

Dynamics of Supply Chain Agreements for Development of Biomass Plants

“Rubires” and the Cogeneration Station of Carmagnola



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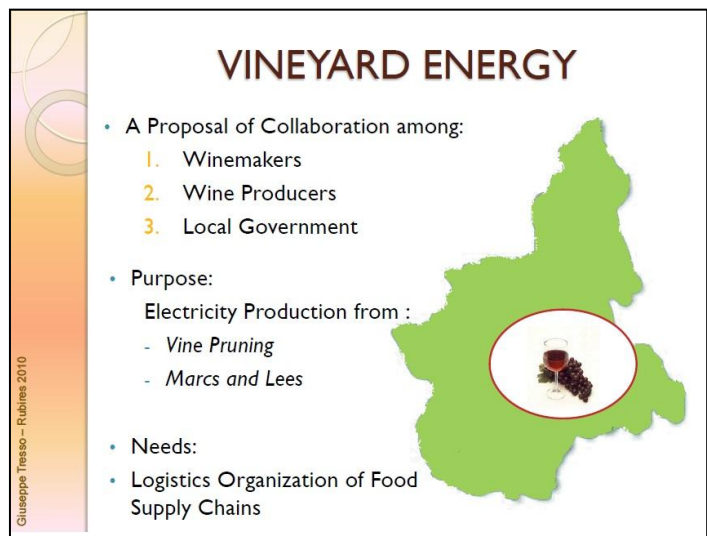
1 Rubires and the Project of the Cogeneration Station of Carmagnola

1.1 Preliminary Remarks

Certainly, the “Rubires - Rural Biological Resources” Project, funded within the 2007-2013 Central European Programme, led to many positive effects in terms of experiential comparison among European countries, providing important elements for a better comprehension of the international scenario of bio-energy.

Concretely, in our region, this effort motivated some private actors to get organized for an agreement with the Consortium Langhe Monferrato Roero (LAMORO), in order to design and build a cogeneration station powers by biomass obtained through one or more local supply chain agreements.

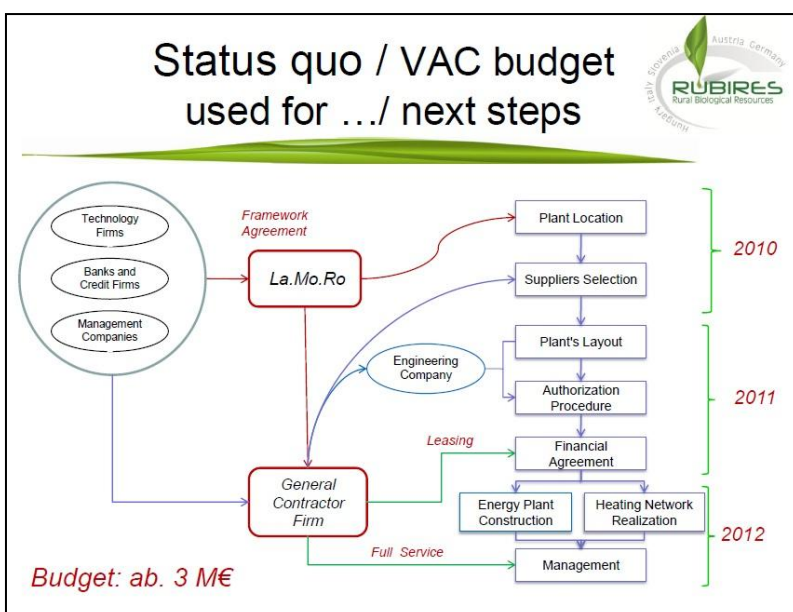
Therefore, thanks to the activity of LAMORO, at the end of the authorization procedures, an energy production plant in Carmagnola (in the Province of Turin) should start operating in 2012. For this plant an agreement has been signed with the Egea SpA [Italian Energy and Environment Management Authority] – the society that manages different district heating networks on the regional territory – for the supply of thermal energy to the district heating network which is currently being built on the municipal territory.



The aim of collaborating in the creation of a cogeneration plant had been suggested during the meeting of 2009 in Asti and established as purpose during the transnational project meeting in Miesenbach (Germany).

Last year, during the transnational meeting in Potsdam (Germany), an organizational pattern was also

suggested, in order to find an appropriate site to house the station, optimize the thermal energy use and involve various energy actors interested in this initiative.



Since the supply chain agreement – defined in order to ensure a sufficient degree of certainty of a long-term supply – appeared to be the main factor motivating companies interested in funding the project, this report means to share some observations on the logistic phase, which is necessary for the economic

and environmental sustainability of the projects, but is often undervalued by the professional actors.

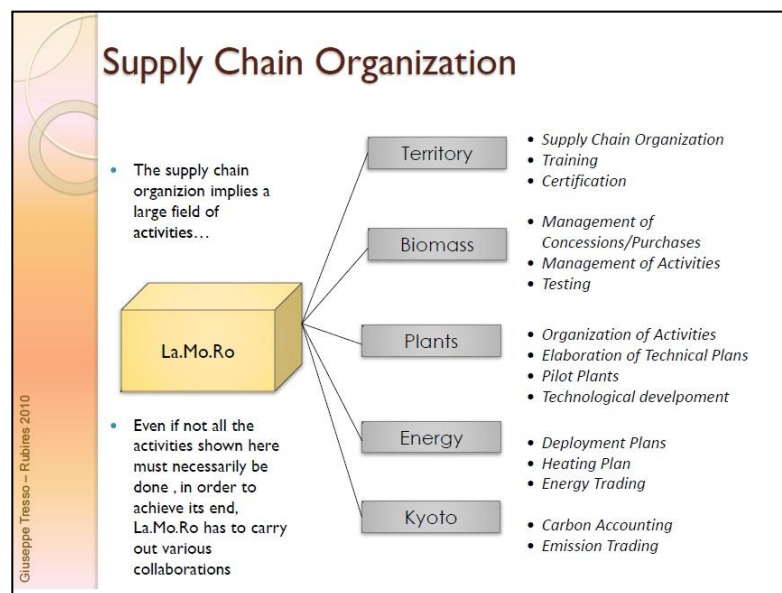
1.2 The Supply Chain Agreement for the Project of Carmagnola

In order to put into effect the abstract basics of analysis and sharing carried out during the Rubires Project, the collaborative staff of LAMORO set itself the purpose of enhancing the local resources in a sustainable way, considering:

1. the technical feasibility of introducing a low-powered station into the territory, especially according to the actual possibility of recovering thermal energy;
2. the availability and cost of local wood management, in accordance with the need to power the station following the reference principles of the “short supply chain”;
3. the involvement and organization on local level of business actors interested in investing resources to build and manage the station, motivated also by the purpose of territorial promotion that may be allowed by energy production.

It was then set up a system project for which, in brief, the all-in fee was not an end in itself, but an opportunity to better exploit the potential value of local biomass and create jobs, distributing the profit margin into the different supply chain actors.

Therefore, LAMORO has put itself into a partnership in order to supervise all the activities (shown in the diagram on the right), directly connected to the settlement of a station, as well as to many development potential areas and a further enhancement of the initiative.



