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# Regions at Risk of Energy Poverty: The case of Apulia. Between potential and limitations of the regional planning for the 2007-2013 programming cycle

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**Abstract:** At the Community level, in recent years, the issues on poverty and energy efficiency as well as the socio-economic impacts are the basis of several political debates. The development of the European territory is having to deal with different mega trends and impacts of policies, in particular the increase in energy prices and the emergence of a new energy paradigm have significant territorial impacts. In fact, some regions are more vulnerable than others because of their socio-economic, climatic and geographic conditions and transportation. However variations in energy prices can offer significant development opportunities for regions able to exploit their potential for renewable energy production and/or to introduce innovations in related industries. The main research themes of the ReRisk project (Regions at Risk of Energy Poverty) are the impacts of the new European energy policy and of prices on economic competitiveness and social cohesion in Europe. The project instead of focusing on energy infrastructure, which is mostly at the heart of studies in the field of energy, looks to a large extent on the consumption side of energy. The policy recommendations of ReRisk do not limit only on energy policy, but the energy is a cross-cutting issue at the regional level. The aim is to reduce the vulnerability of regions in the short term and improve their adaptive capacity in the medium-long term. Starting from ReRisk research, the paper analyses the case of Apulia. The region is characterized by a strong dependence on fossil fuels, by a social, infrastructural, economic and problematic situation, but at the same time it has good potential on a national scale for solar and wind power system which if valued and supported by appropriate policies could represent a significant turning point. Starting from a general description of the Italian context, by searching and combining data from official sources and the main regional plans for 2007-2013 cycle programming, the paper describes the Apulia's context and at last summarize the results in a SWOT Analysis to evaluate intervention policies still in progress, showing their strengths, weaknesses, limitations, but also future opportunities.

**Keywords:** Espon ReRisk, Renewable Energy, Italy, Planning, Apulia

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## 1. Introduction

The Treaty of the European Union - the so-called Lisbon Treaty - has simultaneously integrated two concepts: territorial cohesion and energy. Territorial cohesion is about ensuring the harmonious development of all these places and to ensure that citizens are able to capitalize on the inherent characteristics of these territories. As such, it is a means of transforming diversity into a resource that contributes to sustainable development of the UE. This means that all EU policies should also be considered from the point of view of territorial planning [12].

The focus on the domestic market is not a surprise, but what about the potential interactions with the territory aims to promote energy efficiency and energy saving and the development of new and renewable energy is worth noting. The combination with the one that would allow territory and their inhabitants to take advantage of the inherent characteristics can be extremely fertile and a major driver of innovation, although contradictions could arise between territorial cohesion and the principles of internal energy market. Therefore, territories lie at the intersection of two dimensions: awareness of the complexity of the stakes and challenges, on the one hand, and the awareness of the importance of local action to achieve the global targets on

the other have led local authorities to refer not only to the global and European targets, but also to engage in join them in their territories [12].

The ReRisk applied research project aims at measuring the European regions' vulnerability to rising energy prices in three dimensions: economic vulnerability, regions' dependence on transport and social vulnerability. The project provides answers to the following key research questions such as: the current situation in energy consumption on regional level in transport, private households and industry and the elasticity in these three sectors; the level of impact due to the increasing of energy prices in different types of regions (considering aspects such as climate, geography, population density, accessibility, weight of different economic sectors in the regional economy); the regions which have the development opportunities to generate substantial amounts of renewable energy; the contribution of spatial planning from regional adaptation to more efficient and sustainable energy consumption; the transformations that the regional economy have to undergo to react in a pro-active way to these changing circumstances and conditions [9].

The ReRisk project is well-structured into three main stages. During the initial stage the European regions' vulnerability is being analyzed by using a set of indicators based mainly on harmonized Eurostat data; in the second stage a clustering process is applied to identify groups of regions with similar levels of vulnerability and development potential; in the final stage, the conclusions are made expressed as policy recommendations for actions to be taken from the local to the European level in order to reduce the vulnerability of the regions and to take advantage of the opportunities offered by increased prices for energy derived from fossil fuels. Based on the ReRisk project and on the Italian context description, this paper is aimed to describe the Apulia's status. The region is characterized by an infrastructure and a socio-economic situation quite problematic and the consumer-side shows a strong dependence on fossil fuels in all fields, particularly in industry. However thanks to the special geographical conditions (climatic, accessibility), it offers on European and national level one of the greater potential for the development of renewable energy (wind, solar and biomass), and to mention also the fact that in the past years both the regional programming and the European and national policies are promoting the development and innovation in this sector, particularly in the territory.

The paper, structured in two parts, aims to provide in the first part a comprehensive framework and an integrated research approach, taking into account the social, environmental and economical aspects, researching and combining the data and the analysis contained in the main regional programming documents for the 2007-2013 cycle. In the second part, the obtained results are summarized in a SWOT Analysis in order to assess the circumstances, the policies and the ongoing interventions. Mainly to describe the region's socio-economic situation it is used data and the

analysis contained in the Strategic Document of the Apulia region for 2007-2013 (concerning urban development) [26]; for the region's energy status and for the prospects it is used the Region's Energy Plan (the "Piano Energetico Ambientale Regionale" or PEAR) [24]; for the regional legislation and in order to evaluate its limits and its critical aspects there are used the directions contained in the regional guidelines [28] and in the regional landscape plan (the "Piano Urbanistico Territoriale Tematico Paesaggio" or PUTT, particularly for the identification of areas subject to protection by using the available map data about geographic information system of the Apulia region) [25]; finally the energy potential description is based on various official sources combined. The framework will be supplemented by information on incentives and by the most recent national operational programs aimed at promoting development and the branch innovation within the territory. This preliminary study allows in the second part of the paper to identify the region's type of ownership according to the clustering project ReRisk analysis and to synthesize the main results obtained by using a SWOT Analysis. In the end, the results are discussed on basis of recommendation policies in order to evaluate the future and ongoing policies and strategies. Given the crucial role of the national policies, especially in the energy sector and to present the status of the region, in order to understand its peculiarities and potential, the reference policy and regulatory framework, starting from a brief description in the Italian context and then moving to the analysis of major regional documents are essential.

