# Cumulative impacts assessment in renewable energy sector

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## Abstract

The EU goal to implement 20% renewable energy generation by 2020 is part of Italy's energy policy. However, renewable energy incentives could cause unexpected environmental consequences. Unplanned developments of large wind, photovoltaic and biomass plants could compete against other land uses, particularly food agriculture and breeding farms.
The present case study concerns the Strategic Environmental Assessment (SEA) applied to a municipal Environmental Energy Plan (Sassari, Sardinia, Italy) and discusses the discrepancies between environmental assessment at planning and project levels, and between different planning levels. It highlights the need for cumulative effects assessment at territorial scale, as a reliable tool in order to make a final choice that is consistent with the environmental goals.
In this study, all the renewable energy projects, realized, approved or under approval, have been considered. The final approval of the proposed projects is provided by Sardinia Region, the municipalities being involved only as marginal participants of the decisional process. The realization of several ground mounted solar photovoltaic systems, wind farms, and a 40 MW biomass-fuelled cogeneration facility, could transform agricultural lands in a widespread power plant.
The municipal environmental energy plan SEA has highlighted the lack of strategic planning for energy policy at regional scale. The resulting unplanned renewable energy development contrasts with the local politics, that have chosen to support small plants and short supply chain, with a close spatial relationship between production and consumption, less impacting on the environment.

Keywords: Renewable energy, Strategic Environmental Assessment, Cumulative Effects assessment, Public Participation

## 1. Introduction

The **SEA** has been introduced as a standard procedure in the planning process to remedy the well-known ineffectiveness of EIA in its role of controlling the environmental compatibility at the project scale.
The **CEA** is an essential tool of this new approach. It represents a systematic procedure for identifying and assessing the significance of effects from multiple activities. Although the effects from many individual projects may not be significant, when taken as a whole, the combined effects could be substantial. The spatial and temporal windows adopted in the environmental assessment of a project are too limited for this methodology. On the other hand, the typical spatial and temporal scales of the planning process are adequate to carry out a cumulative impacts assessment that could become a reliable tool for making predictions, a comparative selection between alternatives, and a final choice consistent with environmental goals. This approach should therefore be compulsory in

order to compile an adequate evaluation of the environmental consequences of the actions at different levels of planning.
**Public Participation** is an essential part of the SEA process (as defined by the Directive 2001/42/EC and by the previous conventions of Aarhus and Expoo)
In order for Public Participation to be truly effective, it should:

- Begin in the preliminary stage of planning:
- Contribute to the choice of indicators to be used in selecting alternatives
- Actively involve all the stakeholders and it should not be limited to a single act of formal public consultation

## 2. Methodology

To define the goals of the municipal plan an intensive participation process was carried out. Plenary sessions and thematic groups pointed out more than 30 proposals for municipal energy sustainability. More than 70 participants took part in this process, with representatives from the most important energy companies, associations, universities etc.
4 thematic groups were organized regarding:

1. Sustainable mobility
2. Energy efficiency in public administration
3. Energy saving in the community
4. Energy from renewables

Some critical aspects were found. Firstly, the preoccupation derived from the potential impacts of large plants: the soil consumption, the effects on landscape, the possibility to use waste as complementary fuel in biomass plants, due to a 'peculiarity' of Italian legislation that considers waste as biomass, and grants incentives for energy produced by waste incineration. On the other hand, the uncertainty of rules for the realization of PV in urban context for residential needs, micro and mini wind turbines, and the difficulties in obtaining financial gains for citizens.
The main strategic objectives of the plan defined through the participatory process were:

- Energy saving and energy efficiency as the main renewable energy source
- Energy production from renewables at local scale and from short supply chain, with a close connection between production and consumption
- Sensibilization and training
- Improved communication between offices and agencies for data collection and sharing to monitor the effects of energy planning at different scales

In the SEA of the municipal plan we considered not only the realized projects, but also the authorized and under approval projects of large renewable-resource power plants affecting a vast area which also includes the agricultural land of neighbouring municipalities. Although not provided for by the municipal plan, such actions significantly affect the territory and are highly impactful, and the municipal administration, while not having direct authority in pronouncing judgment on compatibility, has the power to express its reasoned, but non-binding, opinion.

## 3. Results

For the construction of the scenarios, we have made use of GIS technology. Below is a brief summary of the overall scenario emerged from the analysis.
As for the ground mounted solar photovoltaic systems just in the municipality of Sassari, the plants constructed so far reach a capacity of 5 MW. Considering the vast area, if all the proposed plants would be authorised, this would lead to a capacity of 158 MW power, and the amount of land occupied would increase to 312 hectares.

