

**Definition:**

*Embodied Energy*  
*Pesticides*

**Description**

**Benefit:** Energy content can be used for an integrated evaluation of crops. Generally, the type of energy should be specified to distinguish between use as fuel or use as food and feed. For use as animal feed, further definitions are required to determine if lignocellulosic crops qualify. Crops with high per hectare yield will show high efficiencies in this impact area.

**Resource:** Pesticide application negatively affects biodiversity and is partly responsible for the continuing biodiversity decline of Europe's agricultural landscapes. For this reason, it conflicts with policy targets such as those included in the EU 2020 biodiversity strategy and can therefore be considered a stressed resource.

Production processes that provide the same benefits with lower use of pesticides are more efficient. For this indicator, the total amount of pesticides brought into the system should be considered, irrelevant of whether pesticides are applied externally, or produced by genetically modified plants themselves, as in the case of BT-maize.

**Correlation with soil management**

[58] Pesticide use efficiency was highest for sugarcane, sweet sorghum and oil palm

**Strength & weaknesses pertaining to measurement of this impact area**

**Embodied Energy:** Indicators for embodied energy are generally easy to measure and allow integration of or comparison between benefits from very different crops. However, their information value for questions of nutrition is limited because the provision of amino-acids and vitamins is not considered.

**Pesticides:** A weakness of this indicator is that the quantity of pesticides applied is insufficient to determine the associated environment problems. Effects on biodiversity will strongly depend on site characteristics and pesticide specific properties.

**Can be measured as:**










**Embodied Energy:**

- nutritional value (humans) [J]
- nutritional value (non-grazing livestock) [J]
- nutritional value (grazing livestock) [J]
- heating value [J]


**Pesticides:**

- total pesticide application [kg]
- total application of a specific pesticide (e.g. glyphosate) [kg]

**Sample Indicators**

Indicator values from		Survey	
Experiment or direct measurement		Statistical- or census data	
Expert assessment		Literature values	
Model		Maps or GIS	
Stakeholder participation		Not provided	

*Table 1: No Scale*

Indicator	Unit	Indicator values from
[58] Pesticide use efficiency (Net energy yield (Energy content of biofuel and its coproducts – energy used for production, transportation and conversion)/Pesticide input)	GJ * kg <sup>-1</sup>	

**References**

ID	Citation	<sup>1</sup> Soil type/ texture
58	de Vries, S. C., et al. (2010). "Resource use efficiency and environmental performance of nine major biofuel crops, processed by first-generation conversion techniques." <i>Biomass and Bioenergy</i> <b>34</b> (5): 588-601.	n/a

<sup>1</sup>Soil type/ texture: If provided, what are type and texture of the soils studied in the paper?