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

SUCELLOG: IEE/13/638/SI2.675535

D6.1
Diagnosis guide

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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

circe
RESEARCH CENTRE FOR ENERGY RESOURCES AND CONSUMPTION

Project partners

agri-food cooperatives Spain
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About this document

This report corresponds to D6.1 of the SUCELLOG project –Diagnosis guide. It has been prepared by:

SPANISH COOPERATIVES
Agustín de Bethencourt 17, 28003 Madrid
E-mail: cooperativas@agro-alimentarias.coop
Tel: +34 91 535 10 35

With collaboration and input from CIRCE

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1. Introduction

SUCELLOG supports the creation of biomass logistic centres inside agro-industries covering the gap of knowledge faced when willing to start this new activity. Within WP6, SUCELLOG provides an auditing service facilitating the decision making to agro-industries interested in becoming a logistic centre. Beneficiaries will be subject of a previous diagnosis in order to evaluate the degree of matureness to start-up the new activity, their potential and their knowledge gaps.

This guide has been built as a questionnaire for a general auto-evaluation that could be used by any agro-industry interested in starting this new business line. The main issues that will be assessed regard: the raw materials available, biomass market, existing equipment and bioenergy knowledge. General considerations and a matrix are included with respect to all issues mentioned, helping the beneficiary to understand their potential as possible biomass logistic centre.

A summary of the main results from diagnosis and auditing studies developed by the project in Spain, France, Italy and Austria can be found in D6.5 in English and in the national language.

2. Diagnosis questionnaire

The following information should be filled in by the agro-industry. Section 3 includes the considerations that should be taken into account, according to the answers provided, when evaluating its potential to become a biomass logistic centre.

A. General information about their regular activity as agro-industry

A.1 Include here your activity as agro-industry:

- ☐ Forage dehydration
- ☐ Cereal dryer
- ☐ Tobacco dryer
- ☐ Oil extraction industries
- ☐ Animal feedstuff producer
- ☐ Nut industry
- ☐ Sugar industry
- ☐ Wine distillery
- ☐ Oil pomace industry
- ☐ Wine cellar
- ☐ Oil mill

- ☐ Others, please specify:

B. Type of biomass resources available

B.1 Include here the agrarian biomass resources available in a radio of 50 km:

- ☐ **Herbaceous** (cereal straw, maize stalks, rape straw, sunflower straw, etc.)
- ☐ **Woody** (fruit tree prunings, olive prunings, vineyard prunings)
- ☐ **Residues from agro-industries and others** (olive pomace, maize cobs, husks and shells, press cake from sugar extraction)
- ☐ **Other, please specify:**

B.2. Please include here and X in the months when this biomass resource is produced:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Residue 1:												
Residue 2:												
Residue 3:												
Residue 4:												
Residue 5:												

B.3. Who is the owner of this raw material?

- ☐ The agro-industry itself
- ☐ Farmers or agro-industries with some link with the agro-industry
- ☐ Farmers or agro-industries with no link with the agro-industry
- ☐ Other, please specify:

B.4 Which is the average distance to these resources?

- ☐ < 10 km
- ☐ 35-10 km
- ☐ 50-35 km
- ☐ > 50 km

B.5 Are there already logistic chains that could supply the agro-industry with this raw material? At which price can be purchase at the agro-industry gate (€/t)? Please, if that´s the case, specify this information <u>for each type of residue</u> included in B.1.

- ☐ Yes, at approximately _____ €/t
- ☐ Yes but I have no idea about the price
- ☐ No
- ☐ I don't know

B.6 Is this resource used for other purposes (animal feed, soil fertilization, etc.)?

- ☐ Yes, _____
- ☐ Yes, but marginal
- ☐ No, due to harvesting problems
- ☐ No, there is no current interest in it and there are no future expectations
- ☐ I don't know

B.7 Do you have access to other types of wood? In which format?

