

**CITYkeys**



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# **CITYkeys list of city indicators**

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# 1. CITYKEYS INDICATORS FOR SMART CITIES

Because a strong focus of the CITYkeys framework is on the relation between project and city indicators, the selection of project indicators as discussed in chapter 5 has formed the basis for defining city indicators. From the longlist of city indicators, derived from existing frameworks, an indicator was chosen, in consultation with all project partners, that has the closest resemblance with one of the selected project indicators. If several indicators were equally suitable, the preference went to an indicator that cities already use and/or are familiar with. In the next paragraphs, the tables of selected city indicators are shown, discussing the title, the unit, a short description, the source framework(s) and the type of indicator.

- The title of the city indicator is phrased as evaluating a static situation. A static indicator, assessing the situation at a certain recurrence in time, will allow monitoring over various time periods.
- Important in the choice for the unit of the indicator is the comparability of indicators across a variety of cities differing in size, demography, dominant type of companies/sectors, etc. Here too, absolute values are not suitable. Consequently, most city indicators are defined as ‘%’ or use a Likert scale, for instance, the share of population with good access to public transport expressed in percentage.
- It should be noted that in the project indicator set several indicators have been defined as qualitative indicators expressing for instance the quality of public transport connections, while on the city level a more conventional quantitative indicator was selected (such as the share of population with a public transport stop within 500 m). The reason is that on the project level a simple quantitative indicator was judged as insufficient for expressing the impact of the project, while for the city indicator set the traditional quantitative indicator was judged more feasible.
- The short description explains the indicator into more detail. More elaborate descriptions of the city indicators can be found in the report “CITYKeys the indicators”.
- Also for city indicators, existing indicators of already developed frameworks have been used for the CITYkeys framework when available. For these indicators, the original frameworks are mentioned in the description as the ‘source framework’. In addition, new indicators have been developed by the consortium members when they felt this was necessary for performing a complete evaluation of Smart Cities.

## 1.1 People

### 1.1.1 Health

| Indicator title                      | Indicator unit | Definition   | Source             |
|--------------------------------------|----------------|--|--------------------|
| Access to basic health care services | % of people    | Share of population with access to basic health care services within 500m          | Rotterdam SCP; SCI |
| Encouraging a healthy lifestyle      | Likert         | The extent to which policy efforts are undertaken to encourage a healthy lifestyle |                    |

### 1.1.2 Safety

| Indicator title   | Indicator unit | Definition   | Source   |
|-------------------|----------------|--|--|
| Traffic accidents | #/100.000      | Number of transportation fatalities per 100.000 population       | Civitas; Rotterdam SCP; European Green Capital Award study; 2Decide; CASBEE_City_2012; UNECE; ,GCIF; COMIND; URBES |
| Crime rate        | #/100.000      | Number of violence, annoyances and crimes per 100.000 population | Rotterdam SCP; Smart city Wheel; European Smart Cities v1.0 (2007); SCI; City Protocol; GCIF                       |
| Cybersecurity     | Likert         | The level of cybersecurity of the cities' systems                |  |
| Data privacy      | Likert         | The level of data protection by the city                         |  |

### 1.1.3 Access to (other)services

| Indicator title                                     | Indicator unit | Definition  | Source   |
|---|----------------|---|--|
| Access to public transport                          | % of people    | Share of population with access to a public transport stop within 500m  | Rotterdam SCP; Covenant of mayors; OECD; City Protocol; GCIF; 2000-Watt;   |
| Access to vehicle sharing solutions for city travel | #/100.000      | Number of vehicles available for sharing per 100.000 inhabitants  | LEED; DGNB   |
| Length of bike route network                        | % in km        | % of bicycle paths and lanes in relation to the length of streets (excluding motorways)                                 | FIN Indicators; Transform; OECD; UNECE; Covenant of Mayors; European Green Capital Award study; City Protocol; URBES; ISO 37120  |
| Access to public amenities                          | % of people    | Share of population with access to at least one type of public amenity within 500m                                      | Smart city Profiles; RFSC; FIN indicators; Eurbanlab; 2000Watt; SCI; Rotterdam SCP; City Protocol  |
| Access to commercial amenities                      | % of people    | Share of population with access to at least six types of commercial amenities providing goods for daily use within 500m | Eurbanlab ,OECD, Rotterdam SCP; City Protocol  |
| Access to high speed internet                       | #/100          | Fixed (wired)-broadband subscriptions per 100 inhabitants   | ISO 37120; RFSC; Rotterdam SCP; Transform; UNECE; ITU; Green Digital Charter; European Green Capital Award study; City Protocol; GCIF; URBES; Smart city Wheel; Triple Helix Model; European Smart Cities v1.0 (2007); |

|   |         |   |               |
|---|---------|---|---------------|
| <b>Access to public free WiFi</b>       | % of m2 | Public space Wi-Fi coverage                                   | City Protocol |
| <b>Flexibility in delivery services</b> | Likert  | The extent to which there is flexibility in delivery services |               |

