturalised areas on public land in municipality**
- **3.2 Percentage of tree canopy cover in municipality**
- **3.3 Change in number of species of birds in urban area/built-up areas in the city**

3.1 Percentage of protected natural areas, restored and naturalised areas on public land in municipality

What does it measure?

The 'Percentage of protected natural areas in the municipality" and 'Percentage of, restored and naturalised areas on public land in municipality' assess the share of protected natural areas and restored and naturalised areas in the municipality.

Did You Know?

According to the 2020 'State of Nature in the EU' report 81% of EU protected habitats and 63% of EU protected species are in "poor" or "bad" conservation status.

(EEA, 2020)

Urban ecosystems - which consist of cities and the surrounding socio-ecological systems where most people live - are almost completely artificial but they may include all other ecosystem types (forests, lakes, rivers and agricultural areas can all be part of urban fringe) and they are strongly influenced by human activities.[8] Urban protected areas[9], such as NATURA 2000 sites, differ with regards to the

[8] See Maes et al., 2020.

[9] IUCN classifies 6 different types of protected areas according to their management system (Trzyna, 2014): strict nature reserves, wilderness areas, national parks, natural monument or feature, habitat/species management area, protected landscape/seascape, protected with sustainable use of natural resources. Urban protected areas are at the edge of larger population centres, ranging from towns to megacities, including peri-urban areas immediately surrounding urban areas and urban fringes. They include terrestrial, marine (i.e. wetlands, lakes, etc) and coastal ecosystems, Natura 2000 sites, Biosphere reserves including terrestrial,

degree of naturalness, ranging from natural virgin systems with only natural elements,[10] to highly human intervened systems with extensive human activities.

Due to limited possibilities for creating new protected areas in cities and their peri-urban areas, this indicator has one additional element to reflect cities' efforts to increase natural or semi-natural areas in their city[11]: Percentage of restored and naturalised areas on public land within the municipality (%).

Restored areas imply the restoration of degraded or destroyed ecosystems to good ecological functioning[12]. In cities, ecosystem restoration is often performed through nature-based solutions which involve the design and management of new ecosystems[13] (Examples are the ecological restoration of degraded terrestrial ecosystems (i.e. soil and slope revegetation, plant trees/hedges) or the restoration and creation of semi-natural water bodies (i.e. re-vegetation of riverbanks, constructed wetlands)[14].

Naturalisation is a management strategy for green urban areas which aims at reverting urban green to a more natural state to improve provision of ecosystem services towards healthier, better adapted and more resilient cities. This includes the use of native plants, letting nature take its course (i.e. on brownfields, road verges, etc.), adjusting mowing practices to maintain habitats and food sources, as well as design practices that resemble the diversity of natural systems, i.e. creating heterogeneous landscapes with a variety of habitats assembled[15].

How do you calculate it?

To calculate this indicator, take the following steps:

1. percentage of protected natural areas in the municipality:[16]
   (Total of protected areas km2) ÷ (Total area of municipality in km2) × 100%
2. percentage of restored and naturalised areas on public land within the municipality:
   (Total of restored and naturalised areas km2) ÷ (Total public land km2 in municipality) × 100%

marine and coastal ecosystems, Special Protection Areas (SPAs) as result of the European Birds Directive, Special Areas of Conservation (SACs) following the Habitats Directive.

[10] See Trzyna, 2014
[11] Dumitru, A. & Wendling, L., 2021
[12] Gann et al., 2019
[13] Eggermont et al., 2015
[14] Somarakis et al. 2020; Maes et al, 2020
[15] Connop & Nash, 2018; Wilk et al., 2019
[16] This is a status indicator, meaning that not much change can be expected given the strong competition over land-use in densely built-up urban area, resulting in a low chance that more land will be made available for protected natural areas therein.

The use of official data is strongly recommended. For protected areas, park authorities can be requested for polygons or raster maps[17].

For restored and naturalised areas, maps can be requested from the authority responsible for the restoration or naturalisation process. For public land, the municipality can use its own polygons or raster maps; it is recommended to use official data derived from the official Master Plan.

3.2 Percentage of tree canopy cover within the municipality

What does it measure?

