TRIGGERING THE CREATION OF BIOMASS LOGISTIC CENTRES BY THE AGRO-INDUSTRY

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ABSTRACT: SUCELLOG project aims to widespread the participation of the agrarian sector in the sustainable supply of solid biofuels in Europe. The project focuses on the implementation of logistic centres in the agro-industries as a complement to their usual activity in France, Italy, Spain and Austria. Agro-industries are equipped with pelletisers, drying systems, silos, conveyors and work in most of the cases under seasonal regime. These facilities can be utilised in the idle periods to handle and pre-treat biomass feedstocks obtained from different agrarian residues existing in the area. They can produce quality solid biomass to be introduced in the market or consumed in their own facility. This paper will present the major outcomes of the project to stakeholders of the agrarian sector after one and a half year of the project start. The project offered technical support to 4 European agro-industries aiming to start new agro-industry logistic centres in their facilities by providing an evaluation of their boundary conditions, a feasibility study and a complete business model. Furthermore, capacity building for agrarian associations has been organised with training sessions, workshops and other engagement events. Two handbooks and technical guidelines has been elaborated in order to widespread the knowledge created.
Keywords: agricultural residues, agroindustrial residues, agropellet, bioenergy, logistics, capacity building.

1 INTRODUCTION

Bioenergy production in Europe currently accounts for more than 60% of renewable energy sources and is expected to grow in terms of quantity by 2020. Knowing that the biomass resources from forest are limited, agricultural residues which are often not used efficiently and sometimes even polluting have a non-negligible potential to help fulfilling this growth. Solid agricultural residues, which constitute a considerable part, can be used efficiently for heating purposes.

On the other hand, the European Agricultural Fund for Rural Development encourages Member States to use agricultural residues for bioenergy as a way to diversify business activity of farmers and increase the added value.

Agro-industries equipped with agricultural goods processing facilities offer a great opportunity to become an agro-industry logistic centre providing quality solid biomass from raw feedstock. This is possible because of the following significant synergies between agro-industries and solid biomass production facilities:

- Agro-industries have equipment/facilities able to carry out solid biomass pre-treatment for achieving quality requirements of the market (e.g. dryers in cereal industries, pelletisers in forage installations, belt conveyor stackers).
- Their facilities work under seasonal regime due to crop cycles, so they can make compatible some biomass pre-treatments with their own processes.
- Some of them already produce biomass residues. Additionally most of them are surrounded by crop-fields, other ecosystems (forests), and other agro-industries or activities (industries, energy crops exploitations) that generate other type of biomass feedstock. Therefore they have easy access to a wide range of biomass feedstock which can be integrated in order to broaden their offer for solid biomass.
- They have experience with food-products that, somehow, are similar to solid biomass, since they both are organic feedstock (they need to be stored, dried to avoid deterioration, in some cases to be pelletised, etc.)
- Farmers and agro-industries are already quite concerned about the importance of product quality due to Common Agricultural Policy regulations. Adapting to handle and transform biomass in order to bring a product of quality to the market is definitely in line with their work.

The SUCELLOG project has been developed with the aim of triggering the creation of logistic centres in agro-industries bearing in mind the current opportunity for the sector and the existing synergies (Figure 1).

This will be achieved by:

- Providing technical support, helping decision-making and accompanying agro-industries willing to start operating as solid biomass logistic centres
- Creating capacity building in regional and national agrarian associations to provide this service to their associates beyond the end of the project.

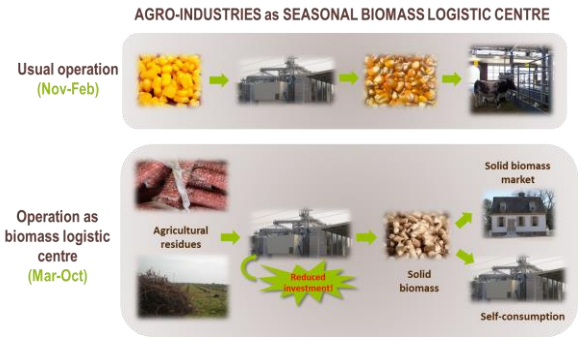

Figure 1: Concept of the SUCELLOG Project

2 TARGET REGIONS

The countries targeted for the implementation of the project precept are those who have high amounts of solid agricultural residues and a large number of agro-industries. Therefore, during the project period, the countries selected were Spain, France, Italy and Austria. For each country, target regions were also chosen based on an analysis of seasonality or in other words availability of biomass resources in the time when the facility is not in operation (idle period). The target regions in Spain, France, Italy and Austria are marked in Figure 2.

