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INDUSTRIAL VS TERRITORIAL?

IMPLICATIONS OF BIODIESEL PRODUCTION CHAINS IN RESTRUCTURING RURAL SPACE.

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Abstract — This contribution focuses on the relationship between rural systems and biofuels production, referring to a more general relationship between territorial organisation and renewable energies. This is a very crucial issue, since energy production from renewable sources is assuming an ever more pivotal role in the most recent international debate on sustainable development. Biofuels represent, in Europe as in other parts of the world, a promising technology to produce fuel and one of the more realistic alternative to partially corrode the role of oil into the transport sector.

Starting from the presentation of two Italian case studies, the paper aims at developing an interpretative framework to analyze the different perspectives/approaches by which the biodiesel production can interact with the territory (mostly rural but not only) and engage different actors. Through the distinction between an industrial and a territorial model and the identification of their respective challenges, potentialities and limits, the paper ends with a reflection on what Italian policies have been done until now to promote a domestic agro-energetic chain of biodiesel.

Key words : Rural territory, biofuels, industrial production, spatial embeddedness.

1. BIODIESEL, SPACE AND RURAL TERRITORY. A MISSING PILLAR?

Biodiesel is a specific typology of biofuel (that is, fuel derived mainly from vegetable biomass) produced from various original oilseeds, mostly rapeseed, soybean and sunflowers. Biodiesel differs from bio-ethanol, which is derived from corn, grains, sugar beet and sugarcane.

Both biodiesel and bio-ethanol are considered first generation biofuels, since they are produced from land extensive crops and they struggle for land with food oriented cultivations¹. Even if researches and applications are concentrating their efforts in developing new generations of biofuels from non-food plants, first generation still remains the most diffuse: this because of the fact that they can be used as conventional fuels in actual vehicles, can be distributed in the existing infrastructure and can be conceived as a concrete (even if partial) alternative to diesel and gasoline (Randelli, 2008)².

Biofuels studies face a substantial lack of data and statistical information: we don't know how many hectares are dedicated to the production of oil-seed for biofuels in Europe as we don't know how many tons of rapeseed, soybeans and sunflower oils do European countries import from abroad to sustain their production. We don't have more knowledge about the interactions between biofuels and other economic activities³ in the food-feed sectors.

Even if a clear picture of the biofuels system in Europe is still missing, biodiesel and bio-ethanol are actually strongly promoted by European Union and National States⁴, mostly for two reasons.

First of all, for their contribution to the energy and climate strategy of the European Union (as they can reduce dependency from fossil fuel and diffuse a more sustainable transport system). The well known "energy package" of the EU has reviewed the previous promotional schemes, and it has fixed a target of 10% of biofuels in the total consumptions in the transports sector for the 2020⁵. This ambitious target has to be reached through specific national action plans that should fix more precise country percentages year by year.

The second reason is the contribution that biofuels may offer towards a more multi-functional European agriculture. The various reforms of the CAP (for example in 1996, 1999, 2003) aimed at elaborate and diffuse "the idea of a multifunctional agricultural sector encouraging the development of alternative sources of income in rural areas while safeguarding the environment" (Simoncini, De Groot, 2009). Moreover, the 2003 reform aimed at helping farmers to become more competitive and market oriented in their production choices and decisions. In this framework, biofuels are seen as a promising source of income and differentiation of production for farmers.

¹ In literature, three different generations of biofuel are considered. Second-generation biofuel is derived from non-food crops, which include waste biomass, the stalks of wheat, corn, wood, and special-energy-or-biomass crops. The third generation is characterized by the use of algae for the production of fuel.

² From the spatial point of view, bio-ethanol and biodiesel see a radical differentiation in production and consumptions: the first is mostly an American product (both northern and southern), with a growing contribution of several Asian countries such as China and India. The second one sees in the European Union its most important producer and consumer. That is why, in this contribution centred on the European situation and in particular on the Italian one, we will concentrate mostly on the biodiesel production chain.

³ Von Wissel (Von Wissel, 2006) has estimated that the growth in biodiesel's production would probably determine a progressive shift in the oilseed industry from food/feed to energy oriented markets.