Reversing the usual approach, which defines the plant size and, according to this, organizes the supply system, the effort was to “bring the plant to biomass”, identifying the structural, methodological and technological conditions useful to the settlement of energy plant near to the production areas.

As said earlier, once defined the biomass type to process (forest product, agricultural by-product, pruning residue, working and popular cultivation waste, wine marc and lee), the use features of thermal production have been analysed.

For that purpose, the agency contacted was the Egea of Alba, which, among the other initiatives, manages many municipal district heating networks in Piedmont.

Rejected, because of technical compatibility problems, the possibility of setting up a plant near to the thermal network of Alba, the first hypothesis considered was to set up a station near the thermal network under construction near Carmagnola, in Turin province.

However, the only available surface to set up the station near the thermal network was limited compared to the need of a cogeneration station with steam turbines or Organic Rankine Cycles (see box in this page), while it was sufficient compared to the structural restraints of an innovative pyrogasification plant of 850 kWe of the German company “Pyrox”.

The Main Cogeneration Systems:

- **Steam Turbines.** Stations with a plant made of pump, boiler, turbine and condenser. The turbine producing energy is powered by the water steam. The operating range of these plants varies from 1MWe up to 50MWe;
- **Organic Rankine Cycles (ORC).** Very common technologies, similar to the traditional steam turbines except for the working fluid that in this case is an organic fluid with high molecular mass able to ensure a better power performance;
- **Pyrogasification.** The gasification is the physicochemical process that, during the thermolysis, converts a solid fuel (wood, wastes and agricultural wastes) into a gaseous fuel. Through this process the energy contained in the organic matter is fully and intensively exploited, with higher power performance and reduced emissions. The size of plants is extremely small: from 50kWe to 2MWe.

To power the station, around 7000 tons of biomass per year are expected.

In this way, it was possible to match the logistic needs of powering the station with the aim of transferring thermal energy to the district heating network of Carmagnola, exploiting, moreover, a technology already in use on the regional territory, in Villanova Mondovì (in the Province of Cuneo), where it resulted compatible with the emission limits set by the so-called “plan zones”, territories considered particularly vulnerable by the Provincial Plan and for this reason subject to environmental regulations that are stricter than the national ones.

The technological choice has obviously influenced the settings of the supply chain agreement, narrowing the field of agro-forestry biomass to the sole chippable material of 50 mm.

This technology is very efficient in terms of electricity production, due to the peculiar characteristics of the pyrolytic reactor, has some rigidity concerning the characterization of the incoming biomass: unless technological or process development, not to exclude in the medium term, the station of Carmagnola is not expected to process wine marc or lee, as well as straw and very fine material. However, the energy and environmental balance remains largely positive for the territory.

Considering the traditional local productions, the supply chain organization will be thereby oriented towards the following materials:

- Wood-chips;
- Fast-growing forest cultivations;
- Orchard and Vine pruning selected residues;
- Orchard explants.

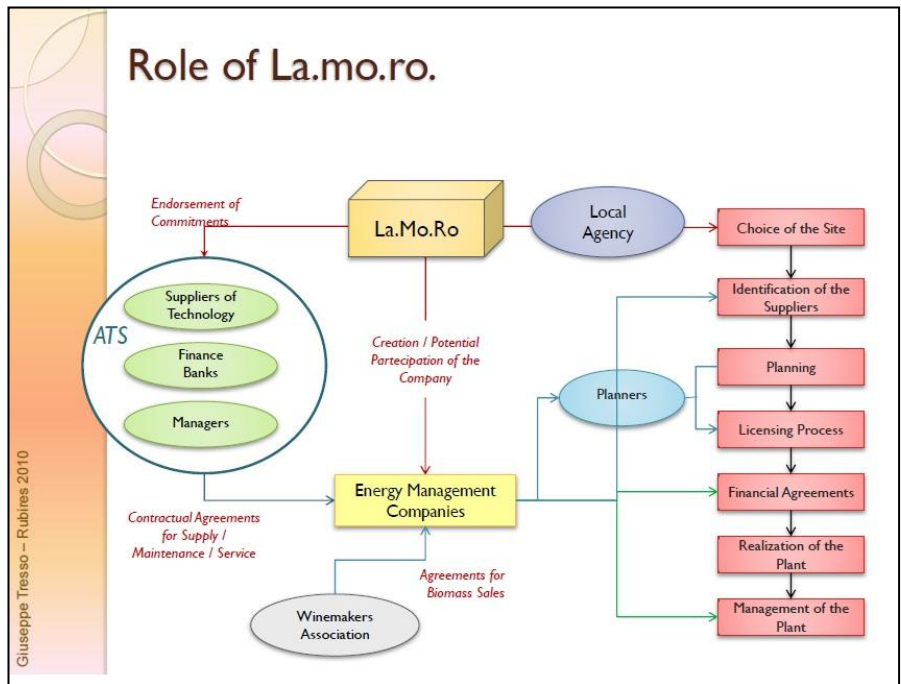
The availability of areas was achieved with an agreement with the owners, and then a request of collaboration with two associations of local farmers and winemakers – Coldiretti [Italian Association of

Farmers] and Associazione Vignaioli Piemontesi [Piedmont Association of Wine Producers] – has been initiated in order to arrange an operational programme aimed to create an associative or cooperative reality able to engage itself on behalf of the producers in agreement (farmers, winemakers, processing plants, wine cellars or forest owners) for the long-term supply of biomass at arranged and guaranteed prices terms.

To follow suit, LAMORO has declared its availability to arrange the terms of a technical policy for supply and management, based on the different types of material, considered in relation with its energy power and recovery, storage and supply conditions, in order to match the remuneration needs of agricultural and/or forest producers.

The final act was the signing of agreements with other local industrial actors (jointed in a so-called ATI, i.e. Temporary Business Association) in order to perform together the activity needed for the creation of a SPV, Special Purpose Vehicle Association.

In the name of this association will be registered contracts for supply chain, transfer of thermal energy and construction authorization, activation and management of the biomass station. Then the purchase of the entire capital of SPV will be offered on the market.



Therefore, the role of LAMORO is central to the interests of all actors involved, since it can direct its activity on many fronts, which will be recognised within the investment plan.

2 The Supply Chain Agreements in the Biomass Sector

As shown in the diagram below, the current regulations provide incentives for the “short supply chain” only for what concerns the biomass stations with a power higher than 1 electrical MW.

A choice, controversial for many, but due by the fact that the original regulations (approved by the Finance Act of 2008, which provided incentives in a discriminating way, depending on whether the biomass was or was not produced within 70 km from the plant, regardless of the power of the plant itself) was challenged by the European Commission as being contrary to the principle of free movement of goods.

To batten down the hatches, in July 2009, an article was added to the Law 99, establishing a fee for any biomass coming from the European territory.

This choice was not intended to promote typical products of the land, but to allow, in pseudo-environmental terms, the energy use of material carried throughout Europe.

Unfortunately, it might not be done otherwise. However, this choice has encouraged the speculative proposal of plants, without cogeneration restraints, powered by “market” biomasses – that is to say coming mainly from foreign countries – regardless local economies and environmental compatibility principles.