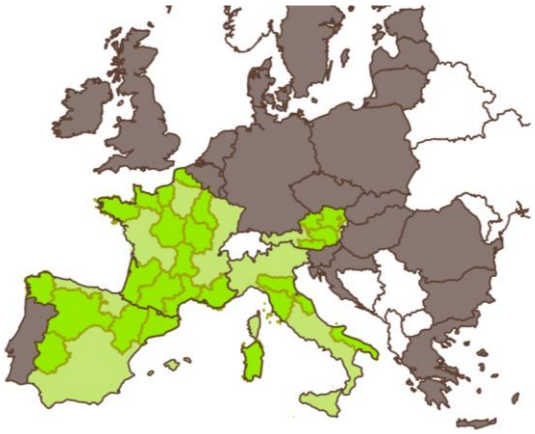

Figure 2: Target regions of the SUCELLOG Project

One of the main goals of the project is to replicate the activities undergone in the target regions to other regions and other countries even after the project comes to an end.

3 MAIN ACTIVITIES

Activities in the project have been planned with the main objectives of fostering the entrepreneurship of the agro-industry in the creation of agro-industry logistic centres from agricultural residues and establishing a permanent capacity for consultancy on agro-industry logistic centres into four European countries. Detailed description of the SUCELLOG project approach is provided by C. Khawaja et al. [1]. In this paper only a short summary of the main activities is provided.

3.1 Determination of the regional framework and stakeholders' engagement.

In the first half of the project duration the assessment of existing agro-industries and biomass resources in the target regions and the identification of potential local areas of action have been conducted.

In parallel to the framework condition analysis, technical and non-technical barriers for the implementation of the project concept are collected and assessed.

Engaging stakeholders mainly agro-industries and biomass suppliers is an important step to identify suitable beneficiaries and to mobilise them to take part in the project in order to benefit from the offered services. National, regional and local stakeholders have been invited to workshops and addressed directly through bilateral meetings. In addition, the workshops have been used to gather information about the real situation in regions.

In SUCELLOG project all agro-industries, including farmers, cooperatives, companies (SME's), are classified in three categories depending on their current interest in becoming an agro-industry logistic centre:

- Category 1: Agro-industries which already have a solid willingness to start a new business as biomass logistic centre.
- Category 2: Agro-industries which are interested in biomass logistics, but still require more knowledge before making the decision.
- Category 3: Agro-industries which are still unaware of their potential to become agro-industry logistic centres.

3.2 Development of a tailor-made business model

Four beneficiaries of the Category 1 have been selected (one in each project target country). The project supports them to implement the logistic centre by evaluation of their boundary conditions and by the development of a feasibility study. Feasibility study includes different business options. After selection of one preferred option, a complete business model has been developed.

The methodology for the development of the business model is provided in Figure 3 and consists of the following 4 steps:

- Selection of the beneficiary and region
- Assessment of boundary conditions, biomass resources and biomass demands in terms of quality, quantity and price
- Evaluation of capacities of the agro-industry to adapt to the new activity including facility compatibility, human resources abilities and the structure of the organisation
- Development of the feasibility study, providing the beneficiaries with several options for the commercialisation of biomass. After the beneficiary makes a decision, a tailor made business plan is prepared for the agro-industry.

3.3 Creation and monitoring of the agro-industry logistic centre

According to the business plan, a detailed planning for the implementation of the agro-industry logistic centre will be prepared. The planning includes a strategic timing of equipment purchasing and installation, change in organisational structures, training of personnel, plant

commissioning and start-up, and commercial operation.

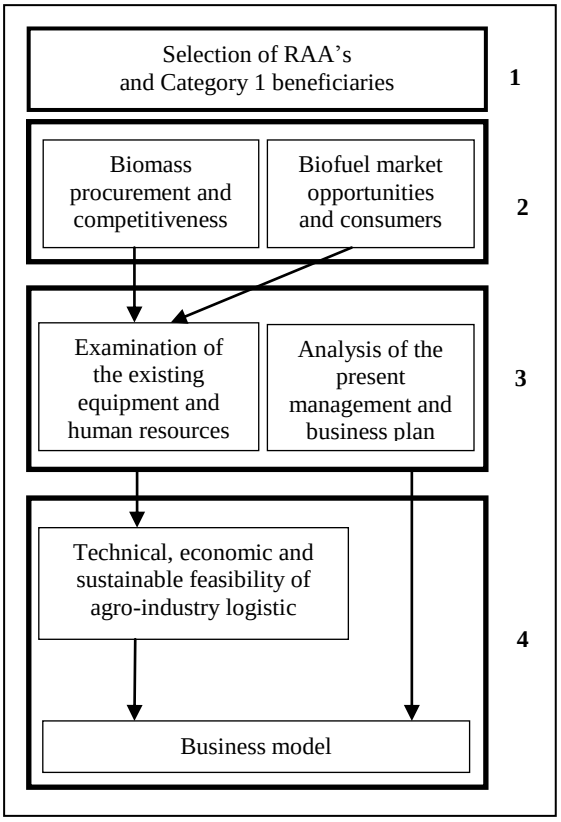

Figure 3: Steps for the development of a business model

Actions related to the first step before plant commissioning will be monitored in SUCELLOG project. Monitoring of a 1 season period will be carried out. Based on the practical experiences gained during the monitoring phase, a guideline for retrofitting agro-industries to function as a logistic centre will be developed.