⁴ In particular, see the 2003/30 Directive on the "promotion of the use of biofuels or other renewable fuels for transport" and the 2003/96 Directive on the restructuring of the "Community framework for the taxation of energy products and electricity".

⁵ See the 2009/28 Directive that updates the European strategy in terms of biofuels production.

Even if they are strongly promoted, the effective contribution of biofuels in terms of sustainability and rural development is subject to a huge debate. Moreover, it is a debate that partially ignores the interactions between biofuels and the territorial organisation of rural spaces. In fact, the debate over biofuels (and biodiesel in particular) see three main research fields.

A first part is technically and technologically oriented: a large portion of the literature has gained ground in the last years concentrating on how innovation in technology may contribute in improving the efficiency and the environmental balance of biofuels (Sheehan, Camobreco, *et al.*, 1998; Pimentel, Patzek, 2005; Hill, Nelson, *et al.*, 2006). Physical and chemical properties of different generations of biofuels are discussed, and comparisons are proposed about emissions, energy balance, input-output productivity and production costs. An important section of this debate is dedicated to the environmental impacts of biofuels and their effective sustainability. Conclusions made are highly controversial: the energy, economic and environmental balances depend on strict and multiple factors that may differ from context to context (Randelli, 2008). It is not possible to ratify the effective sustainability of biofuels *a priori*. It depends on how different productions are organised.

Another part of the debate works over the socio-economical consequences of biofuels production and their interactions with global and (sometimes) regional food markets (Cassman, Liska, 2007; Duque, 2008; Escobar, Lora, *et al.*, 2009). It is mostly an informal debate, profoundly driven by the interest of the media after the 2006 international food crisis and the fact that many articles criticized the contribution of the growth in biomass demand to the rise of food market prices (World Bank, 2008). Some articles also denounce the social conditions of workers in the biofuels industry in developing countries and the so called “new colonialism” connected to land-grab practices in African countries driven by first world multi-national holdings.

A third pillar is spatially oriented. The general questions are: how much land is needed to satisfy actual and future biofuels’ consumptions? Which is the potential production in different global macro-regions (such as Brazil, North America, Europe, etc.)? The answers need to consider a complexity of factors, varying from land availability and productivity to interactions and substitutions between different crops and agro-productions. The EEA (EEA, 2007) published an important study in this field of research: it introduces a set of five principles to achieve a sustainable production of biomass in European countries, preserving quotas of environmentally orientated farming and of extensive land crops at their actual land cover level. In France, the same issue has been investigated by Salmon (Salmon, 2008) and Poux (Poux, 2008), while in Italy a partial study has been published by Fondazione per l’Ambiente (2009), which has particularly stressed the opportunities of biofuels’ production for the industrial world (more than the rural one).

Between these significant fields, an important missing pillar is represented by the relationships among biofuels and territorial organisation: this means to investigate which are the actors and networks involved in biofuels’ production, which are their motivations, which the returns for producers and for the territorial contexts in which producers are located. This lack is particularly noticeable if we consider that just few studies are delivered on the profitability and sustainability of biofuels for the rural world: which is the contribution of biofuels in terms of rural development? Does it bring innovation? Of which kind?

In the next sections, our aim is to present, moving from the presentation of two case studies, two approaches to systematize the possible multiple relationships among (rural) territory and biodiesel’s production chains.

2. ARE WE TALKING ABOUT THE SAME THING?

This section introduces two case studies, exemplifying the Italian context of biodiesel production chain. On the one hand we have Oxem, a plant of the biodiesel making of considerable importance, link a of a long chain, that have its sources (raw materials abroad)

and ends in Italy, even if not necessarily. On the other hand, we have the trial of Confagricoltura of a short chain, that would have its origins and market outlets locally.

The biodiesel plant⁶ of OXEM S.p.A has become operative at January 2009, with an initial productive capacity of 100,000 tons, with the future perspective of catching up more than the double of the production⁷. It's located at Mezzana Bigli, an existing chemical site, which is the head office and plant of Oxon-Sipcam Group. The plant, with an investment over 50 million euros, is born as Oxom's spin-off with the participation in the company's capital of entrepreneurial coming from the oil, sugar and logistics industry.

