51st Congress of the European Regional Science Association
Barcelona, 30th August - 3rd September 2011

Special session: Territorial Governance, rural areas and local agro food systems

Biomass production and land use management in the Italian context: regulations, conflicts, and impacts

Elena Gissi, Giuseppina Siciliano, Matelda Reho
Faculty of Urban and Regional Planning
Università IUAV di Venezia
S. Croce 1957 - 30135 Venezia Italy
contact email: elena.gissi@gmail.com

Abstract

Renewable energy sources, such as biomass can make a positive impact on climate change phenomenon by decreasing our dependence on fossil fuels.

The use of biomass energy is directly linked to the use of the land, from which biomass feedstock is obtained, such as farm land and forests, and its ecosystem services. The biomass production and the use of land and ecosystem services are usually associated with a wide range of environmental and social impacts, depending on what choices are made regarding what types of biomass are used, as well as where and how they are produced.

Choosing management practices that minimize negative impacts and complement planning policies and energy production objectives is often associated with land-use conflicts among both different institutional levels, local, national and European, and different social actors.

Yet, European Directive 2009/28/CE establishes that the energy production from renewable energy by 2020, as well as from biofuel, defined for each member state (Annex 1), must be achieved through a "sustainable" production. Such definition is assigned to national and local contexts, arising issues in policy making, conflicts analysis and methodologies.

The present paper discusses on the recent acknowledgment of the above mentioned EU directive in several Italian Regions, such as Puglia and Marche, which have defined regulations/guidelines regarding their potential contribution to the national objectives of production and consumption of energy from renewable sources (EFR).

Moreover, the present paper confronts such regulations with results found in literature. Several analyses have been done on the energy production from biomass based on technical

and economic aspects of the problem. However, few studies have applied integrated approaches able to take into consideration crucial aspects such as biodiversity conservation and landscape fragmentation, as required by EU Directive 2009/28/CE, side by side with the economic and social dimensions.

This paper aims at filling this gap proposing the application of an integrated framework of analysis, based on multi-criteria approaches able to take into consideration socio-economic, environmental and landscape criteria, as well as institutional and social conflicts linked to the biomass production.

Renewable Energies, biomass and the Italian context: setting the scene

Renewable sources of energy can make a positive contribution to climate change impacts by reducing our greenhouse gas emissions. Wind power, solar power, hydro-electric power, tidal power, geothermal energy and biomass are considered by the EU's energy-related strategies essential alternatives to fossil fuels (EU, 2011)[1].

The Directive 2009/28/EC of the European parliament and of the Council on the promotion of the use of energy from renewable sources defines the European and National targets to be achieved for 2020 as follows:

- Reduction of CO2 emissions by 20% compared to 1990 levels;
- Increase of 20% in end-use energy efficiency compared to current levels (EC Communication of 19.10.2006 "Action Plan for Energy Efficiency: Realising the Potential)
- Promoting renewable energy with a target of 20% of total energy consumption in the EU, with different targets per Member States (Italy 17%) and 10% for each member country, consumption in the land transport sector.
- Establishing a close link between the developments of energy production from renewable energy and increasing energy efficiency.

Compared to the three macro-sectors that comprise the contribution from renewable energy sources, bioenergy gives its contribution in all three areas, that is in electricity production (electricity production from solid biomass, bioliquids, biogas, organic fraction of MSW), in heating / cooling (the use of solid biomass (eg wood chips) in the home, and even other biofuels through district heating networks (thanks to CHP)), and in transport (Biofuels, as biodiesel and bioethanol).

[1] EU, 2011, Renewables make the difference. Available at: http://ec.europa.eu/energy/renewables/index_en.htm.

	2005			2008			2020		
	Consumption from RES	Gross consumption	RES consumption/ Gross Consumption	Consumption from RES	Gross consumption	RES consumption/ Gross Consumption	Consumption from RES	Gross consumption	RES consumption/ Gross Consumption
	Mtoe	Mtoe	%	Mtoe	Mtoe	%	Mtoe	Mtoe	%
Electricity	4,846	29,749	16,29	5,040	30,399	16,58	9,112	31,448	28,97
Heating	1,916	68,501	2,80	3,238	58,534	5,53	9,520	60,135	15,83
Transports	0,179	42,976	0,42	0,723	42,619	1,70	2,530	39,630	6,38
Transfers from other States	-	-	-	-	-	-	1,144	-	-
TOT	**6,941**	**141,226**	**4,91**	**9,001**	**131,553**	**6,84**	**22,306**	**131,214**	**17,00**
transports according to the 10% targets	0,338	39,000	0,87	0,918	37,670	2,44	3,419	33,975	10,06

Table 1: Final gross consumption of energy and renewable energy targets, Source: Italian Ministry of Economic Development, National Action Plan for Renewable Energies in Italy, 2009.

To achieve the European target of 17%, Italy will have to more than triple the renewable energy consumed by 6.941 million tons equivalent oil (Mtoe) in 2005, to 22.306 Mtoe in 2020 (table 1).

