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Life Cycle Assessment applied to energy biomasses : The example of Lin 2000 boiler supply

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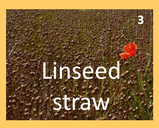
Context and method

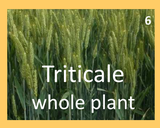
Boiler characteristics:

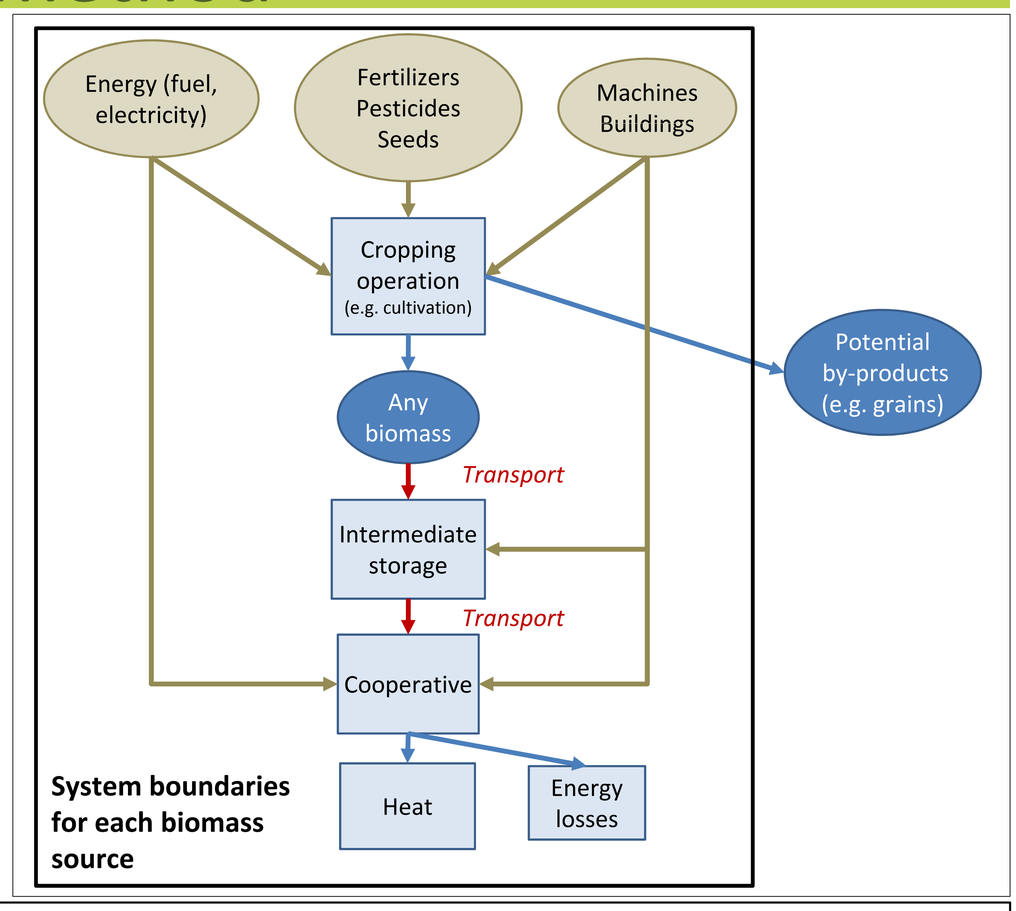
- Power: 10 000 MWh
- Heating period :12 months a year
- 2 supply chains : balls + bulk
- Biomass moisture: 10 to 20 % (optimum 15%)
- Reference biomass: flax shives = by-products of flax scutching