- ☐ Forest wood
- ☐ Wood from energy crops plantations
- ☐ Residual wood
- ☐ I don't know

C. Existing equipment in the agro-industry and availability

C.1 Which of the following equipment is owned by the agro-industry in the normal activity?

- ☐ Pelletiser
- ☐ Dryer

			
☐ Vertical dryer.	☐ Rotatory dryer.	☐ Silo dryer.	☐ Belt dryer.

- ☐ Mill
- ☐ Wood chipper
- ☐ Screener
- ☐ Other, please specify:
- ☐ None of the previous but the agro-industry can afford the investment to buy it

C.2. Please include here an X in the months when the equipment is NOT in use or significantly UNDERUSED:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pelletiser												
Dryer												
Mill												
Chipper												
Screener												
Other, specify												

D. Knowledge on the bioenergy sector

D.1 Is the agro-industry a biomass consumer? Which type of solid biofuel do you use?

- ☐ Yes, the agro-industry consumes around ___t/yr of _____
- ☐ No

D.2. Do you have any experience of production of solid biomass?

- ☐ Yes. Please specify (type of product produced, period of production, if you are currently producing it, etc):_____
- ☐ No

D.3. Do you know which are the most important quality properties to ask to the biomass supplier when you want to compare different biofuels not only according to the price (€/t)?

_____

- ☐ I don't know

E. Biomass market in the region

E. 1 Do you know who are currently consuming solid biomass in your area?

- ☐ The agro-industry itself
- ☐ Other agro-industries or farms
- ☐ Intensive energy demanding industries
- ☐ Public buildings, sport centres, district heating networks
- ☐ Households
- ☐ Other, specify:
- ☐ I don't know

E.2 Which is the average distance to those consumers

- ☐ < 10 km
- ☐ 35-10 km
- ☐ 50-35 km
- ☐ > 50 km

E.3 Which is the product currently consumed by this type of consumer)? Specify for each type of consumer

- ☐ Forest wood chips
- ☐ Low quality wood chips
- ☐ Chips from energy crops (e.g. poplar)
- ☐ Forest wood pellets
- ☐ Wood pellets from energy crops (e.g. poplar)
- ☐ Pellets made with agricultural residues or sub-products (specify which raw material)
- ☐ Olive Pomace (pulverised)
- ☐ Olive pits
- ☐ Grape marc (pulverised)
- ☐ Almond shell
- ☐ Maize cobs (specify if the cob as a whole or the cobs chopped)

- ☐ Other, please specify:
- ☐ I don't know

E.4. Which are the quality specifications and price of the fuels signed in the previous question?

	Moisture content (w-% wet base)	Ash content (w-% dry base)	Calorific value (KJ/kg, kcal/kg or kWh/kg)	Price (€/t or €/kWh)
Product 1:				
Product 2:				
Product 3:				
Product 4:				
Product 5:				
Product 6:				

E.5. On which time of the year is there a higher demand for biomass?

- ☐ In winter.
- ☐ All over the year.
- ☐ Other (specify): _____

3. Considerations to evaluate the potential of the agro-industry to become a logistic centre

According to the experience, SUCELLOG project provides in this section the following considerations for the auto-evaluation of the potential to start a new business activity as agro-industry logistic centre.

If the majority of answers have not been provided due to a lack of knowledge, it can be considered that the degree of matureness of the agro-industry to become a logistic centre is low. In this case, this guide provides with the main topics that should be assessed.

For more information about basic knowledge on all the aspects gathered in this document, please have a look at the Handbook for beginners produced by SUCELLOG project.

A. General information about their regular activity as agro-industry

From all types of agro-industries evaluated, SUCELLOG project has defined that the most interesting are the ones listed in A.1, since they own equipment for the pre-treatment of raw material (dryers and/or pelletisers). However, it may happen that this equipment cannot be compatible with the available raw material (more information in the following sections).