3.4 Start-up diagnosis and auditing services

A start-up diagnosis is performed to 20 beneficiaries per target country. The diagnosis informs beneficiaries about their current situation and the possibility to start a new activity as an agro-industry logistic centre. The diagnosis has been used to classify potential beneficiaries into Category 2 and 3.

After the diagnosis, for 10 Category 2 beneficiaries per target country a comprehensive feasibility study completing a full audit service is developed.

3.5 Transfer of knowledge

An important aim of the project is to transfer the knowledge gained during the project to other actors in different regions and countries. Therefore, 3 handbooks directed to the different categories of the target groups and to key actors with different profile will be developed.

Handbook for beginners: it highlights the current synergies between the agro-industry activities, facilities and business on biomass logistics and addresses the basic demands of information to be taken into account when interested in starting this new activity.

Handbook for medium aware users: the aim of this handbook is to explain the steps and topics which have to be considered when elaborating a feasibility study.

Handbook for highly aware users: it will be developed based on the experience gained from the creation of the agro-industry logistic centres during the project. This handbook will highlight the best practices and the keys for success. It will include the details of the beneficiaries' facilities and cases, the analysis of the local conditions, the different scenarios considered and the final business model adopted. It will also include relevant data like need of retrofitting, investment costs and first results of the solid biofuels marketed.

Furthermore, to enhance the capacities of agricultural sector for new project development, training sessions have been organised. In these sessions regional agricultural associations and national agricultural associations have been trained to become auditors not only in the target regions, but also in non-target regions and countries.

Knowledge transfer activities will be concluded with the analysis on the non-technical barriers and development of policy recommendations to overcome them.

4 RESULTS

4.1 Determination of the regional framework and stakeholders' engagement

An assessment of the real potential of primary agrarian biomass supply has been carried out in the target regions in Spain, France, Italy and Austria. Methodology and results of this study has been previously discussed by C. Khwaja [1]. The results of the assessment are available in [2]. Separate reports for each country, including maps, are available at SUCELLOG website.

Stakeholder engagement actions were conducted through the organisation of 27 workshops gathering more than 450 participants. Furthermore, more than 65 bilateral meetings were carried out in order to follow up with the stakeholders after the workshops for the selection of the beneficiary agro-industries.

4.2 Development of a tailor-made business model

This section presents the results of feasibility studies and business models developed for the 4 selected agro-industries in project target countries:

- Cooperativa Agraria San Miguel de Tauste – Aragón region – Spain
- Luzéal-Saint Rémy – Champagne-Ardenne region – France
- Società Cooperativa Agricola Le Rene s.r.l. – Toscana region – Italy
- Tschiggerl Agrar Gmbh – Styria region – Austria

Framework conditions for feasibility study for the agricultural cooperative in Spain are summarised in Table I. Outcomes of the feasibility study suggests that straw is the most attractive raw material. However, blending with wood is required to ensure the quality of the end-product. The most competitive product is a Class B agro-pellet with a maximum 70% share of straw.

Results of the market assessment in Spanish region indicate that minimum selling price of the agro-pellets is 117 €/t or 0.027 €/kWh. This price is positioned in the middle range of prices of solid biomass in the local market. Secondary benefits should be offered to consumers (e.g. using the ash as low-cost fertiliser, decreasing the Cl content of the soil).

Table I: Framework conditions in Spain

Spain: Cooperativa Agraria San Miguel de Tauste	
Current activities	Production of fodder pellets and bales from alfalfa, cereal drying (mainly maize) and production of feedstuff pellets.
Available agrarian residues	In 18 km radius and owned by members of the cooperative: Cereal straw >11,000 t/year Maize stalks >8,000 t/year
Existing equipment that can be used	Two alfalfa production lines can be used for the pre-treatment of the solid biomass with minor modifications

Recommended business strategy for the company is to develop internal self-consumption chain targeted on the pig farmers, which are the members for cooperative – being the suppliers of the straw and the consumers of the solid biomass. Biomass logistic centre should purchase the straw from pig farmers only under the condition that as well the annual or plurennial agro-pellet sale contracts are made.

Framework conditions for feasibility study for the agricultural cooperative in France are summarised in Table II.

