

SUCELLOG: IEE/13/638/SI2.675535

D5.2b

**Summary report of start-up and
commercial operation of Luzeal**

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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.

Project coordinator



Project partners



This report corresponds to a part of the deliverable D5.2 of the SUCELLOG project – Report on the start-up and commercial operation of agro-industry logistic centres in France. It has been coordinated by LK Stmk and prepared by:

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1. Introduction

This report includes a description of the activities done by the agro-industrial company LUZEAL supported by the SUCELLOG project to create an agro-industry logistic centre. After a preceding creation of a feasibility study and a business model by the project, this report shows the precise steps done during the start-up process: production test, fuel tests and combustion tests, organisational changes, 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

Luzéal-Saint Rémy was conceived recently from the fusion of two cooperatives (Alfaluz and Euro luz) and is currently the most important dehydration cooperative in France. Luzéal-Saint Rémy is working with more than 2,000 farmers in the region and more than 150 employees. The cooperative is located in Champagne-Ardenne, distributed in the entire region in five sites. The site involved in the SUCELLOG project is located in Route de la Croix, Champagne, 51600 St REMY-sur-BUSSY.

The current activity of the company in the site of Saint Rémy is the production of animal feed, more concretely of:

- Alfalfa pellets and bales (from April to October).
- Pellets of beet pulp (from September to October).

Luzéal-Saint Rémy is interested in starting a new business as biomass logistic centre producing and selling 10,000 t of pellets from agricultural residues mainly cereal straw. It is possible to mix these residues with miscanthus, sawdust and wood chips in order to produce standardised agro-pellets.

This report shows the steps done by LUZEAL to start-up an agro-industry logistic centre.

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 analyzation of the produced fuel.

3.1. First production tests

The feasibility study has been done on the St Remy production site, located 50 km from Sept-Saulx site, another production site of the company producing only wood pellets. At this period of the year, St Rémy production site of Luzeal is already used

with for alfalfa production, therefore the machines are not available. Moreover, both sites (Saint-Rémy and Sept-Saulx) have quite the same production characteristics and supply conditions of raw materials are nearly the same (price, source, etc.), that's why LUZEAL decided to realize the production tests in Sept-Saulx, in order to comply with the deadlines of SUCELLOG agenda.

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 (mixed 60% of cereal straw and 40% sawdust and 100% straw), the following equipment is available at LUZEAL:

- mixer
- pelletizing line
- pellet cooler.

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.

LUZEAL decided together with the SUCELLOG project partners RAGT Energy and UCFF (French regional partner of Service Coop de France), to make a test for the creation of mixed pellets.

3.1.1. Goal of the production test

The goal of the first production test at LUZEAL was to produce two different type of pellets: mixed agro-pellets and agro pellets of 100 % straw.

The 13/05/2016 during the morning, a meeting was organized with RAGT Energy to prepare pelletizing tests and decide which data would have to be monitored. It was decided to make different samples of pellets in order to test the effect of water adjunction and different compression rates.

The pelletizing test was carried out by the technicians from LUZEAL in charge of the pelletizer and has plenty of experience in pelletizing different raw materials. The tests were monitored by Mr KOCH, LUZEAL's manager.

3.1.2. Results

STRAW-WOOD mix LOT 1

Test n°1: the first sample pelletized was with no additive, no water added. The press n°2 with a compression rate of 33 was used.

Because of agro pellets low compactness, it has been decided to use press n°1 compression 34 that has a stronger press power.

Test n°2: the second sample pelletized was with no additive, no water added, press n°1 compression 34.

Pellets compactness was greatly improved (¡Error! No se encuentra el origen de la referencia.).

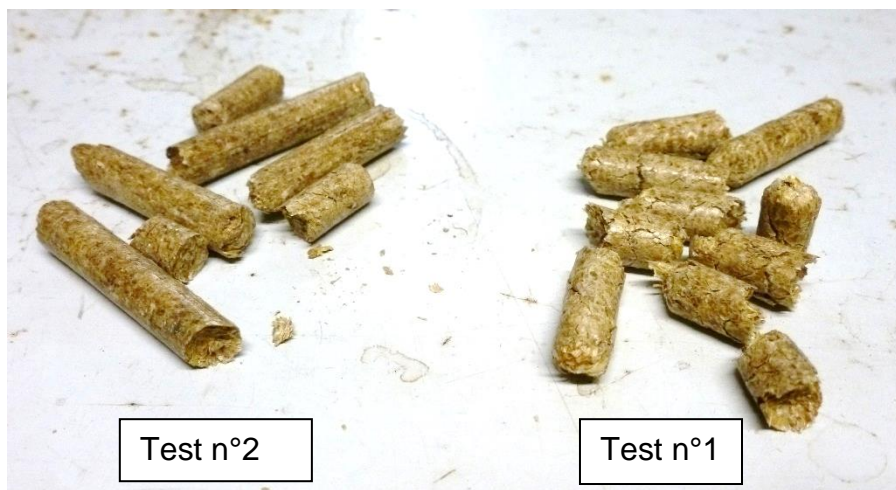


Figure 1: Pellets aspect (test n°2) (Scale: 100 mm = 85mm)

Test N°3 : the third sample pelletized was with no additive, 2% water added, press n°1 compression 34 (See ¡Error! No se encuentra el origen de la referencia.)