## 2. The Italian and Apulia Context

Long ago, Italy has placed the development of renewable energy and of the energetic efficiency among the major priorities of the national policy. The goals of this strategy, outlined in the National action plan for the renewable energy sources [20], are represented by the security of supply, the reducing energy costs for the companies and the citizens, by promoting innovative technological production chains and environmental safeguard (in terms of pollutants and greenhouse gases reduction), all this in order to achieve sustainable development. This way Italy aims to rebalance, on a medium and long term, the energetic mixture too much dependent nowadays on energy imports of fossil fuels, starting also the use of newly developed nuclear energy. According to the Directive no. 2009/28/EC, by 2020 Italy should cover 17% of the final consumption of energy through the use of renewable energy sources, for this to happen will need to consistently increase the exploitation of the potential available in the country, meaning in particular the use of renewable energy sources for heating/cooling and the use of biofuels in the transport sector. The measures to be taken will concern mainly the promotion of the renewable energy sources for heating and transport purposes, the development and maintenance of the electricity network, the further streamlining of the

bureaucratic and authorizing procedures, the development of international projects, the coordination between the different administrations and local authorities, the spreading of information (for further discussion on the financial support mechanisms in Italy, see [20]). Considering the development of the solar paneling, as required by National Strategy, it is expected the installed capacity to reach 1000 MW by the year 2020. Italy and Germany on a global scale are also States that have invested more in this field [15].

In Italy, the development of the renewable energy has transformed the system of producing electricity in a few years and this is mainly due to the provision of subsidies and to the Government incentives, facilitating the transition from a system based on medium-large plants to a distributed generation system, which predominantly consists of small and medium-sized plants [15]. In fact in all the European countries and particularly in Italy, the incentive systems represent one of the determining factors for the development of the renewable energy sources and they are defined as a solid tool of the national energy system [20]. In Europe, during 2012, for the photovoltaic system the feed-in tariff and feed-in premium were applied in 22 countries (including Italy); in other cases, there are used the green certificates (Poland, Romania, Sweden and Belgium) or several incentive systems [15]. Anyway in Italy, for each category of use (thermal uses, transport and electricity generation) there are provided specific incentives [20]. However, as indicated in the national action Plan [20], the growth of shares from the renewable energy in the electricity sector for the achievement of the European objectives must go along, among other interventions, with a modernization and infrastructure development (especially for wind farms and photovoltaic systems in the southern regions of the country, which have great potential but there are not adequately equipped with network infrastructure). For this purpose, among some favorably measures taken for the territories of southern Italy (Abruzzo, Molise, Apulia, Campania, Calabria, Sicily, Sardinia) it is provided the Interregional operative program for the renewable sources and the energy saving of the community support framework 2007-2013 which finances sectorial interventions in the field of biomass, of the technologies production for the renewable energy development and for the energy efficiency and also for the innovative geothermal plants with a share of resources intended for the creation of new Smart grids and for the public sector. This program is structured into three main areas of activity: energy production from renewable sources, energy efficiency and system optimization, technical assistance and complementary actions [19].

In field of discipline and sector planning, the constitutional law no. 3/2001 amended the apportionment of powers between State and Regions; the State has legislative power while the second one enjoys administrative power. Considering the duties allocated to them and in accordance with the constraints imposed by the

national and European legislation, the regions have proceeded at different times to regulate the energy matter. In particular the Law no. 10/1991 has introduced, to the planning field, the Energy Plan instrument by means of the regions programming their goals and interventions, regulating the relations between entities and harmonizing decisions at various levels of the development planning. Therefore, the Plan represents the main reference for the private and public actors that intend to carry out interventions in accordance with the environmental protection and the management goals [20]. Moreover, in this regard, the authorization procedures are widely recognized as one of the main obstacles to the development of the sector. In order to overcome the slowness and the lack of homogeneity at the regional, provincial and municipal level, mostly caused by the administrative decentralization regulation, the national legislature has laid down specific guidelines in order to provide guidance and especially to ensure the compliance of the landscape values into the already mentioned territories. Therefore, it is up to the Regions the task of implementing the guidelines provisions and the identification of areas and sites which are not suitable to install the required or connected plants or infrastructure.

In 2005 Apulia, taking advantage of the opportunity given by the resolution CIPE (20/2004) for the allocation of funds to spread the strategically planning processes in the South of Italy, called for the creation of aggregations of municipalities, subsequently self-organized into ten Vast areas [6]. The documents that define (binding) the path of organization and of goal settings of the ten Vast areas are represented by Strategic Document of the Apulia region for 2007-2013 [26] and the strategic planning guidelines [23]. The regional strategic document represents the "General framework of program guidance for the use of the community resources of the programming cycle 2007-2013" [26]. It promises to be a strong turnaround of trend than in the past, through the adoption of a new management example for Apulia, whose bases are represented by a strategic planning and a democratic participation. The development example outlined and advocated relies on the identity evaluation, requires the coordination and the integration of the various policies and sectors. This way, it is recognized that the context policies have the ability to reinforce the attractiveness and competitiveness factors of the territory. The improvement of the context situations becomes therefore essential for the development of the Apulia regional system. It covers both interventions able to structurally influence the conditions of the accessibility and the mobility of people (as well as of goods) and the protection and the enhancement of the natural resources and of the environment, as well as the resolution of the critical and social problems [26].

According to the regional strategic document, to understand the insufficient development of the region, since the past years, it is necessary to analyze three critical areas: citizens' status (social issues), territorial conditions

(problems of context) and companies' situation (business criticality). This being said, it will be possible to understand the past and current situation of the region, by giving overall trends and identifying the priorities and the strategies for action [26].

Considering the social problems, in particular the socio-economical ones, approximately 1/4 of the regional population lives in poverty, which means 350000 families and about 840000 people. The figure is among the highest in Italy, along with Sicily and Calabria. In fact, while the nationwide incidence of poor families is in total 11.7% average, Apulia stands at around 25%, which means approximately 13% of the poor households in the entire country which lies in the region. The index of relative poverty identifies families with difficulties to maintain certain standards of consumption. The latter focuses mainly on primary goods (housing, food, clothing), with reduced access to higher-ranking heritage (culture, mobility, information society). A proportion of regional population is in conditions of absolute poverty, with difficulty to meet even the basic needs, it's about numerous families (and thus affect youth groups), single-parent families, elderly only [26]. The trend of household consumption between 2000 and 2004 was very modest (in real terms approximately 3%). The economical status shows situations of major difficulties for 24% of the population, with difficulties for over 25%. With regard to the labor market it is evident a structural problem to create job opportunities especially for young people. Apulia registered a lower activity rate (53.4%) than the South of Italy (54.3%) and of Italy (62.5%) to the detriment in particular of the female employment. Particularly popular is the phenomenon of undeclared work (about 21% of total work units in 2002). It concerns, in gradual increase in recent years, agriculture, services, industry and construction. This situation of insecurity, especially among young people, makes stronger the uncertainty and therefore involves a contraction in consumer spending also for the basic necessities [26].

