



Contrato n° EVG1-CT-2001-00054

**District Logistics Analysis (DLA) of  
 “La Vega del Guadalquivir case study”**

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## 1 Correlation between the LCA hypotheses and DLA orientations

In the present paragraph the relation is established between the LCA hypotheses (from the 32 elements of the SWOT) and the conclusions from the LDA with information obtained of the local case study.

The six main hypotheses of innovative options of the LCA have been synthesized in two big paragraphs to put them in relation with the DLA:

1 <sup>st</sup> hypothesis of the LCA	1.1.1 DLA conclusions
<p><b>New forms of management of the territory</b></p> <p>The most global objective must be the putting in march of an instrument of planning on a large scale supralocal (network of cities of La Vega del Guadalquivir) directed to favoring a territorial sustainable development based on the utilization of the endogenous potential, the alteration of the inadequate forms of management of the natural basic resources (water, energy, materials), the subsidiarety (supralocal application of the land use planning) and the participation of the social agents. Between the objectives of this planning, the integrated management of the residues has to develop and the management of the agricultural waste and its energetic utilization.</p> <p>This framework of supralocal planning needs a suitable coordination and integration with the planning of regional area and concretely, with the Plan of the Ordination of the Territory of Andalusia, the Andalusian Plan of Environment, the Energetic Plan of Andalusia and the Plan of Development and Technological Innovation.</p> <p>Likewise, the strategy of territorial development needs the involution of the instruments of government of the territory in the supralocal scale as way to manage to improve the efficiency of the regional policies (subsidiarety) and, simultaneously, to overcome the limitations of the policies on a large scale strictly locally.</p> <p>Finally, it is necessary that the new forms of management of the territory are based on the participation of the social, economic and institutional agents in the process of identification of objectives of development and on the application of the concrete policies.</p>	<ul style="list-style-type: none"> <li>• The territorial, social and economic characteristics of La Vega turn it into an area specially adapted for the development of policies of territorial cooperation between the local powers and the economic and social agents present in the zone.</li> <li>• There exists an incipient structure of territorial cooperation in several fields (waste management, economic promotion) that, nevertheless, needs to be reinforced since they do not constitute in an effective way, instruments of government and management of the territory.</li> <li>• The instruments of regional planning lack a suitable insertion in the different characteristics from every territory by what it must be advanced in the application of the principle of subsidiarety. Likewise, the different sectorial instruments of regional planning (energy, environment, ordination of the territory, technological development) have to establish mechanisms of coordination between them that evaluate its territorial effect.</li> <li>• This double way (reinforcement of the local structures of territorial cooperation and coordination and development of the subsidiarety in the application of the regional policies) must come together in the creation of new instruments of government of the territory in the supralocal scale.</li> </ul>

2 <sup>nd</sup> hypothesis of the LCA	1.1.2 DLA conclusions
<p><b>The management of the waste. The utilization of the biomass.</b></p> <p>The second hypothesis is based on the importance that has the integrated management of the waste and the promotion of the environmental industry for the sustainable development of the area of La Vega. El desarrollo de esta gestión integrada se fundamenta en dos aspectos principales:</p> <ul style="list-style-type: none"> <li>• The existing infrastructure for the management, recycling and recovery of urban waste.</li> <li>• The creation of the Center of Technological Innovation of Waste, integrated inside the Andalusian Network of Technological Innovation put in march for the regional government.</li> </ul> <p>Regarding the most specific object of study of the INNESTO Project, the management of the agricultural biomass waste and its energetic utilization have to be outlined two principal aspects:</p> <ul style="list-style-type: none"> <li>• The existence of an instrument of supralocal cooperation for the management of the waste and the infrastructures of recycling and recovery (plant of treatment) favors the putting in march of a new strategy for the management of the agricultural waste.</li> <li>• The importance of the agricultural and of the annual production of renewable resources like those of the agricultural biomass they guarantee the sufficient availability of waste to start with the system of electrical generation.</li> <li>• The normative instruments and of planning (for instance the Andalusian Plan of Environment and the Energetic Plan of Andalusia) they favor the starting of this kind of systems of management of the agricultural waste and its appraisalment in power plants.</li> <li>• The development of the most adapted technologies for the starting of the system of management of the agricultural waste comes reinforced by the lines of action of the Center of Technology of the Waste created recently in the area of La Vega.</li> <li>• The system of management of the agricultural waste in the area of La Vega needs, for its starting, the creation of a complex logistics that includes the withdrawal of waste in the farms and its</li> </ul>	<p>The principal conclusion of the DLA of the INNESTO PROJECT refers that the solution to the problem of the management of the agricultural waste cannot be confronted only as a technical question. The integrated logistics needs common way of several fundamental aspects:</p> <ul style="list-style-type: none"> <li>• Its consideration as a project linked to the social and economic development of the zone, from the perspective of the sustainability.</li> <li>• The adjustment of the project to the specific characteristics of the economic structure of the agricultural sector of La Vega and of the implied social agents (farmers, companies).</li> <li>• The development of the project of way shared by the institutional local agents: Consortium of Waste Management, Center of Technology of Waste, Society for the Economic Development of La Vega and Municipalities.</li> <li>• The consideration of the new context of regional planning that there contribute the Energetic Plan of Andalusia, the Andalusian Plan of Environment and the Plan of Ordination of the Territory of Andalusia and the need to advance in the subsidiarety of its application.</li> <li>• Specific lines of research on the integrated logistics of the agricultural waste and its utilization for the electrical generation, inside the activity of the new Center of Technology of the Waste.</li> <li>• The design of a system of withdrawal, treatment and transport of the waste from the farm to the power plants.</li> <li>• The design and decision of the size of the power plants depending on the optimization of the areas of withdrawal of raste that guarantee a supply of stable biomass throughout the whole year and to the minor economic cost and environmental derivative of the transport.</li> <li>• Normative measures and of economic incentive for the limitation of the current practices of management of the agricultural waste, as well as for the generation of electricity with biomass.</li> </ul> <p>On the other hand, from the previous approaches of integrated logistics, the DLA concludes the need to</p>

