CIVITAS
Sustainable and smart mobility for all
2030

CIVITAS indicators

Modelled energy demand (ENG_EF_ED2)

DOMAIN

Transport	Environment	**Energy**	Society	Economy

TOPIC	**Energy efficiency**	
IMPACT	**Transport energy demand** *Reducing the energy demanded for mobility*	**ENG_EF**

Category

Key indicator	Supplementary indicator	State indicator

CONTEXT AND RELEVANCE

Transport activity is a source of polluting and greenhouse gas emissions. Emissions are a consequence of energy use. Therefore, 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 is an estimation of the energy demanded for transport. **It is a relevant indicator when the policy action is aimed at reducing the amount of energy used for mobility and transport. A successful action is reflected in a <u>LOWER</u> value of the indicator.**

DESCRIPTION

The indicator is the set of values providing the amount of energy in the experiment city for each 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:

- Gasoline, Diesel, Biodiesel, Bioethanol: 1000 litres
- LPG, CNG, 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

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 energy demanded by all relevant modes of transport for all relevant fuel types, 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	
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 energy demanded in the pilot area** in the period covered by the urban transport model for the following fuel types:
   - **Gasoline**
   - **Diesel**
   - **Biodiesel**

- **Bioethanol**
- **LPG**
- **CNG**
- **Biomethane**
- **Hydrogen**
- **Electricity**

If some of these fuel types are not relevant in the pilot area they are 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 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 energy demand provided by the model is the input required, which need to be translated in an annual value (see Method of Calculation). If the model already provides annual demand, this information is already the indicator.

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:

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

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:

$$\boldsymbol{ModEngDem^e = EngDem^e * ExtpFact}$$

Where:

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

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 "Energy", an **"average"** value is required. The average, **computed within the supporting tool without the need for any input**, consists of total amount of energy supplied expressed in terms of tonnes of oil equivalent (toe), according to the following equation.

$$TotEngDem = \sum_e (EngDem^e * ConvFact^e)$$

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 "Energy". 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:

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

Where:

$TotEngDem[AE]$ = Value of the total energy demand in the After-experiment condition

$TotEngDem[BAU]$ = Value of the total energy demand in the BAU condition

ALTERNATIVE INDICATORS

This indicator deals with the demand of 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_EF_ED1, which is an estimated measure building on exogenous parameters and on transport activity which can be modelled or, again, estimated on parameters. In the latter case, this alternative indicator is less significant, while in the former case, it has the same significant of the indicator described in this factsheet, but its computation is slightly more complex.

The alternative indicator ENG_EF_ED3 is based on observed energy supply rather than on modelled demand. At the same time, even observed supply is probably estimated (as collecting data from all refuelling stations along the whole pilot period is probably unfeasible) and it does not cover energy used for recharging electric vehicles at home. The effort required to compute the indicator is larger (compared to a context where an urban transport model exists).