Considering the criticality of the context and of the enterprises, it is stated that the competitive capacity of the latter depends increasingly on the quality of the contexts in which they are incorporated: from the environmental quality to cultural activities; from safety to the efficiency of the basic services and, in the current international economic situation, from logistic and transportation services [26]. The Apulia economic system has experienced a continuous process of transformation since the second half of the last year, thanks to the development of local enterprises and to the contribution of the large and small external investors. This has led to the emergence of an economic system characterized by a territorially differentiated productive ground: productive agricultural areas, districts of Made in Italy, pillars of specializations in mechanics and capital-intensive, tourist areas, service city centers [26]. However, this system appears nowadays in deep crisis, the various productive sectors shows competitive difficulties for the emergence of new competitors, for the development

of new technologies and new activities based on research and innovation. The major problems concerns: sectorial specialization, low levels of production, the insufficient international opening (in terms of export capacity and attraction of foreign investments), the modest research spending and the reduced average size of the companies. The productive structure of the region, measured in relation to the added value of 2003, is characterized by a smaller impact compared to the Italian average of industry, while it makes a good presence in the services sector. The weight of the agriculture is significant on a national scale, but it has strong structural limits, organizational shortcomings, and inadequate interregional cooperation strategies. Since 2001 among the worst trends there is the industrial sector, hitting mainly the manufacturing area. The situation is better in the food industry, the mechanical industry, in the big companies and in buildings construction (mainly residential, less industrial). As for the tertiary sector there are still weak some areas of business services, transportation, logistics, cultural and tourism services. Regarding the employment rate in different sectors, the 2004 data, confirm a higher percentage in the service sector (about 64% of employees), followed by industry (about 16% versus 22% of the average), in agriculture (9.8% vs. 4.4% of the Italian average) and finally in buildings construction (9.5% versus 8.2%) [26].

Overall, the Apulia economic productivity is significantly lower than the Italian situation. This is mainly due to the sectorial specialization and to the reduced companies' dimensions. Some significant variation relates to the food industry, the handicraft, while the larger negative variations are recorded by the industry in the strict sense of the word and by the buildings construction.

The major shortcomings of context concern the social infrastructures (especially the social welfare structures) and the general infrastructure equipment. The only area where the region has a record concerns the equipment of the rail networks. However, on a regional scale, there is a heterogeneous situation, in fact there are critical situations in different municipalities of Salento, Gargano and also persists the absence of links with the neighboring regions (such as Campania and Molise). The weakest allocation of equipment concerns the airport network and its accessibility. The airports gear and its accessibility is stationary since 2001, confirming the big delay established in respect of the rest of Italy. The territorial situation in terms of air pollution phenomena discloses more problems within the territory of Taranto, mainly due to the presence of an iron and steel production establishments, being a source of huge smelters emissions of pollutants into the atmosphere [26].

Taking into account also the field of technological innovation, the investment in research and development it can be said that they are very modest compared to the national average (in 2002 the expenditure on GDP was 0.6% against 1.16% of the national average). The substantial part of the investment is made, due to the small size of the local companies, by the public administrations

and, in particular, by the universities and research institutions [26].

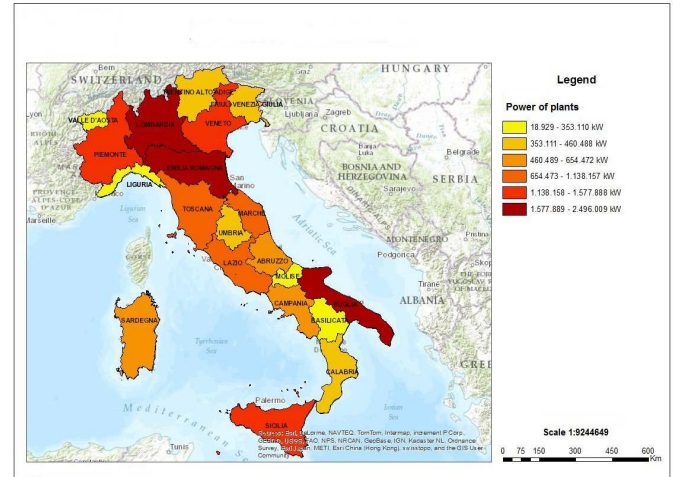
Based on the past trends and on the perspectives for 2013 about productivity and the enterprises employment levels, rises a quite problematic picture for the region seen almost in all sectors. For this reason the regional strategic document states that without an economic policy intervention able to structurally change the region, new poles of economic growth who can generate a demand for the quantity and the quality of working corresponding to the social demands expressed by the Region, it is very difficult to imagine a satisfactory development in the coming years [26]. The hope is for a growth strategy, which takes into account the criticality and the potential of the region and also the new scenario of the national and international economy.

### 3. Potentiality and energy status in Apulia

Nowadays, the support for the renewable energies and the energy efficiency is a priority on public choices, at the Community level as well as at the national and regional levels, for environmental, economic and social reasons, in the latter case, not only in terms of reducing costs and dependence on external supplies, but especially in terms of economic and employment growth for the territories involved. At regional level, the renewable energy sources and the energy saving issues were the subject of a specific programming both in terms of assigned community resources (in particular regarding the regions of Convergence purpose such as Campania, Calabria, Sicily and Apulia) through the Interregional operational program “Renewable energies and energy saving”, and with the creation of the Regional and Environmental energy plan as a tool for planning and development of the sector and of the regional guidelines designed to regulate the topic.

In particular, the regional energy plan (briefly PEAR), approved in 2007, is limited to 2016 [24]. The first part shows the analysis of regional energy system, based on the reconstruction of the energy balance sheet from 1990 to 2004 taking into account both the supply and the demand side. The second part identifies the regional policy guidelines, its goals and priorities. As indicated in the plan, over the past 15 years, the regional energy sources formula has changed significantly in favor of the renewable energy. The latter include essentially the biomass and the different sources of electricity production, mainly wind power and photovoltaic. The region, in fact, thanks to its climatic characteristics (wind and radiation) offers a significant photovoltaic, wind energy and biomass potential at both national and European levels. Considering the power and the big number of photovoltaic systems in the various regions of Italy it can be noticed a heterogeneous situation. The highest number of plants is in the North of Italy, especially in Lombardy and Veneto, but in terms of

installed power Apulia holds the national record (2499 MW) (as shown in Figure 1), as well as for the average size of the plants. In fact, it has the highest concentration of power installed by surface (126.5 Km<sup>2</sup>) followed by Marche (104.7 Km<sup>2</sup>) and Veneto (80.5 Km<sup>2</sup>) [13].



