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Losing the roadmap: Renewable energy paralysis in Spain and its implications for the EU low carbon economy

Patricia Martínez Alonso [a], Richard Hewitt [a, *], Jaime Díaz Pacheco [a], Lara Román Bermejo [a], Verónica Hernández Jiménez [a], Jara Vicente Guillén [a], Hans Bressers [b], Cheryl de Boer [b, c]

[a] Observatorio para una Cultura del Territorio, Calle de Duque de Fernán Nuñez, 2, 1, Madrid 28014, Spain
[b] School of Management and Governance, Department of Governance and Technology for Sustainability (CSTM), University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands
[c] Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, PO Box 217, 7500 AE Enschede, The Netherlands

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ABSTRACT

After many years at the forefront of renewable energy (RE) implementation both in Europe and worldwide, Spain experienced a sudden transformation in 2012 to its RE development model in which national government backing and financial incentives for renewables were removed, throwing the RE sector into a paralysis which continues to the present day. This is in marked contrast to the case of the other major European RE leader, Germany, where it has been argued that RE implementation has produced a "regime shift" that has transformed the energy generation model to a new resilient pathway. In this paper, key differences between Spanish regions are identified in the way the RE implementation process has been carried out. The research brings these different characteristics into focus and analyses the strengths and weaknesses of the RE implementation process in each region. If stakeholders at all levels are empowered and motivated towards the implementation process goal, it is less likely that a few, very powerful actors (e.g. multinational energy companies or governments) can dominate the process, and thus systemic instability can be reduced. In this way, lock-down situations like the current one can be avoided in future and a more resilient system can be designed.

1. Introduction

In the context of the growing political consensus about the seriousness of the threat posed by Climate Change (CC), the transition to a low carbon economy in Europe for 2050 has become an important priority for European member states. An essential step along this road is attainment of the three key objectives for 2020: to reduce greenhouse gas emissions (GGE) by 20%, to obtain 20% of final energy from renewable sources and to reduce by 20% the total energy consumption [16,17]. In this context, development of Renewable Energies (RE) and the improvement of RE implementation in the territory are of decisive importance.

In Spain, subject of the following study, power generation from RE sources has increased spectacularly in recent decades. By 2012, Spain was a major European player in wind power, solar thermal electricity (STE) and even in Solar Photovoltaic energy (PV) despite a slow start in development and implementation of PV systems [6,36]. This large scale deployment of renewable energy systems in a relatively short period of time has seen Spain frequently cited in the international media [1]; The Daily Telegraph 2008; [5,20,21,22]; as the poster child for successful promotion and implementation of RE policies and European climate change mitigation. However, in 2012, the situation changed dramatically. All subsidies for RE were removed by act of parliament (RD 1/2012). This has resulted in the complete paralysis of new RE developments and a situation of considerable uncertainty with respect to the future of RE in Spain. The country's ability to meet its medium term (2020) and longer term (2050) climate change mitigation objectives, which in the very recent past seemed assured, can now be seriously doubted.

This worrying situation has been covered by the international

* Corresponding author.
E-mail addresses: patricia.ma@observatorioculturayterritorio.org (P.M. Alonso), richard.hewitt@observatorioculturayterritorio.org (R. Hewitt), yaimenet@gmail.com (J.D. Pacheco), lara.rb@observatorioculturayterritorio.org (L.R. Bermejo), vero.hj@observatorioculturayterritorio.org (V.H. Jiménez), jaravicente@gmail.com (J.V. Guillén), j.t.a.bressers@utwente.nl (H. Bressers), c.deboer@utwente.nl (C. de Boer).

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media (e.g. Refs. [29,30], and is reported in European Union grey literature e.g. Ref. [10] but does not seem to have made its way into the specialist scientific literature. In this article, the situation is analysed through a process of engagement with key stakeholders in the Spanish energy sector, an approach that differs from previous approaches that have tended to report on the Spanish RE sector objectively, without emphasis on stakeholder engagement, and from a national point of view, in which regional differences in development of RE are treated as a reflection of the national context or simply due to particular geographical circumstances (e.g. more wind, solar radiation etc.). In fact, the picture across each of Spain's 17 autonomous regions[1] is remarkably diverse, with some regions (e.g. Canary Islands) having great potential for RE development but low implementation and others (e.g. Navarre) less obviously rich in natural resources for RE production but highly advanced in its implementation.

Here, we argue that the picture is more complicated than is usually presented in the literature on RE in Spain, and that the marked differences in development of RE across the Spanish regions strongly reflects the different territorial, economic and administrative circumstances in each region. For this reason, special attention is given in this paper to the nature of the implementation process in each region and the different types of relationships that have been developed between the stakeholders involved in the process.