The indicator 'Percentage of tree canopy cover within the city' is a status indicator that assesses the proportion of grown trees (with the potential to grow to full maturity) in relation to the municipal area and gives an indication of connectivity.
Trees are a vital part of urban infrastructure and offer a multitude of benefits[18]. The EU Forest Strategy, combining biodiversity and climate neutrality targets, includes a roadmap for planting at least 3 billion additional trees in the EU by 2030 in full respect of ecological principles. Cities have to step up their efforts to help fulfil this target. The indicator tree canopy cover was chosen to reflect progress in urban tree planting actions.

How do you calculate it?

To calculate this indicator, use the following equation:
(Total area covered by tree canopy in km2) ÷ (Total area of municipality in km2) × 100%

It is highly recommended to use the tree cover density maps with 2018 reference year, 10 m or 100 m resolution of the EEA Urban Atlas.

3.3 Change in number of species of birds in urban area/built-up areas in the city

What does it measure?

The indicator 'Change in number of species of birds in urban area/built-up areas in the city' is a trend indicator that provides an overview of changes in species diversity within the taxonomic groups of birds and butterflies (optional) as a proxy for habitat quality. It is important to focus on densely built-up areas where the number of species is inevitably

[17] Natura 2000 data are available at: Natura 2000 data or Nationally designated areas (CDDA)

[18] Such as cooling, filtering air, carbon sequestration, habitats and biodiversity, energy savings, stormwater attenuation, noise reduction etc.

lower than that found in natural ecosystems. A change can occur through the re-introduction or extinction of species.

This trend indicator looks at changes in species diversity over time rather than at absolute numbers, recognising species recovery, re-introduction and restoration efforts whilst acknowledging that is not easy to recover or re-introduce species successfully over a short period of time.[19]

This indicator aims at awareness raising through citizen science,[20] not to serve as a benchmark.

How do you calculate it?

All GCA signatories are requested to list the number of species of birds (and butterflies optional) prevalent in their city. Possible sources of data include government agencies in charge of biodiversity, city municipalities, urban planning agencies, biodiversity centres, nature groups, universities, publications, etc.

The result of the first assessment will be taken as the baseline (time 1) for species count for subsequent monitoring (time 2). In their subsequent monitoring, signatory cities and towns will calculate the percentage of change in species for the respective taxonomic groups.

Cities can choose between two ways of collecting data for this indicator:

The basic version is to use a citizen science tool that includes bird/butterfly sightings registered by citizens[21]. The number of species will be assessed based on registered sightings and provides coordinates of these sightings. This version does not allow for a focus on built-up areas, but looks at city boundaries.

Did You Know?

According to the IUCN Red List of Threatened Species over half of Europe's endemic trees, including the horse-chestnut, Heberdenia excelsa and the sorbus, are at risk of extinction.

(IUCN, 2019)

The second option is to collect the data in select built-up area(s) of the city (ideally where an intervention has taken place) using structured local field surveys. *It is important to stick to the same boundaries of assessment, once the assessment method is chosen.*

Using the data acquired, indicator 3.5 is calculated as:

19 See CBD, 2014.
20 In case cities decide to make use of citizen science tools they should be aware of the drawbacks in data quality and lack of data representativeness since the number of entries is based on citizens' proactivity. Thus, changes over time could be due to an increase or decrease of social interest.
21 www.inaturalist.org or any other tool with reliable data on city-level

(Number of species assessed at time 2 – x) – (Number of species assessed at time 1 – baseline) ÷ (Number of species assessed at time 1 – baseline) * 100%

This equation will provide the percentage of change in species from the previous survey to the most recent survey.

4 Waste & Circular Economy

Green City Accord Goal: *Advance towards the circular economy by securing a significant improvement in the management of household municipal waste, an important reduction in waste generation and landfilling, and a substantial increase in re-use, repair and recycling.*

Overview of Indicators

- **4.1 Municipal waste generated per capita (tons)**
- **4.2 Recycling rate of municipal waste (%)**
- **4.3 Percentage of municipal waste landfilled**

4.1 Municipal waste generated per capita (tons)

What does it measure?

The indicator 'Municipal waste generated per capita (tons)' measures the weight of municipal waste generated within the city, including waste prepared for export before treatment.

The amount of municipal waste generated consists of household and similar waste collected by or on behalf of municipal authorities. For areas not covered by a municipal waste collection scheme the reported quantities need to be estimated.