Regarding the wind energy, just in the municipal area, the plants constructed so far reach 21 MW of power, produced by 10 wind turbines. The potential increase, from the assessment based on the EIA procedures, could result in the installation of 45 wind turbines with a total capacity of 120 MW. Considering the vast area, the combination of the completed projects and the proposed projects would lead to 360 MW power and to the installation of 145 wind turbines.
Regarding the biomass production, the plants under 1 MW follow a simplified procedure that don't require any environmental study. However, it is important to recall that cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Only one system has been built, another is authorized, and 3 more are under authorization process. Our recognition on small plants was obstructed by the simplified procedure and the lack of communication between different authorities. Therefore, the number of small plants could be more. Nevertheless, the most significant project presented it is connected with an important industrial project for bio-based products. The power plant is designed to produce 43.5 MW biomass-fuelled, using a not endemic species of thistle (*Cynara cardunculus*). The supply needed for this production amounts to 250,000 ton/year. The supply basin has been identified in the underlying territory at a radius of about 70 km from the proposed plant site, for 3 reasons:

1. it is the theoretical limit of the economic sustainability of the supply (transport costs);
2. it is reported as the measurement of the so-called "short supply chain" in the literature and legislation;
3. it supports the desire to benefit the northern part of Sardinia, the area most affected socially and economically by the crisis involving the agricultural/national food sector in the last decade.

Within the supply basin, using the *Land Use Classification*, the following were excluded a priori:

- areas with a slope greater than 15%
- areas currently affected by natural and semi-natural boundaries, or by traditional agro-forestry-pastoral cultures
- urban, industrial and recreational areas
- areas optioned for the supply of biomass to other plants

The remaining surfaces have been evaluated in relation to their intrinsic ability to support thistle cultivation without resulting in soil depletion. The *Land Suitability Classification (LSC),* methodology developed by the FAO, was used for this purpose.
The SIA submitted by the proponent, however, fails to include the comparison between the areas suitable for thistle cultivation as defined by *Land Suitability*, and the classification of soils according to their *Land Capability*. The study only analysed the current use of the land and not its potential. This correlation, on the other hand, is essential for verifying whether the most productive areas for thistle cultivation identified by the *Land Suitability* could fall significantly in areas of high *Land Capability*.
The Municipality of Sassari, has, in fact, applied the procedure of *Land Capability Classification (LCC)* and drawn up the relative Land Capability map, with the aim of identifying the "best" lands (good agricultural land) and discriminating against the "worst" (bad agricultural land). As part of SEA, we carried out a comparison between LSC and LCC. 2 aspects have been taken into account for the LCC characterization: the biomass production capability and the possibilities of wide spectrum cultivation without soil degradation risk. The overlay of the LSC and LCC maps show that the most suitable lands for thistle cultivation are also the best lands in terms of their capability (Fig.1).