Figure 2: Pellets aspect (test n°3) (Scale: 100 mm = 80 mm)

Notes:

- Moisture = 8.2% Bulk density = 688
- 0.6 l/min = 36 l/h approximately 2% of water added.

Luzeal was satisfied with the pellets aspect.

STRAW 100% LOT 2

Concerning 100% straw pellets and following primary tests for mixed pellets, it was decided to use the compression³⁴ and test water adjunction as well.

The same conclusions can be made: the adjunction of water has a positive impact on pellet quality.

The last operation of the process is the packaging, in order to store the pellets in good conditions and preserve their properties, their quality.

3.2. Combustion tests

3.2.1. Goal of the combustion tests

Combustion tests have been carried out by RAGT Energy for the two types of pellets. The following sections are part of the RAGT Energy report. The sample pellets were characterized in real combustion conditions by means of a series of combustion tests carried out in two different items: a fixed-bed boiler and a moving grate 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

Through the experimental work carried out in this work with different biomass fuel samples, it has been revealed that the combustion technology impacts significantly the combustion behaviour.

Concerning slagging formation, it has been observed that the moving grate technology decreases considerably the phenomena, avoiding boiler blockages and limiting the maintenance. In a fixed-bed boiler, a daily maintenance is required because the slag part of the ashes can block and stop the boiler if this part is not removed.

Regarding the atmospheric emissions, the combustion staging allows to decrease the CO emissions considerably, with no need of changing the air excess. In a boiler without combustion staging, the air excess needs to be reduced (to 6% O₂ content in flue gases minimum) in order to have admissible CO emissions. The NO_x emissions do not change notably comparing the two boiler technologies.

Also, from the tests carried out with the moving grate, it can be suggested that the primary and secondary air distribution does not impact in a significant way the combustion results, at least for the tested configurations.

Finally, it is necessary to say that the agro-pellets made with cereal straw (straw-wood pellet and straw pellets samples) have a very good combustion behaviour in comparison to the others agro-pellets (with cereal straw) that we used to test in the past. Consequently, special attention is needed to have the same thermochemical quality during all the production period.

3.3. Agro-fuel analysis

Regarding thermochemical classification, all the samples agree with the EN ISO 17225-6A, except for the straw pellets sample, which exceeds the maximum chlorine content by more than 15 % with respect to the limit established. However, the chlorine content is in compliance with the EN ISO 17225-6B.

With respect to the ash fusibility, straw-wood pellets and straw 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). According to the results, the risk is higher with the straw pellets sample than with the straw-wood pellets sample.

Concerning physical analysis, both straw-wood pellets and straw pellets do not satisfy the EN ISO 17 2556A because of the mechanical durability. This parameter could be optimized through the modification of the die compression rate.

4. Summary and Conclusions

SUCELLOG project supported LUZEAL agro-industry to become a logistic centre of biomass produced from agriculture resources (cereal straw) 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, as well as making a large variety of contacts with different type of stakeholders interesting for the development of the new business line.

Through production tests, LUZEAL demonstrated it was able to produce mixed agro-pellets (wood-straw) and 100% straw. Water adjunction and compression rate are two essential factors that have to be monitored during pelletizing process. No additive was used. Most of the equipment of the Sept-Saulx site is adapted to logistic centre activities. In fact, LUZEAL wishes to get better equipment for straw pre-treatment.

Chemical analysis of pellets run by RAGT Energie show that quality of the raw material used was very good.

Conclusions about combustion test can be summarized as below:

Recommendations summary		
Fuel	STRAW/WOOD PELLETS	STRAW PELLETS
Excess of Air	6% (λ 1,6) (11% WP - λ 1,9)	6% (λ 1,6) (11% WP - λ 1,9)
Boiler technology	Moving grates	Moving grates (Fix bed boiler possible)
Optimal distribution of secondary and primary air	80% primary air 20% secondary air	80% primary air 20% secondary air
Movement of the grate	1,8 cm/min	
Maintenance recommendations	Daily cleaning in case of fix bed boiler 2 times higher compare to Wood pellets (Heat exchanger cleaning)	
Start-up process	50% Increasing of the start-up process	
Compliance with NOx national limits (NOx : 525 mg/Nm3)	YES	YES
Compliance with CO national limits (CO : 250 mg/Nm3)	NO	NO

LUZEAL is quite satisfied with these results even if some improvements have to be done. The agro-industry has already a good experience in pelletization process as it is already its main activity. Still, following feasibility study, capacity tests and production tests, LUZEAL wishes to adapt its equipment and is looking for new machines for straw pre-treatment notably.

SUCELLOG results were used to promote LUZEAL's products through regional workshops (Ile de France and Aquitaine), and energy sector meetings. In that sense, contacts with interested consumers were maintained during all the production/combustion tests phase in order to keep them informed. Combustion tests results were important data for them since it allowed them to have a better idea of pellets properties and performances. Some negotiations took place between LUZEAL and potential consumers and are still taking place.

A persistent problem is that, at the moment, agro-pellet remains a non-competitive fuel compare to other products available. Nevertheless, stakeholders show great interest in production and combustion tests results. Some boilers manufacturers believe in agro fuels potential. Some national agencies promoting biomass energy projects confirmed an initiative such as SUCELLOG and pilot agroindustry like LUZEAL can help them to promote and support energy projects including agro pellets supplies. In France, more examples on agro-pellets projects (like the logistic centre developed through the project by SOFRAGRAIN during SUCELLOG) are missing to trigger more initiatives in this line.