



# Renewable Energy policy implementation in Spain from a territorial perspective.

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## INTRODUCTION

Climate change may be the most important environmental, economic and social challenge currently faced by the international community. As a global phenomenon, national governments worldwide have defined objectives to try to mitigate climate change through reduction of greenhouse gas emissions and adoption of low carbon energy production systems. European Member states, Spain among them, need to meet these objectives. Nonetheless, the extent to which these policies will be successful depends on the attitude and position of the stakeholders involved in the process.

However, actions aimed to mitigate climate change, specifically those related to the implementation of renewable energy installations, can generate effects that may be harmful in other areas, despite their benefits in terms of reduced greenhouse gas emissions at the point of production. In terms of land use, for example, food production and the renewable energy generation may find themselves in competition for the same land areas. This may give rise to social conflicts or rejection of policies aiming to promote the development of renewable energies. Many actors are involved in the complex decision making process that surrounds the implementation of renewable energies for a low carbon future.

The debate about how to achieve successful implementation of renewable energy technologies and their associated infrastructure is still open. In Work Package 3 of the COMPLEX FP7 project, we explore a wide range of factors and elements and the complex interactions between them from the point of view of land use and landscape, together with the adaptive processes that are emerging which may determine success or failure in the widespread implementation of these clean energy technologies.

## METHODS

Two different approaches were used: a) an **LUC analysis** to measure the importance of LUC change associated with RE implementation and the establishment of what we have termed Renewable Energy related Landscape Features (RELF), especially focused on wind energy and solar energy; and b) **initiation of a participatory process** using techniques based on those employed in **Participatory Action Research** (following Pretty 1995, Villasante et al. 2000) specifically, sociograms and semi-structured interviews with selected national and regional stakeholders involved in the implementation of the RE policies.

With respect to land occupation by RELF, the proportion of the LUC category occupied (agriculture, forest, urban) was obtained by means of cross tabulation (Pontius et al 2004, Hewitt and Escobar 2010) of two datasets: Corine Land Cover (CLC) level 3 (year 2000) for the LUC categories and the Land Cover Information System for Spain (SIOSE) for the year 2005 for the RE occupation.

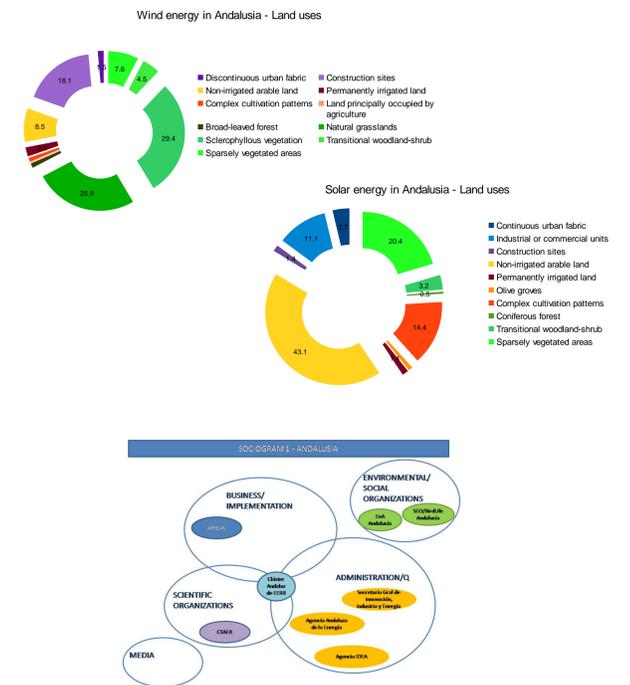
To initiate the participatory process, main national and regional stakeholders were identified and mapped. Several sociograms were carried out both at national and regional level. To do this we used the 'Venn diagram' technique in which stakeholders were represented using circles. Then, two stakeholders were selected at the national level and 2 per study region. Interviews lasted 50 minutes each and covered four main issues: RE current situation and tendencies, regional policies, stakeholders involved in the process and cartography availability. 9 interviews were carried out in total, at least one per region.

Five **indicators** have been developed to assess the different situations among the six Autonomous Communities studied here:

- I1. Potential implementation problems;
- I2. Ambition to move forward;
- I3. Bottom-up actions/Local initiatives on RE or CC,
- I4. Interest and involvement of stakeholders,
- I5. Availability and quality of cartographic data for both LUC and RELF and
- I6. Association of RE technologies with LUC

Below we indicate the results for these indicators with the exception of indicator 3 because stakeholders only knew about top-down local initiatives.

Example for Andalusia:



## RESULTS

### ANDALUCÍA

- I1 Conflicts with national legislation. Initially, there were some conflicts with environmentalists and hunters' groups, but stakeholders interviewed find them overcome. Currently, off-shore developments have conflicts with fishing.
- I2 Regional interest on RE development. Objectives fixed in the last regional RE planning were achieved.
- I4 Both stakeholders interviewed seem to be interested in the COMPLEX project.
- I5 Regional land use cartography directly downloadable. RE cartography. Some would be available for the COMPLEX project.
- I6 Currently, 0.08% of the territory (594ha) Wind energy mainly located on natural land. Solar energy mainly located on agricultural land (particularly non-irrigated arable land).

