CIVITAS
Sustainable and smart mobility for all
2030

CIVITAS indicators

Modelled transport pollutant emissions (ENV_PL_PE1)

DOMAIN

Transport	**Environment**	Energy	Society	Economy

TOPIC	**Pollution**	
IMPACT	**Transport pollutant emissions** *Reducing the pollutant emissions of urban mobility*	**ENV_PL**

Category

Key indicator	Supplementary indicator	State indicator

CONTEXT AND RELEVANCE

Transport activity is a major contributor to pollution, significantly impacting air quality, human health, and climate change. A substantial portion of transport activity takes place in urban areas, where high population density and concentrated economic activity lead to high travel demand. The reliance on motorized vehicles powered by fossil fuels exacerbates pollution levels by emitting particulate matter, nitrogen oxides and volatile organic compounds. These emissions contribute to respiratory diseases and environmental degradation. By addressing urban transport emissions, cities can enhance air quality, reduce carbon footprints, and create healthier, more sustainable environments for residents.

This indicator is an estimation of the amount of urban mobility pollutant emissions. **It is a relevant indicator when the policy action is aimed at reducing the impact of urban mobility and transport on the urban air quality. A successful action is reflected in a LOWER value of the indicator.**

DESCRIPTION

The indicator is not a single number but **a vector** of the quantity of emissions, expressed in **tonnes/year**, for three pollutants: **Particulate Matter (PM), Nitrogen Oxides (NOx), Volatile Organic Compounds (VOC)**.

METHOD OF CALCULATION AND INPUTS

Even if values should be directly extracted from an urban transport model, there is anyway some steps to be managed in order to ensure that the indicator makes reference to a conventional period of one year. **If a city transport model exists** and provides an estimation of the pollutant emissions by all relevant modes of transport, this method has very limited complexity. Furthermore, assuming that the model is reliable, results have a good level of significance. However, **if an urban model does not exist**, its complexity becomes high because building an urban transport model is not straightforward.

The calculation method is explained below. **The indicator should be computed exogenously and then coded in the supporting tool**.

Method 1	
Pollutant emissions drawn from an urban transport model	Significance: **0.75** 

INPUTS

The following information is needed to compute the indicator:

a) **The volume of transport emissions of PM, NOx and VOC** in the period covered by the urban transport model.

Urban transport models can refer to different periods e.g., one peak hour, two peak hours, one peak and one off-peak hour, an average day and so on. Whatever is the

period, the emissions provided by the model are the input required, which need to be translated in an annual value (see Method of Calculation). If the model already provides annual emissions, this information is already the indicator.

The experiment would result in a modification of the amount of emissions estimated by the model.

METHOD OF CALCULATION

The indicator should be computed **exogenously** according to the following steps:

- **Identification of the period covered by the transport model** (e.g., one peak hour, two peak hours, whole day, etc.)**.**
- **Identification of the share of daily of traffic covered by the transport model.** The share of traffic covered by the transport model depends on the modelled period and on the distribution of transport activity in the 24 hours. This distribution is different in different contexts. If a transport model exists, this parameter is usually known. If not, 10% is a reasonable value for a morning peak hour.
- **Definition of the factor to extrapolate from day to year.** Most of the models refer to an average working day. If so, this term depends on the number of working days per year. Again, if a model exists, this parameter is usually known. If not, 270 working days/year can be considered.
- **Calculation of the extrapolation factor**. The extrapolation factor should be the product of two terms above (see the following equations).
- **Application of the extrapolation factor and estimation of the indicator** (see the following equations).

EQUATIONS

The extrapolation factor should be computed as:

$$\boldsymbol{ExtpFact} = \frac{\mathbf{1}}{\boldsymbol{DayModShr}} * \boldsymbol{DaytoYear}$$

Where:

$DayModShr$ = share of daily of traffic covered by the transport model

$DaytoYear$ = Factor to extrapolate from day to year

Example, if the model covers two hours and $DayModShr$ = 16% of daily traffic, and 270 working days ($DaytoYear$) are considered, the extrapolation factor is:

$$ExtpFact = \frac{1}{0.16} * 270 = 1687$$

The value of the indicator is then computed as:

$$^{p}\boldsymbol{ModPollEmis} = {}^{p}\boldsymbol{PollEm} * \boldsymbol{ExtpFact}$$

Where:

$^{p}PollEm$ = Emissions of pollutant *p*, related to the modelled period, extracted from the model (**tonnes**).

NORMALISED VARIATION INDEX

This indicator is made of several values. In order to derive the contribution of this indicator to the overall change induced on the domain “Enviroment”, an **“average”** value is required. The average, **computed within the supporting tool without the need for any input**, consists of a weighted average according to the following equation.

$$AvPollEmiss = \sum_{e} \left({}^{p}ModPollEmis * {}^{p}PollEmisWght \right)$$

Where:

$^{p}PollEmisWght$ = weight associated to emissions of pollutant *p*

These weights are pre-defined as follows:

PM: $^{p}PollEmisWght = 0.5$

NOx: $^{p}PollEmisWght = 0.3$

VOC: $^{p}PollEmisWght = 0.2$

A successful experiment corresponds to a lower value of this average.

A “normalised variation index” can be used to compute the summary impact of the pilot in the domain “Environment”. For this purpose, it is required that the value index becomes larger as the pilot is successful. The index respecting this requirement is obtained **within the supporting tool without the need for any input** as:

$$NMIPollEmiss = \left(2 - \frac{AvPollEmiss[AE]}{AvPollEmiss[BAU]} \right) * 100$$

Where:

$AvPollEmiss[AE]$ = Value of the average emissions in the After-experiment condition

$AvPollEmiss[BAU]$ = Value of the average emissions in the BAU condition

ALTERNATIVE INDICATORS

If a transport model is not available, an alternative indicator is **ENV_PL_PE2**, which is based on energy demand. This alternative indicator is of limited complexity (provided that energy demand is known) and its significance depends on the source of energy demand.

This indicator refers to pollutant emissions in a certain period. Even if emissions affect the air quality, which is however better measured by the concentration of pollutants. The same amount of emissions can result in different concentrations depending on several conditions such as weather (e.g., given a certain level of emissions, air quality will be better in a windy context). The indicator **ENV_PL_AQ2** refers to the air quality and can be used in alternative to this indicator. The disadvantage of the alternative indicator is that observed concentrations used for its computation is not necessarily available in all pilot areas and, even when available, they can make reference to a limited number of spots only. Furthermore, given that concentrations are affected by the weather, assessing whether a modification of the alternative indicator depends on the pilot or not can be impossible.