CIVITAS
Sustainable and smart mobility for all
2030

# CIVITAS indicators

## Estimated transport pollutant emissions (ENV_PL_PE2)

### DOMAIN

| Transport | **Environment** | Energy | Society | Economy |
|---|---|---|---|---|

| | | |
|---|---|---|
| **TOPIC** | **Pollution** | |
| **IMPACT** | **Transport pollutant emissions**<br>*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

The method for the calculation of the indicator is estimating pollutant emissions building on energy use for urban transport activity. The energy use should be available by fuel type. Energy use by fuel type can be obtained from different sources. One option is collecting energy supplied at refuelling stations and energy operators (see factsheet related to the indicator ENG_EF_ED1). Another option (see factsheet related to the indicator ENG_EF_ED2) is extracting energy consumption from an urban transport model, if there is a city transport model providing energy consumption by fuel type (but not pollutant emissions, otherwise the first method can be applied). A third option is estimating energy used building on vehicle fleets, mileage and use factors (see factsheet related to the indicator ENG_EF_ED3).

If energy demand is known from one source or another, the calculation of this indicator is straightforward (furthermore, **the calculation is managed endogenously within the supporting tool**). If energy demand is unknown, the calculation of this indicator implies that one of the energy indicators mentioned above is computed. The significance level of this indicator of estimated emissions largely depends on the significance level of the indicator of energy demand.

The estimation process is explained below.

| Method 1 | |
|---|---|
| **Pollutant emissions estimated from energy consumption by fuel type** | Significance: **0.50**  |

## METHOD OF CALCULATION

The indicator is computed **within the supporting tool** according to the following steps:

- **Estimation of the pollutant emissions by mode of transport** (see equation below)

## INPUTS

**The following information is needed** to compute the indicator:

a) **The amount of energy used in a given period** for each relevant fuel type. The fuel types to be considered are the followings:
   - **Gasoline**
   - **Diesel**
   - **LPG**
   - **CNG**
   - **Electricity**

   **If some of these fuel types are not relevant in the experiment area, they can be excluded**.

b) **The emission factors** of each fuel type. This element consists of a predefined set of values based on chemical characteristics of the fuels and on technical characteristics of the vehicles. The following average values are used:

| | *PM* | *NOx* | *VOC* | *Unit* |
|---|---|---|---|---|
| Gasoline | 0.063 | 6.517 | 0.294 | g/l |
| Diesel | 0.737 | 9.522 | 0.476 | g/l |
| LPG | 0.022 | 0.078 | 0.118 | g/l |
| CNG | 0.027 | 0.088 | 0.000 | g/kg |
| Electricity | 0.006 | 0.000 | 0.000 | g/kWh |

The experiment would result in a modification of the amount of energy used. The emission factor of each fuel is fixed.

## EQUATIONS

The pollutant emissions are obtained by simply applying the average emissions factors to the total value of energy by fuel type:

$$^{p}\boldsymbol{EstPollEmiss} = \sum_{e} \left( \boldsymbol{EngDem}^{e} * {}^{p}\boldsymbol{EmissFact}^{e} \right)$$

Where:

$EngDem^{e}$ = energy demand of fuel type *e*

$^{p}EmissFact^{e}$ = average emission factor for pollutant *p* of fuel type *e*

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.

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

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 an urban transport model estimating pollutant emissions is available, an alternative indicator is **ENV_PL_PE1**, which is based on modelled emissions. This alternative indicator is of limited complexity (provided that a transport model exists) and provide results with a good level of significance.

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.