Additional sectors like cellars or oil mills have also been taken into account, even if they do not present compatible equipment, because of their important capacity to gather agrarian biomass coming mainly from vineyard and oil mill prunings.

B. Type of biomass resources available

It is important that the agro-industry knows about the available resources around, the competitive uses of them and their price in the market. Check B.1, B.5 and B.6.

The most convenient would be to use as raw material for the logistic centre a resource that has none or marginal competitive use in order to guarantee the supply. However, sometimes this type of resources is associated to a lack of developed logistic chain, to problems in the harvesting or to sustainability issues, which should be taken into account when considering possible raw materials. For example: the implementation of an agro-industrial logistic centre based on fruit tree prunings, which in some countries are burned or included on the soil to avoid disposal costs since they have no market, can be a good alternative. Nevertheless, in some cases, it can be found that there are no existing companies in the area that gather this type of residues meaning that, if the agro-industry wants to use it as raw material, a new logistic chain should be promoted in the area. Another example can be the rice straw, with no extended market and whose soil disposal can be a problem in some cases: the harvesting is complicated due to soil compaction

and therefore is a problem to be solved if planning to be used for solid biomass production. In other cases, residues are preferred to be left on the soil to keep nutrients or humidity and this fact should be taken into consideration when evaluating the availability.

Additionally, in order to avoid risk of supply, the ownership of the resources can also be an important issue to be aware of. It can be seen as an advantage the fact that the biomass resources belong to the agro-industry itself or to their associates or the owner has already a link to the agro-industry (check B.3).

Distance to resources (check B.4) should also be taken into account, since transport implies one of the most important costs from the overall (purchasing raw materials, pre-treatment, transport and personnel). It can be of importance for distances higher than 50 km (more than 10 €/t), being for that reason, local scale commercialization highly recommended. When the distance from the resource to the agro-industry is less than 10 km, transport can be most probably performed by the own farmer with his/her agricultural vehicle. Moreover, in the case of herbaceous resources, short distances to the agro-industry can imply that bailing is not needed, which reduces significantly the purchasing cost of the material.

C. Existing equipment in the agro-industry and availability

The possibility of the agro-industries equipment to handle and to process the available biomass is important since otherwise the agro-industry may have to incur relevant costs for purchasing new equipment and to set-up new process lines. This causes the costs and risks to rise due to the investment, especially when a pelletiser or a dryer is required. The cost of the rotatory dryer and the pelletizer from the pelletiser line can be around 1,250,000 € and 1,150,000 €, respectively, for a production capacity of 4 t/h; and around 1,800,000 € and 2,400,000 € for a capacity of 14 t/h.

The type of existing equipment (C.1) and the compatibility with the available resources (B.1) should be therefore checked to see if relevant investment is needed. The following assumptions should be considered:

In general, rotatory dryers present a large versatility, being able to process a higher variety of raw material formats (herbaceous, chips, pits and shells). Vertical dryers are compatible with granulated material (pits or shells), impossible to handle herbaceous products and difficult to work with chips. Silo dryers and belt dryers can work with granulated products and chips but not with herbaceous.

Regarding the milling system and the pelletiser, they are compatible with all types of products although maintenance operations can rise and flow capacity can decrease when working with products that are different in structure than the normal ones. For example, in an alfalfa dehydration facility the pelletiser could work with wood but the flow can be 1/3 of the flow when alfalfa is produced.

Remember that not all particle size can enter the drying system (normally the maximum particle size is 100-150 mm for herbaceous and 3 cm^2 section for wood chips is permitted), which means that in some cases a previous particle reduction process should be considered. Additionally, reduced particle size is needed before the pelletiser (less than 3.15 mm for herbaceous and than 2 mm for woody resources) and this implies in most cases to mill the material previously.

Screening system is not considered as essential equipment but can increase the quality of the product since it reduces the amount of fine particle that create dusty atmospheres. Chipper can be the only equipment required if dealing with agricultural prunings.