Source: GSE, 2013 [13]

Figure 1. Italy power of photovoltaic plants per region.

The development of photovoltaic system in Apulia, as in the rest of Italy, is due especially to the “Solar Roofs” program since 2001. By different interventions and the photovoltaic systems achievement, the photovoltaic system installed in Apulia would amount to about 53 MW with a production of approximately 65 GW with the peculiarity that the Apulia facilities have medium to large sizes [24]. Regarding the wind farms production, Apulia also holds the primacy on national scale (with an incidence of more than 30%), while Sicily is ranked second for power and production (as shown in Table 1).

Table 1. Italian regions by number, wind farms production and power

Region	Number	Power	Production
Apulia	257	1.393,54	2.255,80
Basilicata	54	301,9	455,09
Calabria	45	783,87	1.281,36
Sicily	82	1.680,87	2.369,94
Sardinia	39	962,21	1.047,84
Piemonte	7	14,37	21,72
Valle D'Aosta	1	0,03	0,02
Lombardy	3	0,02	0
Trentino Alto Adige	8	3,08	0,36
Veneto	9	1,43	1,48
Friuli Venezia Giulia	2	0,01	0
Liguria	23	23,11	46,37
Emilia-Romagna	29	18,12	19,85
Toscany	48	45,6	72,67
Umbria	4	1,51	2,43
Marche	17	0,71	0,26
Lazio	12	51,04	22,37
Abruzzo	27	220,44	297,37
Molise	26	367,2	617,14
Campania	114	1.067,11	1.344,32
Total Italy	807,00	6936,17	9856,39

Source: Our elaboration based on GSE, 2013 [14]

Biomass sources represent for the region, one of the concrete options in terms of potential and technological development. In fact, it may contribute to revitalizing the agriculture, forestry and livestock farming activities which play a central role in the local economy. Considering the different types of agro-forestry biomass, excluding those with forestal origin (the main functions of forests in Apulia are connected to their ecological value, landscaping and biodiversity protection rather than for premium value) turns out that the most significant is the use of residual biomass having agricultural origin (in particular in the province of Foggia) and the dedicated crops which due to Community Agricultural Policy reform (the so called PAC), in particular the decoupling mechanism, allow farmers to enhance the marginal and the productive restructuring area (notably the plain of Foggia and partly of Bari region, which lend themselves to such uses).

The use and investments in renewable sources in Apulia are growing from 2005 as an important source of primary production in the region. The study of the energy situation and its evolution since 1990 to 2004 shows a significant increase of installed power and of energy production by renewable source systems and especially in the last years, but still heavily dependent on fossil-fired plants (in 2004 the 97.4% of the production against 2.6%) in some cases the plants working in cogeneration produce steam for industrial use [24].

Taking into account the last energy consumption from 1990 to 2004, we can say that the trend is growing in all areas (in total about 19%). The largest increase during the already mentioned period concerns the tertiary sector, followed by the agriculture and residential ones (see Table 2). The comparison of consumption quotas for different sectors is between Apulia and Italy, highlights the significant impact of the industry (49% versus 31%) and the solid fuels. Going to analyze the situation of the different provinces of Apulia, the breakdown of consumption in 2004 clearly shows the dominance of Taranto with an incidence of 44% of the regional total, followed by Bari with 24%. Emerges without doubt the weight of the Taranto industry whose consumption accounts for approximately one third of regional ones. The partitioning of energy consumption for vectors also confirms the substantial weight of coal used in the province, followed, but to a much lower extent, by natural gas and electricity [24].

In the province of Bari, the biggest impact of the transport sector justifies the highest consumption of diesel and natural gas. Considering the energy consumption trends for the production sectors at a regional level, comes to light the predominant role of the metallurgy (over 70%) especially in Taranto. The 2016 previsions show an increase in consumption by about 15% compared to 2004, with a considerable share constantly held by Taranto (70% of the regional total) and a consistent use of coal (2800Ktep) while to a lesser extent by natural gas and liquid fuels [24].

The residential sector shows significant variations from

1990 to 2004. The increase of energy consumption is followed by an increase of natural gas (100%) at the detriment of diesel (by one third reduced over the mentioned period). The provincial-scale analysis shows the predominant role of the province of Bari (approximately 43% of consumption), followed by Lecce (17%), Taranto (15%), Foggia (14%) and Brindisi (11%). More interesting is the vectors breakdown which is quite different at a provincial scale. The province of Bari has at regional scale the higher incidence of natural gas consumption (followed by electricity). For an energy consumption analysis within the residential sector and especially to evaluate the possible future scenarios, is being analyzed the request for thermal energy existed by identifying the structural characteristic and by using several variables (demographic and housing divisions by province and by climate zone). The study reveals major needs and consumption for thermal use of the territories more in the North region than in the costal ones. For electric consumption mainly it is thought to be aimed towards thermal and refrigeration uses, rather than others that concerns electronic consumption, washing and lighting and air conditioning systems. The 2016 trend scenario shows a significant consumption increase of 26.5% but also a greater energy efficiency in buildings. It suggests an increase in overall consumption mostly of the natural gas and wood while in slight decrease of diesel and GPL. Basically, excepting the present situation, the residential sector will register a consumption increase for about 23% [24].

For the tertiary sector which has recorded a significant increase in consumption from 1990 to 2004, the breakdown of vectors shows an increase of electricity (over 60%), of natural gas (245%) and oil (56%). Provincial level analysis shows the predominant role of the Bari's province, which owns more than 40% of consumption, followed by Lecce (18%), Foggia (15%), Taranto (14%) and Brindisi (10%). A subsectorial distribution of the consumption for electricity shows the weight of trade (32% of the total consumption), other commercial services (18%), hotels and restaurants (14%), lighting (13%) [24]. The assessment of the consumption trends for the coming years calculated according to predictions on variations of the added value contained in the Strategic Document of the Apulia region for 2007-2013, shows until 2016, an increase of 29% with a predominant use of electricity and natural gas [24].