The plant is connected via pipe-line to the nearby ENI refinery of Sannazzaro de' Burgondi, which represent the main OXEM's buyer.

The localisation of the plant, beyond reasons related to logistical and services facilities (being integrated into the OXON chemical site and close to the oil refinery) does not have strong relationships with the territory (excluding the 14 workers that comes from the area). The vegetable oil for the production (65% rapeseed oil, and the remaining part soybean and palm oil) of biodiesel come mostly from abroad via cargo, and then by train or by truck to the plant. Rapeseed oil comes from France, Germany and East of Europe, soybean oil mainly from Italy and palm oil from Malaysia⁸ and Indonesia.

For the storage of a quantity of oil equal to 13,000 tons, OXEM use the terminal of Savona, far 125 km from the plant. Besides being a biodiesel producer, Oxem is also a biodiesel trader and for this purpose the company has access to additional storage facilities at the port of Genoa. The fluctuations in raw materials and oil prices and the limited competition due to the oligopolistic market sometimes make more profitable the direct purchase of biodiesel, rather than to produce it. Generally supply contract are spot, with a maximum length of a couple of months.

In addition to accessing vegetable oil from the international markets, OXEM is looking for developing a more local provisioning network through the collaboration with Agrodinamica and the "Distretto AgrienergEtica"⁹.

For what concerns the distribution, most of the biodiesel produced is transferred via pipeline to the ENI's refinery of Sannazzaro de Burgondi. The rest is sold in Italy and in the Slovenia and Austrian market.

In 2006, while the OXEM group was rising, in a 150 km² area between Bologna, Verona, Vicenza and Ferrara - in the middle of the Po plan in the Northern part of Italy - another initiative in the bioediesel sector was taking place. The project was promoted by Confagricoltura (one of the Italian associations of farmers) with the engagement of more than 200 local farmers. The aim was to develop a short supply chain to provide soybean oil for the industrial production of biodiesel. The logistic saw approximately 1000 ha destined to energy crop's production for a target of 1000 tons of oil (and biodiesel) generated every year: crops should be collected together in a stock area near Bologna (provisioned by the local rural consortium), and finally directed to seed's pressing and crushing. The supply chain was completed by the commitment of an important industrial oil-mill property of a multinational holding (Cereal Docks). Biodiesel should have been finally produced in a medium-size production plant belonging to the Oil-B S.p.A, with a capacity of over 200.000 tons for year.

The initiative represents the first attempt to formally institute a biofuels' local supply chain in Italy. The project was motivated for the common frustration of rural associations in front of

⁶ The plant includes also a vegetal oil pre-treatment section.

⁷ The plant also has production capacity of 20,000 tons per year of Glycerine and of over 10,000 tons/year of phospholipidic gums.

⁸ With the specific aim of favouring the purchase of palm oil, Oxem has set up a joint venture with Wilmar Oleo, part of the Wilmar International group, one of the leading Asian producer and processor of palm oil.

⁹ Both the subjects are active in the promotion of energy crops in Italy.

the incentives for biofuels' generation in Italy, that were considered not sufficient to support local and endogenous crop's productions and mostly industrial oriented. Thus, the network of actors was formalised by a contract through which a 20% surplus over the market price of oilseed was paid to local farmers involved in the supply chain. The project was conceived as a *start-up* idea: the first attempt was to locally produce biodiesel to be consumed directly by local farmers in a truly local chain. By the way, the lack of precise national criteria to norm the self-consumption of biodiesel as agricultural fuel and the absence of small oil-mills in the area forced the proponents to involve large industrial oil-mills and to produce oil for the market.

The interest for the plan was not only due to the economic returns to local farmers. The local production of biofuels was seen as a tool for rural innovation in a more general sense: to increase the multi-functionality of agriculture, to invest in new machineries, to acquire competences and know-how, to diffuse a better capacity in working together and promoting integrated projects and, finally, to generate interests in young generations of farmers.

Even if the project generated a certain attention in the rural world, it could not be able to survive more than a few years. The reasons of failure were mostly two: the inadequacy of public policies in sustaining local production chains and the convenience in producing food crops or other biomass for electricity (more supported by national incentives).

