Information System Better-iS

ZALF - Output

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Title

ZALF Better-iS Master thesis result: A Multifunctional Platform (MFP) in the village of Laela, Rukwa Region, Tanzania, using sunflower oil as diesel substitute. An economic analysis of centralisedprocessing of sunflower seeds after harvesting

Problem and Objective

Only 14.3 % of the rural population in Sub-Saharan Africa have access to electricity. They use therefore traditional or low tech energy sources, such as firewood and charcoal although such forms of energy are associated with a variety of health and social problems.
Electrification through biofuels, if cultivated locally and sustainably, can provide electricity at lower up-front and running costs. Additionally, income for small farmers would be generated if the required oilseeds are produced on a small share of the available agricultural land. Biofuels have a broad field of application and can for example be used as domestic fuel for cooking or lighting or for the use in a diesel engine to produce electricity.
The Multifunctional Platform (MFP) is a low-cost technology to provide rural energy services potentially through the use of locally produced biofuels. It consists of a diesel engine to which a variety of end-use equipment can be added (grain mills, oil presses, generator to power a mini-grid or a battery charger, etc.). The technology is comparably simple and can relatively easily be installed and maintained even in remote areas in developing countries.
In Laela, a village in Rukwa region (Western Tanzania), lack of energy and especially of electricity is perceived as most relevant socio-economic problem. An MFP has been unsucessfully been installed in Laela in November 2009 by the Tanzanian NGO TaTEDO. The Master thesis aims at analysing the

economic performance of the MFP using sunflower oil as diesel substitute. The oil is produced locally with seeds from Laela processed after harvesting. Three seed-price scenarios are evaluated:

1) Low price = 170 TZS/kg;
2) Break even price = 330 TZS/kg;
3) High price = 833 TZS/kg.

Method

The Master thesis theoretically analyses the MFPs economic performance using sunflower oil as diesel substitute. The oil is produced locally with seeds from Laela processed after harvesting. Three seed-price scenarios are evaluated:

1) Low price = 170 TZS/kg;
2) Break even price = 330 TZS/kg;
3) High price = 833 TZS/kg.

Because weighting balances are neither widely available nor trusted by the farmers in rural areas, it is difficult to evaluate the price of one kg seeds. The weight of one bag of sunflower seeds may fluctuate between about 48 kg and about 60 kg and, in 2010, the price of one bag in Laela was ranging between TZS 10 000 and TZS 40 000. Consequently, it will be assumed that, in 2010, in Laela, the price of sunflower seeds varied between TZS 170 and TZS 833 for one kg seeds.

This price depends on the quantity of seeds on the market. Immediately after the harvest, the amount of sunflower in Laela is maximal and its price is therefore the lowest.

The price of one litre of fossil diesel in Laela was about TZS 1800 in 2010. One litre of fossil diesel corresponds to 1,1291 litres of sunflower oil (one litre of sunflower oil corresponds therefore to 0,8857 litre of fossil diesel).

The break even price (330 TZS/kg) of sunflower seeds is reached when the production costs of 1,13 litres of sunflower oil become competitive to the price of one litre of fossil diesel.

The daily wages in Laela range between TZS 1000 and TZS 3000 depending on labour demand (lower wages during the dry season than during the harvesting season).

The data used in this study were generated through semi-structured qualitative interviews with local stakeholders and a quantitative socio-economic household survey compiled in a three-week field visit in Laela, in November and December 2010.

Results

The economic analysis shows that sunflower oil production in Laela, when seeds are processed immediately after the harvest, would be competitive to current fossil diesel prices up to a purchase price of seeds of TZS 330 per kg. In the low price scenario (170 TZS/kg), production costs of the sunflower oil equivalent to one litre of fossil diesel amount to TZS 1150 which is highly competitive compared with the diesel price of TZS 1800 per litre.

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The seeds are the main spending, even when the seed price is the lowest. Seeds respectively represent 58,42 %, 73,17 % and 83,32 % of the global expense of seed-price scenarios “low price”, “break even price” and “high price”.