Did You Know?

The average EU citizen produces around 505kg of municipal waste a year, only 48% of which is recycled.

(Eurostat, 2021)

Municipal waste is defined in Article 3(2) of European Council Directive 2008/98/EC on waste as "mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, bio- waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture" and "mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households. It excludes waste from production, agriculture, forestry, fishing, septic tanks and sewage network and treatment, including sewage sludge, end-of-life vehicles or construction and demolition waste."

How do you calculate it?

Data on municipal waste generation can be obtained from the local administration's waste department, in charge of waste collection, or from companies contracted by the municipality to handle waste collection.

The indicator should be disaggregated into different waste fractions as much as possible. This will help make collected data more comparable.

The indicator can be expressed as "tons of municipal waste generated per capita per year" and to allow for comparison between cities, quantities should be reported in absolute and in per capita terms.

If data is not available for some fractions, assumptions can be made by cities, whilst communicated transparently.[22]

4.2 Recycling rate of municipal waste (%)

What does it measure?

The indicator 'Recycling rate of municipal waste (%)' measures the share of recycled municipal waste of the total municipal waste generation. See Eurostat definition for more details.

Recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances that are not waste and may be used for the original or other purposes. Recycling typically generates secondary raw materials which may then be reprocessed into new products. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

Recycling includes material recycling, composting and anaerobic digestion. The ratio is expressed in percent (%) as both terms are measured in the same unit, namely tonnes. The recycling rate of municipal waste provides a good indication of the quality of the overall waste management system.

This indicator is widely known and used, and is clearly connected to EU policy objectives. Member States are required to achieve the following targets: 65% by 2030; 75% of packaging waste by 2030.

22 For more details on compiling and reporting municipal waste data, see the EU Guide for the compilation and reporting of data on municipal waste and the EC Guide on Municipal Waste Collection.

How do you calculate it?

To calculate this indicator, the ratio of recycled municipal waste in the total municipal waste generation must be obtained and expressed as a percentage (%).

Data on municipal waste recycling can be obtained from the local administration's waste departments or from companies contracted by the municipality to handle waste collection & treatment.

In many Member States, different waste streams are treated by different companies – e.g. paper may be recycled through a different contractor than plastics. Mixed municipal waste treatment could be handled by yet another entity (also relevant for landfilling targets).

GCA signatories should therefore strive to get as much data on the different recyclables within their municipality, and, where necessary, communicate openly on gaps and uncertainties due to lack of data. This is particularly relevant for waste streams for which the treatment is beyond the control (and knowledge) of the city administration so that the local recycling rate coincides, in principle, with the regional or national recycling rate for a given waste stream (this is for instance often the case with plastic packaging recycling).

In conclusion, signatories are asked to use local original data on recycled quantities as much as possible and to fill in the gaps, where needed, with regional or local recycling rates, which then need to be applied to local waste quantities (i.e. those reported for municipal waste generated - see above - including waste prepared for export outside of municipal and/or national borders, to avoid trade-offs induced by the boundary challenge).

Rates should be reported as disaggregated as possible, meaning that figures should be reported for all waste streams defined under municipal waste (see description and references above).[23]

4.3 Percentage of municipal waste landfilled

What does it measure?

The indicator 'Percentage of municipal waste landfilled' measures the share of municipal waste generated within the city boundary that is landfilled. 'Disposal' means any

[23] For more details on reporting, see the EU Guide for the compilation and reporting of data on municipal waste and the EC Guide on Municipal Waste Collection as well as the EU Recycling Rate of Municipal Waste indicator definition.

operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Landfilling is one of these disposal operations (next to 'incineration' or 'other').[24]

Landfilling quantities include the weight of waste resulting from treatment operations prior to recycling or other recovery of municipal waste, such as sorting or mechanical biological treatment, which is subsequently landfilled. Thus, the total amount of landfilling shall include the amount of waste entering incineration disposal operations, less the amount of material recovered from such operations.

Did You Know?

According to the European Commission, the development of a more circular economy in the EU could create up to an estimated 2 million new jobs by 2030.

(EC, 2014)

By 2035, municipalities must not exceed a maximum of 10% of municipal waste landfilled and respect the ban of landfilling separate collectables.