3. RURAL WORLD AND BIODIESEL: TWO PERSPECTIVES

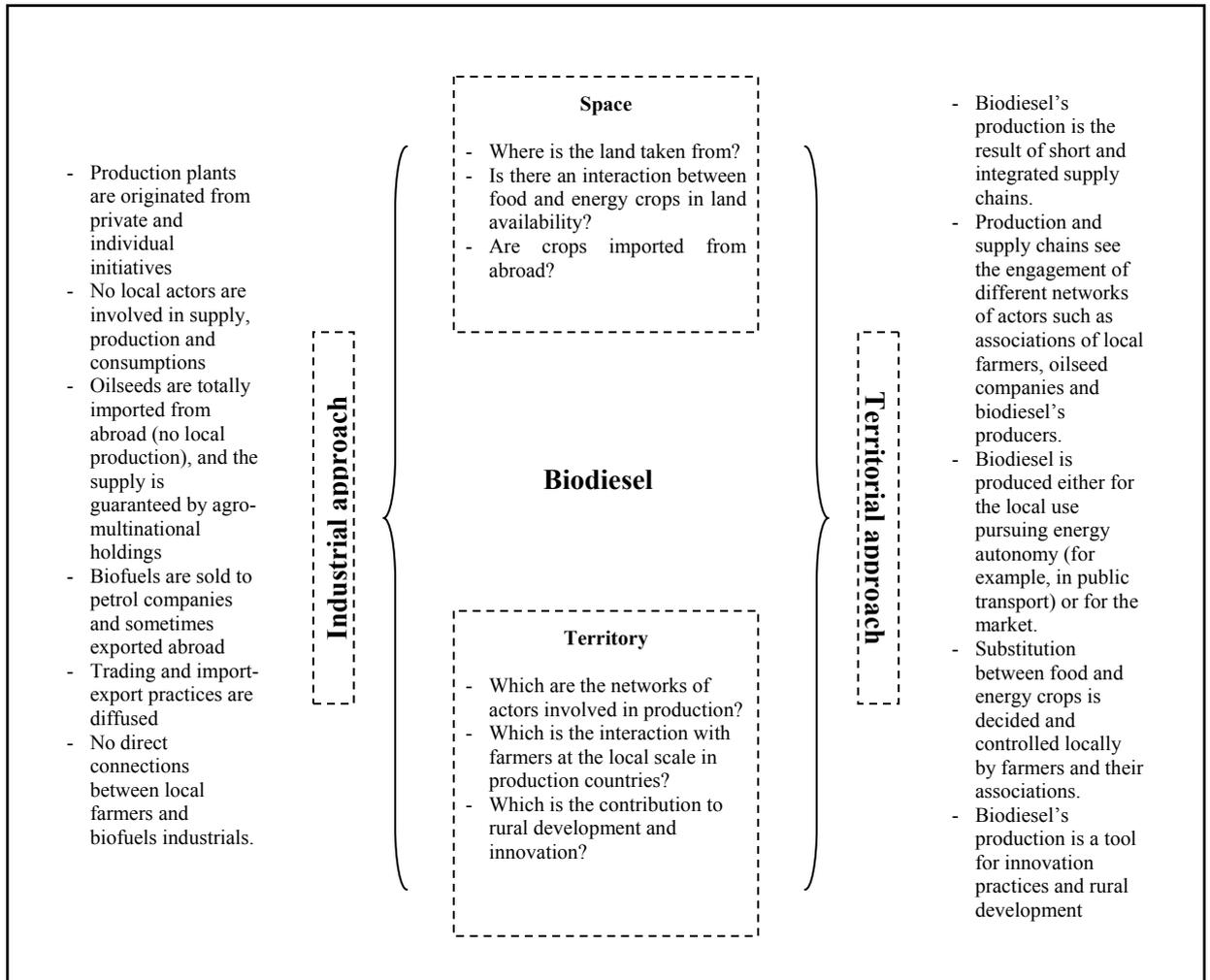
In a geographical informed perspective, space and territory are two different concepts that it is not possible to explore deeply here (Mitchell, 1979; Raffestin, 2003; Dematteis, Governa, 2005; Governa, 2005). We consider *space* as a support for human actions, a container of fixed (tangible and intangible) potential resources that have to be recognized and valorised by social actors, while we may define *territory* as a network of complex tangible and intangible relationships between actors (at different scales) and local resources. Territory is thus a relational concept, since it results from a system of multiple relations between society and its environment that may be both horizontal (between actors) and vertical (between actors and territorial resources – milieu – and between the local scale and super-local scales). Space and territory interact, in the sense that the territorial organisation (the way in which resources and relationships among actors are developed and organised) has its own spatial dimension (that is, it produces and requires a particular spatial organisation).