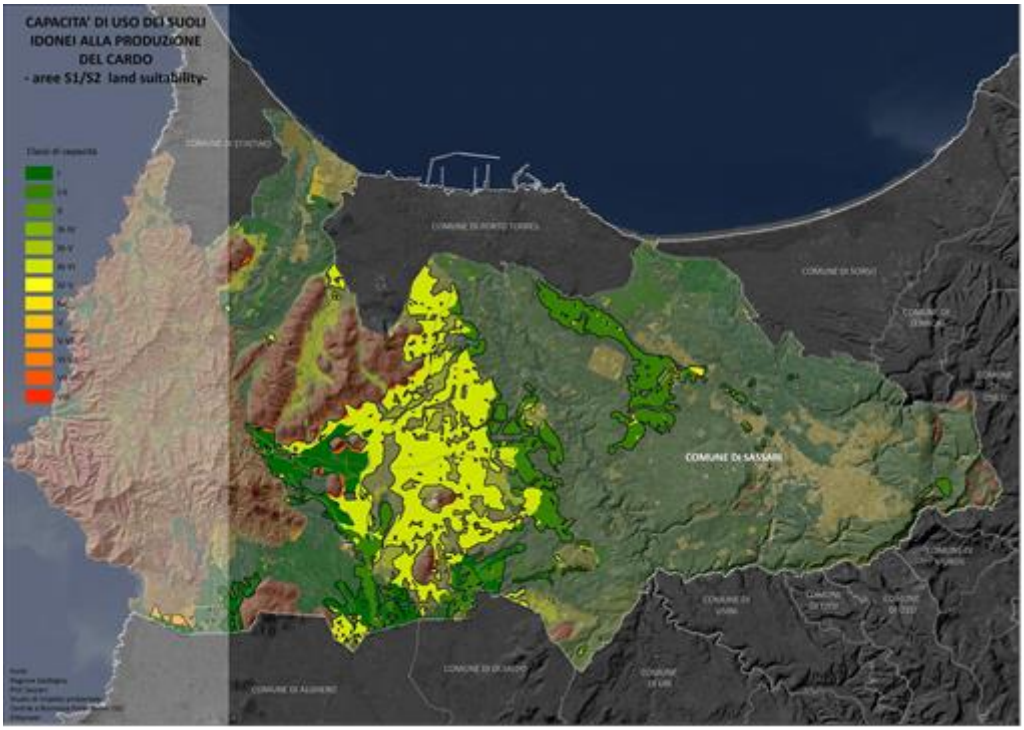

Fig.1 Overlay of LCC and LSC maps (S1-S2 classes)

Mapping all the projects realized or under approval, the overall scenario shows agricultural lands that could be transformed in a widespread power plant (Fig.2).

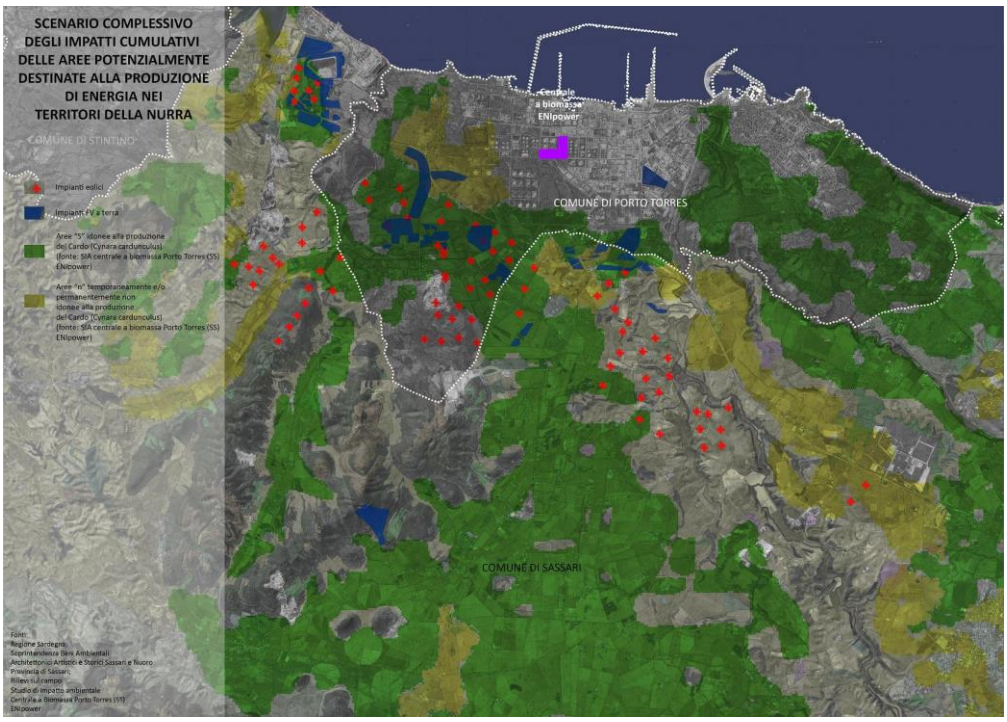

Fig.2 Overall scenario of renewable energy sector
(Red: turbines, green: biomass cultivation, blue: PV plants)

## 4. Conclusion

The overall scenario highlights the strong pressure exerted by the energy sector on the Municipality of Sassari and the surrounding area, in contrast to the policies that the municipal administration has decided to go ahead with by means of an environmental energy plan that concentrates primarily on actions aimed at energy saving and efficiency. This pressure is not so much due to the effects of a shared regional energy policy, but rather a consequence of the actions of private entrepreneurs attracted by the economic benefits generated by renewable energy incentives.
SEA applied to the municipal environmental energy plan has emphasized the lack of strategic planning for an energy policy at the regional scale. This unplanned renewable energy development contrasts with local politics that have chosen to support small plants and short supply chains, with a close spatial relationship between production and consumption, and less affecting the environment. The final approval of the proposed projects is provided by the Sardinia Region, the municipalities being involved only as marginal participants in the decision-making process.
To improve the sustainability of renewable energy development, we have proposed:

- a permanent technical commission involving all agencies competent for project authorization aimed at defining assessment criteria and indicators;
- a new Regional Energy Plan supported by CEA and consistent with other territorial plans (waste, forestry, agricultural, mobility etc.);
- the implementation of a WebGIS for sharing data and monitoring;
- and that the legal requirement for the application of CEA in EIA should be demanded and verified in practice.

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