As a more serious problem, the unsettled regulations led to the current Italian situation, where a unique approach does not exist yet in terms of agro-forestry supply chain agreements, but there are at least three different trend-lines:

- Concerning the biogas plants related to agricultural or zoo-technical productions, the supply chain agreements are always signed contextually to the building of the plant and do not pose particular difficulties.
- Concerning the agricultural sector, some large business companies (i.g. Enel Green Power) have signed intent agreements with representation organizations of agricultural actors – *Coldiretti*, *Confagricoltura*, *Cia* – that however have not produced, until today, substantial results in Piedmont, because of the technological pattern chosen by companies (with a power higher than 1 MWe) which, besides having problems for the authorization, are not able to “pay” the biomass for its costs. It must be however pointed out that, moving in this direction, with a commercial structure dedicated to the signing of agreements with landowners, Mossi & Ghisolfi (an important multinational company in the polyethylene terephthalate industry) is currently trying to organize

The Italian System of Incentive for Biomass Energy Production.

The Producers can ask for incentive through Green Certificates or, according to some criteria, through the payment of an All-in Fee for a 15-year period.

a) System of Green Certificates

Green Certificates have a unit value equal to 1 MWh and are issued by GSE [Energy Service Company] for an amount equal to the product between the net production of incentivable power and a coefficient, different for each source, which is equal to 1,80 for biomass and biogas produced by agricultural, breeding and forest activities.

The Finance Act of 2008 defined the calculation features of the offer price of the Green Certificates by GSE: they are put on the market with a price – referred to electrical MWh – equal to the difference between 180 €/MWh (reference value) and the average annual value of the price of electricity sales defined by the Regulatory Authority for Electricity and Gas and communicated by this Authority by the 31st January of every year.

b) System of All-in Fee

At the instance of the Producer, as an alternative to Green Certificates, the incentive can be given by GSE through the payment of an All-in Fee in the case of plant with a average annual rated power not exceeding 1 MWe. For biomass, the All-in Fee is equal to 28 euro cents for each kWe.

the supply system of its own station in Crescentino, that will become operational in 2012, producing bio-ethanol from cultivations of *Arundo Donax*.

- Concerning the forest biomass, until today no supply chain agreements have been signed neither by the companies owning the existing wood chip combustion plants nor by the three firms having the authorisation for 5 MWe, approved before the definition of the current regulation, which requires the following agreement: these organizations only guarantee purchase prices of wooden material, regardless the origin, usually at around 40/50 euros per ton (a price very far from the minimum value required to enable local productive supply chain, especially in the forestry sector).

Since the situation on the other Italian territories is not so different from the Piedmont case, it can be said that, despite the incentive of the legislation and the all-in fee, except for the biogas plants, almost all the biomass plants in our region and on the Italian territory are not related to any supply chain agreement.

For this reason, it can be said without any doubt that the above mentioned “Rubires” initiative of Carmagnola, represents an innovation in this field, since the supply chain agreement has been considered crucial in this initiative, involving public and private institutions as Coldiretti, Pronatura and Ipla (Forestry and Environment Institute).

Indeed, in our case, a technological and management pattern able to distribute the value on all the supply chain has been chosen, in order to recover and use forest product, agricultural by-product, pruning residue, working and poplar cultivation waste, wine marc and lee.

2.1 What does “Supply Chain Agreement” Mean

A common mistake, not only in Italy, is to refer to “biomass” in an undifferentiated way, considering the transformation technology or the deriving energy product rather than the production or recovery context (forest, dedicated cultivation, agricultural residue, municipal solid waste organic fraction, ect.). Usually, people talk about “biogas” or “biodiesel” rather than generic “incinerators”, as if these were the consequences of linear supply chain processes, while the biomass derives from some specific conditions and refers to very different use fields.

It is not simply a matter of terminology: each type of existing or recoverable biomass on a specific territory has complex logistic needs, besides the technical ones, connected to specific local situations. Because of this particularity, certain recovery methods and technological processes become inappropriate in some cases, while in other use fields are perfectly functional.

A supply chain agreement aimed to produce, recover, characterize and transfer biomass from the territory to an energy production plant must take into account of this complexity.

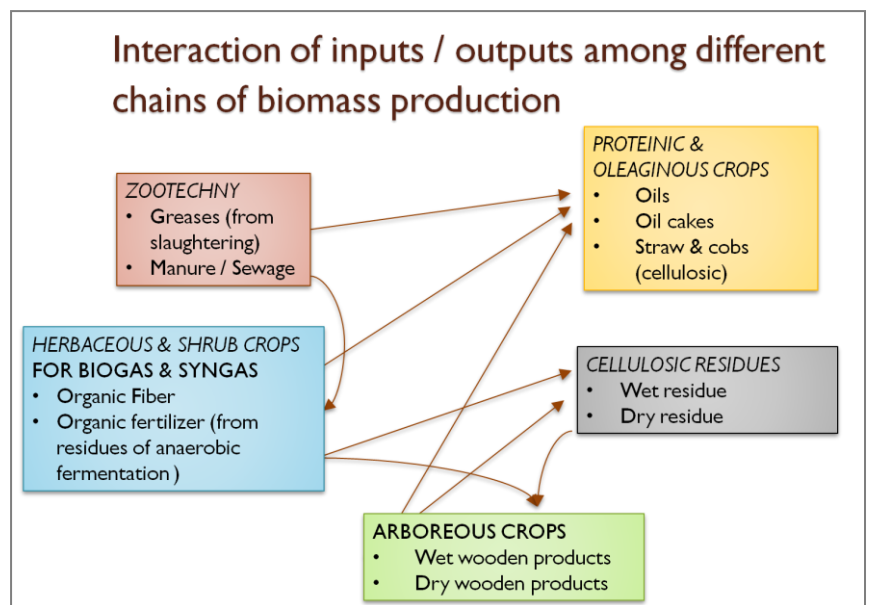
2.1.1 Analysis of the Territorial Potential

Before signing a supply chain agreement, it is necessary to assess the territorial potential, searching for the maximum integration of the different energy types deriving from agricultural and forest activities.

Indeed, there is a close interdependence among different supply chains of biomass production, since one strategic plan can include zoo-technical wastes and their derivatives, protein and oleaginous crops, cellulosic residues, wood chip crops (the so-called *Short Rotation Forestry*), forest management, herbaceous and shrub crops for biogas.

Since the race for biomass is a recent phenomenon, there is still a long way to go in order to better define the technical and cultivation processes. The nearby diagram – already presented in the meeting of Miesenbach – shows the complexity of these interactions and opens interesting perspectives on the themes of process innovation and cultivation techniques, especially in agriculture.

Problems limiting the development of bio-energies, as the potential competition between the crops for human or animal feed and the energy



crops, can be solved changing the approach in choosing and selecting agricultural varieties, diametrically compared to what has been done in the last years.

An example in the cereal sector can help to understand the importance of this effort: in order to reduce the needs of water and fertilizers, as well as the production of wastes, in the last decades the genetic research carried out by the companies producing seeds has led to the reduction of the stems related to the maximum production of grains.

Instead, the scenarios opened by the race to bio-energies might led to go back in respect to this philosophy, since the green waste (an excellent energy product) can ensure an interesting income supplement proportional to the vegetable volume that was once considered "residual".

For agro-forestry systems, process innovation and investment in evolved technologies are the two parallel ways to compete with international markets: a reversal of perspective in terms of plants is necessary and, considering that, the technological innovations and those related to the agro-forestry management process (the formers can not go without the others) could play a fundamental role in defining industrial and supply chain patterns compatible and profitable.