Biofuels' production needs both space and territory (figure 1). It needs space in terms of disposable land to convert in energy crops' cultivation: space may be obtained either substituting food crops into energy ones or colonizing new available land (especially abroad). New spatial configurations have to be considered in their environmental footprints and impacts over traditional rural landscape as in their consequences on food and energy regional and global market. Production patterns may thus radically differ in terms of space: where is the land get from? Which are the consequences for the traditional rural mosaic? Which kinds of impact are generated?

But space it is not sufficient to fully understand the way in which biofuels influence rural organisation. In fact, spatial structure is determined by territorial organisation: which actors and networks do participate in the production's chain? Which are the aims that activate the production? Whom the major returns are for? Which is the role of local farmers) in supply and production chains? In other words, who decides how space is exploited and organised?

Moving from space to territory, we propose a twofold approach to biofuels' production (figure 1).

Figure 1 . Two territorial models for biofuels production chains.



The first approach is defined here *industrial*. It is the most common geographical blueprint of biofuels' supply right now. Production plants result from private initiatives (usually carried out by large multi-national holdings connected to oil markets). A combination of three main features characterise this approach: large scale production, indifference to where biomass is produced and low (or absent) connection with local actors and local territory. Industrial plants have high production capacity (that is, hundred thousand tons of biodiesel) and their supply is constantly guaranteed by traders and intermediaries who import large quantitative of biomass from abroad (usually via cargo), on a global scale. Investments in production plants are motivated by business purposes: to expand activities into new industrial branches, to develop know-how and for the presence of high economic incentives (normally fixed at a national or supra-national scale). This generates a substantial independence in localisation: no consideration is given to the rural context in which the production plant is localised or to the possibility of locally supplying it. Local farmers have no connections with biofuels' companies. These are usually embedded in networks with oil companies (sometimes even physically through pipelines that distributes biodiesel to refineries to mix it with normal diesel) and sometimes they work as direct traders of the final products (biofuels) buying and re-selling it abroad.

The second approach is defined *territorial*, and it is radically different while far less diffused. It sees the presence of integrated supply and production chains at the local scale (even if the

scale of the *local* is here quite ambiguous). The crucial feature of the territorial approach is that biomass is not imported, but crops are produced locally by farmers who decides to destine their land to energy purposes. Usually, farmers are networked each others through cooperatives and associations that organise the chain. The supply chain is connected with oil-crushing plants and final biodiesel's production plants. This standard model may then vary depending on the final destination of biofuels. In some cases (diffused especially in France and Germany) oilseed are crushed locally, biodiesel is produced via small plants and it is destined to local fuel autonomy: for rural tractors and machineries as in public transports. Other cases see the processes of oil-pressing and biodiesel production held into large industrial plants. Biodiesel is no more produced for self-consumption at the local scale, but it is sold to energy markets as a part of the biodiesel derived from imported biomass. Nevertheless, a surplus in economic return is usually guaranteed to local farmers integrated in the production chain.

Even if the two models are very different, it's important to remark that they are not in competition each against the others and that they don't represent the two only possible models for biofuels' production. They embody two blueprints: in between, many possibilities may be carried out. Similarly, they shouldn't be opposed in terms of sustainability: no one is sustainable nor non-sustainable *a priori*, but they have to be declined in their different impacts on the environment as well as on international and regional markets, social and cultural organisations and spatial patterns.

We suggest that the two models are not directly comparable, since they differ both in quantity as (most importantly) from the qualitative point of view.

