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12.9 Mean level of exposure to ambient air pollution

Project Name: URBAN GreenUP (Grant Agreement no. 730426)

Author/s and affiliations: Raúl Sánchez[1], Jose Fermoso[1], Silvia Gómez, María González[1], Jose María Sanz[1], Esther San José[1]

[1] *CARTIF Foundation. Parque Tecnológico de Boecillo, 205, 47151, Boecillo, Valladolid, Spain*

Mean level of exposure to ambient air pollution	**Air Quality**
Description and justification	Air pollution consists of many pollutants, among other particulate matter. These particles are able to penetrate deeply into the respiratory tract and therefore constitute a risk for health by increasing mortality from respiratory infections and diseases, lung cancer, and selected cardiovascular diseases. The mean annual concentration of fine suspended particles of less than 2.5 microns in diameters ($PM_{2.5}$) is a common measure of air pollution. The mean is a population-weighted average for urban population in a country, and is expressed in micrograms per cubic meter [µg/m3]. Other important pollutants are ozone and NO_X. This indicator can be calculated using the different pollutants depending on the data availability and problems caused by each pollutant (according maximum levels reached in extreme events). This indicator has been defined using the SDG indicators numbers 3.9.1 and 11.6.2 as references but adapting it for use at urban scale.
Definition	This KPI is useful to assess the level of population exposed to low air quality levels in the city and the importance of this challenge for the city. Further analysis could be developed using public health or hospital admission data to correlate the importance or green infrastructure on air quality levels. This KPIs is calculated from ground measurements by the official Air Quality monitoring networks in cities applying a methodology defined by URBAN GreenUP Project adapted from different sources. Additionally, information on the

	type of the zone (road traffic, city background, industrial, etc.) has been assigned to the different areas/streets of the city to weight population.
Strengths and weaknesses	- Specific Method for polluted air solutions. - PM monitoring device required.
Measurement procedure and tool	**Data processing** Calculation of annual and monthly mean levels of NO_2, O_3, PM_{10} and $PM_{2.5}$ at each station location. There are three main types of stations for city domains (excepting industrial sites that are no considered for this KPI). ▪ Road traffic ▪ Urban background ▪ Peri-urban background According to this classification, it can be obtained average values for road traffic areas, urban areas and peri-urban areas. Then, using a GIS software, a model of the city can be built that classifies all locations/streets/areas of the city in those categories. Spatial Analysis software QGIS is the GIS software proposed to be used, due to it is an open source and multiplatform software and it is distributed under Creative Commons Attribution-Share Alike 3.0 licence (CC BY-SA). We recommend to use the last long-term release repository, most stable (QGIS 2.18 is currently the last one). Data processing involved in this KPI can be done with the standard version and the standard toolbox. **Results** The main result of this KPI is a city map where can be shown air quality average levels for the city. This outcome can be used to define population exposition levels and to highlight buildings used by vulnerable groups such as schools or residences for the elderly.
Scale of measurement	Street/Building
Data source	
Required data	Air Quality monitoring stations network in major urban agglomerations. **Measurements** Concentrations of NO_2, O_3 and airborne particulate matter are measured by recording PM mass per cubic meter of air ($PM_{2.5}$ and PM_{10}).

	Unit of measurement PM - Micrograms (mcg) per cubic meter, µg/m^3. (Microgram (µg) One-millionth of a gram; a milligram (mg) = 1000 micrograms). NO_2 – Micrograms (mcg) per cubic meter, µg/m^3. (Microgram (µg) One-millionth of a gram; a milligram (mg) = 1000 micrograms). O_3 - Micrograms (mcg) per cubic meter, µg/m^3. (Microgram (µg) One-millionth of a gram; a milligram (mg) = 1000 micrograms).
Data input type	Continuous monitoring of NO_2, O_3 and particulate matter.
Data collection frequency	Continuous monitoring in the selected points hourly.
Level of expertise required	High
Synergies with other indicators	
Connection with SDGs	SDG3 / SDG11
Opportunities for participatory data collection	--
Additional information	
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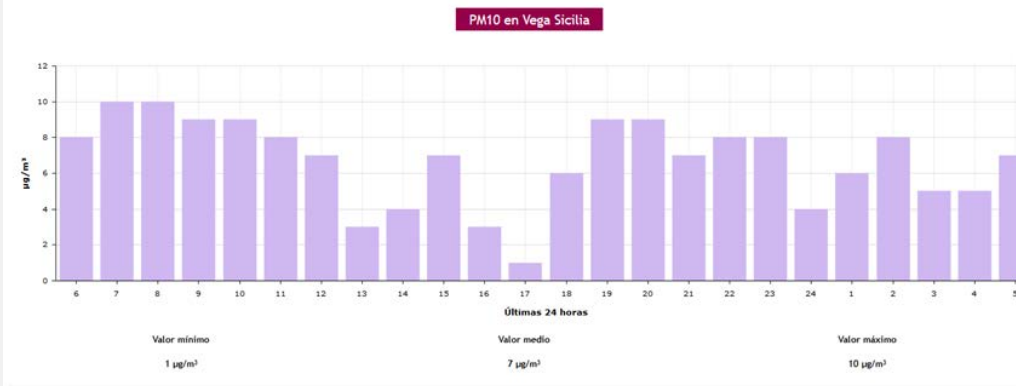
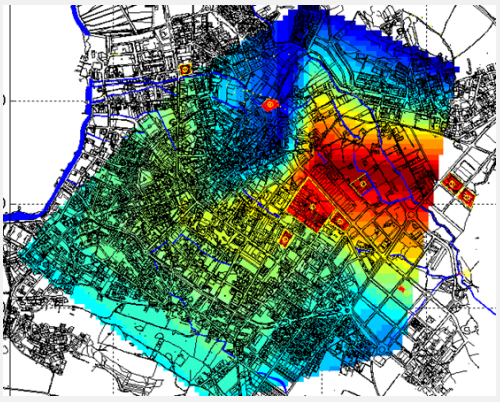
SDG indicator 3.9.1 https://unstats.un.org/sdgs/metadata/files/Metadata-03-09-01.pdf
SDG indicator 11.6.2. https://unstats.un.org/sdgs/metadata/files/Metadata-11-06-02.pdf



Generic PM10 data collection in Valladolid.



GIS analysis of air quality in a model city.