2.1.2 Choice of the Technological Pattern

The following table – related to the different energy possibilities of wooden biomasses – gives us a starting point to understand how the contextual conditions influence the choice of a particular technology, which, in turn, would influence the aims of a supply chain agreement.

**Quali tecnologie possono “reggere”
80 euro / Ton ?**

	Turbina 1MW	ORC	Gassificaz. < 400 kWt	Gassificaz. > 500 kWt
Costo Impianto a kWt	5.300	4.800	4.000	4.400
kWt / kg biomassa anidra	1,15	1,11	1,33	1,71
kWt / kg biomassa anidra	3,69	3,11	2,13	1,88
MWt da vendere su 1 Mwe	3,20	3,00	1,50	1,03
Percentuale sul totale	80%	55%	100%	70%
Energia termica totale da vendere	2.56 MW	1.65 MW	500 kW	720 kW

point to understand how the contextual conditions influence the choice of a particular technology, which, in turn, would influence the aims of a supply chain agreement.

This sample can be referred to the current technological characteristics of the small cogeneration systems. The onerous conditions for the forest biomass recovery in Piedmont make the choice

of adopting a particular technological process depend on the actual use possibilities of thermal energy.

Indeed, the matrix shows the equivalent parameters of the different technological solutions currently on the market compared to the possibility to sell thermal energy with the purchase conditions of biomass of 80 euro per ton, taking into account even the amount of electricity transferred to GSE [Energy Service Management] for 0.28 euros per kWt.

Basically:

- Today no technology fits for this use field, unless using also the thermal energy in the same time.
- If it is possible to connect a biomass plant to a network able to absorb constantly more than 2,56 MW of thermal energy, it would be worthwhile to adopt a turbine plant or, as an alternative, an ORC technology, that is even more efficient.
- Finally, if it is impossible to identify on the territory an economic use feature of the thermal energy with a power above 1,65 MW (as typically in Piedmont case), the potential technological solutions field is further restricted, making possible only the way of gasification system (with all the technological risks of a new technology at the beginning of its implementation).

However, since the gasification technologies require non-heterogeneous and strongly characterized biomass, in the case of a small plant, the supply chain agreement shall be limited to the sole forest producers, without extending the proposal to the producers of biomass from agricultural activities or process residues.

In the opposite case – which can be referred to the thermal supply of a big shopping centre or an extended municipal thermal network – the high demand of thermal energy allows to adopt traditional technologies, more appropriate to deal with heterogeneous biomass.

The nearby table shows a short classification of the best combinations of the available technologies and the potential use fields of thermal energy. So, to make the local resources become an added value developing valuable processes within a local economy is an aim that integrates the choice of “which” and “how much” energy has to be produced with other two fundamental questions: “how” producing it and, most importantly, “where”.

<i>Tecnologia</i>	<i>Destinazioni energia termica</i>
• Turbina da > 1 Mw. / ORC	<ul style="list-style-type: none"> ◦ Centri commerciali (vendita termico) ◦ Frutticoltura / Pioppicoltura / SRF ◦ Filiere agricole - Paglie
• Gassificatore 200/400 kW	<ul style="list-style-type: none"> • Upgrade su reti termiche esistenti <ul style="list-style-type: none"> • Caseifici • Imprese
• Gassificatore 500/1000 kW	<ul style="list-style-type: none"> • Gestione forestale • Produzione pellet • Reti termiche pubbliche
• Torcia al plasma 200 kW (da verificare)	<ul style="list-style-type: none"> • Vinacce / Fecce • Upgrade Reti termiche • Fraz. Organica RSU

The supply chain agreement should be considered not only as a commercial relation between producers and clients for a specific biomass, based on prices defined in accordance with types of material, delivery times or relative humidity.

The guarantee of origin of biomass, the best thermal energy use possible and the extension of the commercial perspective of wood, agricultural residues and agro-forestry products, are the three main objectives to be taken into account in arranging the logistic system of the supply chain.

Beyond the ethics of this approach, the integrated management of the supply chain in its entirety, starting from the biomass production reality up to the connected productions and the use of thermal energy, is considered to be necessary.

Indeed, it is interesting to notice that, despite the development of this sector is only at the beginning, on the Italian territory some critical situations have been registered in terms of competition in supplies and final products (wood chips for energy against chipboard, lack of construction wood).

This market reality becomes even more complex since in Italy there are not many local industrial contexts and, therefore, the local biomass management is often limited by the extemporaneousness and the lack of perspective.

2.2 Which Actors Should Be Involved?

A supply chain agreement represents the crucial contractual relationship that binds all the actors involved (forest and land-owners, public administrations, forest actors, energy transformation companies, thermal energy clients) in a necessarily enlarged management of material.

This idea is the key of the system and can be understood observing the following diagram related to the projects carried out in Piedmont by UNCEM, the National Union of Mountain Municipalities, Communities and Authorities, which is implementing some programmes concerning biomass stations and in July 2009 has shared with LAMORO the organization of the successful local meeting of Rubires in Alba, named “Vineyard Energy”.

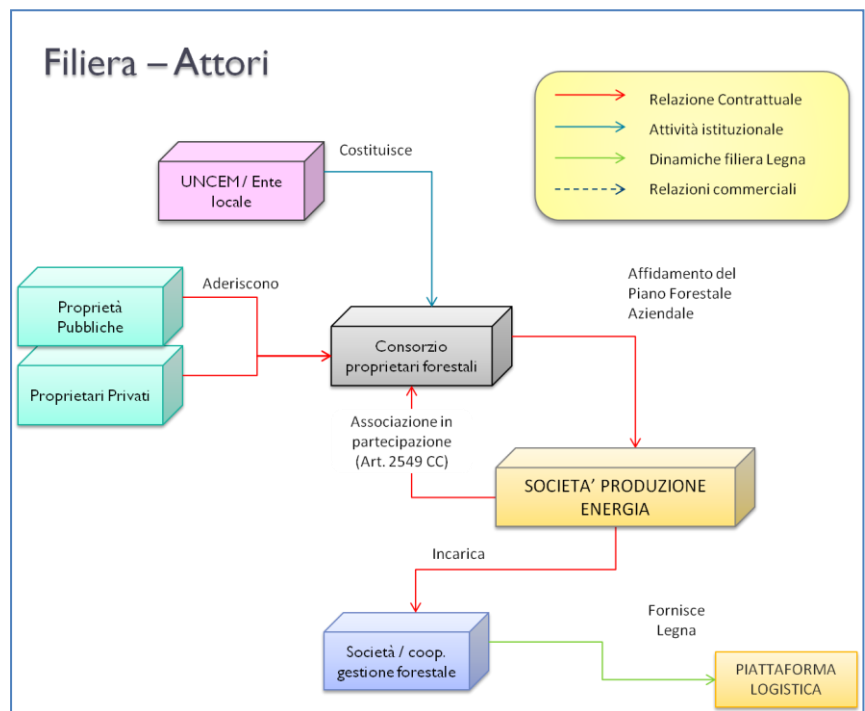
This diagram shows that the supply chain of a biomass station is a complex process involving many actors (professional people, firms, public authorities) and “moving” on the territory equipment, intermediate materials and final products.