### 1.1.4 Education

| Indicator title                        | Indicator unit | Definition   | Source                          |
|--|----------------|--|---------------------------------|
| <b>Access to educational resources</b> | Likert         | The extent to which the city provides easy access (either physically or digitally) to a wide coverage of educational resources | Adapted from project definition |
| <b>Environmental education</b>         | % of schools   | The percentage of schools with environmental education programs  | SCI                             |
| <b>Digital literacy</b>                | % of people    | Percentage of target group reached   |                                 |

### 1.1.5 Diversity and social cohesion

No indicators identified at city level.

### 1.1.6 Quality of housing and the built environment

| Indicator title                          | Indicator unit                         | Definition   | Source                                     |
|--|--|--|--|
| <b>Diversity of housing</b>              | Simpson Diversity Index/Social housing | Simpson Diversity Index of total housing stock in the project area<br>OR<br>Percentage of social dwellings as share of total housing stock in the project area | LEED; UNECE; City Protocol; Eurbanlab; SCI |
| <b>Preservation of cultural heritage</b> | Likert                                 | The extent to which preservation of cultural heritage of the city is considered in urban planning  | Eurbanlab; CASBEE_Urban development_2014   |
| <b>Ground floor usage</b>                | % of m2                                | Percentage of ground floor surface of buildings that is used for commercial or public purposes as percentage of total ground floor surface                     |  |
| <b>Public outdoor recreation space</b>   | m2/cap                                 | Square meters of public outdoor recreation space per capita  | OECD; Rotterdam SCP; City Protocol         |

|                    |                  |  |   |
|--------------------|------------------|--|---|
| <b>Green space</b> | hectares/100.000 | Green area (hectares) per 100.000 population | UNECE; ClimateCon; OECD; SCI; European Green Capital Award study; City Protocol; GCIF; URBES; Rotterdam SCP |
|--------------------|------------------|--|---|

## 1.2 Planet

### 1.2.1 Energy & mitigation

| Indicator title                                   | Indicator unit | Definition   | Source   |
|---|----------------|--|--|
| <b><u>Energy consumption/demand</u></b>           |                |  |  |
| <b>Annual final energy consumption</b>            | MWh/cap/yr     | Annual final energy consumption for all uses and forms of energy   | Eurbanlab; Transform   |
| <b><u>Renewable energy production</u></b>         |                |  |  |
| <b>Renewable energy generated within the city</b> | % of MWh       | The percentage of total energy derived from renewable sources, as a share of the city's total energy consumption | Eurbanlab; Transform; OECD; UNECE; READY   |
| <b><u>CO2 –emissions</u></b>                      |                |  |  |
| <b>CO2 emissions</b>                              | t CO2/cap/yr   | CO2 emissions in tonnes per capita per year  | ISO 37120; Smart city Wheel; SCI; FIN indicators; DESIRE; RFSC; UNECE; European Green Capital Award study; City Protocol; GCIF |
| <b>Local freight transport fuel mix</b>           | % in kms       | The ratio of renewable fuels in the local freight transport fuel mix.  | 2DECIDE<br>CIVITAS   |

### 1.2.2 Materials, water and land

| Indicator title                      | Indicator unit | Definition  | Source |
|--------------------------------------|----------------|---|--------|
| <b><u>Materials</u></b>              |                |   |        |
| <b>Domestic material consumption</b> | t/cap/year     | The total amount of material directly used in the city per capita |        |
| <b><u>Water</u></b>                  |                |   |        |

|                                 |                 |   |   |
|---------------------------------|-----------------|---|---|
| <b>Water consumption</b>        | liters/cap/year | Total water consumption per capita per day  | Siemens Green City Index; FIN Indicators; European Green Capital Award study; UNECE; OECD; ClimateCon; Rotterdam SCP; City protocol; GCIF; COMIND |
| <b>Grey and rain water use</b>  | % of houses     | Percentage of houses equipped to reuse grey and rain water  | OECD  |
| <b>Water Exploitation Index</b> | % of m3         | Annual total water abstraction as a percentage of available long-term freshwater resources in the geographically relevant area (basin) from which the city gets its water | DESIRE  |
| <b>Water losses</b>             | % of m3         | Percentage of water loss of the total water consumption   | Siemens Green City Index; UNECE; FIN Indicators; City Protocol; GCIF; URBES   |
| <b>Land</b>                     |                 |   |   |
| <b>Population density</b>       | #/km2           | Number of people per km2  | FIN Indicators  |
| <b>Local food production</b>    | % of tonnes     | Share of food consumption produced within a radius of 100 km  |   |
| <b>Brownfield use</b>           | % of km2        | Share of brownfield area that has been redeveloped in the past period as percentage of total brownfield area  |   |

