Triggering the creation of biomass logistic centres by the agro-industry

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D5.2d
Summary report of start-up and commercial operation of Tschiggerl Agrar GmbH

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About SUCELLOG project

The SUCELLOG project - Triggering the creation of biomass logistic centres by the agro-industry - aims to widespread the participation of the agrarian sector in the sustainable supply of solid biofuels in Europe. SUCELLOG action focuses in an almost unexploited logistic concept: the implementation of agro-industry logistic centres in the agro-industry as a complement to their usual activity evidencing the large synergy existing between the agro-economy and the bio-economy. Further information about the project and the partners involved are available under www.SUCELLOG.eu.

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About this document

This report corresponds to a part of the deliverable D5.2 of the SUCELLOG project - Summary of the start-up and commercial operation of agro-industry logistic centres in Austria. It has been prepared by:

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1. Introduction

This report includes a description of the activities done by the agro-industrial company Tschiggerl Agrar GmbH supported by the SUCELLOG project to create an agro-industry logistic centre. After the development of a feasibility study and a business model by the project, this report shows the precise steps done during the start-up process. Starting with fuel tests and analysis, moving to the organisational changes, to marketing activities and finishing with the monitoring of the operation.

The aim of the project in this work package is to give the agro-industries support in those steps.

2. Company description

Tschiggerl Agrar GmbH is one of the most important companies in cereal harvest, treatment and trading in Styria, Austria. Furthermore the company is a logistic operator for straw. Additionally the company produces pellets for animal feeding and bedding. Mr. Harald Tschiggerl, the owner and manager, established the company in 2012. The company is located in the Southeast of Styria in Austria.

After the feasibility study performed showed the potential of a logistic centre (D4.3) and a business model (D4.4) was created by SUCELLOG project, the company has decided to start-up with this new business activity is to produce and sell:

- 750 t/yr of loose corn cobs;
- 2,200 t/yr of corn cobs grits;
- 1,500 t/yr of corn cobs pellets.

This report shows the steps done by Tschiggerl Agrar to start-up an agro-industry logistic centre. Furthermore it includes the necessary steps for the association “Heu and Pellets”, with is the owner of the pelletizing line, Tschiggerl Agrar uses to create corn cob pellets. Tschiggerl is a member of this association and their pelletizing facilities are in Tschiggerl Agrar GmbH site.

3. Primary tests

After a positive feasibility the first step in starting up a new logistic centre within an existing agro-industry is to make first production and combustion tests and the analysis of the produced fuel.

3.1. First production tests

During the feasibility study a technical assessment was conducted to see if the existing equipment of the agro-industry can handle agricultural residues. For the production of the planned agro-fuels (loose cobs, grits, corn cob pellets), the following equipment is available at Tschiggerl Agrar GmbH:

- chipper
- bed dryer
- pelletizing line (owned by association “Heu & Pellets”)

Although this existing machinery theoretically can be used for the production of agro-fuels it is absolutely necessary to make a real production test. Often it is quite difficult to adjust the machinery in way that agro-fuels of a good quality can be produced.

Tschiggerl Agrar decided together with the SUCELLOG project partner LK Stmk to make a test for the creation of corn cob pellets. For the production of loose corn cobs and corn cob grits no initial production test was performed. The reason for that is that loose corn cobs do not need a special treatment. They are just harvested, stored and sold. For the production of grits, chipping and drying of the corn cob is necessary. As Tschiggerl Agrar already produces grits as animal bedding they already know how to make them.

3.1.1. Goal of the production test

The goal of the first production test at Tschiggerl Agrar GmbH was to produce agro-pellets 100 % out of corn cobs. It was decided to make two different samples of pellets. The first sample will be produced without any additives. In the second sample water steam will be added during the pelletizing process. Each sample will be pelletized for one hour. Afterwards both samples will be analysed in terms of quality (moisture, durability and bulk density) and their suitability for selling them in the agro-fuel market.

3.1.2. Results

The first sample pelletized for one hour was with no additives and no water steam added in the pelletizing process.

The production rate of this first sample was a bit lower than expected. The bulk density was high and the share of fines really low. For measuring the fines the pelletizer has an integrated screener with a 2 millimetre sieve. The durability of the pellets looked good. They were hard and had a very good durability.

The second lot was also pelletized for one hour. In this case, there was water steam added in the pelletizing process.