*Table 2. Consumption and variations in the 'trend scenario' of Apulia*

Sector	Final consumption (ktep)			Variations (%)		
	1990	2004	2016	2004 /90	2016/ 04	2016 /90
Residential	890,0	1148,7	1415,3	29,1	23,2	59,0
Tertiary	288,0	478,1	620,5	66,0	26,7	115,4
Agriculture fisheries	358,1	493,0	694,8	37,7	36,7	94,0
Industry	4093,0	4425,5	5083,9	8,1	24,1	24,2
Transport	1862,0	2391,9	2601,0	28,5	6,8	39,7
Total	7491,1	8937,1	10415,5	19,3	20,2	39,0

Source: Regione Puglia, 2007 [24]



The results of the study carried out in PEAR are synthesized in Table 2. It shows the consumption trends over the time and its sectors. You can see that the increase trend in consumption between 1990-2004 will continue until 2016 almost in all sectors. The civil sector registers a steady increase, and the tertiary sector, even if expecting a reduction in consumption in the coming years, will however show quite high values, as well as agriculture and fisheries.

Based on the context analysis and of the predictions until 2016, the PEAR comes to headings of objectives and tools for the programming cycle 2007-2013. In terms of the offer, the region intends to have a diversified energy mix that is compatible with environmental protection goals [24]. In particular, starting from the awareness of the exceptional production capacity of the territory regarding the domestic demand, the diversification objective of the energy mix must pay particular attention to the impacts on the environment. Excluding the nuclear option, it will be greatly scaled back especially the coal consumption by increasing at the same time the use of natural gas and renewable sources. In particular, their implication will gradually increase the thermal, electric and traction use. A particular attention should be granted to the development of wind and biomass sources for the development of the local supply chains and of the final uses [24]. From here the plan identifies specific target scenarios for different policy areas which are defined on basis of specific required actions and intervention. For the electric final-uses, compared with the current situation there might be a slight reduction in consumption (3%) this especially related to the uses of refrigeration, lighting and washing, while the use of air conditioning systems and electronics shows a gradual increase. For the tertiary sector, even if in the scenario goal it couldn't be avoid the increase of consumption as well as for the civil sector; however a significant contribution may be provided through interventions on public lighting. In particular, the tourism sector represents an area in which the energy saving goals and the use of renewable energy sources can be done with considerable success thanks to the agreements between local authorities and different profile associations. The fields of agriculture and fisheries play an important role on both the demand side and the supply side. In fact, within the farm companies field, not only the energy savings could exist, but also the presence of an adequate potential for biomass production for energy purposes. More problematic is the industrial sector. From the analysis of the Apulia status, it rises a vocation for the co-generation plants adoption mainly in the following sectors: food, textile and paper industry. The PEAR aims, for other sectors than the steel one, to maintain unchanged the final consumption of electricity and fuels for heating purposes for the next few years. To achieve the desired goals, the region shows as a priority the programmed actions in order to create the favorable conditions for the improvement of the energy efficiency in the industrial sector and through several tools including accounting and

energy audit inside the enterprises, monitoring and energy management activities, information and authorization procedures that encourage the use of the best available techniques and technologies [24]. The transport sector which accounts for about 27% of the total consumption is expected to increase in the coming years and this especially will concern the urban areas. In particular, in recent years, the carriage of goods does not register an improvement in terms of efficiency, while the rail one is still the most efficient mean. From all the interventions the plan identifies the promotion of the sustainable urban mobility, the improved public means of transport by increasing the efficiency and the innovation, strengthening the interregional and intraregional rail system by promoting the modernization and the link of the national and the regional networks, the transfer of the shares of freight traffic from road to rail, through the expansion of the railway network, the completion of the freight inter-harbor network and promotion of the integrated logistics [24].

On the supply side, considering the significant weight of fossil fuels to produce electricity (coal with a share of 57% and 16% of oil products), the plan shows for the poles of Brindisi (the Brindisi North and Cerano power station), of Taranto and Enel power station in Bari, specific operations to be implemented in order to reduce the use of fossil fuels, the CO<sub>2</sub> emissions or for the modernization. According to the "scenario goal", the subsidy content of the different energy sources will be modified for the benefit of a bigger use of natural gas (from the current 13% to 32%), of renewables (from 3% to 18%) and a significant reduction of coal (from 57% to 32%), of petroleum products (from 16% to 3%) and a simultaneous reduction of emissions of 9% [24].

According to the regional plan the mentioned objectives can be achieved through the development of the renewable energy sources, in particular of the wind (the small wind plants) which is compatible with the rural sector needs (in fact it is subsidized by the Regions' specific actions in the Rural development plan and therefore in the Local development plan of 25 Local action groups the so called LAG of Leader approach). As indicated in the PEAR, the development of the wind sector requires address policies to avoid an uncontrolled spread on the territory (unfortunately as has already happened). To this end, the basic criterion should consider either the availability of the resource or the environmental constraints. Therefore, it comes out the involvement and the harmonization necessity of the local governments choices (especially through plans that indicate unsuitable areas), the definition of an integrated checking procedure to allow a preliminary assessment of the various project recommendations to avoid the risk of overlapping and of incongruities, the definition of a control parameter for regulating the facilities installation in certain territories.

The regional plan also states that the objectives defined by the energy power supply and demand offer are subject to prosecution through the activation of different types mechanisms (organizational, regulatory, procedural,

participatory) including in particular the role of technological research. Especially, if in the territory, there is proficiency within the public and private research system, on the other hand, the region is characterized by a certain fragmentation of the efforts of both brokers and the research actors [24].

As a conclusion, based on the reconstruction of the regional energy balances from 1990 to 2004, the plan foresees the impacts of regional energy policy. Reworking the plan's data it is possible to compare two scenarios: "trend" (in the absence of corrective action) and a simulated one named "goal". The compliance with the indications contained in the plan could allow a significant reduction in the fuel consumption (from 13.8% to -0.2%), gasoline (from 9.4% to -10%) and GPL (9.7% to -15.4%) and fuel oil (from 12.8% to -50%), while there is an increase prospect in consumption of wood (21.2 percent to 354.5%). Also for the production of electricity, within the scenario goal, it is mentioned a significant reduction in the use of fossil fuels (coal, petroleum products) for the benefit of renewable energy sources (natural gas and renewables). More interesting is the comparison of the different sectors, in which you can see in Table 3, a general reduced consumption (residential, commercial, industrial and transportation) excepting the agriculture and the fishery ones (from 36.7% to 40.9%), where specific measures it should be taken in the next few years in view of the peculiarities and significant contribution in terms of added value to the regional economy. Considering this, it should be remembered that the energy plan, based on the good potential of the region, includes among its goals the use of the residual biomass or of agro-forestry origin destined to the solid fuels production; the activation of crops aimed at the production of solid and liquid biofuels with low-input agricultural techniques; the use of the residual biomass of oil and wine industry. Also during this cycle programming, the Rural Plan of the Apulia region provides for the activation of specific measures (311 entitled "Diversification of non-agricultural activities" and in particular the action 311.5 "Functional investments, in production and in sales, to the operators of biomass energy from crops and/or livestock residues from crops, from the agricultural industry under-products and other renewable energy sources") intended to finance the installation of small photovoltaic and wind power systems as long as compatible or limited to a power of 1 MW [27].