### 1.2.3 Climate resilience

| Indicator title                    | Indicator unit        | Definition   | Source    |
|------------------------------------|-----------------------|--|-----------|
| <b>Climate resilience strategy</b> | Likert scale          | The extent to which the city has developed and implemented a climate resilient strategy                    | Eurbanlab |
| <b>Urban Heat Island</b>           | °C UHI <sub>max</sub> | Maximum difference in air temperature within the city compared to the countryside during the summer months |           |

### 1.2.4 Pollution & waste

| Indicator title | Indicator unit | Definition | Source |
|-----------------|----------------|------------|--------|
|-----------------|----------------|------------|--------|

| <b><u>Air quality</u></b>                        |             |   |   |
|--|-------------|---|---|
| <b>Nitrogen oxide emissions (NOx)</b>            | g/cap       | Annual nitrogen oxide emissions (NO and NO2) per capita           | Siemens Green City Index; European Green Capital Award study  |
| <b>Fine particulate matter emissions (PM2.5)</b> | g/cap       | Annual particulate matter emissions (PM 2,5) per capita           | Siemens Green City Index; European Smart Cities v1.0 (2007); European Green Capital Award study; Civitas  |
| <b>Air quality index</b>                         | Index       | Annual concentration of relevant air pollutants                   | RFSC; FIN Indicators; Rotterdam SCP; OECD; COMIND   |
| <b><u>Miscellaneous</u></b>                      |             |   |   |
| <b>Noise pollution</b>                           | % of people | Share of the population affected by noise >55 dB(a) at night time | ISO 37120; FIN Indicators; Rotterdam SCP; OECD; ClimateCon; European Green Capital Award study; City Protocol; URBES                                      |
| <b><u>Waste</u></b>                              |             |   |   |
| <b>Municipal solid waste</b>                     | t/cap/yr    | The amount of municipal solid waste generated per capita annually | Siemens Green City Index; Smart city Profiles; Rotterdam SCP; Transform; Desire; OECD; ClimateCon; SCI; European Green Capital Award study; City Protocol |
| <b>Recycling rate</b>                            | % of tonnes | Percentage of city's solid waste that is recycled                 | Siemens Green City Index; Smart city Profiles; Rotterdam SCP; Desire; OECD; ClimateCon; CASBEE_City_2012; SCI; City Protocol; GCIF; 2000-Watt             |

## 1.2.5 Ecosystem

| <b>Indicator title</b>                    | <b>Indicator unit</b> | <b>Definition</b>  | <b>Source</b>    |
|---|-----------------------|--|------------------|
| <b>Share of green and water spaces</b>    | % in km2              | Share of green and water surface area as percentage of total land area | CASBEE_City_2012 |
| <b>Change in number of native species</b> | # of species          | Net change in number of native species                                 | City Protocol    |

## 1.3 Prosperity

### 1.3.1 Employment

| Indicator title         | Indicator unit | Definition                                  | Source  |
|-------------------------|----------------|---|---|
| Unemployment rate       | % of people    | Percentage of the labour force unemployed   | ISO 37120, ClimateCon; SCI; European Green Capital Award study; City Protocol; UN HABITAT CPI; GCIF; Triple Helix Model; SCI; European Green Capital Award study; COMIND; RFSC; UNECE |
| Youth unemployment rate | % of people    | Percentage of youth labour force unemployed | ISO 37120; European Green Capital Award study; City Protocol  |

### 1.3.2 Equity

| Indicator title          | Indicator unit  | Definition  | Source                |
|--------------------------|-----------------|---|-----------------------|
| Fuel poverty             | % of households | The percentage of households unable to afford the most basic levels of energy | Eurbanlab; Transform  |
| Affordability of housing | % of people     | % of population living in affordable housing                                  | Eurbanlab; UNECE; SCI |

### 1.3.3 Green economy

| Indicator title                   | Indicator unit | Definition   | Source                                |
|-----------------------------------|----------------|--|---------------------------------------|
| Share of certified companies      | % of companies | Share of companies based in the city holding an ISO 14001 certificate  |                                       |
| Share of Green Public Procurement | % in €         | Percentage annual procurement using environmental criteria as share of total annual procurement of the city administration               | FIN Indicators                        |
| Green jobs                        | % of jobs      | Share of jobs related to environmental service activities that contribute substantially to preserving or restoring environmental quality | Green Digital Charter; SCI; Transform |
| Freight movement                  | # of movements | Freight movement is defined as the number of freight vehicles moving into an area (e.g. the city)  | 2DECIDE<br>CIVITAS                    |