With the addition of water steam to the pelletizing process the results were quite different. The water steam caused a slightly increased moisture content of the final product. Also the production rate increased slightly. But with the added water steam the durability of the pellets was not good anymore. They broke very easily and the amount of fines increased significantly.

Figure 1: Sample pellets with and without steam

Tschiggerl Agrar was satisfied with the first test. Especially the first sample looked really good. Those pellets of the first sample were used for the combustion test in the pellet boiler.

3.2. Combustion tests

3.2.1. Goal of the combustion tests

The Tschiggerl Agrar GmbH plans to produce and sell three different types of agro-fuels:

- corn cob pellets,
- corn cob grits,
- loose corn cobs.

In this first combustion tests each fuel will be tested in an existing boiler. The goal is to make a visual analysis of the working performance of the boilers with the agro-fuel, a measurement of emissions and an analysis of the ash. With these results, possible problems during the combustion in regular boilers normally fired with other kind of biomass should be detected. It is very important to identify possible problems before the start-up of logistic centre. Therefore the agro-industry could react on those possible problems.

3.2.2. Results

The corn cob pellets were tested in a moving grate wood pellets boiler of a farmer with a full load output of about 50 kW. Emissions were measured for CO, NOx and dust. All measured emissions were far below the national law for the use of standardized

biofuels. There was a steady combustion, but some slagging problems occurred. The majority of the ash was smaller than 3 mm.

The second test was also conducted with an underfeed screw burner wood pellet boiler. This boiler can, according to the manufacturer, handle agro-fuels. The fuel used for the test in this boiler was corn cob grits. The results of the emission measurement were ok. All measured emissions were within the national law for the use of standardized biofuels. Although the dust emissions were close to the limit. Furthermore the CO emissions were fluctuation because of the movement of the underfeed screw. The ash looked very homogenous and fine. No big ash fractions could be found. The majority was smaller the 3mm. Also no slagging problems occurred in the boiler.

The test with the loose corn cobs conducted with a moving chain wood chip boiler with a full load power of about 100 kW. The results of the emission measurement were good. All measured emissions were far below the national law for the use of standardized biofuels. The ash was quite homogenous and fine. Not as fine as the ash from the grits, but far better than the pellet ash. There were very little fractions with more than 8mm.

3.3. Agro-fuel analysis

During the start-up process and agro-fuel analysis was conducted by SUCELLOG partner RAGT to check the quality of the corn cob fuels.

Regarding thermochemical classification, all the samples agree with the EN ISO 17225-6A, except for the corn cobs pellets sample, which exceeds the maximum chlorine content with respect to the limit established. However, the chlorine content is in compliance with the EN ISO 17225-6B. Furthermore the chlorine content strongly depends on the kind of maize, the soil and the fertilization. Through a good management in the supply the chlorine content could be decreased.

With respect to the ash fusibility, corn cobs pellets present an ash deformation temperature lower than the recommended value in order to avoid slagging problems. This means a higher risk of maintenance and operation problems and the convenience of using a certain type of boiler technology (cooled or moving grate and automatic ash disposal).

Concerning physical analysis, corn cobs pellets do not satisfy the EN ISO 17225-6A yet because of the mechanical durability, but they are very close to the limit. This parameter could be optimized through the modification of the die compression rate.

4. Change in organisational structures

For the implementation of the logistic centre within the agro-industry of Tschiggerl Agrar it was necessary to adapt the organisational structures to the new business line. The key element at Tschiggerl Agrar was the merging of the production processes of the company and the association Heu & Pellets, which owns and operates the pelletizing line at the facility of Tschiggerl Agrar.

Especially for this pelletizing line a lot of adjustment and optimization steps were necessary to produce agro-pellets of high quality, as corn cobs were a new resource used for pellets. Furthermore new storage areas have been created and the structure of space has been optimized for both business lines, to ensure short ways during the production processes. Moreover, the existing personnel have been trained to the new business processes. Thanks to SUCELLOG project they also had a training course about quality of agro-fuels. Additionally one person was hired in part time to meet the additional labour force.

Thanks to the support of the project also a new partnership has been created between Tschiggerl Agrar and Alwera AG. Alwera has dry corn cobs available as a residue from their production process. Now both companies swap corn cobs. Tschiggerl gets the dry cobs. Therefore they save costs for drying. Alwera gets wet cobs, which they can use in their industrial boiler to cover their heat demand. The dry cobs were too dry for this boiler and caused a lot of problems. This cooperation is a win-win situation for both companies.