Besides the local authorities, the main actors involved in this partnership model are at least five:

- The company owning the energy production station;
- The companies interested in investing resources on the different industrial or commercial initiatives of the so-called “Logistic Platform” (pellet, thermal energy or added value product);
- One or more cooperative associations between public and private owners of forest or agricultural areas of the territory, in order to have a common ownership;
- The local authorities interested in purchasing supply of thermal energy from the thermal network or produced locally with pellet;
- The companies and/or cooperatives of forest actors.

Therefore, the complexity of this process seems obvious and it will be necessary to settle an appropriate system of agreements to ensure both the correct working of the local supply chain and the respect of the existing regulation on the competition and on the limits of the public initiatives.

The focus of the operation is the business structure, conventionally called “Logistic Platform”, made of connected industrial realities which in the previous diagram are indicated in yellow.



In this pattern of supply chain is the logistic platform that represents the main destination of the local biomass, which will be organized and distributed according to wood characteristics and market opportunities.

2.2.1 Benefits for Local Authorities

The importance of an organic reference pattern of commercial relations and logistic and industrial processes, signed by the different actors involved, is a feature really appreciated by institutions that interact with the authorization process or have to take choices having a direct impact on the life of local people.

A single supply chain agreement among the above mentioned actors allows to manage the whole process, avoiding unwanted impacts and reducing the risk of authorizing a plant to use the local wood and then having only imported wood chips with no attractive prices for local actors, wasting in this way all the organizational efforts.

2.2.2 Benefits for Companies

A further reason to look for a positive collaboration between private and public realities is the fact that the changed conditions of the biomass market on the international level introduce strong critical elements, making very attractive, for an investor, the possibility of signing long-term agreements for the guaranteed supply of biomass.

Therefore, this company will assume the management of the supply chain activities, assigning to the forest actors the operations of tree felling, wood hauling, transportation and wood-chipping, and using the final product for energy purpose.

Instead, for what concerns the payment, the company managing the project will have the possibility to arrange a fee with the cooperatives according to the pre-established values or to share the profits coming from its own activity.

2.2.3 Public-Private Partnership

The key points for the right supply chain strategy can be summarized as follows: sustainable management of collective goods, innovation-friendly context, ethics in investment choices, fair sharing of the profits and, finally, governance of initiatives through public-private partnership.

Therefore, this perspective requires not only to consider the potential efficiency of an energy production method, but also to check if the adoption of a particular technology in a common way could be the launch pad for a common aim.

The purpose of the socio-economic fallout on the local level of the biomass projects is based on an essential principle: any choice connected to the energy use of mountain or marginal areas must deal with the territory itself and leave on site the most part of its profits in terms of added value, job, environmental and landscape quality.

Limiting the energy power of the plants, managing the existing resources locally and performing all the connected productions (for example the added value wooden products), it would be possible to make the

energy production area closer to the fuel supply area and to the cogeneration final use, reducing costs of the facilities and the material transportation.

To encourage the creation of common local micro-economies, environmentally sustainable, producing energy, is a valuable starting point for the economic promotion process and represents a great potential market.

This approach allows the possibility of a significant competition for the small Italian companies, which – better than any other international actor – are able to manage and make profitable, as history proves, the restricted business fields.

Therefore, the logic of the so-called “short supply chain” represents a staging post if the aim is to transform the economic incentive currently recognized to the biomass into an actual long-term strategic opportunity for a territory.

2.3 Potential Critical Elements in a Supply Chain Agreement

Currently, the trade flows of biomass – from the forest or agricultural areas towards the plants – are managed, throughout Europe, mainly by two types of actors: wood merchants and forest actors.

In the meantime, due to the positive commercial scenario, many producers of technologies for the biomass energy use (both traditional and innovative) have started aggressive promotional strategies in order to present their own proposals to the potential clients.

In the last years we have noticed that today in Italy these three business categories are the most active actors for a supply chain agreement: they take part in meetings for the promotion of initiatives, propose logistic solutions or contractual ideas, present themselves as a candidate to perform promotion actions addressed to forest owners and public authorities and, sometimes, offer themselves to fund the supply chain operations.

Apparently, they are positive actors to deal with and to be involved in a territorial agreement; however, for the reasons mentioned below, it is necessary to act with extreme caution in introducing these actors into a contractual system of forest supply chain.

With all due respect to the fact that usually these are legitimate, positive and absolutely good-faith commercial approaches, carried out by professional and helpful business actors, the interests of people selling a plant or working in operations of tree felling and wood hauling, as well as people trading fuel or wooden materials, are necessarily different from the interests of investors and forest owners.

This difference between clashing interests is particularly clear when referring to forest biomass, which in Piedmont represents the 2/3 of the bio-energy potential.

Indeed, unlike forest areas north of the Alps and almost all the European agro-forestry areas, the Piedmont territory (and great part of Italy) is characterized by:

- Limited agricultural space available for energy crops or short rotation forestry (SFR): the Italian territory is mostly mountainous and the small part suitable for cultivations is largely used for quality food production, with a high economic value.

- Large forest areas with a very high biodiversity level, which have not been managed for decades, unless with naturalistic function or for a coppice cultivation, and are not so suitable for primary production or construction wood: there is not a significant production from waste that can be used for energy purpose.
- Predominantly mountain forests: the restricted accessibility and the objective operational difficulties determine a very high cost for the management of the Italian forests, as shown in the nearby diagram,

based on a real case in a mountain area of our region, which can be considered as an average reference point for all the territory.

	Residui	Piante Intere				Scarti Segheria	Totali
		Diradamenti		Tagli Maturita'			
		Gru	Trattore	Gru	Trattore		
<i>volume mc/anno</i>	1.236	285	1.567	147	6.188		9.424
<i>volume t/anno</i>	989	228	1.254	118	4.951	250	7.789
<i>costo cippato €/t</i>	23	92	75	74	65	40	61,4

Es: Costo di esbosco, raccolta e cippatura legno in Valle Orco e Soana (Fonte Ipla)

- Extreme fragmentation of forest holdings and difficulties in transforming into a common heritage the forest resources within cooperative structures. Frequently, the owners of small forest areas do not live in site and it becomes difficult to contact or involve them in any project of associated management.
- Usually, the companies for the management and forest intervention are small, poorly equipped and very conservative.

In this context, the first objective of a supply chain agreement must be motivating public or private owners to provide their wood. To achieve this result, it is necessary to pay the wood more than the current value recognized by the forest actors.

Only the economic incentive is able to encourage the associations: for this reason, it is essential to have the most direct relationship possible between seller and buyer (investor). The intermediary inevitably represents a bottleneck element in a commercial agreement.

It is the actual "availability" of wood (that is the possibility of taking it directly) that can protect an investor from the risk of supply disruption necessarily involved in an intermediate trading relationship.

Despite significant differences (in particular the fact that materials are produced by active business activities and this simplifies relations and logistics), something similar happens in the case of agricultural biomass.

It is not enough to collect residues as they were wastes from a production activity: each organic by-product represents a value in itself that must be distributed to all the actors involved in the process.