<p>transport to the power plants, giving response to a double exigency:</p> <ul style="list-style-type: none"> <li>- The coordination with the farmers and the food-processing industries to guarantee and to make viable the availability of the agricultural waste.</li> <li>- The availability of the waste to a viable cost for its utilization in the electrical generation.</li> </ul>	<p>modify the technological options considered till now for the electrical generation, choosing for a decentralized system of minor's plants promotes that they would guarantee the technical and economic viability of the project and that, simultaneously, they would turn into a factor of socioeconomic development for La Vega favoring the introduction of new productive activities (it is an improvement of the energetic local infrastructure) and generating new fields of activity in the following sectors:</p> <ul style="list-style-type: none"> <li>• The environmental industry.</li> <li>• The agricultural activity.</li> <li>• The energetic industry.</li> <li>• The local sector of the transport.</li> <li>• The research, the development and the technological innovation.</li> </ul>
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## 2 District Logistics Analysis

One of the principal conclusions that are obtained of the DLA of the case of La Vega del Guadalquivir is that the integral approach of the logistics that there proposes INNESTO PROJECT allows to have a new perspective to confront the challenges of the management of the agricultural waste, inside a more general context of innovation and sustainable development of the zone.

Till now the projects to set a system of management of the agricultural waste production of La Vega have faced several kinds of main problems:

- The lack of knowledge on the volume of waste that are generated in the zone. For it specific studies were realized on the distribution of the agricultural cultures and an estimation of the volume of waste of biomass that are produced annually.
- The difficulty of involving the farmers (specially to the smallholders) in a general program of management of the waste of the biomass.
- The lack of a regulation and specific planning on the agricultural waste that, until very recent dates, has not begun to be considered in the environmental and energetic policy.
- The need to design a technology for the electrical generation adapted specifically to the model of management of the agricultural waste of every differentiated territory.

Definitively, from the point of view of the INNESTO PROJECT team, some problems of the starting of an integrated management of the waste derives that, till now, the problem has been focused only from a technical point of view (need to justify the technical and economic viability of a power plant from the biomass).

The main conclusion of applying INNESTO's methodology is, nevertheless, that the solution to the problem is not only technical, but, first of all, it is required to take in consideration of an integrated way the aspects referred to the economic and social specific structure of the zone, as well as the institutional structure, to be able to identify which are the really existing potentials to be able to set a system of management based on the sustainable logistics.

Likewise, the technical problems must not be confronted from a limited perspective. Depending on the characteristics of the economic, social and institutional existing way in La Vega, the technological options have to adapt to such specific aspects.

So, the new methodological approaches that there contributes INNESTO PROJECT have allowed to approach the analysis from a new perspective that, using part of the already existing knowledges previously, set, nevertheless, a new way of organizing the above mentioned knowledge of an integrated form that does not separate the technological aspects of social, economic and institutional. Definitively, INNESTO contributes a tool of utility for the analysis and, specially, for the capture of decisions.