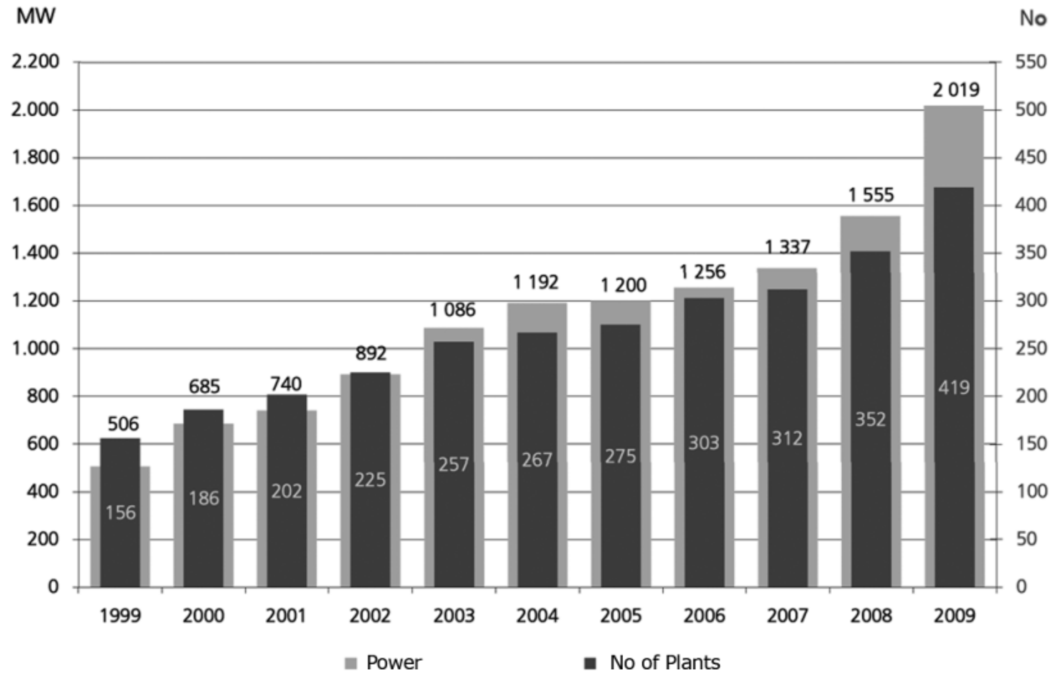

Fig 1: trend of biomass power plants and total power per year in Italy (source: GSE, 2009).

The Minister of Economic Development, with the "National Action Plan for Renewable Energies in Italy" (NAP)[2], gives great attention to biomass. In the time between 1999 and 2009, the biomass plants park has considerably grown: the average annual rate of growth was 10.4% for the number and 14.8% for the installed power (GSE, 2009)[3]. This growth was characterized by an average size, in terms of power, more and more significant: in 1999 the

[2] Italian Ministry of Economic Development, National Action Plan for Renewable Energies in Italy, 2009.
[3] Gestore Servizi Energetici (GSE) 2009, "Biomasse 2009, rapporto statistico", www.gse.it

plants have an installed capacity of 3.2 MW average growing up to 4.8 MW in 2009 (GSE, 2009)[4] (Fig. 1).

The path for the achievement of the EU national targets is not free from uncertainties. According to GSE (2009)[5], energy production from biomasses is variably distributed among Italian Regions (table 1). Yet, Regional biomass potential production, influenced by different climatic and soil conditions which characterizes Italian Peninsula, has not been fully explored.

GWh	**Urban Solid Waste bio**	**Solid Biomass**	**Biogas**	**Bioliquids**	***Biomass TOT***
Piemonte	13,7	201,7	197,4	7,7	*420,5*
Valle d'Aosta	-	-	5,6	-	*5,6*
Lombardia	766,8	178,9	337,0	136,9	*1419,6*
Trentino Alto Adige	10,5	18,6	30,4	44,0	*103,5*
Veneto	91,3	17,4	149,5	40,5	*298,7*
Friuli Venezia Giulia	49,7	123,8	6,5	-	*180,0*
Liguria	0,4	-	101,2	-	*101,6*
Emilia Romagna	254,3	369,8	287,2	557,9	*1469,2*
Toscana	49,0	86,8	86,4	83,2	*305,4*
Umbria	-	95,8	28,1	4,2	*128,1*
Marche	5,7	-	126,9	3,0	*135,6*
Lazio	93,6	-	101,0	10,5	*205,1*
Abruzzo	-	3,6	34,7	-	*38,3*
Molise	46,1	107,8	5,1	-	*158,9*
Campania	95,1	-	64,9	201,1	*361,1*
Puglia	42,1	705,7	63,5	97,4	*908,7*
Basilicata	15,6	-	-	137,4	*153,0*
Calabria	48,5	719,4	10,5	-	*778,3*
Sicilia	-	-	91,8	21,8	*113,6*
Sardegna	33,8	198,4	11,7	102,4	*346,3*
ITALY TOT	**1.616,2**	**2.827,7**	**1.739,6**	**1.447,8**	**7.631,2**

Table 2: Power production from biomass per Region (Source: GSE, 2009)

Different scenarios might be taken into consideration according to different energy mix and to different strategies to share the National targets among the 21 Regions, process known as 'burden sharing'. The competence of the energetic sector is in fact shared between the regional and the national level, leaving space for a fruitful but nevertheless uncertain discussion, since methodologies and tools might be different on Regional level.