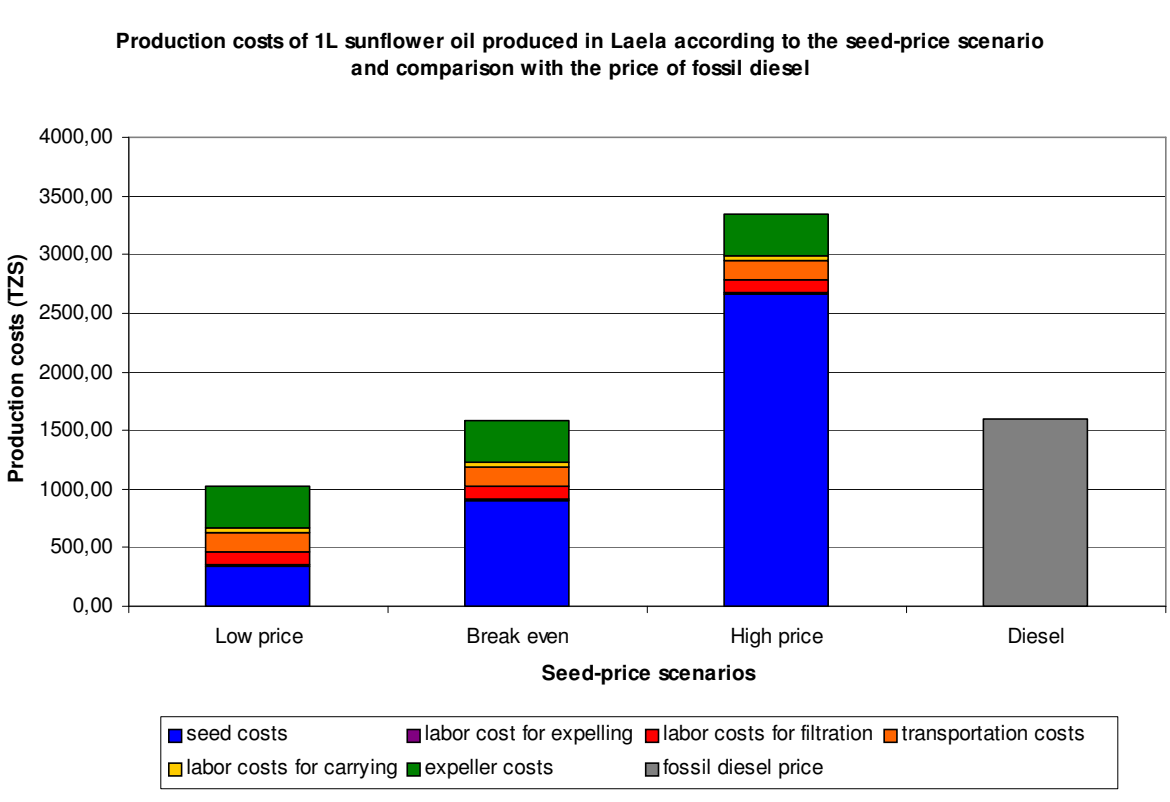
Lessons learnt

It is assumed that business opportunities for the production of sunflower oil in Laela to sell it on the local market or to export it to other markets currently do not exist because prices are not competitive with oil from Sumbawanga, the main city of the district. Processing costs in Laela are higher because the pressing machines are older, smaller and more inefficient compared to the electricity-powered expeller used in Sumbawanga. Thus, processing for local consumption is the only market available. Two sub-markets could be differentiated: A higher priced market for cooking sunflower oil and a potential lower priced market for oil to be used in diesel engines. As the former market is very limited, the only possibility of extending the market of producers of oil would be to sell it at a lower price making it competitive with diesel. This business case is profitable only if the end consumer of the diesel substitute would organize the value chain of sunflower seed processing to be able to source lower cost fuels or if the producer of seeds would process directly.