This new perspective establishes, in synthesis, the following aspects:

- The analysis of the production of biomass:
  - Agricultural cultures and its evolution.
  - Estimation of the production of annual biomass.
- The analysis of the economic structure and of the agents involved in the management of the agriculture:
  - Structure of the property of the land.
  - Structure of the companies: cooperative and big exporting companies.
- The analysis of the social and institutional structure:
  - Consortium for the management of the waste.
  - Center of Technology of Waste.
  - Society for the Economic Development of La Vega.
- The analysis of the policies and instruments of planning:
  - Energetic planning.
  - Environmental planning.
  - Planning of the territory.
- The analysis of the technological options:
  - The logistic organization of the agricultural waste.
  - The technological options of the electrical generation from the biomass.

## 2.1 The power plant of biomass and the environmental industry

La Vega del Guadalquivir is one of the agricultural zones that major potential presents in the production of biomass of the Iberian peninsula. The richness of its soil, the annual hours of the sun, the irrigation infrastructures that it has and the kinds of cultures more extended in the region, sustain the above mentioned potential. This originates at present a great environmental problem derived from the habitual practices that realize with these waste, that the indiscriminate burning includes, generating a great emission of greenhouse gases and, nevertheless, the same waste can be used as fuels for the production of electric power.

The utilization of the biomass like fuel, beside helping to lessen the dependence of Andalusia in primary energy, helps to diminish the emission of greenhouse gases and help, of an important way, to the creation of richness and employment in the region across the labors necessary for the preparation, withdrawal, transport and compactación of the fuel.

The project presents a series of advantages that we can classify from several points of view.

From the energetic point of view approximately 100.000 tons per year of biomass that are generated in the region can produce 86 Gwh/year of electricity, that is like production of primary equivalent energy in oil of the order of 30.000 tons.

Economically the net annual invoicing of this energy, to the prices gathered in the in force legislation, would be approximately to approximately 5.500.000 euro.

It reduces energetic imports. For the motive above indicated; the fuel is equivalent energetically to approximately 30 ktoe/year.

Also they present environmental improvements related to the global balance of CO<sub>2</sub>. The above mentioned balance is negative if it is considered to be the not renewable replaced fuel, with what the above mentioned balance is of approximately -90.000 tons of CO<sub>2</sub> per year.

The combustion of stubbles and prunings does not give place to phenomena of acid rain, for the practically void content in sulphur of these fuels.

The production of fuel includes an approximate surface of approximately 30.000 hectares, which need for its preparation, withdrawal and transport of approximately 35.000 annual hours of work, between machinists, transporters and quality controllers of the biomass. All this without counting the employment that would be generated in the power plant.

### 2.1.1 Production of biomass in the region.

#### a. Distribution of the crops

The main crops in the in the region are distributed the woody cultures being located in the most fertile lands, near the river and the rest of the irrigated lands between the level 50 and the river. This zone is the one that can name with property La Vega.

#### b. Evolution of crops

Given the characteristics of the main crops in the region that they are capable of energetic utilization, especially the herbaceous crops in irrigation, it is necessary to estimate the production depending on the evolution of these crops, because they are in the habit of rotating annually and depending also on the water availabilities and on the penalties derived from the EU policies. The woody crops are stabler, because these have a period of exploitation of 10 years and more.

In the following table there appears the evolution of the surfaces of the producing crops of biomass in the region. The herbaceous of irrigation in the region evolve depending on the availabilities, water an effect being observed substitution of crops more intensive in water in years of drought. Nevertheless, it is necessary to say that the irrigations of the region, at least a great part of they, the correspondents to the irrigations of the Viar river, are that fewer problems come having in the years of drought, since they are supplied

of the marsh of El Pintado by a capacity of 213 Hm<sup>3</sup> of water dammed and destined exclusively to the irrigations of the region. The irrigations of the Valle Inferior del Guadalquivir are supplied of the general regulation of the river.

The above mentioned systems of irrigation allow an agrarian production constants since these, they muffle of considerable form the oscillations of the yields of the crops supporting a sensitively constant production since they do not depend on the water natural contributions, except the years of restrictions.