The present contribution aims at setting the scene for a comparative analysis of regional implementation of the European Directive 2009/28/CE according to the Italian acknowledgement by Law 28/2011.

[4] Ibidem.
[5] Ibidem.

Barriers to biomass production: an overview

Among all the renewable sources of energy, biomass energy differs from them in the extent to which its use is directly linked to the use of the land (mainly agricultural areas and forests) from which biomass feedstock is obtained. Because of this close relationship, the use of biomass has the potential to result in a wide range of conflicts, constraints and impacts (positive and negative) related to the economic, environmental and social dimensions, above and beyond its use as a substitute for fossil fuels.

In this respect, various studies have already analyzed the different controversial aspects which relates to biomass productions. In this section of the paper, a range of these controversial aspects of biomass production have been identified and categorized through a comprehensive literature and case study review. In particular, impacts on soils, water resources, biodiversity, ecosystem function, and local communities, as well as legislative/normative constraints and social conflicts have been identified as the main limits/barriers for a sustainable production of bioenergy from biomass.

The severity of economic, environmental and social conflicts, impacts and constraints depends often on the types of biomass used, the localization of the plants and the extent to which the different social actors are involved in the decisional process. In this sense, the achievement of sustainability in bioenergy production refers mainly of choosing management practices able to satisfy land-management objectives and simultaneously to minimize adverse environmental and social impacts.

One conflict that often arises in biomass production for energy is the so-called "food-vs.-fuel" debate, which refers to the competition between the use of the land for food production or bioenergy (Nonhebel and Kastner, 2011[6]; Koh and Ghazoul, 2008[7]; Amigun et al., 2011[8]; Kenney and Erichsen, 1983[9]; Pimentel et al., 1988[10]; Dwivedi and Alavalapati, 2009[11]). Corn, sugar and vegetable oils, which have been traditionally produced as food crops are also some

---

6

7 Koh L. P., Ghazoul J., 2008. Biofuels, biodiversity, and people: Understanding the conflicts and finding opportunities, Biological Conservation , 141, 2450-2460.

8 Amigun B., Musango J.K., Brent A.C., 2011. Community perspectives on the introduction of biodiesel production in the Eastern Cape Province of South Africa, Energy 36, 2502-2508

9 Kenney V. P., Erichsen R. L., 1983. Conflict between fuel and food: the ethical dimension, Energy in Agriculture, 2, 285-306

10 Pimentel D., Warneke A. F., Teel W. S., Schwab K. A., Simcox N. J ., Ebert D. M., Baenisch K. D., Aaron M. R.,1988. Food versus biomass fuel: socioeconomic and environmental impacts in the United States, Brazil, India, and Kenya, Advances in food research, 32

11 Dwivedi P., Alavalapati J. R.R. 2009. Stakeholders' perceptions on forest biomass based bioenergy development in the southern US, Energy Policy 37, 1999–2007

of the most commonly used energy feedstock. This shift in the use of agricultural products from food to bioenergy has also contributed to increased prices for many of the food commodities. This aspect has been identified in the literature as one of the negative side effects of the use of biomass for energy production (Kautto et al., 2011[12]; Koh and Ghazoul, 2008; Adams et al., 2011[13]), together with potential global food shortages and therefore potential negative implications for food security at the global level. Moreover, the economic and technological dimensions of the barrier to biomass production refer to a wide range of aspects. These refer mainly to: (i) the technology used, such as the uncertainty of conversion technology, operational costs; (ii) the competition versus other investments; (iii) limited or uncertain return on investment; (iv) the seasonal effect of bioenergy supply; and finally (v) the instability or changing of the bioenergy market.

Constraints to bioenergy production from biomass are often related to the public acceptance, mistrust between local community, developers and agencies and risk perception (Upreti, 2004[14], Upham et al., 2005 and 2011[15]; Amigun et al., 2011; Adams et al., 2011). Various studies have reported through the realization of local surveys, negative public opinion with regard to the construction of bioenergy power-plants. The main causes of public mistrusts are often a consequence of poor consideration and involvement of local stockholders or the perception of a lack of early involvement and consultation in both, (i) negotiating local renewable energy strategies and (ii) in deciding the localization of bioenergy plants. In general, siting conflicts and public mistrust, which affect public support or opposition, are linked to unfamiliar technology or its performance, socio-cultural context where the power plant is proposed to develop, as well as uncertain and unclear policy and regulatory frameworks (Upreti, 2004[16]). With regard to siting conflicts, and according to a study realized in 2010 by Kalf et al., 2010[17] in the Netherlands, the NIMBY ("Not in My Back Yard") effect, which refers to the public resistance to having biomass energy projects near to where they live, is increasing. In this situation, in order to avoid local oppositions it is important to put in

[12] Kautto N., Arasto A., Sijm J., Peck P., 2011. Interaction of the EU ETS and national climate policy instruments e Impact on biomass use. Biomass and bioenergy, in press

[13] Adams P.W., Hammonda G.P., McManus M.C., Mezzullo W.G., 2011. Barriers to and drivers for UK bioenergy development. Renewable and Sustainable Energy Reviews 15, 1217–1227

[14] Upreti B. R., 2004. Conflict over biomass energy development in the United Kingdom: some observations and lessons from England and Wales. Energy Policy 32, 785–800

[15] Upham P., Shackley S. 2006. The case of a proposed 21.5MWe biomass gasifier in Winkleigh, Devon: Implications for governance of renewable energy planning, Energy Policy 34, 2161–2172, and Uphama P., Riesch H., Tomei J., Thornley P., 2011. The sustainability of forestry biomass supply for EU bioenergy: A post-normal approach to environmental risk and uncertainty. Environmental Science and Policy, in press.