Lin 2000 Boiler

Comparison of environmental impacts flax shives ***vs*** other biomass sources







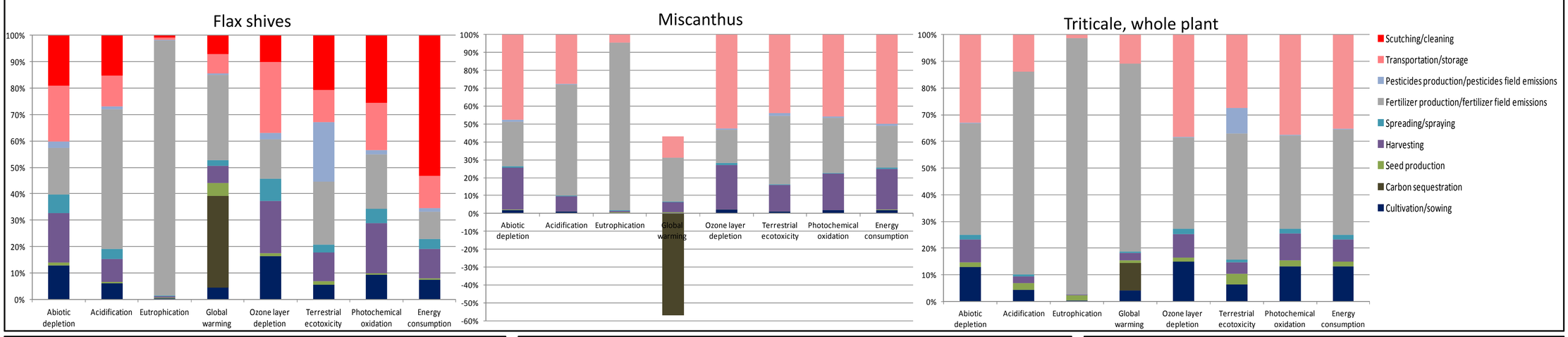
- Functional unit= **10 000 MWh** of biomass
- Economic allocation
- Data for fuel production and fuel consumption: adapted from EcoInvent database and Gest'im (2010)
- Charicterisation method used: CML 2000, Cumulative Energy Demand and Uses-LCA 2.0

Methods used for field emission estimations:

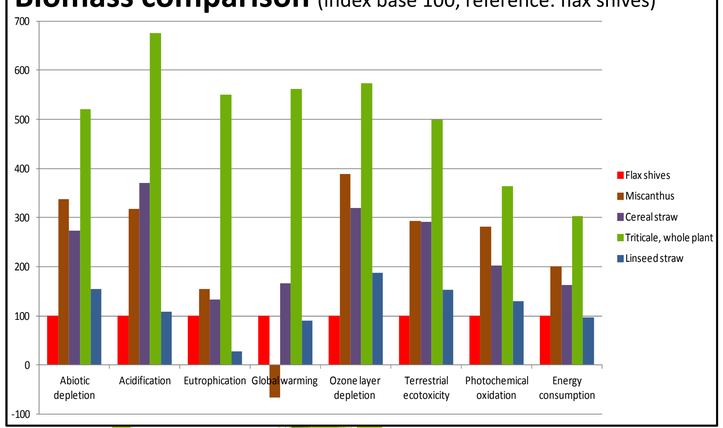
	Methods	Sources
Nitrogen emissions (NO_3^-, N_2O, NH_3, NO_x)	Emission coefficients + N balance	BioIS-ADEME, 2010 and IFEU, 2000; Laville et al., 2005; Gest'im ,2010
Phosphorus emissions	Emission coefficients + USL Equation (erosion)	Nemecek, 2007; Wischmeier and Smith, 1960, 1978 for erosion calculation
Pesticides emissions	Pest-LCI and Uses-LCA models	Birkved, 2006; van Zelm et al., 2009
Carbon sequestration	AMG model	Saffih-Hdadi and Mary, 2008

Results

Contribution analysis



Biomass comparison (index base 100, reference: flax shives)



Conclusion:

- Fertilization and transport contribute the highest share of impacts
- Flax shives and linseed straw have the lowest impacts except for global warming
- Flax shives and linseed straw have the highest energy yields
- Relevance to integrate local data and especially for soil carbon sequestration
- Miscanthus has the lowest global warming impact

Net energy yield comparison

Biomass sources	Net energy yield ($MWh_{produced}$/ $MWh_{consumed}$)
Triticale as whole plant	8.5
Miscanthus	12.8
Cereal straws	15.7
Flax shives	25.6
Linseed straw	26.5

Net energy yield: Ratio of the energy produced by the boiler ($MWh_{produced}$) to the renewable and non-renewable energy consumed during the production and logistics steps ($MWh_{consumed}$).

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