	Evolution of the surface (hectares)											
	Herbaceous						Woody					
	Cotton			Sunflower			Maize	Fruit-bearing		Olive grove		
Year	dryness	irrigation	total	dryness	irrigation	total	total	citrus fruits	bone	Oil-mill	table	Total
1986	0	918	918	2.895	1.282	4.177	12.028	4.384	1.549	853	1.227	2.080
1987	0	2.001	2.001	1.611	1.973	3.584	6.835	4.530	1.664	833	1.234	2.067
1988	0	2.489	2.489	3.502	1.323	4.825	6.281	4.516	1.951	837	1.237	2.074
1989	0	3.577	3.577	3.868	1.503	5.371	9.833	5.052	2.453	661	1.209	1.870

1990	0	3.796	3.796	5.487	3.147	8.634	7.693	5.093	2.502	411	1.559	1.970
1991	0	4.504	4.504	4.509	2.660	7.169	8.262	5.000	2.200	411	1.506	1.917
1992	0	5.526	5.526	4.487	3.815	8.302	6.146	5.127	2.114	411	1.487	1.898
1993	0	4.326	4.326	5.220	8.613	13.833	3.256	5.206	2.101	411	1.479	1.890
1994	0	3.318	3.318	3.366	5.431	8.797	4.687	5.466	2.330	411	1.479	1.890
1995	55.000	3.428	3.483	1.713	5.680	7.393	3.247	5.570	2.347	416	1.479	1.895
1996	30.000	3.877	3.907	1.355	6.919	8.274	3.417	6.037	2.574	326	1.449	1.775
Averag.	8.000	3.433	3.440	3.456	3.850	7.305	6.517	5.089	2.162	542	1.402	1.944

In case of the herbaceous, the fuel for the generation of energy will come from the residues generated after the withdrawal of the crops, whereas in that of the woody ones, this one will be taken of the pruning of the trees.

The residues of biomass capable of being taken advantage as fuels are the following ones:

**Herbaceous:**

Residues of Maize

Residues of Cotton

Residues of Sunflower (dryness and irrigation)

**Woody:**

Pruning fruit tree: peach, nectarines, plum-trees, etc.

Pruning of citrus fruits

Pruning of olive grove (olive to eat)

Pruning of olive grove of oil-mill

**c. Production for type of biomass.**

The production of biomass depends on the yields for hectares of the different crops. They are, approximately the following:

Crop	Yield (ton/hectare)		
	Max	Min	Average
Citrus fruits	2,00	1,00	1,50
Fruti trees	5,00	2,50	3,75
Olive grove (table)	3,00	1,50	2,25
Olive grove oil-mill	2,00	0,50	1,25
Sunflower dryness	2,00	0,80	1,40
Sunflower irrigation	3,00	1,25	2,12
Cotton	7,50	4,50	6,00
Maize	6,50	4,25	5,38

The following table shows the production of minimal and maximum biomass from the values obtained of the sum of every surface of crop multiplied by its yield. In this table it is shown the productions of biomass of the irrigated zones of the region, including the correspondents to the dryness. The information of crops corresponding to the irrigated zones has been given by the respective communities of rerough canvases. The production of biomass ranges, according to yield, between 105.000 tons of maximum to the 57.000 of minimum, correspondent to the information of the year 1996.

Crops	Hectares	Yield (ton/hectare)			Production ton		
		Max	Min	Average	Q-max	Q-min	Q-ave
Citrus fruits	6.037	2,00	1,00	1,50	12.074	6.037	9.056
Fruit trees	2.574	5,00	2,50	3,75	12.870	6.435	9.653
Olive grove (table)	1.449	3,00	1,50	2,25	4.347	2.174	3.260
Olive grove oil-mill	326	2,00	0,50	1,25	652	163	408
Sunflower dryness	1.355	2,00	0,80	1,40	2.710	1.084	1.897
Sunflower irrigation	6.919	3,00	1,25	2,12	20.757	8.649	14.668
Cotton	3.907	7,50	4,50	6,00	29.303	17.582	23.442
Maize	3.457	6,50	4,25	5,38	22.471	14.692	18.599
<b>Total</b>	<b>26.024</b>				<b>105.183</b>	<b>56.815</b>	<b>80.982</b>

Year: 1996

In general, the process of production starts from the delivery of the waste by the farmer. This one is considered to be waste as soon as the farmer presents it in form to be gathered by the services of the Consortium. The obligations of the farmer depend on the type of crop. These have to realize the tasks of preparation of the waste in order that they could be withdraw.