The definition of the supply chain agreement is based on this guarantee agreement between investors and owners. The other actors should be involved according to the following market regulations:

1. The technologies should be chosen according to the ability to reward the investment on the basis of specific conditions and not to represent a prejudicial restraint. Unfortunately, some great industrial

groups have chosen the technologies first, and then they have tried to impose them on the territory, even if they were not able, as said earlier, to pay the actual local supply chain costs.

2. The forest actors or the intermediary must not be put in the condition of limiting the efficiency of the logistic system (as happens today, due to the fact that relations with owners are almost always managed by these organizations, often not very professional or with strong structural restraints), setting non convenient prices or supply conditions, but they rather must be incentivised to organize themselves in terms of business with the motivation of long-term job contracts.
3. The wood merchants do not respond to the need of the territorial supply chain promotion; on the contrary, they are clearly in competition with it, providing a periodic amount of cheap fuel coming from foreign countries to the only use of the owner of the station.

2.4 The IT Support to the Supply Chain Organization in Forestry Sector

The need of organizing an agreement among the actors of the field is particularly felt in the forest sector, where one of the assortments that can be derived from the silvicultural interventions is the wood-chip, which usually uses the lower value timber, or some by-products that currently are less marketable or represent a waste material.

The higher value wooden material will be addressed to other uses, such as construction wood, pole fabrication timber or firewood in pellets. Totally, summing up all the different assortments, from the forest areas considered for each cubic metre of wood dedicated to the wood-chip production, it is possible to obtain another cubic metre of material that can be used to derive some added value assortments such as construction wood, pole fabrication timber or firewood in pellets.

The supply chain approach based on the above-mentioned logistic platform and, therefore, the direct management of the whole wooden biomass – not only of the wastes to be chipped and burnt – helps to create virtuous economies enhancing the entire heritage.

Summarizing what has been said earlier, the context to sign a supply chain agreement on a mountain area is characterized as follows:

- a) Thanks to the adoption of the all-in fee, the incentive regulations for the renewable electricity production significantly reward the industrial projects based on the exploitation of biomass energy.
- b) The Italian territory is mostly mountainous, but underused compared to the traditional use of wood, and the possibility to significantly reward the wood-energy supply chain represents a great opportunity for the entire forest system, which in Italy is predominantly made of mountain forests.
- c) However, the main problem in organizing supply chains (organic plans of wood hauling and management according to environmental sustainability criteria) is represented by the extreme fragmentation of forest holdings and by the lack of actors to deal with and/or organization able to help the unification of forest properties through associations, consortia of owners or forest cooperatives.
- d) The unification of the properties is the only solution to organize a system able to assess the value of wooden storage and put it on the market according to trading logics, providing a 15-year supply.

- e) Although there is some resistance on the functionality of the associations, the alternative (agreements, often related to practice of favouritism, with the companies of forest workers in order to obtain a long-term supply) is definitely not appropriate compared to the needs of investors: the agreements with the supplier represent a dangerous influence and do not ensure to the businessman the certainty of supplying.
- f) The “supply commitments” without a real counterpart are worthless. There are too many variables that can lead a forest company to a failure in delivering the wood as established and in compliance with the request or to an arbitrary increase of prices.
- g) Currently, the Forest Offices of the Mountain Communities manage the private procedural requests with the wood hauling requests. However, in terms of information system, the territory is not able to manage the records of outstanding and interventions starting from the land-register data: basically, a real “Forest Management Plan” on a large scale is missing.

The main problem of the definition, on the regional or national level, of intervention policies and models is that today there are not valuable actors to deal with in order to organize the unification of forest properties on the territory – through associations, consortia of owners or forest cooperatives – to assess the value of wooden storage and put it on the market, providing a 15-year supply.

The associations may arise thanks to private initiative or someone’s enthusiasm, but if we want to really help the exploitation of the wooden heritage, the unification of forests should be the focus of mountain policies rather than the unification of municipalities, starting from the public properties and encouraging the association of private people to the existing consortia.

Also the creation of the IT support (manageable by mountain municipalities or communities) appears necessary in order to geo-reference not only the forest data, which in some regions like Piedmont already exist, but also the land-register data and those related to the properties and to the planning of cuts.

In this way, an instrument having the ISO Certification would be available for the forest management plans and a support for the planning of interventions based on the actual value of forest properties.

Essentially, the investment is divided into two big processes: the IT part, managed by computer experts, and the implementation of database that can be done by forest actors involved by mountain municipalities and/or communities.

It is very likely that in the future incentives will be recognized only to the companies able to demonstrate the traceability of the wood supply chain (of Community origin and, within certain limits, collected in a range of 70 km from the plant).

So it won’t be possible to implement forestry operations without the registration, which will monitor any movement and record it.

Since the facilities will be the integrated system for the management of the cooperative operations, the service will keep track of the exact entity and value of the biomass managed and issue a periodic invoice to the consortium for an amount to be defined according to volume parameters (X euro per ton) or to value parameters (% compared to the turnover).

3 Operational Development of a Supply Chain Agreement

The operational development of a bio-energy supply chain is divided in some project activities phases ordered in a specific sequence, but not rigid, and defined by the guidelines shown earlier in this report.

The first of these sub-projects, which can be referred to the sharing of term and definition meaning, may seem a rhetorical exercise but it should not be under-evaluated: a supply chain is the result of an economic contractual agreement and it is necessary to avoid misunderstandings that can generate inconvenience or a reorganization of the expectations of the different actors involved.

The European experience of the last years in the biomass energy sector has always been positive. In lots of cases, the reason of the failure of these initiatives is represented by the disappointment of the economic expectations due to a not so clear industrial agreement.

A common example is related to the need of the above mentioned characterization of the biomass.

Some technologies that had high efficiency and performance levels in particular operational conditions, once introduced in different use fields (with biomass and different environmental conditions) without prior analysis of the compatibility and feasibility, have not achieved the expected standard, with an obvious damage for investors and supply chain actors.

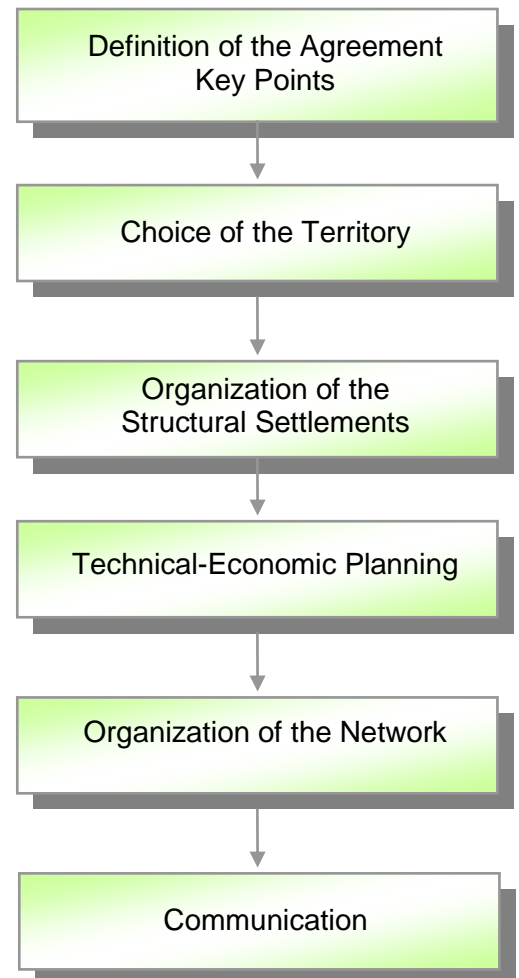
The subsequent controversies between clients and suppliers – often with legal implications – have proved that some underlying misunderstandings, about the meaning of “biomass” and the characteristics of the material for the plant, were the reason of the problems.