Table II: Framework conditions in France

France: Luzéal-Saint Rémy – Champagne-Ardenne	
Current activities	Production of fodder pellets and bales from alfalfa
Available agrarian residues	In a radius of 30 km: Cereal straw 32,000 t/year Rape straw >40,000 t/year Miscanthus, sawdust and wood chips are available for blending
Existing equipment that can be used	Two current alfalfa production lines can be used for the pre-treatment of the solid biomass with minor modifications

Outcomes of the feasibility study indicates that in the region only cereal straw can be considered, since rape straw is mainly left on the field as fertiliser. Blending of cereal straw with wood is required. The most competitive product from economic feasibility is a Class A agro-pellet with 60% straw and 40% sawdust mix.

Results of the market assessment in French region indicate that minimum selling price of the pellets is 163 €/t or 0.037 €/kWh. In order to be competitive in the local industrial market dominated by wood chips, the production costs should be reduced.

Two scenarios have been assessed in the business strategy of the cooperative: i) reduction of production costs; and ii) extending the range of the services provided by the cooperative – selling not only the biomass, but also heat, becoming an ESCO (energy service company).

Framework conditions for feasibility analysis of the region in Italy are summarized in the Table III.

Outcomes of the feasibility study in Italy indicate that despite high availability, cereal straw is not considered in a first step because of the high price. The most competitive products are class A agro-pellets and mixed agro-prunings chips and hog fuel.

Table III: Framework conditions in Italy

Italy: Società Cooperativa Agricola Le Rene s.r.l. – Toscana region	
Current activities	Sunflower harvesting, treatment and trading, cereal drying (maize and rarely wheat), production of pine nuts and production of olive oil.
Available agrarian residues	Industrial residues from own activity are available. In 30 km radius: Olive pomace 1,500 t/year Corn cobs 3,500 t/year Prunings of permanent crops 2,500 t/year Olive prunings 1,900 t/year
Existing equipment that can be used	Vertical dryer used currently for corn and wheat drying is compatible with drying of olive pits. Pelletiser is available and 25,000 m^2 (open area) and 2,000 m^3 (warehouse) of storage capacity.

In a market assessment study precise market prices of the products were not defined yet, since the exact quality of the produced fuel (ash and Cl content) was not known. Production costs are comparatively low. Thus an attractive price for consumers can be offered.

The suggested business strategy for the cooperative in Italy is to focus on households (main consumers) and as well as to medium to large consumers (industries, district heating plants, greenhouses). The manufacturing process of the agricultural prunings should be improved (diversifying the products obtained from them depending on the quality) and the residues from other processes (proper or connected with the agro-industry) should be re-used. The agro-pellets will represent the top product of the biomass logistic centre and the sub-products from agro-pellets production (chips and hog fuel from the agro-prunings treatment process) would be secondary products offered in the new business line.

Table IV: Framework conditions in Austria

Austria: Tschiggerl Agrar Gmbh – Styria region	
Current activities	Corn harvesting, treatment and trading, logistic operating of straw, pelletizing of corn cobs and straw for animal feeding and bedding.
Available agrarian residues	In 30 km radius: Cereal straw 5,190 t/year Hay 200 t/year Corn cobs 15, 249 t/year
Existing equipment that can be used	Drying facility that is currently used for drying the cobs used in animal bedding

Framework conditions in Austria are summarised in Table IV.

Corn cobs are the most interesting raw material due to the lack of important competitive uses. Only corn cob-derived products are feasible. Corn cob grits offer large potential market and chance of good profit. Minimum selling price of loose cobs is 58 €/t (0.017 €/kWh), of grits 144 €/t (0.038 €/kWh) and of pellets - 192 €/t (0.044

€/kWh).

The main consumers in Austrian case are expected to be farms and industries using wood chips and pellets. The market would be extended to households but they are currently not allowed to use corn cobs by law in Styria. The best strategy for the company would be also to produce a small amount of corn cob pellets to be proposed to the consumers as test products in order to facilitate the transition to grits.

Feasibility studies and business plans for four agro-industries supported by the SUCELLOG project have been published on the SUCELLOG website.

4.3 Transfer of knowledge

SUCELLOG project has published two of the three handbooks – the Handbook for beginners [3] and the Handbook for medium aware users [4]. All reports detailing the results can be downloaded from the project website www.sucellog.eu.

5 PARTNERSHIP

The SUCELLOG project is coordinated by CIRCE - Research Centre for Energy Resources and Consumption (Spain). The project consortium includes RAGT Energie SAS (France), SPANISH COOPERATIVES - Cooperativas Agro-alimentarias de España (Spain), SCDF - Services Coop de France (France), DREAM - Dimensione Ricerca Ecologia Ambiente (Italy), Lk Stmk - Styrian Chamber of Agriculture and Forestry (Austria) and WIP Renewable Energies (Germany).

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7 DISCLAIMER

8 PROJECT LOGO