Especially the tasks to realizing for each of the waste are the following ones:

- Preparation of the waste
- Withdrawal
- Transport and compactación
- Qualit control of the waste

### 2.1.2 Characteristics of the fuel.

The waste of biomass will have to appear, in the power plant, of a certain way to be considered to be a fuel capable of energetic utilization. The following table shows this characteristics:

Biomass	Definition	Presentation	Compact	Dampness	Heating power
		Max. Size	Kg/m <sup>3</sup>	%	Kcal/kg.
Cotton	Stems and roots of the plant	Crushed in chunks of 0,8 cm.	175	17	3.266
Maize	Stems and leaves of the plant	Crushed in chunks of 0,8 cm.	114	17	3.190
Sunflower	Stems of the plant	Crushed in chunks of 0,8 cm.	180	10	3.352
Citrus fruits	Branches proceeding from the pruning of the orange trees < 10 of cm. of diameter	Crushed in chunks of 0,8 cm.	335	23	2.673
Fruit trees	Branches proceeding from the pruning peachtree, nectarines plum-trees, etc. < 10	Crushed in chunks of 0,8 cm.	335	23	3.123

	cm. of diameter				
Olive grove	Branches proceeding from the pruning olives trees. < 10 cm. of diameter	Crushed in chunks of 0,8 cm.	390	23	3.283

Nevertheless it will be used as fuel and the price will have to be fixed by 1.000 Kcal, independently of the dampness. Therefore there will be established a table of valuation of the fuels depending on its relative dampness.

Finally, for all the biomasses the percentage in weight of arid and / or strange elements it will have to be a minor of 1 % of the gross weight.

### 2.1.3 Logistic flows. Agricultural waste.

#### Transport of the waste from the farm to the power plant of biomass

The economic and social agents who intervene and the relations that operate between them that allow the good purpose of the project are the following:

Farmers.

Company of production of electric power.

Consortium of Municipalities: managing organisation of the service.

Companies of withdrawal.

Public organisations.

## 2.2 The analysis of the economic structure and of the agents involved in the management of the agriculture.

The objective of the DLA is to identify inside the economic structure of La Vega, which are the opportunities and the existing limitations to start the integrated logistics of management of the biomass. It is like that for that, depending on the type of organization and economic agents involved in the agricultural sector and agroindustrial, there will have to be designed a strategy adapted specifically to such characteristics.

From the study of the characteristics of the agricultural production in La Vega there is deduced the special importance that two main aspects have:

- Structure of the property of the land.
- Structure of the companies: cooperative and big exporting companies.

In relation with the first aspect, in La Vega a clear duality exists between an important number of small farms (linked with smallholders) and a few farms of major size (linked to exporting companies).

In case of the small farms there appear specific problems derived from the major difficulty to design a common strategy for the management of the agricultural waste, simultaneously that a minor technological and financial aptitude to approach the start of the integrated logistics. This way, the management of a significant volume of waste of biomass needs the negotiation with a too high number of small farmers. On the other hand, the needs of management of the biomass (machinery for its compacting, infrastructure of storage) raise also major difficulties of viability in case of the small farms.

The farms of bigger size, nevertheless, allow to approach the management of bigger volumes of biomass with a smaller number of farmers. These farms also possess a major technological and financial aptitude to approach the necessary actions of management and logistics of the waste.

In relation with the second aspect, the kind of companies, it also reproduces the same duality.

On one hand, the bigger farms link themselves with companies of bigger dimension and, therefore, with major complexity in its organization. It is a question of companies to commercialize the agricultural production with destiny to the exportation and, partly, for the local and regional markets.

The small farms have forms of organization for the marketing of its products by means of cooperative societies that centralize the production of a great number of small farms for its marketing. From the point of view of the INNESTO PROJECT it thinks that these cooperative societies have to be the speaker adapted to approach the starting of the integrated logistics of the waste of biomass since they contribute the economy on a large scale adapted as for the volume of agricultural annual production and, in addition, they can offer bigger organizational, technological and financial capacities.

### 2.3 Analysis of the social and institutional structure

The objective of the DLA is to identify if the current institutional framework in La Vega constitutes a factor of impulse, or not, to start the integrated logistics of management of the waste of the biomass.

In this sense, from the approach of the INNESTO PROJECT it is considered that they exist the instruments and institutional sufficient structures to start this process. The main identified elements and that have to recover an important role in the impulse of the integrated logistics of the biomass are:

- **Consortium for the management of the waste.** This Consortium constitutes the central element for the starting of the project although it is the manager of the management of the urban waste of the totality of municipalities. Therefore it contributes, on the one hand, the technical base and of specific management for the management of the waste (systems of domiciliary withdrawal in every municipality, plants of transfer and plant of recycling and compost of waste). On the other hand, the Consortium constitutes an experience of territorial cooperation that it allows to involve in the process to the totality of the municipalities of La Vega, indispensable requirement to achieve the economy on a large scale that needs the integrated logistics of the biomass (there is necessary a high volume of waste of biomass to start the electrical production).
- **Center of Technology of Waste.** This Center, of recent creation, is a part of the Andalusian Network of Technological Innovation, a network of centers and spaces of innovation of the regional government of Andalusia which Technological Parks and Centers of Research join specialized distributed by the region. The Center of Technology of Waste is, therefore, an installation of regional character but that is born linked directly to the management of the Plant of Recycling and Compost of Waste of La Vega. The development of technologies for the management of the biomass is one of the lines of work established in the program of the Center.
- **Society for the Economic Development of La Vega.** This society is a good example of institutional structure based on the supralocal cooperation of the municipalities of La Vega linked with the social and economic development of this territory. The society has elaborated a Strategic Plan of Innovation and Sustainable Development for the zone what means a good base on which to sustain the starting of the integrated management of the waste of biomass. On the other hand, the society incorporates, besides to the public agents (Municipalities), mechanisms of participation of the social and economic agents what allows to possess a forum to raise the projects that necessarily have to imply the set of institutional, social and economic agents.

## 2.4 Analysis of the policies and instruments of planning.

The objective of the DLA is to know if the existing instruments of regional planning offer a sufficient base on which to develop the project of integrated logistics of the waste of the biomass. Likewise, the need appears of that, applying the principle of subsidiarity, such instruments of planning (elaborated from the regional perspective) could be developed from area of La Vega. It has to produce an adjustment of the regional planning to itself to the characteristics specific and differentiated from every territory and that, in its development, there imply the institutional, social and economic local agents.

The INNESTO PROJECT has taken in consideration three fundamental instruments of planning:

- **Energetic planning.** In 2004 the new Energetic Plan of Andalusia 2003-2006 has been approved. It constitutes the main instrument in which to sustain the project of integrated logistics of the waste of biomass. The Plan contemplates, inside its program of promotion of the renewable energies, a specific offer for the biomass that raises three types of uses: generation of electric power, thermal final uses and production of biocarburantes. In the field of the electrical generation it proposes to reach in 2010 an installed power of 250 MW in electrical plants in Andalusia.
- **Environmental Planning.** The Plan of Environment of Andalusia has its period term of application fixed for the years 2004-2010. Though it does not include between its specific programs a paragraph dedicated to the energy (it exists, since a sectorial plan has distinguished itself previously on this matter), if it considers the energetic question with relation to many of the objectives and actions that are programmed. In the context of INNESTO PROJECT's objectives, certain lines of action especificied in the Plan can mean a reinforcement of the viability of its approaches. Mainly regarding:
  - The impulse of lines of research and technological development for the improvement of the sustainability of the agriculture and the management and reutilization of the agricultural, cattle and agroindustrial waste, as well as the crops with energetic purposes. Apoyo económico a la adopción y comercialización de tecnologías basadas en la utilización de energías renovables.
  - Support to RDT projects on alternative fuels for the automotion.
  - Cooperation with the Andalusian Agency of the Energy in projects of experimentation in renewable energies.
  - Design of common actions with the agrarian and agroindustrial associations to promote the production and utilization of the biomass by means of the development of campaigns of diffusion and sensitization on its energetic potentials.
- **Planning of the territory.** The Plan of Ordination of the Territory of Andalusia (Bases and Strategies) takes the consolidation of the networks of cities as one of its main proposed. In case of La Vega is identified a network of medium size cities on which the strategies of cooperation have to be sustained for the territorial development. The objective of development for the area of La Vega are based in advancing in the sustainability of the agricultural model of irrigation by means of the rational use of the natural resources, specially the water.

## 2.5 The analysis of the technological options.

The methodology of the INNESTO PROJECT, based on an integrated concept of the logistics, raises the need of that the technological options that are adopted base, in a process of analysis of the economic, social, institutional and of planning context, so that such technological options will meet determined, in a decisive way, by the implication of the social agents and the public power in the process of making decisions.

In this sense, the conclusions to which the DLA comes allow to affirm that, really, the consideration of the economic, social and territorial context and of the agents and public instruments of intervention, it does that the technological option should adapt to the specificities of the territory. It is important to make notice that this process is in the habit of being, exactly, I contradict, that is to say, the technological solutions they turn out to be like determining previous and immutable to that they must adapt the different territories.

Hereby, the DLA has appeared the objectives to make depend the technological options (so much as for logistics as of the type of technology to using for the electrical generation) of the proper characteristics of La Vega and of the capacities of the social, economic and institutional agents to contribute new forms of cooperation and organization.