3.1 Definition of the Agreement Key Points

The organizations proposing a supply chain agreement must formally commit themselves to start collaborations not only for trade but also aimed to the development of integrated projects of biomass sustainable management in order to organize “wood-agriculture-energy” industrial supply chains.

Considering as reference the project of LAMORO in Carmagnola, these are some of the key points to be introduced in the programme:

- a) The agreement must clearly explain that the cogeneration station involve in the supply chain agreement shall work in compliance with the regulations in force on the specific territory.



Technologies that in another European nation can be appropriate to the legislative standards concerning emissions might be not conform to the local requirements.

In particular, the project of Carmagnola:

- *Can use plant biomass classified as “by-product” and also the wooden biomass deriving from pruning and explanting at the end of the life cycle of the fruit trees;*
- *Can’t use fuels deriving from the processed wood and containing chlorinated substances or those coming from industrial producers declared contaminated by the Plant Protection Service;*
- *Must work in compliance with the terms and requirements concerning emissions for the plan zones, established by the province of Turin.*

- b) The organizations involved must agree on implementing a territorial supply chain defining an operational and logistic structure for production, collection, supply and processing of biomasses, and clearly establishing the role of actors dedicated to storage and transfer of these material into the station;
- c) To define in advance and clearly the meaning of “biomass”.

According to the European definition¹, the specific case of Carmagnola has the following types of natural materials:

- *Plant products deriving from cultivation or agricultural wastes.*
- *Products of waste deriving from the first processing of wood in sawmill.*
- *Wooden products deriving from the forest management.*
- *Plant materials deriving from pruning and the green urban space management.*
- *Ligno-cellulosic products deriving from shrub crops within the short rotation forestry.*

- d) To define which biomasses are interesting for the supply chain actors.

Considering the reference example, among the above mentioned types of biomass, *“the cultivation of vine and fruit trees seems to be an important energy supply chain by value and extent of cultivated area on the Piedmont territory and able to avoid the combustion on site (forbidden by regulations). These crops require:*

- a. The annual pruning of branches in excess;*
- b. The removal from soil, at the end of the life cycle of the plant, of trunks and roots;*
- c. The possibility of energetically recover the wine making by-products (marc and lee)*

The use of the materials for energy purpose can help to incur the operational and logistic costs of producers for the disposal”.

¹ Directive 2001/77/CE of the European Parliament and of the Council of September 27, 2001: “(…) biomass is the biodegradable part of products, wastes and residues deriving from agriculture (including vegetable and animal substances), forestry and agro-industry, as well as the biodegradable part of industrial and urban wastes”.

Once making clear the issue among the actors of the initiative, it will be possible to proceed with the operational programme.

3.2 Choice of the Territory

Level and quality of available information permitting, comparative analysis should be carried out in order to assess the characteristics of the economic, social, infrastructure and production fabric of the different areas and, therefore, the reasons of interest for the development of a territorial energy supply chain.

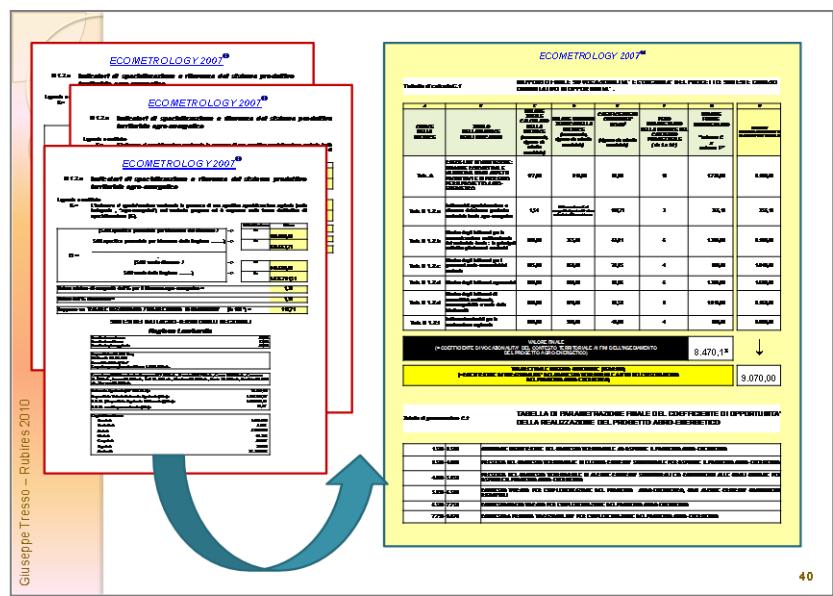
During the meeting of Potsdam, it has been presented an extract of “Ecometrology”, the support methodology for the territorial analysis developed by Professor Alessandro Arioli, teaching technology of biomasses at the “Università del Piemonte Orientale” [University of Eastern Piedmont].

In the more complex territories (such as those where there is an actual risk of competition between energy supply chain and traditional economies) it will

be carried out a more analytical study, planning several research interventions that can be summarized as follows:

“Ecometrology” is a Information methodology, approved by Italian Ministry for Agriculture and Forest Policies, aimed to an ex-ante evaluation of a specific territory in order to organize and manage bio-energy agricultural-forest chains taking into account both the diffusion of advanced technologies and the transfer of know-how in the local context. This purpose is achieved through training processes and institutional planning actions to be implemented in collaboration with local partners, to achieve the following purposes:

- Identification of biomass availability on the territory to produce energy;
- Elaboration of resources management and environment protection programmes;
- Planning of agricultural-forestry activities;
- Certification of processes and supply chains.



- Analysis of the availability of local biomass and the dynamics of production, trading and use;
- Analysis and contact with the business institutions, potentially functional to the development of a supply chain network;
- Identification of local partners for technical, economic and administrative field;

- Research and assessment of the possibilities of investment and trading relation;
- Analysis of the forest, agricultural and territorial protection and plan policies;
- Analysis of the local legislative context;

- Check of timetable, actors and development methods of structural projects and the relative public contribution;
- Analysis of the potential location of the firms;
- Envision of financial instruments to attract new investors;
- Analysis of the energy market and use;
- Arrangement of framework agreements.

Through these actions it will be possible to define an analytical framework of the dynamics, which can be carried out on site to build (or strengthen) stable relations in the business system.

