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ABLATIVE FAST PYROLYSIS – POTENTIAL FOR COST-EFFECTIVE CONVERSION OF AGRICULTURAL RESIDUES

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CONVENTIONAL STRAW RECOVERY

A major parameter for the profitability of biomass pyrolysis plants is the costs of the feedstock used in the process. Economic studies have proven, that costs for the logistic chain play a dominant role within the feedstock costs for e.g. agricultural crop residues (like straw). For straw as feedstock, the logistic costs consist of baling, loading and machinery, transporcostt and storage (see Fig. 1). Compared to the costs for straw on the field (€ 19.80/t) the logistic costs account for € 69.40/t (350 % of the costs of straw in field, see Fig.2).

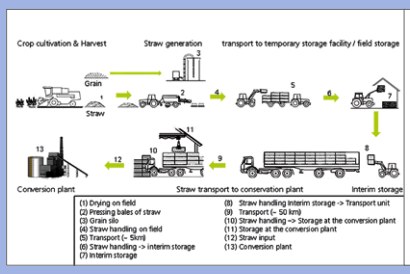

Fig. 1: logistic chain for straw recovery

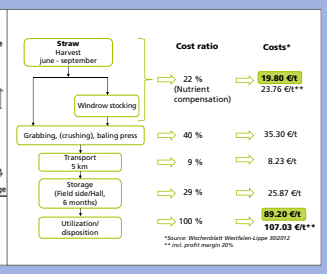

Fig. 2: straw recovery cost distribution

ALTERNATIVE PROCESS

Avoiding these logistic costs will lead to a far more economic biomass pyrolysis process. In order to reach this aim, a mobile biomass pyrolysis plant, operating on – or at least alongside – the agricultural fields, will be developed within the "Fraunhofer Innovation Cluster Bioenergy". The concept, developed together with the industrial partner Claas Group, a manufacturer for agricultural machinery, consists of energy autonomous on site fast pyrolysis, using the pyrolysis gases as a process heat resource. The by-product biochar, containing all the minerals of the former plants, is meant to be recycled on field as fertilizer generating a so called terra preta (see fig. 3).

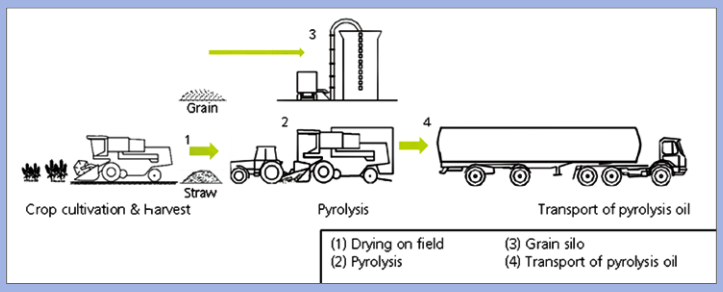

Fig. 3: logistic chain for mobile pyrolysis

ECONOMIC RESULTS

The economic evaluation for the concept of mobile pyrolysis leads – under boundary conditions given in the paper – to production costs of € 104.71/t pyrolysis oil (see Table I). To increase profitability, the utilization of additional feedstock is assessed. If miscanthus is used, the oil production costs are 41 % higher than for straw, although only additional costs are calculated. This relates to the high biomass price. Alternatively, the use of cheap grassland cuttings give a price 47 % lower. Combined costing for the three biomass feedstock results in a production price for pyrolysis oil of € 103/t (see Fig. 4).

TABLE I: COST STRUCTURE OF MOBILE PYROLYSIS OIL PRODUCTION

COST CATEGORIES	[€/t]
Capital costs Θ_{Ca}	23.96
Feedstock costs Θ_{F}	39.60
other consumption-related costs Θ_{Co}	34.93
operation-related costs Θ_{Op}	4.73
other costs Θ_{O}	1.49
Production costs Θ_{P}	104.71

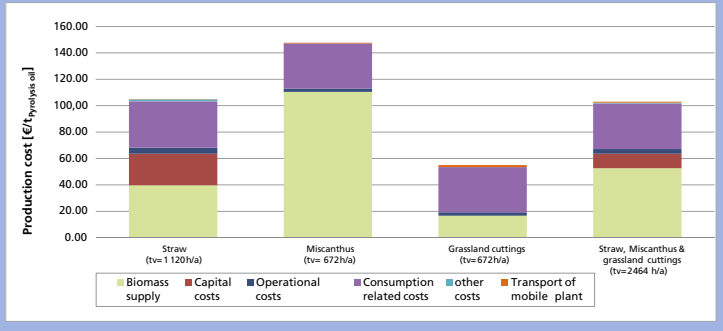

Fig.4 : share of cost components for different biomass feedstock

bioenergy

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