[16] Upreti B. R., 2004. Conflict over biomass energy development in the United Kingdom: some observations and lessons from England and Wales. Energy Policy 32, 785–800

[17] Kalf, R., H. W. Elbersen and J.W.A. Langeveld. Limiting the NIMBY-effect at the introduction of bioenergy production chains: a case study for the Netherlands. Paper presentated at the 18th European Biomass Conference and Exhibition, held inLyon (France) 3-7 May, 2010.

place local communication and participation processes which have the capacity to involve as much as possible all the social actors involved in the realization of the project (Upreti, 2004; Van der Horst, 2007[18]; Kalf et al., 2010; Adams et al., 2011).

Moreover, public oppositions to biomass energy production are often associated with problems of access to land and physical resource limitations in terms of land availability, especially in projects regarding the use of public lands, such as public forests (Stidham et al., 2011[19]). In developing countries, the concerns of local people are often related to the relationship between land availability and cultural and ideological community identities (Amigun et al., 2011). In these cases, project failures can be attributed to cultural misunderstandings, rather than strictly technical or economic obstacles (Fischer et al. 2005[20]).

From an environmental point of view, a vast body of literature has analyzed the negative environmental impacts of biomass production for energy purposes, especially with regard to biofuel production. These impacts range from air and water pollution, soil degradation, habitat and biodiversity losses to potential harm on the character and amenity of the landscape (Koh and Ghazoul, 2008; Ariza-Montobbio and Lele, 2010[21]; Trimble and Van Hook, 1984[22]; Upreti, 2004; Pimentel, 1988). In addition, environmental conflicts between different social actors, usually local community and institutions or private developers and investors have been identified with regard to physical resource limitations (land availability) and competition for water resources. Agricultural expansion and increasing irrigation for biomass production, as well as the use of water in bio-refineries for biofuel production, may compete with other uses for water and thus contribute to rising water demands (Pickett et al., 2008; Koh and Ghazoul, 2008; Ariza-Montobbio and Lele, 2010). Pressures on water supply are increasing worldwide and this could have negative consequences in terms of the availability of clean water for humans.

From a legislative point of view, a study realized by Kautto et al. (2011) shows that the application of multiple policy instruments and normative in energy policy field and in the bioenergy field in particular, at both EU and Member State levels, sometimes can result in: (i)

---

[18] Van der Horst D. 2007. NIMBY or not? Exploring the relevance of location and the politics of voiced opinions in renewable energy siting controversies. Energy Policy 35:2705–14

[19] Stidham M., Simon-Brown V., 2011. Stakeholder perspectives on converting forest biomass to energy in Oregon, USA, Biomass and Bioenergy 35, 2 0 3-2 1 3.

[20] Fischer S., Koshland C. P., Young J. A., 2005. Social, economic, and environmental impacts assessment of a village-scale modern biomass energy project in Jilin province, China: local outcomes and lessons learned, Energy for Sustainable Development, Volume IX No. 4

[21] Ariza-Montobbio P., Lele S., 2010. Jatropha plantations for biodiesel in Tamil Nadu, India: Viability, livelihood trade-offs, and latent conflict, Ecological Economics 70, 189–195

[22] Trimble J. L., Van Hook R.I., 1984. Soil disturbance, nutrient depletion and impaired water quality, Biomass.

an increased complexity in the interpretation of the laws, (ii) uncertainties regarding how to implement them in practice and (iii) conflicts among policy objectives at different territorial levels. This aspect might result in an obstacle in the achievement of the policy objectives and arise local oppositions to the realization of biomass production projects.

The following table shows a categorization of the main barriers identified in literature to biomass production, based on the dimensions they refer to (economic/technological, environmental, social and normative) and on a distinction between conflicts, constraints, impacts and uncertainties.

In particular, barriers are considered all the aspects that can limit in different ways, the achievement of targets and policy objectives, as well as the implementation and effectiveness of projects. Barriers can be of different nature. In this paper we classified them as follows (see table 3): (i) constraints; (ii) conflicts; (iv) impacts; and (v) uncertainties. Impacts are meant as direct and/or indirect effects, which can be positive or negative, linked to the implementation of the project on social-ecological systems. Constraints have been considered as any element, factor, or subsystem that works as a bottleneck. It restricts an entity, project, or system (such as a production plant or decision making process) from achieving its potential with reference to its goal. In the case of the presence of uncertainty we refer to a situation where one or more of the following conditions can occur: (1) there is poor knowledge; (2) the consequences, extent, or magnitude of circumstances, conditions, or events is unpredictable; and (3) credible probabilities to possible outcomes cannot be assigned, (4) lack of coordination and synergy between tools and policies at different levels and between different dimensions. Conflicts are considered as oppositions resulting from real or perceived differences or incompatibilities of interests, goals, priorities, expectations between different social actors involved in the issue under consideration.

