Definition:

$$\frac{Embodied\ Energy}{Nitrogen\ fertilizer}$$

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: Nitrogen fertilizer is considered a stressed resource for several reasons. While the supply of nitrogen is effectively unlimited, its production is highly energy intensive and its application results in emissions of ammonium and nitrous oxide, creating a conflict between nitrogen fertilizer application and climate change mitigation targets.
Depending on the application rate and type of nitrogen fertilizer (in combination with site specific conditions), diffuse pollution and contamination of water resources is also relevant. Diffuse nitrogen pollution may also strongly affect nutrient poor natural ecosystems and alter species composition.
Finally, fertilizer application is a relevant factor in farmers‘ cost calculations.

Correlation with soil management

[45] Precision farming (applying nutrients and pesticides match temporally and spatially crop requirements) increases fertilizer use efficiency. Locating food production in areas with the suitable climate and soil conditions for a crop can increase agricultural input efficiency (the amount of food produced per input of fertilizer or feed)
[58] Soybean performed well on nitrogen use efficiency (ability to fix nitrogen)

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.

Can be measured as:

Embodied Energy:

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

- heating value [J]

Nitrogen fertilizer:

- total nitrogen fertilizer application [kg N]

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] Nitrogen use efficiency (Net energy yield (Energy content of biofuel and its coproducts – energy used for production, transportation and conversion)/Nitrogen input)	GJ * kg^{-1}	

Table 2: Farm Scale

Indicator	**Unit**	**Indicator values from**
[45] Nitrogen use efficiency (Digestable calories in grain yield/Nitrogen fertilizer)	Kcal * g^{-1}	

References

ID	Citation	[1]Soil type/ texture
45*	Clark, M. and D. Tilman (2017). "Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice." Environmental Research Letters **12**(6).	n/a
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." Biomass and Bioenergy **34**(5): 588-601.	n/a

[1]**Soil type/ texture:** If provided, what are type and texture of the soils studied in the paper?

*The resource use efficiency discussed on this factsheet is not a focus of the cited paper