The industrial model is driven by business purposes. The territorial one by rural development and by the increase of returns (not only economical) for local farmers. Thus, the two models may also coexist. The first doesn't bring no advantage to the rural context of the country in which production plants are located: relationships with local farmers are almost nil. At least, it produces consequences in rural territories where the biomass comes from. The second one, instead, may use industrial production plants already existing (thus, an interaction between the two model may exist): but the final purpose is not to increase biofuels' generation, but to sustain local agriculture and to produce oilseeds compatible with the local spatial and territorial potential.

The qualitative difference between the two should suggests the fact that also the policies to support biodiesel's production should be differentiated. Incentives that sustain industrial production may not be suitable to develop a territorial model, and vice-versa. In the next section, we will show how the inadequacy of support policies represents one of the first constraints for the development of local supply chains in Italy.

4. THE ITALIAN CASE: BIODIESEL FOR WHOM? BIODIESEL FOR WHAT?

Italy is the Eu's third-largest producer of biodiesel after Germany and France. In 2008 it has produced 595.000 tons against the German 2.819.000 and the French 1.815.000 tons (EBB data, 2010).

Nevertheless this good position among the European producers of biodiesel, the country has not developed a real domestic agro energetic chain. Currently, the development of the sector, has been restricted to the phase of biodiesel-making and the domestic supplies of raw materials for its production as much as the indoor consumption are still limited.

In the country there are 19 plants of biodiesel production¹⁰, 4 of which under construction with a cumulative productive capacity of 2.257.194 tons (Assocostieri data, 2010). They are located mainly along the coasts, nearby industrial harbour and the oil coastal deposits (Savona, Genova) and in the Po valley in the North of Italy (in the regions of Lombardy and Veneto).

The development of biodiesel plants in the peninsula has been drawn and supported by the obligation of blend petrol and diesel imposed by law. Starting from 2005, oil companies are obliged to add in petrol and diesel, a percentage¹¹ of biofuels, increasing from year to year¹², according to the Directive 30/2003 of the European Community.

For the present year, the legislative decree of 25 January 2010 (Ministry of Economical Development, 2010) have established that at least 5,75 percent of total fuel consumed in Italy (both diesel and gasoline) must be biofuel by the end of 2010 and also oblige companies that place gasoline and diesel on the market to blend at least 3,5 percent of biofuel.

Nevertheless, Italy is still far from the goals imposed by law. The data provided by the "Biofuel Progress Report", registered in 2005 an average percentage of biodiesel incorporation less than 1% (Commission, 2007). In spite of the presence of a guaranteed supply establish by law, the development of the sector has difficulties in taking off on the provision and consumption sides.

For what concerns the raw material's origin, most of the biodiesel that is produced in Italy (about 60%) is based on imported rapeseed, soybean and palm seeds and oil both from European (France, Spain, Germany) and extra-European countries (Argentina, Brazil, Canada, Malaysia) (Vannini, 2006; Scrosta, Cerrioni, 2008). The constraints for "a made in Italy by Italian materials biodiesel" concern not only, the limited surface devoted to oleaginous coltures for biodiesel production until now (10-20,000 hectares in the last years according to Vannini, 2006)¹³ (but also the strict interconnection between the final cost of biodiesel with the that of the raw material. Not only the Italian market is not competitive with the foreign market for its relative higher costs, but for farmers the cultivation of soybean and rapeseed if less attractive compared to other crops for economical and technical reasons.

Besides, in the attempt of favouring the realisation of short chain to supply locally the raw material through agreement signed by all actors, the Italian legislator didn't hold the organisations belonging to the rural world in due consideration, conceding the right to a tax reduction solely to oil producers and any kind of facilitation and forms of incentive to soybean and rapeseed's producers.

So, until now the biodiesel Italian chain has been far away from the agricultural world, with an added value which fall outside the agricultural system when biodiesel is used for auto-transportation.

In this framework, farmers have been only producers that have sold their seeds according the market prices established by the international system of exchanges (Chicago Board for the Soybean, Rotterdam for the rapeseed), with a limited incidence on the percentage on the raw material that have been use for the biodiesel production.