5. Marketing & sales

Tschiggerl Agrar plans to directly sell the products to his final customers from the logistic centre with no wholesalers used. At the biomass logistic centre the three agro-fuels (loose corn cobs, corn cob grits, corn cob pellets) are sold. The products can either be bought with or without any package. Therefore they are transported loose on a trailer. That is especially for bigger amounts suitable. Corn cob grits are mainly sold in big bags. Pellets for small scale demand can also be bought in 25 kg bags, but this option is currently rarely used. The prices for the three products are independent on the amount and are oriented on prices of competitor fuels, of competitor uses and of production costs.

In the field of marketing and communication the SUCELLOG project supports Tschiggerl Agrar in different actions to increase publicity. Business relationships with farmers from the regular business activity were intensified also in the new business line. Furthermore publicity was reached through articles in regional and national media. Moreover two homepages were created. One in cooperation with the association Heu & Pellets, where agro-fuels and animal feedstuff and bedding products were promoted. Another one, which provides information about corn cob fuels and there properties.

6. Summary and Conclusions

SUCELLOG project supported Tschiggerl Agrar agro-industry to become a logistic centre of biomass produced from agriculture resources with no current use in the area. At a first stage the project performed a study to determine the technical and economic feasibility (evaluating resources, market and production costs) and a business model to propose a business strategy for the new products. Since the results (to be consulted in D4.3 and D4.4) were attractive enough, the project supported the cooperative in a more practical way to become logistic centre by performing production and combustion tests. Support on marketing and sales were also activities provided by SUCELLOG project.

Thanks to the SUCELLOG project a biomass logistic centre for agro-fuels could be successfully implemented into the agro-industry Tschiggerl Agrar. The operation of the logistic centre started with 2016. According to the SUCELLOG concept, there is mainly existing infrastructure used at the logistic centre. Therefore the utilization of the company could be increased.

SUCELLOG especially supported the start-up process of the logistic centre through the organisation of production tests. In this test the settings for the pelletising process were optimized to produce corn cob pellets of high quality. This was necessary as corn cobs differ from other agrarian residues in the pelletising process. Through this optimisation it was possible to significantly reduce the fines of the pellets. Furthermore the durability could be increased. The agro-fuel analysis conducted by SUCELLOG project partner RAGT showed that corn cob fuels are agro-fuels of good quality according to the EN ISO 17225-6 standard. The durability does not meet the criteria of quality A yet, but this should be done through a further optimisation of the pelletising process. Furthermore the chlorine content is slightly too high for quality A pellets. Nevertheless the chlorine content strongly depends on the kind of maize, on the soil, the harvesting time and the used fertiliser. A good quality management in the supply of the raw material can further increase the quality of the final agro-fuels. Therefore it seems possible to produce quality A agro-pellets according to EN ISO 17225-6 with corn cobs.

On combustion tests all three kinds of corn cob fuels (loose, grits, pellets) were tested. Good results have been achieved in those tests. But in comparison to wooden fuels, the corn cobs have a lower deformation temperature, which causes more slagging problems. Therefore it is recommended to use boilers with a moving or cooled grate and an automatic ash removal system to reduce problems.

During the implementation of the biomass logistic centre within the agro-industry Tschiggerl Agrar it was necessary to adapt the organisational structures to the new business line. The key element at Tschiggerl Agrar was the merging of the production processes of the Tschiggerl and the association Heu & Pellets, which owns and operates the pelletizing line at the facility of Tschiggerl Agrar. Furthermore a new

person was hired for this new business line. The whole personnel (existing and new) were trained for the new business line. The SUCELLOG quality training was one important part of this training.

Another important step during the implementation of the logistic centre was the created cooperation between Tschiggerl Agrar and Alwera. This partnership is a win-win situation for both companies. The benefit for Tschiggerl Agrar was that the production costs for grits and corn cob pellets could be reduced significantly.

The monitoring of the first year of operation showed that the sold amounts are below the expected amounts. The reason for this in on the one hand, that the publicity of the logistic centre has to be increased. One the other hand, the use of corn cob fuels in private households in Styria is just since summer 2016 allowed. The SUCELLOG consortium strongly lobbied for the change of this law. There were meetings with members of the Styrian government, where advantages of using this current unused residues and the use of local fuels were explained. Those meetings had a strong influence on the change of the law. For 2017 Tschiggerl Agrar expects an increase in selling of agro-fuels in the logistic centre.