*Table 3. Consumption in trend and scenario goal*

Sector	Trend Scenario	Scenario goal
	(%) 2004-2016	(%) 2004-2016
Residential	23,2	6
Tertiary	26,7	7,2
Agriculture e fisheries	36,7	40,9
Industry	24,1	11
Transport	6,8	4

Source: Our elaboration based on Regione Puglia, 2007 [24]

## 4. The Development of Renewable Energy and Environmental Compatibility

Apulia was the first Italian region to adopt the implementing regulation of the Ministry for economic development Decree from 2010, more exact the guidelines for the authorization of facilities powered by renewable energy sources, including the identification of non- suitable areas and sites for the installation of plants powered by renewable sources (wind, solar, biomass) [28].

The guidelines are an important tool, even though repeatedly criticized (even by specific judgments of the Constitutional Court for the numerous imposed prohibitions) aiming on one hand, to simplify and accelerate the authorization procedures for the construction and plant operation powered by renewable sources and associated works (one of the priority objectives of the national lawmaker), and on the other hand to check the compatibility of the latter with the environmental, landscape and historical-artistic values, the local food traditions that characterize and rich Apulia territory (as indeed confirmed and reiterated in [25]). Regional guidelines identify with extreme precision and extent the mentioned sites listed by name, the main normative, institutional and regulatory references, the number of areas and its surface, the regulatory issues for installation and finally the highlighted problems (by preliminary analysis). Trying to analyze and synthesize the information contained in the document and to read together every site about the regional protection provisions and the highlighted issues, it can be sad that they are particularly restrictive. In the presence of values, identified from time to time and for which there are no specific regulations, in particular the regional ones (such as the Unesco sites, buildings of considerable public interest, or in case of blades and ravines), the Plan indications (such as the Plan for landscape) or when they haven't established prohibitions or special limitations (as in the case of Important Birds areas), in almost all these cases, the regional regulation intervenes forcing total bans. Shortly, therefore, in the guidelines, the partial bans, the lack of specific provisions in regional law or in the plans become total denials for the permission granting.

The causes of the highlighted incompatibility are generally related, in the case of wind farms to: the risk of mortality for the birds and bats; the consumption of the territory; the increase of the anthropic pressure due to new tracks. In the case of photovoltaic systems: the subtraction of the useful fauna areas; other gradual constraints; alteration of the natural surfaces covered by habitat of Community interest, while for biomass: soil consumption; transformation of the traditional farming from extensive to intensive with biodiversity loss; possible pressure on the forests for the biomass production. From the conducted analysis it is revealed that the guidelines play a key role in



the installation of plants discipline powered by renewable energy sources and at the same time represent a useful tool for reconnaissance. In the first case, in fact, they allow to fill glaring gaps in regulations, as it is the case of the Unesco sites for which there are no specific provisions, so they could be among the suitable sites for different types of installations. In the second case, the accurate and wide recognition allows a specific rules for each type of site (in case of Unesco sites in fact it is established that for all types of site the incompatibility with the historical, cultural and landscape values) and this could facilitate the monitoring and control, but only with the support of the coordinated and integrated planning tools.

Regarding the development of the renewable energy and especially the research and innovation promotion in this sector, a key role (in particular in the “Convergence objective’ regions”), is carried out by national operational programs for the programming cycle 2007-2013 of the European structural funds. Among these, in particular the “Renewable energies and energy saving” program provides three axes of intervention: energy production from renewable sources (to which there are destined about 780 million Euros); energy efficiency and system optimization (765 million Euros); technical assistance and accompanying actions (65 million Euros). The most advanced is the PON research and Competitiveness Program 2007-2013 [18], which finances specific projects in fields as scientific research, technological development, industrial and innovation competitiveness, capitalizing on the successful experiences of the National operational programs “Scientific research, technological development, higher education” and “Local business development 2000-2006”. The purpose of the program is to foster the ability to produce and use research and innovation excellence in the four interested regions in order to ensure sustainable development in the territories. The main novelty of the program is to have involved two ministries: Ministry of the University and Research and Ministry of Economic development. The Management-time coexistence of the two Ministries helps foster the research policies integration, the technological development, the economic development and industrial innovation. The actions structured in three priority axes, provide for various measures as structural nature, as the promotion of scientific and technological networks and the facilitations for enterprises (1axis); the competitiveness and attractiveness improvement of the territories through a strengthening of the innovative capacity (2 axis); the effectiveness strengthening of the planned interventions (3 axis). This program therefore should allow regions to take advantage of their research systems skills, the potential (thanks to the characteristics of the places) and the presence of the territorial resources [18].

A research, conducted by querying the database of the projects financed in Apulia for the Energy sector [21], reveals a significant presence in the field of industrial research, 13 projects (for a total of 84340967 Euros) in

which in addition to Apulia are involved different regions of the objective extra-convergence and convergence; followed by the Social innovation, 6 projects all falling in the regional territory; Structural strengthening, 3 from 4 projects in the region; Enterprise creation, 4 projects in Apulia; Districts and laboratories, 2 projects also in Apulia and finally the unspecified category which counts 5 projects also located entirely in the region.

As a conclusion of this study, crossing the data and the information contained in the main regional programming documents for the period 2007-2013, we try to assess the energy vulnerability and the future prospects considering different sectors (economic, social, environmental, energy). All this allows placing the region into one of the ReRisk research identified types. This in fact based on the indicators used for describing different features of energy poverty in the European regions, has used in the second stage, the cluster analysis to identify groups of regions with similar characteristics, which could be approached by a common set of policies. The original indicators used to measure the economic and social vulnerability, as well as the (motorized) transport dependence were finalized with data on the climate characteristics in the regions (important for heating and cooling demand), and with the potential to develop renewable energy resources (solar and wind) [9]. Based on the results obtained, the ReRisk research identifies the presence of five regional typologies in Europe: “With problems and potential”, more geographically extended and more heterogeneous as it includes European capitals such as Paris, Berlin, Rome, but also semi-peripheral and semi-rural areas, being territories with good potential in terms of renewable energy sources that can represent an excellent basis for a change towards alternative energy supplies; “Well-off with trouble ahead” this group of regions is mostly concentrated and located around Central Europe, it is about densely populated territories, characterized by high levels of industrialization and average levels of employment within high energy consumption industries and low potential for developing wind and solar energy; “Struggling looking for jobs and a brighter future” mainly concentrated in the East of Europe, these are regions characterized by spending an important share of GDP on fuel costs, low levels of commuting, with potential to develop renewable energy, but lack of the resources to do so; “Wealthy and commuting” is mainly made up of regions belonging to the Pentagon “hinterland”, with a high potential for polycentric development, but with fewer possibilities for using wind and solar power; “Cool and windy, but working” this is predominantly for Nordic regions characterized by extreme peripheral location on the coastline and a high energy demand for heating, offering excellent opportunities for the development of the wind energy system [9].