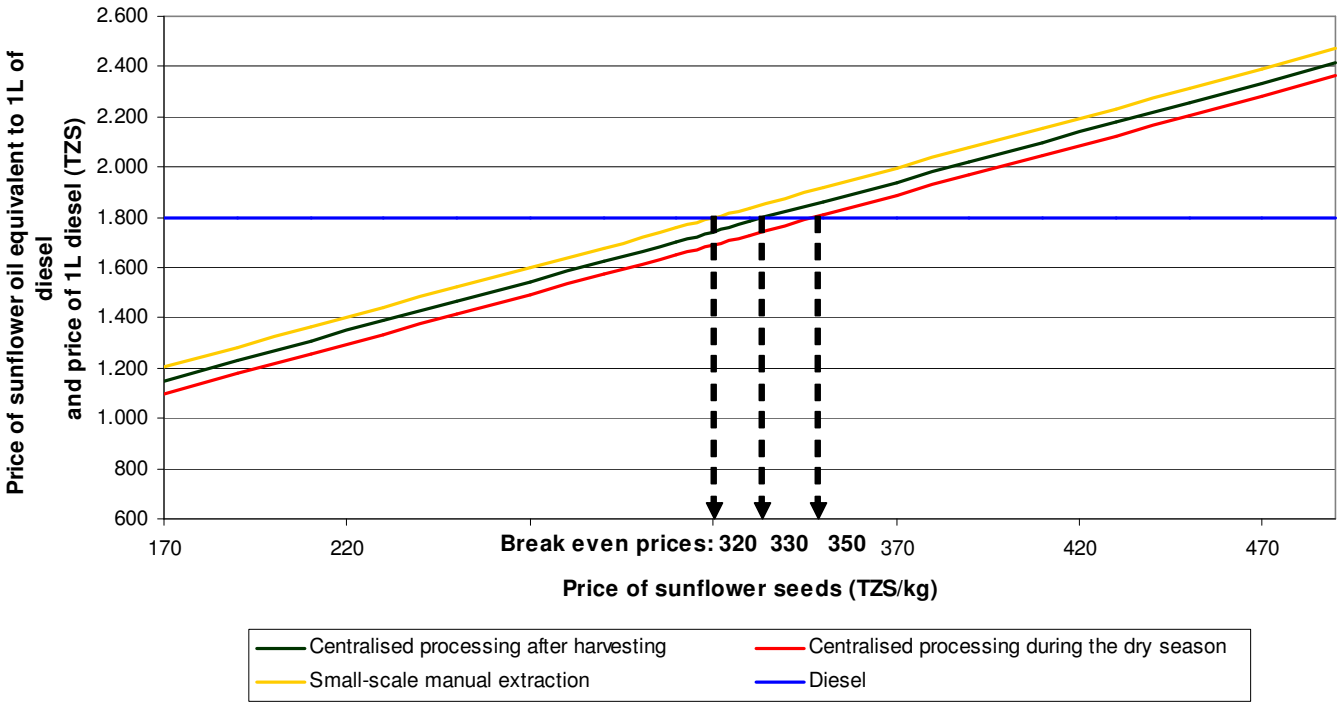
Documentation

Parameters / Price	Low price (170 TZS/kg)	Break even price (330 TZS/kg)	High price (833 TZS/kg)
Price of sunflower seeds (TZS/kg)	170,00	330,00	833,00
Oil extraction rate (kg/L)	3,50	3,50	3,50
seed costs (TZS)	**595,00**	**1155,00**	**2915,50**
Total expeller costs (TZS)	367,50	367,50	367,50
Total filtration costs (TZS)	105,00	105,00	105,00
Total transportation costs (TZS)	210,00	210,00	210,00
income from press cake (TZS)	-259,00	-259,00	-259,00
Production costs for 1L of crude sunflower oil (TZS)	**1018,50**	**1578,50**	**3339,00**
Volume of sunflower oil equivalent to one litre of diesel (L)	1,1291	1,1291	1,1291
Price of sunflower oil equivalent to 1L of diesel (TZS)	**1149,99**	**1782,28**	**3770,06**
Share of sunflower seeds in the total price (%)	**58,42**	**73,17**	**87,32**
Diesel price (TZS/L)	**1800,00**	**1800,00**	**1800,00**

Economic analysis of the production costs of sunflower oil produced after the harvest in Laela.



Prices of sunflower oil equivalent to 1L diesel according to the price of sunflower seeds, for the three different scenarios



Production costs of one litre of sunflower oil locally produced according to the seed-price scenario.
The income from the press cake (TZS 256 per litre of oil) has been deducted from the seed costs.

Policy Recommendations

- This business case is profitable only if end consumer of the diesel substitute (SME or MFP) could organize the value chain of sunflower seeds at low costs
- Producers of seeds together with producers of oil could extend their market if achieved lower production/processing price makes it competitive with diesel.

On behalf of Federal Ministry for Economic Cooperation and Development

Reference:

RORDORF, J. (2011) *Opportunities for a sustainable rural energy supply through renewable energies in developing countries. Socio-economic feasibility study of the operation of a multi-functional platform in the village of Laela, Tanzania on locally produced biofuels. Master thesis: Berlin School of Economics and Law, Institute of Management, 158 p.*

The chapters of the factsheet do provide an overview of the thesis. The whole document can be downloaded via this link:
http://www.better-is.com/files/Master_thesis_Rordorf.pdf

Additional detailed and comprehensive background information available at Better-iS homepage:
http://www.better-is.com/files/Hoffmann_etal_2012_Sunflower_as_horesepower_IFSA_conference_Aarhus.pdf

Participating institutions: International Food and Policy Research Institute (IFPRI), Leibniz-Centre for Agricultural Landscape Research (ZALF e.V.), World Agroforestry Centre ICRAF, SOKOINE University of Agriculture, Potsdam Institute for Climate Impact Research PIK, Institute for Environmental Economics and World Trade IUW, Wuppertal Institute for Climate, Environment and Energy, Waterboard, Association for Strengthening Agricultural Research in Eastern and Central Africa

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