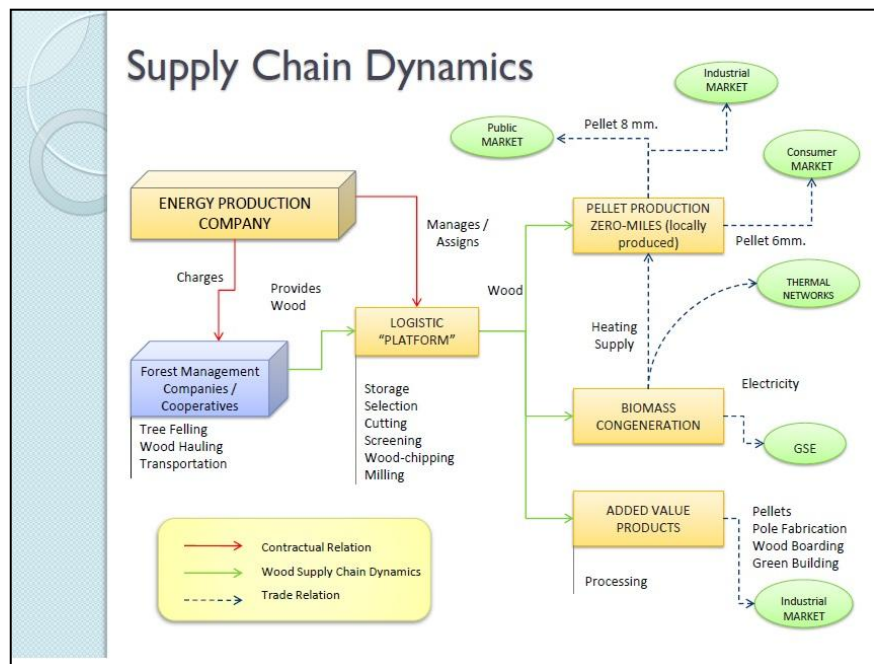
3.3 Organization of the Structural Settlements

A territorial programme of supply chain should be able to carefully assess the structural needs connected to logistics, environmental conditions of supply chains and operational restraints of the different process phases.

Although the starting point is the Cogeneration Station, it is also necessary to envisage the other space and flow requirements of an industrial system based on the transportation of unwieldy material on a limited territory.

The example shown in the nearby diagram, based on the above mentioned initiatives carried out in the forestry sector, highlights the need of a logistic structure connected to the wooden biomass transferring and processing phases: starting from the forest up to the final energy use or added value product.

This example shows that it is necessary to find areas and facilities for the management of



wood hauling and for the intermediate storage on the territory, as well as facilities and equipment for the material transportation and processing.

Finally, the needs due to thermal energy use and potential connected production (industrial use or networks) should not be under-evaluated.

3.4 Achievement of Studies and Technical-Economic Projects

Once checked, on one hand, the technical, environmental, logistic and economic possibilities of the different investment hypotheses identified in the scouting phase and, on the other hand, the interest and availability of local institutions in supporting specific development programmes, it will be necessary to examine closely all the initiatives selected in order to assess their actual feasibility:

- from the technical point of view;
- in terms of environmental protection and management;
- according to the available resources;
- from the contractual point of view;
- from the commercial point of view;
- in terms of economic and financial planning.

In accordance with the last two points, the business plans of the specific projects will be implemented taking into account the different scenarios and envisaging guarantee instruments and any measure aimed at reducing the business risks.

Furthermore, the technical planning and economic activity must comply with the Community standards and/or the sustainable development principles.

Secondly, since this is a programme aimed in producing and selling renewable energy, it will be necessary to assess the possibility of setting the specific measures of project financing, in collaboration with the national bank institutions.

3.5 Creation of the Network

The analysis and territorial planning activity carried out so far should have allowed the promoters to understand if there are the conditions to build a station within a territory and which actors have to be involved in the supply chain agreement.

At this point begins the real contractual phase among the actors that will be involved, on different levels, in the management of the supply chain.

Usually, there are the following three categories, but the participation of other actors, such as the local authorities, is not to exclude and must be analysed in its specific function:

- **Producer:** *agricultural and/or forest businessman or the processing plant that has to collect materials and transfer them to the specific storage centres or to the Manager of the plant.*
- **Association / Cooperative:** *organization representing producers that has to organize the transfer of material according to the terms arranged with the Manager of the plant, to set the economic conditions of supplying and invoicing, and to distribute economic values among the Producers involved, in compliance with specific regulations.*
- **Manager of the plant:** *energy production company that has to receive the material from Producers,*

directly or through intermediate storage centres, and to use it for energy purpose in compliance with laws and authorization conditions, giving to the Association / Cooperative the agreed fees.

The specific legal conditions of the supply chain agreement can be defined according to the characteristics of each single project. However, three features should always be present (again, the following examples are taken from the project of Carmagnola).

3.5.1 Subject of the Agreement

It should be the best defined and the most delimited possible.

Example:

“The subject of the supply chain agreement is the collection, processing, transport and use for energy purpose of the plant by-products deriving from agricultural and forest activities, as well as the management of the subsequent legal compliance. The agreement framework is valid for the biomass collected in the provinces of Turin, Cuneo and Asti”.

3.5.2 Technical Policy

The signatory organizations must commit themselves in arranging a specific technical policy to define and regulate roles, activities and responsibilities of the different actors involved, according to the Agreement.

In particular, the Technical Policy defines:

- The procedures to prepare the material at the producer;
- The procedures to collect the material at the producer;
- The procedures to transfer the material from the producers to the intermediate storage centres managed by the Association / Cooperative or directly by the Manager of the plant;
- The procedures to manage the intermediate storage centres;
- The procedure to transfer the material to the station;
- The documentation to be attached to these operations;
- The checks to be made during the whole process of the supply chain.

3.5.3 Traceability and Certification

To commit the supply chain actors involved in respecting a certifiable production system:

“In the management of annual pruning and wood hauling it will be necessary to adopt a plan in accordance with the principles of accountability and cooperation of all the actors involved, and also a control system to guarantee the of the chain traceability and the environment protection”.

4. Conclusions

The building of a station on a mountain territory or near to thermal networks in an urban industrial area should not generate any negative effect, but the potential impact of the facilities must not be underestimated.

Indeed, in addition to the bureaucracy, today the main obstacle to the development of initiatives in the energy sector is represented by the opposition, usually based on prejudice, of people living in the areas near the site where the station should be built.

Therefore, the last operational function of the process – which must be present in all the phases of the development of the programme – is the creation of a specific communication strategy on the territory. These targeted interventions are not simple institutional information, but represent the crucial condition for the success of the whole project.

Creating a network implies a great effort for the following issues: information, promotion, time for understanding the innovations, need of opportunities for comparison, workshops, training, as well as a potential exchange of partners and actors involved.

It will be necessary to clearly communicate to the different social actors the objective of a bio-energy supply chain, not only able to produce energy from biomass, but also to manage a local reality in its entirety, in the view of the creation and management of value, as well as the efficient use of energy sources.

It is important to underline that the supply chain management pattern does not imply a simple purchase of biomass by an industrial actor disconnected from the local reality, but is intended to directly manage the supply operations, according to the Agreement and within a single organizational plan.

In mountain areas, the complexity of a cooperative organization is represented by the high fragmentation of properties and the difficulty of involving directly all the landowners, due to the fact that they are untraceable or not interested in the proposal of creating an association that uses their own heritage.

The experience carried out in the last years shows that, in order to start-up a programme integrated with the territory, the promoters have to make a great communication effort and be ready to take part in institutional meetings, public assemblies and meetings of potential supply chain actors, facing sometimes the disapproval of some residents.

To conclude, within this project a series of initiatives aimed in promoting the programme among the different potential actors must be planned and implemented on the regional level and on markets selected for the purpose of the development of a supply chain.