Dimensions	Type of barrier	Reference
Environmental		
Forests and biodiversity conservation	Impact	Koh and Ghazoul, 2008
Competition for water resources	Conflict	Koh and Ghazoul, 2008; Ariza-Montobbio and Lele, 2010
Soil disturbance, nutrient depletion and impaired water quality	Impact	Trimble and Van Hook, 1984
Air pollutants, solid wastes and wastewater	Impact	Trimble and Van Hook, 1984; Pimentel, 1988
Negative effects to ecology and landscape	Impact	Upreti, 2004
Soil Erosion and nutrient losses	Impact	Pimentel, 1988
Social		
Food security	Impact	Koh and Ghazoul, 2008; Nonhebel and Kastner, 2011;

		Amigun et al., 2011, Romijn and Caniëls, 2011
Competition for arable lands	Conflict	Ignaciuk et al., 2006
Competition between food, livestock feed and energy	Conflict	Nonhebel and Kastner, 2011
Competition between biomass and food/wood production	Conflict	Koh and Ghazoul, 2008; Kenney and Erichsen, 1983; Pimentel, 1988
Public mistrust of the relevant authorities	Constraint	Upham and Shackley, 2005; Amigun et al., 2011
Stockholder Risk perception	Constraint	Upham et al., 2011
Land availability and community identity	Conflict	Amigun et al., 2011
Health risk	Impact	Upreti, 2004; Amigun et al., 2011
Location of the plant/NIMBY effect	Conflict	Upreti, 2004; Upreti and van der Horst, 2004; Van der Horst, 2007; Kalf et al., 2010;
Feeling of injustice	Constraint	Upreti, 2004
Cultural misunderstanding	Constraint	Fischer et al., 2005
Access to land/ Physical resource limitations	Conflict	Stidham and Simon-Brown, 2011; Adams et al., 2011
Economic/technological		
Food/Wood price increases	Impact	Koh and Ghazoul, 2008; Kautto et al., 2011 Adams et al., 2011
Competition versus other investments	Constraint	Adams et al., 2011
Uncertain development and operational costs	Uncertainty	Adams et al., 2011
Uncertainty of conversion technology/equipment	Uncertainty	Adams et al., 2011
Limited/uncertain return on investment	Constraint/uncerta inty	Adams et al., 2011
Seasonal effects of bioenergy supply	Uncertainty	Adams et al., 2011
Unsettled/changing bioenergy market	Uncertainty	Adams et al., 2011
Return on investment	Constraint	Adams et al., 2011
Legislative/normative		
Unclear and complex legislative issues/unclear legislative limitations	Uncertainty	Adams et al., 2011
Lack of synergistic and coordinated policy instrument mixes	Uncertainty	Kautto et al., 2011

Table 3 Barriers to bioenergy production from biomass: impacts, conflicts, constraints and uncertainties

A brief introduction to specific cases in the italian context

In the following section examples of the presence of different types of barriers in the implementation of bioenergy production from biomass are presented with regard to the Italian context.

With respect to the normative issues, in Italy the regulative body on renewable energy was delivered in an incremental way. A series of Decrees were issued, composing a fragmented body of laws, whose impacts are far from being properly interpreted and assessed. Legislative

Decree 28/2011[23] of the 3rd of March 2011 (from here on D.lgs. 28/2011), acknowledging the European Directive 2009/28/CE, tries to bring order to the system of rules and decrees that have gone add up. The decree, made of 47 articles and 4 annexes, and the reference to numerous specific implementing legislation still not in place, renovates the entire renewable energy sector with new rules about permits issues procedure, incentives and payments, transmission and distribution networking (with the center to the investment in smart grid), district heating and cooling, as well as biogas dissemination standards and new targets for biofuels (minimum of 5% to be entered for consumption in 2014).

While the European Directive underlines the necessity of focusing on sustainability criteria along with the supply chain of RES, several issues and uncertainties arise from the Italian legal framework, issues which have to be tackled in the implementation phase that has to come.

Regional potentials, burden sharing and regional targets

The first critical issue is related to the distribution of the targets expected at National level by the EU "climate package" at local level to the Regions, process known as "burden sharing"[24], that implies contextualization and downscaling according to local factors.

The D.lgs. 28/2011 does not quantify the sharing rates but the methodology for their calculation. For renewables in the electricity sector, the local development capacity since 2000 and the definitions of "regional potential 2020" contained in Regional Energy Plans are the two references for the regional burden sharing of the national target with respect to increasing domestic production. Moreover the D.lgs. 28/2011 suggests the identification of the regional potential, that is the quantification of each resource availability. While for the hydroelectric sector, this criterion is constrained to the instream flow, for the wind sector to landscape constrains and to a maximum of power per Kmq, with respect to biomass sector constrains and rules are weaker. Uncertain scenarios might open as methods adopted to calculate the regional potential consider issues related to biodiversity and landscape heterogeneity, and not only closely linked to land cover surface percentage. Regional rate targets might be revised along with the implementation phase, as they might not be achievable.