Based on our study, it can be said that even in outline (as expressly provided by the authors of the ReRisk project one of the limitations in finding “Mean values” is given by the difficulty of finding data on local scale), Apulia can be

placed in the first category, especially considering the wind energy potential and photovoltaic, climatic conditions (mostly considering the average of the values in January, and July degrees, based on Median Temperatures ReRisk date, 2004), social vulnerability and economic structure. The temperature (except for the infrequent peak periods) which

is not too cold in winter and too hot in summer, it allows considerable energy savings (heating in winter, cooling in summer). This figure is significant especially in this region where the fossil represents a significant share for domestic and industrial use. The results of the study are briefly reported in Table 4 through a SWOT Analysis.

*Table 4. SWOT Analysis and evaluation of the region's vulnerability to energy price*

<b>Strengths</b>	<b>Weaknesses</b>
<p>Starting projects a few years ago for the renewable energy development            Climatic conditions are not extreme (Mediterranean type)            The highest potential for wind power and photovoltaic system on national and European scale            Good accessibility level for most of the territory            Good rail system and expanding            Excellent potential for bio-energy production            Industrial expertise in the solar and wind energy supply chain            Regional framework for the development of renewable energy sources as long as they are compatible with the values of the territory            National measures to encourage the development of renewable energy sources from which Apulia has greatly benefited in the past years            Research and innovation development thanks to the integration between Ministry of Education and Research and Ministry of Economic Development            Presence of the universities and public research bodies for the triggering of the widespread innovation processes            The presence of a dynamic category of companies able to activate innovation processes            Job offer, especially for women and young people with a good level of qualification            Good even though still limited presence of medium size enterprises            Energy planning            Environmental, natural, historical and artistic heritage is significant and widespread            Strategic geographic position for trade and internationalization</p>	<p>Low levels of income for a large part of the population            High rates of unemployment especially among young people            Persistence of irregular work phenomena            High dependence on fossil fuels in all sectors            Presence of large factories heavily dependent on fossil fuels (Taranto, Brindisi)            Cultural, organizational and structural weaknesses for a major part of the entrepreneurial category            Excessive number of incentive instruments with frequent overlaps on the territory            Conflict between different legal sources            Low levels of investment in R&amp;D            Energy planning difficult to achieve within a such limited horizon            Inadequate main infrastructural facilities (transport, energy and environmental networks, informatics, telematics, and social)            Small size companies and difficulty at replacement on the market            Lack of social policies and support            Fragmentation of the initiative of both agents and research actors.</p>
<b>Opportunities</b>	<b>Threats</b>
<p>New governance model based on strategic planning and on sustainable development            EU funding and regional projects to encourage mobility by public transport            National laws that promote administrative decentralization in the field of renewables            European funds (including the Leader program) for the development of renewable energy sources in rural areas            Partial dynamism and innovation signals in the production system and progressive opening of enterprises to international markets            The initiation of coordinated interventions in research/innovation field thanks to an integrated management of Ministry of Education and Research and Ministry of Economic Development (such as PON research and competitiveness)</p>	<p>Increased competition from developing countries not only regarding the attracting labor-intensive sectors, but also the high-tech investment            Risk of marginalization of small and medium-sized enterprises if they won't be determined to take care of their structural weaknesses            Loss of Community funds for the next years            The attractiveness objectives for foreign investment can turn into indiscriminate exploitation of the territory</p>

Source: Our elaboration

The study shows that the region has good potential thanks to its geographical position (favorable climatic conditions, wind and solar potential) and a decent level of accessibility supported, in recent years, by infrastructural interventions especially on mobility. During the new regional planning, special attention was given to the objectives of sustainability and environmental quality. In fact there are mentioned specific lines of action and there are provided special projects (to be implemented by EU funding) focused on the research and development of renewable energy sources, in particular solar and wind power. According to these indications a real development (through access to EU funding) of the wind and solar renewable energy sources could be achieved in the coming years. Since currently the region is still heavily dependent

on fossil energy sources (industry, households, services) the cost of installation and conversion to renewable energy sources are quite high. It's therefore essential for the public-private to cooperate under the form of "industrial symbiosis", to access the EU funding (not only for the current 2007-2013 programming cycle, but especially for the future) and also the social policies for the bands segments of the population that recently have been greatly affected by increased costs for the homes and for energy. The region can count on a good capacity for innovation, especially in recent years, thanks to public and private structures and to programs aimed to achieve greater synergy and integration between different ministries and sectors but closely complementary (like PON research and competitiveness). For ReRisk research local or regional

R&D constitutes a good basis to optimise energy systems and to reduce vulnerability. Besides, the yield of renewable energy sources and the types of optimal technologies depend, in part, on local (climatic) conditions [9]. In particular there are different development opportunities in the field offered to the region, it can be mentioned that in all programming (both specific for the energy sector and concerning the rural and urban development) there have been provided particular incentives and funding aimed for this purpose. However, the redundancy in the number of incentive instruments with obvious overlaps in the territory, the evident conflict between the protection and the development regulation of the sector can produce fragmentation and inhomogeneity of interventions, the realization of investments articulated by mere opportunism and often with short-term limitations with indiscriminate resulted exploitation of the territory.