In this sense the DLA has considered two fundamental aspects:

- **The logistic organization of the agricultural waste.** The solution to the management of the agricultural waste appears, first of all, as a logistic problem. It is necessary to implement a system of withdrawal, compact, storage and transport of the waste from the farms to the power plants. This one has been, till now the main problem for the implantation of the management of the waste although, the dispersion of the points of generation of the waste (the farms), the seasonal variation in the generation waste (in every type of crops it is in a certain period of the year), the need to implement systems of withdrawal and compact of the agricultural waste inside every farm, and the need to establish a system of transport up to the power plants, they are factors that were determining the lack of economic profitability of the system of management.

From INNESTO PROJECT a series of priorities have been identified directed to solving the above mentioned limitations:

- The system development of withdrawal and treatment of biomass (technologies for the creation of machinery for the withdrawal, punctured and packed of the agricultural residues) foreseen specifically in the program of RDI of the Energetic Plan of Andalusia. This project would develop in the Center of Technology of the Waste.
- - The establishment of a system of provisioning waste throughout the whole year, organizing the withdrawal of the waste of the different types of crops (woody and herbaceous) existing in La Vega and that would

guarantee the supply of the power plants throughout the whole year. In a complementary way there is contemplated the implantation of energetic crops in the zone that they cover the demand of biomass of a stable, way also an a contemplated in the Energetic Plan of Andalusia.

- - The establishment of a system of transport of the biomass from the farms to the power plants based on the identification of ideal routes that minimize the economic cost of the transport and its environmental impact. The starting of the system is, in addition, a factor of impulse of the development and the employment on the transporters of the zone.
- To know the dimension of the power of electrical generation of the plants of biomass from the calculation of the area of influence of every plant (area of withdrawal of waste with an extension that promotes the costs of transport). For it one proposes the implantation of a geographical information system (developed already initially on the part of the Consortium of waste management) in that there are identified the agricultural developments and the system of communications (rural ways, roads) that would shape territorial self-sufficient areas to give the biomass to the power plants.
- The modification of the regulatory context of the electrical production from the biomass so that there is improved substantially the economic viability of the management of the waste. In this sense there are two fundamental lines. On the one hand, the increase of the public subsidy to the kWh generated with biomass (contemplated in the Energetic Plan of Andalusia). For other one, the environmental regulation of the burning of the agricultural residues, establishing limitations to this practices given its void economic benefits and its high environmental impact.
- **The technological options of the electrical generation from the biomass.** Till now, the technological solutions were consisting of power plants of 5-10 MW of power that would need volumes of biomass that are produced in territorial too extensive areas and that, consequent, with a high price of the transport and were reducing the economic viability of the power plants.

The need to adapt the technological solutions to the social and economic characteristics of every territory does that in case of La Vega it is more viable to choose for a system of small power plants (of 1 MW of power) distributed in all the zone. The decision on the location of the power plants will be a result of the introduction of the geographical information system before mentioned, that calculates the ideal areas of influence of every power plant. On the other hand it is of emphasizing that this system offers an additional advantage since it allows to link every power plant to concrete projects of productive development in the different municipalities of La Vega that, at present meet affected by the insufficiency of the networks of transport and electrical distribution and it is a limitation for the implantation of certain industrial activities. Definitively, a system of electrical generation

decentralized will allow not to manage only in an integrated way the agricultural waste, but, in addition, to convert into a decisive factor for the impulse of the economic development for the zone.

The starting of this option has to accompany of the first phase of demonstration in which, by means of agreement with the different social and economic agents implied (farmers, cooperative, big companies, municipalities, Society for the Development of La Vega, Consortium of waste management, Center of Technology of Waste and Andalusian Government), there is organized the complete process of analysis and capture of decisions that culminates with the creation of a pilot power plant who will be submitted to a process of follow-up and monitoring of its functioning to measure its technical, economic and environmental efficiency.

## 2.6 Synthesis on the effects expected from the development of the integrated logistics of the waste of the biomass.

The approaches developed by the INNESTO PROJECT in La Vega del Guadalquivir for the implantation of a system of management of the agricultural waste and its utilization for the generation of electricity is based in the overcoming of an exclusively technical vision of the problem, reinforcing the need to take in consideration, besides such technical aspects, all the factors and agents (territorial, social, economic and institutional) that are involved in the process.