23 Legislative Decree of the 3rd of March 2011, no. 28, Implementation of Directive 2009/28/EC on the promotion of renewable energy, and subsequent repeal of amending Directives 2001/77/EC and 2003/30/EC. (11G0067).

24 art. 37 - paragraph 6 - will set a new deadline for the regional burden-sharing (i.e. that must be done within 90 days after the entry into force of the D . bye-law (ie June 27) with a MSE-Minambiente decree, after consultation with the Joint Conference

REGIONS	Straw (Kton)	Pruning (kton)	Olive and vineyard residues (kton)	Woody biomass (kton)	Biogas (Millions Nm³)
Piemonte	2.478,63	110,21	48,47	256,57	337,87
Valle D'Aosta	0,20	1,70	0,30	1,09	12,16
Lombardia	3.616,85	40,01	16,98	242,13	723,31
Veneto	1.744,74	367,09	74,73	90,99	272,61
Trentino-Alto Adige	1,52	64,63	12,95	34,99	67,66
Friuli-Venezia Giulia	592,80	56,40	11,15	65,13	48,80
Liguria	4,23	19,36	5,38	96,47	43,91
Emilia-Romagna	1.556,55	398,46	62,62	236,54	318,05
Toscana	724,08	237,67	63,76	365,07	127,68
Marche	539,23	57,86	16,96	32,32	56,47
Lazio	436,80	247,85	56,70	112,33	229,43
Umbria	430,10	101,89	13,73	67,15	43,78
Abruzzo	229,23	290,35	54,99	60,13	55,05
Molise	163,45	31,48	29,04	43,75	18,83
Campania	316,88	286,58	65,85	119,83	260,19
Basilicata	452,10	49,96	11,58	65,28	35,95
Puglia	1.219,42	813,88	369,64	46,43	136,87
Calabria	212,11	1.012,21	189,92	153,80	85,23
Sicilia	731,97	597,92	186,35	25,58	210,50
Sardegna	260,00	120,90	28,78	65,01	122,43
TOT	**15.710,90**	**4.906,40**	**1.319,90**	**2.180,58**	**3.206,77**

Table 3: Regional Biomass potential by typologies (Source: ENEA, 2009).

In fact the estimate of residual biomass (livestock), at the base of the energy planning, is a very complex operation because it depends closely for each culture on factors such as local climatic conditions, soil fertility, the production system and the technology used, while the availability of agricultural residues varies mainly because of differences in yield, type and moisture of cultivations. Italian NAP projections are based on the estimate made by ENEA[25] (Motola et al. 2009)[26], which can leave space to uncertainties in the implementation phase, between targets and their real achievement. Among some methodological limitations, it is possible to mention the fact that the estimate was carried out at Provincial level, associating each Province to a specific eco-climatic zone, without considering local heterogeneity, which is a peculiarity of Italian Peninsula and soils. Moreover, with respect to energy crops, while traditional field crops (eg wheat and maize), and to a lesser extent also for biomass from trees (eg poplar), there is a national network and sufficiently detailed data to allow direct estimate

25 The Report takes into account the agricultural and forest biomass and forest biomass, as well as the productivity of herbaceous energy crops, and the estimated potential of biogas from biomass producible fermentable (Motola et al. 2009).

26 Motola V., Colonna N., Alfano V., Gaeta M ., Sasso S., De Luca V., De Angelis C., Soda A., Braccio G. (2009), Censimento potenziale energetico biomasse, metodo indagine, atlante Biomasse su WEB-GIS, ENEA, Ente per le Nuove tecnologie, l'Energia e l'Ambiente, Report RSE/2009/167.

of potential crop production at the provincial level, the sector of herbaceous biomass crops, foreseen as strategic for National target achievements (Ronchi, 2009)[27] is still partially explored, with experiences in less than 10 provinces (Bologna, Udine, Catania, Pisa, Bari, Potenza)[28]. Therefore, the ENEA's estimate of productivity has required extensive extrapolations and indirect comparisons. This means that the provincial average productivity might have been overestimated, and preliminary studies would be needed to assess yields under soil and eco-climate local conditions. Moreover, impacts of climate change in agriculture (Olesen and Bindi, 2004)[29] introduce another level of uncertainty in the calculation of biomass feedstock, as CIRCE[30] (2011) reports that the displacement of climatic areas has already being started.

Potential productivity of the Italian Provinces should also be assess and reconsidered in relation to the quality of agricultural land use and its destination, as suggested by the DM Settembre 2010, with respect to IGP and DOP productions which might enter in conflict with. ENEA's methodology makes the calculation on Utilised Agricultural Area (UAA), without considering current land use of UAA, nor its multi-functionality linked with ecosystem services and landscape richness that could be lost in the transition to dedicated crops. Another relevant limit to the ENEA estimate is that productivity is not assessed with respect to water availability, which might heavily affect the availability and accessibility of resources in each region, because of the scarcity and conflicts arisen by water management and agriculture (Puma and Cook, 2010)[31].