How do you calculate it?

This indicator is expressed as "tons of municipal waste landfilled/tons of municipal waste generated." It can also be expressed in absolute terms per capita to allow for inter-city comparison.

Data on landfilling of municipal waste can be obtained from the local administration's waste department or from companies contracted by the municipality to handle waste collection or treatment. The amount of waste to be reported under landfilling is the amount that enters the landfilling operation facility. Data reported should be consistent with the EUROSTAT definition that delineates landfilling quantities as consisting of all materials entering the incineration disposal operations, minus the materials and energy actually recovered.

To adhere to a 'polluter pays principle,' GCA signatories must be sure to report the share of municipal waste generated on its own territory that is landfilled (and *not* overall landfill figures from a landfilling site which happens to be on the city territory). Similar to the recycling rate calculation, signatories need to first understand whether or not incineration and landfilling is occurring on the municipal territory. Local data from these operations can then be complemented with regional data or proxies (e.g. from the materials not recovered during incineration).

Rates should be reported as disaggregated as possible, i.e. per municipal waste stream and not as a single, aggregated figure.[25]

24 Annex I of Directive 2008/98/EC
25 For more details on reporting, see EU Guide for the compilation and reporting of data on municipal waste.

5 Noise

Green City Accord Goal: A significant reduction in noise pollution, moving us closer to the levels recommended by the World Health Organization.

Overview of Indicators

- **5.1 Percentage of the population exposed to average day-evening-night noise levels (Lden) ≥ 55 dB**
- **5.2 Percentage of the population exposed to night-time noise (Lnight) ≥ 50 dB**
- **5.3 Percentage of (adult) population with High Sleep Disturbance**

5.1 Percentage of the population exposed to average day-evening-night noise levels (Lden) ≥ 55 dB

What does it measure?

The indicator 'Percentage of the population exposed to average day-evening-night noise levels (Lden) ≥ 55 dB' was established according to existing EU legislation and reflects ongoing local and national estimates reported at the EU level.[26] Lden represents the average noise level to which a citizen is exposed throughout the day, evening, and night over the period of one year.

Did You Know?

The WHO classified traffic noise - including road, rail and air traffic - as the second most significant cause of ill health in Western Europe.

(WHO, 2018)

How do you calculate it?

To calculate this indicator, use the following equation: Percentage of the population exposed to average day-evening-night noise levels (Lden) ≥ 55 dB.

26 Assessed (modelled) based on the method set out in Annex II of the Environmental Noise Directive (END) which was amended in 2015 and 2020, the latter of which has not been published but is set to be adopted in the second quarter of 2021.

5.2 Percentage of population exposed to night-time noise (Lnight) ≥ 50 dB

What does it measure?

The indicator 'Percentage of the population exposed to night-time noise (Lnight) ≥ 50 dB' was established according to existing EU legislation and reflects ongoing local and national estimates reported at the EU level.[27] Lnight refers to an annual average period of exposure to noise at night.

How do you calculate it?

To calculate this indicator, use the following equation: Percentage of the population exposed to night-time noise (Lnight) ≥ 50 dB.

5.3 Percentage of (adult) population with High Sleep Disturbance

What does it measure?

The indicator 'percentage of (adult) population with High Sleep Disturbance' is correlated with indicator 5.2, but provides further information on the health impacts of exposure to noise. Indicator 5.4 refers to self-reported sleep disturbance, which directly affects quality of life and may also lead to subsequent health impediments. The effects of sleep disturbance may also be associated with cardiovascular disease.

How do you calculate it?

This indicator is easily calculated by implementing the formulas set out in the Commission Directive (EU) 2020/367 in an Excel worksheet and by using data acquired from indicator 5.2:

Population noise exposure data (i.e. from indicator 5.2) plus *dose-effect relations* (i.e. formulas specifying how the effect changes as a function of exposure) equals the *risk of harmful effects* of noise on health.

"High Sleep Disturbance" is one of the effects, or 'health endpoints', that can be calculated.

Did You Know?

The European Environmental Agency estimates that 22 million people suffer chronic high annoyance due to noise exposure and 6.5 million people suffer chronic high sleep disturbance.

(EEA, 2019)

[27] Idem

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