The regional energy planning, as clear as it is in the regional context description and in the definition of possible scenarios for the next few years, suffers from a very limited time horizon for the concrete feasibility of interventions, especially with regard to the industrial sector. Furthermore, a comparison between the objectives and priorities contained in the Regional strategy document and in the environmental energy plan highlights some inconsistencies in the “social criticality” section, particularly with regard to the nature of the interventions and the final beneficiaries. More coherent seems the “context criticality” section where in both plans the interventions aim at promoting sustainable urban mobility, the improvement of public transport means increasing its efficiency and innovation, the interregional and intraregional rail system development by promoting the modernization and the interconnection of national and regional networks, the transfer of freight traffic shares from road to rail. As already noted, the region falls under the first category enjoying a great photovoltaic and wind potential, and also it has a good potential in the field of bioenergy, the latter could in fact encourage the use of marginal or abandoned areas and it may represent a supplementary source of income for entrepreneurs, especially in the northern areas of Apulia (Capitanata region) where the ecologically sustainable cultivation, together with the forest preservation, with its rational management and the strengthening of forage systems which is a continuous degrade, it may also contribute to mitigating hydro geological instability. The promotion of new forms of agriculture to environmental purposes (for the defense, the protection, the hydraulic forestry or agricultural protection of the territory) and the economic recognition of their function, the exploitation of biomass (residual or from dedicated crops) aimed at the energy production (including partial or complete coverage of corporate power consumption), it may represent new forms of local development. This is possible by focusing on technological innovation, based on new organizational and production ways.

## 5. Regional Policy Evaluation and Conclusions

For every regional category identified by the cluster analysis, the ReRisk project formulates conclusions under the form of policy recommendations for actions to take from local to European level, in order to reduce the vulnerability of regions and to seize the opportunities that may result from an increase in prices for energy from fossil fuel sources. As a conclusion of this study, using the results of the Apulia study case, briefly reported in the SWOT Analysis and reading jointly the developed policy recommendations in the ReRisk project it will be evaluated the intervention policies in progress, showing the strengths, criticality, limitations and future opportunities.

Taking into account the limitations of regional competences in the energy field, considering the “General policy recommendations” of the ReRisk project it is possible to state that some of the region’s objectives are: the promotion of energy solidarity between regions and territories; the awareness of the region’s future prospects and the need to diversify the energy mix in behalf of renewable sources such as wind, solar, biomass and natural gas (as emerges from the comparison of the two scenarios, that is “trend” and “scenario goal”); the attempt to define a development vision (although for a short term, the 2016), while the interventions are less concrete to strengthen the local and regional networks. For the category “Spatial and urban planning” the energy plan aims to become a tool of coordination and linking with other planning tools. Actually it is a constant goal met in the Apulia strategic planning, but poorly realized in practice [6], [7] and [17]. In a real case, the difficulty lies in reconciling the timing of implementation of the objectives and interventions (the time limit indicated in PEAR seems very small) and the compatibility, the lack of coordination, integration and operation with other programming tools that insist on the territory or having the same matter subject. As our analysis indicates it is recognized that the irreconcilability between the objectives of local values protection (as emerges from the study and from the comparison with guidelines) and of promotion, development of renewable energy sources. This disagreement certainly limits the development of renewable energy, making more complex the authorization procedures, but it can become dangerous when it could be possible to circumvent the obstacles by inefficient solutions which it may produce negative impacts on the territory.

The policy recommendations: “Environmental protection and risk prevention” identify on a local and regional-scale actions aimed to the bioenergy development and at preparing for climate change in the regional infrastructure system. Considering the Apulia programming, we can say that there are involved different instruments in the present subject. In particular the PEAR which identifies specific actions for sectors including interventions for residential and domestic use in general and the Region’s Rural Plan that provides a financial contribution in the rural areas

especially in favor of wind turbines development. The study shows that the contributions and the national and regional facilities that the Apulia territories enjoyed especially in recent years it had certainly encouraged the development of actions in this direction. Among the renewable energy sources, biomass, however, are still poorly developed and promoted, even if they could represent an opportunity for the development of marginal or abandoned areas and they could constitute an additional source of income.

Regional policies that intervene in the area “Policies to fight Energy poverty” provide for direct actions to improve transparency and information about energy consumption; the consumer’s awareness and education with the participation of the latter, and finally the social policies. Considering the situation in Apulia it can be said that the actions of promotion and communication concern mainly the topic of environmental education (for a summary of the activities see [26]), while social policies although applicants in different analyzed documents, it does not include specific lines of intervention, thus making it less effective and in many respects merely rhetorical and instrumental. Considering the socio-economic context, the region is indeed characterized by a problematic situation, as well as by a strong dependence on fossil fuels (especially in industry). In terms of vulnerability, therefore, it is believed that the major effects from increased energy costs will fall on people, especially on lower classes and on youth. In fact, the latter, in view of expected increase during the coming years for heat and air-conditioning use, will have to endure the major disadvantages and costs of increased energy costs and overall of final goods.

As explicitly mentioned in PEAR, to pursue the objectives indicated in the 2016 scenario, within the energy framework policies it is necessary to follow three main directions: a bigger efficiency and rationality in energy final-uses, the adoption of innovative ways, cleaner and more efficient use and fossil fuels processing (the dominant energy source in the territory), an increasing reliance on renewable sources of energy and a greater involvement of local authorities. Therefore, the overall objective to identify an optimal mix of actions and tools should ensure the development of an efficient and sustainable local energy system that gives priority to energy saving goals and to the use of renewable energy sources (especially according to this research) and must be consistent with the local socio-economic context. Also the fulfillment of these objectives relies on the tools adoption to encourage the public and private actors involvement within a national and international energy context [24].

Therefore for the concrete realization of the objectives set out in the plan and generally, for the regional programming effectiveness, it requires greater cooperation between the regional administration and the municipalities to be encouraged in particular the transformation of the energy-intensive economy. But the actions and policies aimed at promoting cooperation between local governments

in this sector are still too weak. The public-private partnerships on municipal level could encourage in alternative energy production investment and promote the involvement of the private companies and the society and to reduce the strong dependence on external contributions (national and European). The state is the government level that places the most emphasis on security of supply, while the region plays a significant role in relation to energy efficiency and environmental protection. Although national laws favoring devolution, however, there is a strong dependence on higher levels of government, especially in terms of external funding (European and national).

Finally the objective of increasing the attractiveness of the territories in order to encourage the inflow of foreign investment, constantly in all plans for the 2007-2013 cycle, can represent for the energy sector a double-edged sword. The standards of protection and regulation of the sector are quite careful in assessing suitable areas for the installation of plans, but the redundancy with other instruments, regulations (with frequent overlaps is the case of incentives) can only produce application uncertainty and possible negative impacts on the territory. For this purpose, it is considered necessary a concrete coordination between the various programming tools, only this way it will be possible to promote a balanced development of the sector and at the same time exert a greater control and monitoring the protection of the unique values of the region.

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