A good matching of the seasonal production of biomass with the idle periods of the agro-industry is recommended in order to decrease the storage period which could incur in matter loss due to fungi activity. Therefore a comparison between the idle periods of the equipment and the production months of the biomass resources should be performed (check table of B.2 with table of C.2). Additionally, it should be taken into account that, from the moment that the logistic centre stops production to turn to the regular activity as agro-industry, a cleaning process should be performed in order to avoid risk of contamination.

Concerning this, it is as well interesting that the period of biomass demand is few months later than the residues harvesting or the idle period (check B.2, C.2 and E.5). This will minimise the storage capacities of the product in the agro-industry. Since many agro-industries would work under demand, it is an important issue.

D. Knowledge on the bioenergy sector

The fact of being familiar with the bioenergy (as a consumer) or even having experience producing solid biomass, means understanding the concept that quality in solid biomass is, as it is in the agrarian activity, also essential.

It is important to have clear that the moisture content and the ash content or the ash content and the calorific value are the main quality characteristics that should be asked when evaluating the price of a product (the reason will be explained in the following section). It this information is not included within the price €/t, the message is incomplete.

E. Biomass market in the region

The existence of a biomass market in the region is essential to start a logistic centre otherwise the risk will be unacceptable. Moreover, having already an idea about who is the target consumer the agro-industry would like to focus is important to figure out the quality requirements that our product needs to fulfil. In general terms, it can be said that households are high quality demanding consumers followed normally by public buildings and heating networks. In general agro-industries and farms demand medium quality products and bad quality biomass is

used by intensive energy industries (check who are the main consumers in the area in E.1).

But, what can be considered a high quality biomass? Which form the solid biofuels in the market are considered as high quality products?

The quality of the product is measured as a first sight by the moisture content (the aspect that influences the most the calorific value) and the ash content (related to problems of fouling and slagging that leads to the malfunctioning of the boiler). Whereas woody biomass has high moisture content but low ash content, herbaceous residues present the opposite case. However, while the moisture content can be decreased by a drying process, the ash content is due to the own resource mineral composition (although it can be increased by exogenous material like sand or stones during its harvesting or handling). In general, high quality biomass means less than 25 % moisture content (weight percentage in green) AND less than 3 % ash content (weight percentage over the dry weight of the fuel).

Often biomass that can fulfil these 2 figures are: forest wood chips, energy crop chips, forest wood pellets, wood pellets from energy crops, forest chips, pits and shells. This does not mean that chips cannot have more than 3 % ash content but probably chips with less quantity of ash can be found in the market.

Taking this into consideration, it can be said that from agrarian resources (not forest) only pits and shells could achieve high quality. For the rest of resources, it can be assumed that medium quality products would be generated. Currently the existence of mixed pellets (pellets of a mixture of resources) is growing in Europe and it is an option to upgrade the quality of herbaceous resources with wood for example. Finally, low quality products should be avoided unless it characteristics satisfies a large share of market consumers. Developing a logistic centre to supply just one consumer is risky unless a long time supply contract is signed.

Format is another issue that should be considered when assessing the product to be generated by the logistic centre since it is mainly linked with the feeding system of the conversion equipment. See below the compatibility among formats: if for example the target consumer has a pellet boiler, normally he/she will not be able to use chips unless he/she changes the feeding system.

Format of products consumed by the target consumer	Compatible formats for this boiler	
Granulated products: pellets, pits, shells	Pellets Pits, shells Chipped cobs	
Chips	Chips Pellets	Pits, shells Chipped cobs
Powder (pulverised)	Powder (pulverised)	

Quality demands

The following exercise should be done to understand if the product planned to be generated will satisfy current market quality demands:

- Take the resources from B.1 and B.7
- Take the target consumers in E.1
- Take the type of fuels consumed stated in E.4 and E.4
- Analyse with the previous considerations if the quality demands could be fulfilled.