Regional Energy Plans should be revised to establish, according to the principle of burden sharing, effective environmental, economic and social potentialities, to calibrate regional rates according to multi-dimensional sustainability criteria. In fact the implementation of EU

---

27 Ronchi, e. (2009), L’Europa e le Regioni per lo sviluppo delle energie rinnovabili, Rapporto 2009 della Fondazione per lo sviluppo sostenibile, http://fondazionesviluppostenibile.org/f/ Documenti /Convegno+Ue_regioni_Rapporto09/ Rapporto_2009_ Fondazione_per_lo_sviluppo_sostenibile.pdf

28 Barbanti L., Grandi S., Vecchi A., Venturi G. 2006. Sweet and fibre sorghum (Sorghum bicolor (L.) Moench), energy crops in the frame of environmental protection from excessive nitrogen loads. European Journal of Agronomy 25, 30-39; Barbanti L., Monti A., Venturi G. 2007. Nitrogen dynamics and fertilizer efficiency in leaves of different ages of sugar beet (Beta vulgaris) at variable water regimes. Annals of applied biology 150, 197-205.

29 Olesen J.E. and Bindi M. 2004. Agricultural impacts and adaptations to climate change in Europe. Farm Policy Journal, 1: 36-46.

30 The main objectives of CIRCE (Climate Change and Impact Research: the Mediterranean Environment), Integrated Project, funded under the European Commission's Sixth Framework Programme, are to predict and to quantify the physical impacts of climate change in the Mediterranean, and to assess the most influential consequences for the population of the region. Key research issues include the impact of climate change on agriculture, forest fires, and tourism; adaptation strategies for agriculture and natural ecosystems; and the role of agriculture and forestry in climate change mitigation. www.circeproject.eu.

31 Puma MJ, Cook BI (2010), “Effects of irrigation on global climate during the twentieth century”, Journal of Geophysical Research-Atmospheres, 115(D16).

directive, from the side of policy makers and officers, is affected by several operational uncertainties, with respect to biomass traceability procedures, permits issues and effective sustainability assessment. Even if procedures are coherent to the legal framework defined by Law, uncertainties, conflicts and barriers might arise along with implementation phase. Planning tools, knowledge framework and permits issues procedures, are not yet coordinated in scale (National, regional and local) nor according to sectors (environmental protection, landscape planning, agricultural policies).

Traceability of biomass

The Decree[32] of the Minister of Agricultural Policies on tracing of biomass for electricity production issued in March 2010 establishes the requirements of energy plants feedstock to access to the incentives and financing aids, as well as the requirements about the traceability of the biomass origin through the Minister Decree of the 2nd of March 2010[33]. The traceability is based on identification of feedstock site of production (localization of biomass site production according to 'short supply chains', identified as within a distance of less than 70 km from the power plant; or biomass deriving form 'supply chain agreements'), without providing information on the feedstock conditions and methods of production, which would deeply affect supply chain sustainability assessment.

Landscape sustainability and regional knowledge frameworks

Moreover, with respect to power plants localization, the Ministerial Decree of 09/10/2010[34] delegates to Regions (according to the issue of Regional bylaws) the definition of criteria of placement with respect to landscape and sustainability criteria, as well as the identification of any unsuitable areas (Article 17) that the regions can identify only as part of the measures with which they lay down the tools and methods to achieve their rate to the European objectives in the development of RES. The critical issues stands with respect of availability of adequate knowledge frameworks which Regions can confront plants projects with, to answer to all EU sustainability requirements in a consistent way, as to improve and to support

32 Decreto del ministero delle politiche agricole e alimentari e forestali, 2 marzo, 2010, in attuazione della Legge 27/12/2006, n. 296, sulla tracciabilità delle biomasse per la produzione di energia elettrica, pubblicato nella gazzetta ufficiale n. 103 del 05/05/2010).

33 Decreto del Ministero delle politiche agricole alimentari e forestali, 2nd of March 2010, Attuazione della legge 27/12/2006, n. 296 sulla tracciabilità delle biomasse per la produzione di energia elettrica.

34 Decree 09.10.2010 (published in Official Gazette No. 219 of 18.09.2010) and with it the guidelines for the simplification of permits for plants fueled by renewable sources – Linee guida per il procedimento di cui all'art 12 del Decreto legislativo 29 dicembre 2003, n. 387 per l'autorizzazione alla costruzione e all'esercizio di impianti di produzione di elettricità da fonti rinnovabili nonché linee guida tecniche per gli impianti stessi.

energetic sector implementation. In fact biomass resources are limited, and authorizations deals with competing feedstock supply and demand, as well as to sustainability criteria which should be put in place along with plants permits assessment procedures. Yet, Italian regions react to this crucial point in different ways, according to their knowledge frameworks and planning tools. Puglia Region issues its Bylaw[35] in time (within 180 days from the DM release), based on the fact that the Regional Landscape Plan[36] establishes a complete and coherent knowledge framework with respect to biodiversity, landscape characterization and eco-climatic areas, according to a range of rural and urban morpho-typologies. On the contrary, Veneto Region hasn't yet proceeded in the release of its Regional Bylaw, and decided for a postponement of all permits issues for year 2011, to take time to define criteria and requirements. However, not just planning tools but also methodologies to define criteria and values are left to Regional initiative, with an evident difficulty since only 13 Regions were able to issue their bylaws in time.

