CIVITAS
Sustainable and smart mobility for all
2030

CIVITAS indicators

Non-fossil energy demand index (ENG_DC_FC2)

DOMAIN

Transport	Environment	**Energy**	Society	Economy

TOPIC	**Decarbonization**	
IMPACT	**Non-fossil energy demand in transport** *Increasing the share of non-fossil energy in the transport sector*	**ENG_DC**

Category

Key indicator	Supplementary indicator	State indicator

CONTEXT AND RELEVANCE

Transport activity is a source of pollution and greenhouse gas emissions. Emissions are a consequence of energy use, and their volume depends on two main elements: the amount of energy used, and the sources of the energy used. Improving the sustainability of urban transport implies that either the amount of energy used is reduced or that the role of renewable energy is increased, or both. This indicator focuses on the latter approach.

This indicator is an estimation of the non-fossil fuel energy demanded for transport. **It is a relevant indicator when the policy action is aimed at increasing the amount of renewable energy used for transport. A successful action is reflected in a LOWER value of the indicator.**

DESCRIPTION

The indicator is a set of values providing the amount of energy used yearly in the experiment area for each non-fossil fuel type. Therefore, the indicator is **multidimensional**, made of **several values**.

The indicator is expressed in **various units of measurement**, depending on the fuel type:

- Biodiesel, Bioethanol: 1000 litres
- Biomethane, Hydrogen: 1000 kilograms
- Electricity: 1000 Kwh

Not all the fuel types are necessarily included in the indicator; if some fuel type is not relevant in the experiment context, it can be skipped.

METHOD OF CALCULATION AND INPUTS

This indicator relies on non-fossil fuels demands extracted from an urban transport model. **If a city already has a transport model** that accounts for energy demand across all relevant modes and fuel types, the calculation of the indicator is relatively straightforward. However, **if no such model exists**, the complexity increases significantly, as developing an urban transport model from scratch is a complex and resource-intensive task.

This section describes some steps to be taken ensure that the indicator reflects a standardized one-year period. **The indicator should be computed exogenously and then coded in the supporting tool**.

Method 1

Energy demand drawn from an urban transport model	Significance: **0.50** 

INPUTS

The following information is needed to compute the indicator:

a) **The modelled volume of non-fossil energy demanded for transportation in the pilot area.** This should cover the timeframe modelled by the urban transport model and refer to the following non-fossil fuel types:
   - **Biodiesel**
   - **Bioethanol**
   - **Biomethane**

- **Hydrogen**
- **Electricity**

If some of these fuel types are not relevant in the pilot area they may be excluded from the indicator and from the data collection. If the transport model does not provide energy demand for some of the fuels type above, the coverage of the indicator will be incomplete.

Urban transport models may cover various timeframes, e.g., one peak hour, two peak hours, one peak and one off-peak hour, or an average day. Regardless of the period covered, the modelled energy demand by fuel type serves as the input for this indicator and must be scaled to annual values (see *Method of Calculation*). If the model already provides annual energy demands, no scaling is necessary.

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:

$$\boldsymbol{RnwEngDem^e = ModRnwEngDem^e * ExtpFact}$$

Where:

$ModRnwEngDem^e$ = Energy demand for non-fossil fuel type *e* related to the modelled period, extracted from the model.

NORMALISED VARIATION INDEX

This indicator consists of the energy demand values per non-fossil fuel type. To assess the contribution of this indicator to the overall change induced on the domain "Energy", the **total non-fossil energy demand** is calculated and **expressed in tonnes of oil equivalent** (toe). This total is **computed by the supporting tool automatically**, using the following equation:

$$TotRnwEngDem = \sum_e (RnwEngDem^e * ConvFact^e)$$

Where:

$RnwEngDem^e$ = Yearly energy demand of **non-fossil fuel type** *e*.

$ConvFact^e$ = Conversion factor from the native unit to toe for non-fossil fuel type *e*.

A successful experiment corresponds to a higher value of this total energy demand.

A **Normalised Variation Index** (NMI) can be used to compute the summary impact of the pilot in the domain "Energy". For this purpose, it is required that the value index becomes larger as the pilot is successful. The index is **automatically obtained within the supporting tool** without the need for any additional input as:

$$NMIRnwEngDem = \left(\frac{RnwEngDem[AE]}{RnwEngDem[BAU]}\right) * 100$$

Where:

$RnwEngDem[AE]$ = Value of the renewable energy demand in the After-experiment condition

$RnwEngDem[BAU]$ = Value of the renewable energy demand in the BAU condition

ALTERNATIVE INDICATORS

This indicator deals with the demand of renewable energy for transport activity in the pilot area. It is a **modelled** indicator, rather than an observed measure, but in principle it includes the whole demand, including energy used for recharging electric vehicles at home, which is currently a significant share of total energy used for recharging electric vehicles.

An alternative indicator is **ENG_DC_FC1**, which is an **estimated** measure building on exogenous parameters and on modelled transport activity. **This alternative indicator can be employed if the transport model of the experiment area does not account for energy consumption.** Otherwise,

the indicator described in this factsheet should be preferred, as it is equally significant while being simpler to compute, as it requires less steps and inputs.

Alternative indicator **ENG_DC_FC3** is based on **observed** energy supply at public charging stations and hydrogen or biomethane fuel stations, rather than on modelled demand. However, its significance is nonetheless limited, as it does not account for energy used to charge electric vehicles at home, and fuelling or charging within the experiment area does not necessarily imply that transport activity takes place there. It should also be noted that the effort required to compute the indicator is larger compared to extracting information from an urban transport model, when one exists, as it requires requesting and collecting information from charging stations providers and fuel stations operators.

To assess **total fuel** demand (i.e., fossil and non-fossil fuels), indicators **ENG_EF_ED1, ENG_EF_ED2** and **ENG_EF_ED3** can be used. These indicators allow to evaluate measures that aim to decrease energy use by the transport sector in the experiment area.