For example: from the answers, it is said that the only resource available is herbaceous (which means that the only format to be produce is then pellet, no chips, and no high quality fuels would be produce). If the target consumer are only households (high quality demanding consumers in general) that consumes wood pellets (high quality product), the result of this case would be that it will be difficult to penetrate in the market even offering a cheap price, which will make the project not successful.

Price of the final product

Finally, **to evaluate the price of the final product planned to be generated by the logistic centre, products currently in the market of similar quality should be taken as reference. The minimum price will be stated as the price that covers the costs of production and the profit that the agro-industry fix to start production (cover risks or indirect costs).** From that figure, any price higher will provide an additional profit. Production costs involve the purchasing of the resource, the pre-treatment, the personnel and the transport. Regarding the latter, as happened with the supply of raw material, local scale commercialization (< 50 km distance) is also highly recommended for the consumers (E.2).

Comparing the price of the resource (B5) with the price of the products in the market with similar quality (E4), it can be seen if there are some resources whose prices are higher or equal than similar quality products, making the project not feasible. For example: if the only biomass resource available is straw with a purchasing price of 70 €/t and the solid biofuels in the market with similar quality cost around 80 €/t, it can be said that the project will be risky.

4. Test your potential

According to your answers on the Diagnosis questionnaire, you can evaluate your potential to become a biomass logistic centre. Please include the results in the following matrix, they have been built from the considerations set out in section 3. **It is therefore highly important that section 3 is read before filling in the matrix.**

The closer the results in the red zone of the matrix, the less the potential to become a biomass logistic centre. If the answer in most of the questions is “I don’t know”, then the potential should be considered as very limited.

						MARK YOUR ANSWER			
TYPE OF BIOMASS RESOURCES AVAILABLE	Who is the owner of this raw material? *(CHECK B3)*	Farmers or agro-industries with no link with the agro-industry	Farmers or agro-industries with some link with the agro-industry	Farmers or agro-industries associated	The agro-industry itself				
	Are there already logistic chains that could supply the agro-industry with this raw material? *(CHECK B5)*	No			Yes				
	Which is the average distance to these resources? *(CHECK B4)*	> 50 km	50-35 km	35-10 km	< 10 km				
	Are these resources used for other purposes? *(CHECK B6)*	Yes	No, due to harvesting problems		No or marginally				
EXISTING EQUIPMENT IN THE AGRO-INDUSTRY AND AVAILABILITY	Which equipment is existing in the agro-industry? *(CHECK C1, B1)*	None and I cannot invest in this moment		I dont have any but I dont mind to invest in it	Wood chipper in the case of woody resources; Dryer and/or pelletiser in the case of herbaceous resources				
	Does the idle period of the main equipment match with the production of the possible residues and with the solid biomass demand? *(CHECK B2, C2)*	The difference is important	The matching is not the best and there are problems in storing the material	The matching is not the best but there are no problems in storing the material	The matching is good				
KNOWLEDGE ON THE BIOENERGY SECTOR	Is the agro-industry a biomass consumer? *(CHECK D1)*			No	Yes				
	Do you have any experience of production of solid biomass? *(CHECK D2)*			No	Yes				
	Do you know which are the most important quality properties to ask to the biomass supplier appart from the price (€/t)? *(CHECK D3)*	I dont know	Moisture content or heating value		AT LEAST Moisture content or heating value; ash content				
BIOMASS MARKET IN THE REGION	The product planned to be generated can satisfy the current market quality demands? *(CHECK B1, B7, E1, E3, E4 and "Quality demands" of the section 3)*	No		Partially	Yes				
	Which is the average distance to those consumers? *(CHECK E2)*	> 50 km	50-35 km	35-10 km	< 10 km				
	The difference between the similar products in quality in the market and the raw material cost is *(CHECK E2, B5, E4 and "Price of the final product" of the section 3)*	Very similar			High				