### ARAGÓN

- I1 Conflicts with national legislation. Electricity network capacity. Conflicts with neighbouring regions because of landscape impacts.
- I2 By 2020: duplicate RE production, maintain energy production from conventional sources, even when they produce more energy than they need.
- I4 Both stakeholders interviewed seem to be interested in Complex project.
- I5 There is no regional cartography either for LUC or for RE location.
- I6 Currently, 0.14% of the territory (693ha) Wind energy mainly located in agricultural areas (particularly Non-irrigated Arable Land)

### CANARY ISLANDS

- I1 Conflicts with national legislation. Lack of land planning for RE installations. Electricity network capacity. Conflicts with environmentalists' groups.
- I2 There is a regional plan (PECAN), which establishes specific objectives. These objectives have recently been reviewed and reduced.
- I4 OCT has contacted 4 different stakeholders and only one wished be interviewed. RE development is especially interesting in Canary Islands due to the higher cost of conventional energy than on the mainland.
- I5 There is no regional cartography either for LUC or for RE location.
- I6 Currently, 0.15% of the territory (110.37ha) Wind energy is located in both agricultural and natural areas.

### CASTILLA AND LEON

- I1 Conflicts with national legislation. Conflicts with neighbouring CA. Conflicts over distribution of economic benefits.
- I2 There is regional wind energy planning, which establishes objectives that the interviewee considers achievable.
- I4 Interest from the research sector, but not from the institutions.
- I5 EREN has RE location cartography in kml format directly downloadable from the internet. The Valladolid University researcher contacted by COMPLEX has developed a map of wind energy installations that he would be happy to make available to the Complex project. There is no regional LUC cartography.
- I6 Currently, 0.12% of the territory (1119ha) Wind energy is located particularly in natural areas. Solar energy is located in both agricultural and natural areas.

### NAVARRRE

- I1 Capacity of the electricity network. Conflicts with environmentalists' groups. Conflicts related to a biomass plant presently under consideration.
- I2 There is a regional RE planning currently in force.
- I4 Both interviewees have been very collaborative.
- I5 Regional LUC cartography with energy LUCs. Possibly wind energy cartography.
- I6 Currently, 0.82% of the territory (857ha) Wind energy is located in both natural and agricultural areas. Solar energy is located particularly in agricultural areas.

### THE RIOJA

- I1 Conflicts with environmentalists' organisations. Also some conflicts with hunters and vineyard owners.
- I2 As far as COMPLEX is aware, the Government of The Rioja has not fixed an objective for RE development.
- I4 Up to now, only an environmentalists' group has expressed its interest in Complex project.
- I5 There is neither a regional land uses cartography nor a RE location cartography.
- I6 Currently, 0.39% of the territory (857ha) Wind energy is located in both natural and agricultural areas. Solar energy is located particularly in agricultural areas.

## CONCLUSIONS

National legislative framework has driven RE development in all of the regions analysed here. At present, RE production is no longer subsidized in Spain and its development has slowed. Furthermore, electricity network capacity (Red Eléctrica Española is the sole energy transmission operator in Spain) emerged as a key element affecting RE development in all regions. Nevertheless, neither the overall RE development nor the current situation with respect to RE is the same in the different Autonomous Communities.

- From the regional institutions, different strategies for RE have been applied in recent decades. In some Autonomous Communities, for example Navarre, the regional government has been involved in RE development since the beginning, and has taken part in business and research, and has promoted the development of regional RE plans. At the other extreme, some Autonomous Communities such as The Rioja have never published any regional plan focused on RE.
- In relation to RE potential implementation problems, two main groups of conflicts can be discerned: a) those related to ecosystem modification and landscape impacts due to RE installations and b) those related to the distribution of economic benefits of RE implementation. The former is particularly associated with environmentalists' groups, but also with hunters and other land ownership groups (e.g. vineyard owners in The Rioja). Owing to the multi-level distribution of political competence in Spain, RE landscape effects are also suffered by autonomous communities that have not decided to implement RE from their neighbours who have. In this latter group only Castille-and-Leon (on the border with Cantabria) has been specifically named, but there are likely to be other cases that have not been detected in this study so far.
- In relation to land occupied by RELF, Navarre stands out with 0.82% of its territory occupied by wind and solar energy developments. It is not always straightforward to distinguish between these two types of RELF included in the analysis; although it seems to be generally agreed that solar energy has been implemented mainly in agricultural areas and wind energy in natural areas, this may be an oversimplification. There are some exceptions, for example in the case of Aragon, where wind energy has generally been developed on non-irrigated arable land perhaps because of the low agricultural yields in these areas. At this point, there is a general agreement between the stakeholders interviewed about productive combinations of land uses (e.g energy production plus agricultural production), which se-

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