### 1.3.4 Economic performance

| Indicator title          | Indicator unit | Definition                                      | Source   |
|--------------------------|----------------|---|--|
| Gross Domestic Product   | €/cap          | City's gross domestic product per capita        | Triple Helix Model; Green Digital Charter; ClimateCon; City Protocol; UN Habitat CPI; GCIF; READY; UNECE |
| New business registered  | #/100.000      | Number of new businesses per 100,000 population | Triple Helix Model; European Green Capital Award study; City Protocol                                    |
| Median disposable income | €/household    | Median disposable annual household income       | ClimateCon; European Green Capital Award study; GCIF; COMIND; Triple Helix Model                         |

### 1.3.5 Innovation

| Indicator title                 | Indicator unit | Definition   | Source  |
|---------------------------------|----------------|--|---|
| Creative industry               | % of people    | Share of people working in creative industries                                       | Triple Helix Model; European Green Capital Award study; Smart city Wheel            |
| Innovation hubs in the city     | #/100.000      | # of innovation hubs in the city, whether private or public, per 100.000 inhabitants |   |
| Accessibility of open data sets | # stars        | The extent to which the open city data are easy to use                               | City Protocol   |
| Research intensity              | % in euros     | R&D expenditure as percentage of city's GDP  | Triple Helix Model; ITU; UNECE; Smart city Wheel; European Smart Cities v1.0 (2007) |
| Open data                       | #/100.000      | # of open government datasets per 100.000 inhabitants                                |   |

### 1.3.6 Attractiveness & competitiveness

| Indicator title      | Indicator unit | Definition  | Source  |
|----------------------|----------------|---|---|
| Congestion           | % in hours     | Increase in overall travel times when compared to free flow situation (uncongested situation) | IDEAS; European Green Capital Award study; City protocol; 2Decide |
| Public transport use | #/cap/year     | Annual number of public transport trips per capita  | City Protocol; ISO 37120; GCIF                                    |
| Net migration        | #/1000         | Rate of population change due to migration per 1000   | CASBEE_City_2012; European Green Capital                          |

|                                    |           |  |   |
|------------------------------------|-----------|--|---|
|                                    |           | inhabitants  | Award study   |
| <b>Population Dependency Ratio</b> | #/100     | Number of economically dependent persons (net consumers) per 100 economically active persons (net producers) | GCIF  |
| <b>International Events Hold</b>   | #/100.000 | The number of international events per 100.000 inhabitants   | Smart city Wheel  |
| <b>Tourism intensity</b>           | #/100.000 | Number of tourist nights per year per 100.000 inhabitants  | UNECE; European Green Capital Award study; Triple Helix Model |

## 1.4 Governance

### 1.4.1 Organisation

| Indicator title                                | Indicator unit | Definition   | Source              |
|--|----------------|--|---------------------|
| <b>Cross-departmental integration</b>          | Likert         | The extent to which administrative departments contribute to “smart city” initiatives and management                             | Transform           |
| <b>Establishment within the administration</b> | Likert         | The extent to which the smart city strategy has been assigned to one department/director and staff resources have been allocated | Smart city Profiles |
| <b>Monitoring and evaluation</b>               | Likert         | The extent to which the progress towards a smart city and compliance with requirements is being monitored and reported           | RFSC                |
| <b>Availability of government data</b>         | Likert         | The extent to which government information is published  | ITU                 |

### 1.4.2 Community involvement

| Indicator title                  | Indicator unit | Definition  | Source        |
|----------------------------------|----------------|---|---------------|
| <b>Citizen participation</b>     | % of projects  | The number of projects in which citizens actively participated as a percentage of the total projects executed | Transform     |
| <b>Open public participation</b> | #/100.000      | Number of public participation processes per 100.000 per year   | City Protocol |

|                            |             |   |  |
|----------------------------|-------------|---|--|
| <b>Voter participation</b> | % of people | % of people that voted in the last municipal election as share of total population eligible to vote | ISO 37120; European Smart Cities v1.0 (2007); UNECE; European Green Capital Award study; City protocol; GCIF; COMIND |
|----------------------------|-------------|---|--|

### 1.4.3 Multi-level governance

| Indicator title   | Indicator unit | Definition   | Source              |
|---|----------------|--|---------------------|
| <b><u>Strategies and policies</u></b>   |                |  |                     |
| <b>Smart city policy</b>  | Likert         | The extent to which the city has a supportive smart city policy                      |                     |
| <b><u>Budget</u></b>  |                |  |                     |
| <b>Expenditures by the municipality for a transition towards a smart city</b> | €/capita       | Annual expenditures by the municipality for a transition towards a smart city        | Smart city Profiles |
| <b><u>Multilevel</u></b>  |                |  |                     |
| <b>Multilevel government</b>  | Likert         | The extent to which the city cooperates with other authorities from different levels | RFSC                |

## 1.5 Propagation

As the potential for dissemination of smart city projects to other contexts or other cities is only relevant on the project level, indicators on propagation are not included on the city level.