It supposes that the project of management of the agricultural waste will have also another consequences and that can be synthesized of the following form:

- Effects on the agricultural activity: increase of the activity (withdrawal, treatment and storage of the waste); increase of the revenue (income for the sale of biomass).
- Environmental effects: reduction of the impact of the burning of the waste in the farms; reduction of the emission of pollutants to the atmosphere.
- Energetic effects: reduction of the consumption of fossil fuels; increase of the use of energetic renewable sources; increase of the electrical local generation.
- Economic effects: improvement of the deficits of electrical supply and increase of the capacity of location of new productive activities; increase of the activity and the employment in the energetic sectors, of the transport, environmental and technological to local level.

## Annex: DLA questionnaire

### 1 Basic Information

- Name of the interviewed person: \_\_\_\_\_
- Profession/post \_\_\_\_\_
- Employed employees in the company:
  - Full-time \_\_\_\_\_
  - Partial-time \_\_\_\_\_
- Turnover of the company in the last year:
  - < 250.000 euros \_\_\_\_\_
  - 250.000-500.000 euros \_\_\_\_\_
  - 500.000-1.000.000 euros \_\_\_\_\_
  - 1.000.000-2.500.000 euros \_\_\_\_\_
  - 2.500.000-5.000.000 euros \_\_\_\_\_
  - 5.000.000-10.000.000 euros \_\_\_\_\_

### 2 Type of clients

- How are sales distributed according to type of markets to which it is destined?

	%
Sale in bulk (oil-mills, extractor of cotton...)	
Sale of wholesalers	
Sale to retailers	
Sale to distribution companies	
Sale to industrial manufacturing	
Sale to end-consumer	
Others	

- How are the sales of the company distributed according to destiny of the production?

Geographical destiny	%
Province of Seville	
Rest of Andalusia	
Rest of Spain	
European Union countries: Mediterranean	
European Union countries: center and north	
Rest of Europe	
North of Africa	
Middle East	
America	
Rest of the world	

### 3 Characteristics of the farm and production of waste

- What kind of crop are exploited in the farm?

Crop	Hectares	Tons
Cotton in dryness		
Cotton in irrigation		
Sunflower in dryness		
Sunflower in irrigation		
Corn		
Citrus fruits		
Fruit tree of bone		
Olive to eat		
Olive of oil-mill		
Others		

- Which is the production of agricultural useful waste for the generation of biomass?

Kind of waste	Tons
Waste of corn	
Waste of cotton	
Waste of sunflower	
Pruning fruit tree of bone	
Pruning citrus fruits	
Pruning olive tree of olive to eat	
Pruning olive tree of oil-mill	
Others	

- Which is the destiny that today has this waste?

Burning stubble \_\_\_\_\_

Controlled dump \_\_\_\_\_

Plant of transference \_\_\_\_\_

Uncontrolled dump \_\_\_\_\_

Others \_\_\_\_\_

- On what season of the year there is waste originated by the agricultural activities?

Crop	Spring	Summer	Autumn	Winter
Cotton in dryness				
Cotton in irrigation				
Sunflower in dryness				
Sunflower in irrigation				
Corn				
Citrus fruits				
Fruit tree of bone				
Olive to eat				
Olive of oil-mill				
Others				

- In how many days are produced the waste derived from the crop or labors of pruning?

Tipo de residuos	1 week	2 weeks	3 weeks	1 month	> 1 month
Waste of corn					
Waste of cotton					
Waste of sunflower					
Pruning fruit tree of bone					
Pruning citrus fruits					
Pruning olive tree of olive to eat					
Pruning olive tree of oil-mill					
Others					

- Which is the time limit that should pass from the production of the waste up to the withdrawal of this?

Less than 1 week \_\_\_\_\_

1 week \_\_\_\_\_

2 weeks \_\_\_\_\_

More than 2 weeks \_\_\_\_\_

- How do you value the interest that would have for your farm the withdrawal of the waste for its utilization in the powerplant of biomass?

Very positive \_\_\_\_\_

Positive \_\_\_\_\_

Medium \_\_\_\_\_

Slightly positive \_\_\_\_\_

Very slightly positive \_\_\_\_\_

- Do you have you a system to transport the waste up to the powerplant of biomass?

Yes \_\_\_\_\_ No \_\_\_\_\_

- If you have answered affirmatively, would you be ready to transport the waste up to the powerplant of biomass?

Yes \_\_\_\_\_ No \_\_\_\_\_

#### 4 Logistic organization of the transport of the waste

- What forecasts of fleet of trucks exist for the withdrawal of the waste and its transport to the powerplant of biomass?
- In which season of the year it is foreseen to concentrate the labors of withdrawal of the agricultural waste?
- How many days you calculate that there will last every campaign of withdrawal of waste?
- How many different routes you have foreseen to realize?
- What frequency of distances will be in every route?