¹⁰ The biodiesel productive plants have been associated within the Unione Produttori Biodiesel in the wider framework of Assocostieri.

¹¹ The percentage is calculated on the total quantities of petrol and diesel that enter to the market for the consumption in the previous year, according the energetic content.

¹² In 2008, at least 2.5 percent of total fuel consumed in Italy must be biofuel and also companies were to blend at least two percent of biofuel.

¹³ According to the data provided by Agri.Istat the surface devoted to soybean, rapeseed and sunflower have been increased since 2005. However is not possible infer from the data the percentage of hectares of these crops devoted for biodiesel production.

Alternatives paths, that look for a wider and deeper involvement of the agriculture and where a bigger quota of the added value falls on farmers and on the territory, such as the production of biodiesel for the generation of energy through endothermic engine, the use in agricultural vehicles or in local transport have been until now limited to experimental experiences (as the experience of Confagricoltura).

Even if the production/consumption side has received by the government a bigger attention at the legislative level by the government, also this fraction of biodiesel chain, show several market and structural weaknesses. Most of Italian firms, currently works in a situation of negative profit, due to the difficulties in competing with the big international producers, that can offer biodiesel at a price even inferior to that the Italian producers buy the oil (the price of biodiesel that come from the Usa and Argentina, is highly competitive for exportations' subsidies).

Since 2005, dislike the European trend, the Italian level of biodiesel production is well above to the actual domestic production. Industry sources indicate that about two thirds of total production (or 400,000 tons) were shipped to other EU countries (mainly, and in order of magnitude, Germany, France, Austria and Spain).

In other words, Italy imports from other EU countries large volumes of rape and soy oil, which are processed into biodiesel, only to be re-exported within the EU, sometimes to the same countries from whence the raw material came.

Most of Italian plants are in a situation of underproduction, for the limited proportion of potential output that receives the tax relief¹⁴ for domestic use. In the future, the situation would seem to become even worse. The comma 54 of the article 1 of the budget law of 2010, establishes the reduction of quota that receives the tax relief from the 250,000 tons of 2007 to 18,000 tons for the year 2010. These limits imposed on the level of tax relief have pushed and probably will incentive even more the exportation of the biodiesel "made in Italy".

According to the government if until now the tax relief has not had positive effect on the domestic agricultural production, there's no sense in going on with it and that's why the quota has been reduced of 90%. However, the measure by itself, neither represent a way to disincentive the importation of raw material for biodiesel production, nor a tool to sustain the agricultural world but rather risk to slow still further the development and the investment of an infant industry, that to be competitive will have to look for foreign market for inputs' provision and outputs' commercialization.

5. CONCLUSIONS

If we apply the interpretative framework that we have developed in paragraph n. 3 to the Italian context of biodiesel chain, we can observe the absolute predominance of the industrial model. This unbalance seems to be due to the myopia of the government toward the rural compartment that does not enters, if not only marginally, in the representation of the development of biodiesel production and that translates itself in a legislative framework that reward mostly the industrial production model.

As we have seen from the analysis of the case studies in particular and then through the contextualization of whole Italian policy on this matter, the development of rural production systems is conditioned by funding and specific supporting norms, qualitatively different from that devoted to the industrial one. They concerns policy to promote the cooperation and a fair

¹⁴ The actual amount of tax relief has been reduced in 2007 from 100 percent to 80 percent. In other words, in-quota biodiesel production will pay 20 percent of the 423Euros per cubic meter of the normal consumption tax for diesel. Out-quota biodiesel production will pay 100 percent of the consumption tax.

remuneration among the different actors of the chain, to support small-scale production and plants, to tax-relieve biodiesel made by certified chain.

Also recently, with the heavy reduction of the tax-relief quota, the national policy would seem to show a lack of understanding in the substantial differences between a more industrial or more territorial orientation. If the real and previous aim was to support an Italian production of biodiesel, as supplier for the consumption of other European countries (although maybe initially unconsciously), it's a non-sense strategy to curb the production part of the chain in the attempt of counterbalancing the provision side, without dedicating to it an appropriate set of regulations. In this way both models for the development of biodiesel agro-energetic chain will face serious difficulties.

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