Permits issues and cumulative effects

Since new plants permits are issued on Regional or Municipal base, according to types of feedstock and to power production level, some difficulties might be foreseen in the assessment of cumulative impacts, for example, by concentration of micro-generation plants, whose permits procedure is Municipal, according to Decree 28/2011, and it is not subjected to Environmental Impact Assessment. In the case of Veneto Region, the average of Municipal surface is around 25 Kmq, widely under the 70 km threshold defined by the Dlgs 28/2011. Moreover, Guidelines don't automatically foreseen compensation measures, if not with respect to "territorial concentration of activities, plants, and infrastructure of high territorial impacts" (criteria for eventual measure of concentration, point 2 comma b). Territorial concentrations might be expected even from the presence of micro-generation plants. But inter-municipal monitoring of new plants placement is not foreseen, nor a coordination among municipalities are foreseen, even if competition for biomass supply can affect the success in targets achievement as well as private investments effectiveness and return.

Even with respect to landscape permits, specific attention is devoted to the valorization of local energetic potentialities in terms of feedstock production and availability. However the contextualization of RES power plants is intended in more in visual terms, as it is not

35 Regione Puglia, "Regolamento per la realizzazione degli impianti di produzione di energia alimentata a biomasse".

36 Regione Puglia, Piano Paesaggistico, 2009.

considered the entire supply chain, from the production of the biomasses to the transformation and distribution, but the regulation insists on rules related to power plant location, and only mentions possible negative impacts on IGP, DOP and specific agricultural production.

The case of Marche region and the normative conflict due to unclear legislative limitations

In the Marche region, under Article 5 of the Legislative Decree No. 387 (Implementation of Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources) and in accordance with the Regional Environmental Energy Plan (PEAR), approved in 2005, biomass plants for the production of electricity can be authorized if they meet the following characteristics: a) a generating capacity not greater than 5 MW; b) use of biomass feedstock found at local or regional level; c) reuse of the heat produced by the plant , so as to prevent emissions on the environment. This regulation have been already applied to a biomass energy production project in the provinces of Pesaro and Urbino, which didn't received the authorization by the Marche region due to the fact that it was exceeding the power capacity limit (5 MW). Since the national law on the promotion of biomass energy does not foreseen such a threshold of 5 MW, the Italian government has decided to ban the Marche region law.
This is a case of a normative conflict between different territorial levels, state-region linked to unclear and complex legislative issues. In particular, there has been a problem of unclear legislative limitations or targets from the national laws regarding the dimension and power of the biomass plants. This uncertainty has conducted to a State-region conflict from a normative point of view.

The Veneto region and the competition "food-bioenergy"

Differently from the case presented above, in the Veneto region a conflict generated by the competition between the use of the agricultural product for food or the production of bioenergy has been identified. According to experts from the regional agricultural associations, which have been interviewed about biomass productions, one of the most important conflicts related to biomass production in the region is the final use of the agricultural product. In this case, there is in particular a problem of competition between the use of biomass for energy proposes or alternatively for livestock feed. Moreover, there is also a problem of livestock feed price increase.

The Puglia region and the conflict for biomass plants siting, the NIMBY effect

In this case the conflict refers to public oppositions to the construction of a biomass power plants in the province of Lecce, Puglia region. After a protest from local citizens, the Enigma Srl. Company has renounced to the construction of a biomass power plant of 1 MW. The population were strongly against to the project for fear that the incinerator, originally planned for incinerating the wastes of the olive trees, would be also used to incinerate municipal solid waste and industrial products. In this case the conflict was generated by a poor communication and stockholder involvement, public mistrust of the relevant authorities, as well as stockholder health risk perception.

Conclusions

The present paper identified a vast range of issues / barriers that may affect the achievement of biomass implementation projects and strategies. Several actions may be foreseen to manage those barriers.

Coordination and monitoring strategies are needed with respect to payments, permits issues and biomass feedstock production. Mechanisms of policies building, as well as monitoring activities and projects assessment procedures should be focused on the entire supply chain, from feedstock production to costumers delivery. Direct and indirect impacts, constrains and uncertainties may be effectively managed if several requirements are accomplished.

First of all, legal and knowledge frameworks should be coherent and substantive intertwined with the operational level of local administrators and civil servants who perform and govern through planning tools and authorization procedures. Moreover, monitoring systems should consider new projects, feedstock production levels and methods as well as energy demand variation. It aims at identifying concentrations of plants, or competition from feedstock or demand fluctuations so to avoid negative cumulative effects. Monitoring and coordination strategies should be structured to monitor multi-scale actions and effects, as to combine National, regional and municipal choices on proper spatial dominion.

Along with the logic of integration, assessment procedures of biomass supply chains should integrate biodiversity and landscape indicators with the indications from the Directive 30/2009/CE, which centers the assessment in the CO2 reduction.

Further investigation is needed with respect to crucial questions which have been identified, to define and contextualize barriers and related choices and solutions with respect to the variability of local conditions and to strategies of stakeholders and communities involvement.