The current state of RE development paralysis in Spain can be seen as an opportunity to reflect on the previous actions undertaken at the different levels of governance and civil society. By investigating the historical dynamics of the RE implementation process at the regional level, key elements or milestones in the process (e.g. relationships between stakeholders, potential benefits produced to the region or historical implementation trajectory) can be identified for each region, and clear objectives can be defined. In this way the search can begin for a way to restart the process without excessive reliance on national policy makers, top-down stimulus regimes, or multi-national energy operators, all of which have played an important role in Spain's previous successes, but none of which have been able to bring about a genuine and resilient transformation (regime shift) in the nation's energy model, similar, for example, to Germany's *energiewende* [38].

2. Research background

2.1. A multi-level energy policy in Spain

In Spain, legislative responsibility for energy issues is shared between the National Government and the Autonomous Communities (ACs). The national government maintains the legal authority to define the basic framework, to coordinate the general planning of economic activity and to authorize electricity installations where energy supply comes from inside one AC but is destined for another AC. For their part, ACs have statutory authority over land planning, urban development and promotion of economic development in the region in accordance with the objectives fixed by the national economic policy. Finally, municipalities have responsibility for spatial planning. For such major changes to the energy production system to be resilient[2] robust lines of communication need to be established as well as an adequate balance of resources (financial, knowledge) and power (policy instruments, power of veto) between the key stakeholders involved in the development process at all levels.

2.2. Renewable energy in Spain

From the beginning of the 1990s Spain saw a major RE boom, initially in wind power, which saw a hundredfold increase in capacity between 1990 and 2003 [12]. Solar Thermal Electricity (STE) dramatically increased capacity after 2004, climbing from 2.2 MW in 2004 to a total generating capacity of 1643.4 MW [36]. Solar Photovoltaic energy (hereafter PV) first appeared in Spain in the mid 1970s but was slower to develop, accelerating dramatically after 2006–7 with 2708 MW installed by 2012 [36]. Other types of RE, such as biomass and geothermal energy are less well-developed in Spain. Following the removal of subsidies, no new development of biomass energy is currently planned [11].

Two main contextual factors have supported the widespread development of RE in Spain: 1) the high level of external dependency on external energy sources (upwards of 75% according to [41]) and 2) the favourable climatic conditions for RE production. These factors alone, however, cannot account for the rapid successful diffusion of RE in Spain since 1990.

Most authors cite feed-in tariffs (FITs) (guaranteed minumum per unit energy price paid to producers) as primarily responsible for the growth of the sector (e.g. Refs. [7,8,27,28]). [9] ,however, is rightly sceptical about the role of FITs, pointing out that the policy initially had an unattractive design for investors [9]. The FIT explanation also does not account for the slow diffusion of PV compared to wind energy, which only took off around 2006–7 (see Refs. [36]; p. 327), even though the FIT had been in place since 1998 [28]. Dinica [9] emphasizes the role of Private–Public Partnerships (PPPs), which encouraged groups of investors (typically regional governments, utilities companies and manufacturers) to pool resources and risks. Del Rio and Unruh (2007) ascribe the impressive pace of wind energy expansion between 1995 and 2004 (the period studied by these authors) to a variety of factors, including falling manufacturing costs worldwide, technological improvements and Spain's position as a world leader in key technologies (e.g. turbine manufacturing - commanding 16.4% of the market in 2002; Del Rio and Unruh 2007). The structure of the sector and the scale of developments has also clearly played an important role. Both wind and solar developments have tended to be large scale and implemented in a centralised fashion, an approach that has been particularly favoured by the PPP model as well as the availability of land in Spain, the second largest country in the European Union.

2.3. The structure of the Spanish energy sector

European directive 2009/28/CE establishes a common framework in the EU to promote energy production coming from RE sources, and establishes specific mandatory goals for the different countries, 20% in the case of Spain for 2020. From this indicator (Fig. 1), it can be seen that Spain has increased from an 8.3% share in 2004 to a 14.1% share in 2012. Although this is an encouraging trajectory, there is still a long way to go if the goal of 20% by 2020 is to be achieved. Specifically, RE production in Spain has been mainly destined to electricity production where the development has been higher than the mean of the EU countries, increasing from 19% in 2004 to 33.5% in 2012.

Energy from renewable sources in Spain comes mainly from hydroelectricity and wind power. These two sources are the earliest forms of RE to be established on a large scale, and also have greater installed capacity 19803 MW and 22573 MW installed capacity

[1] Spain's national territory also includes two autonomous cities on the African continent, Ceuta and Melilla. For reasons of size, these two Spanish dependencies were not considered in the present study.

[2] [40] define resilience as "the capacity of a system to absorb disturbance and reorganize while undergoing change, so as to still retain essentially the same function, structure, identity, and feedbacks".

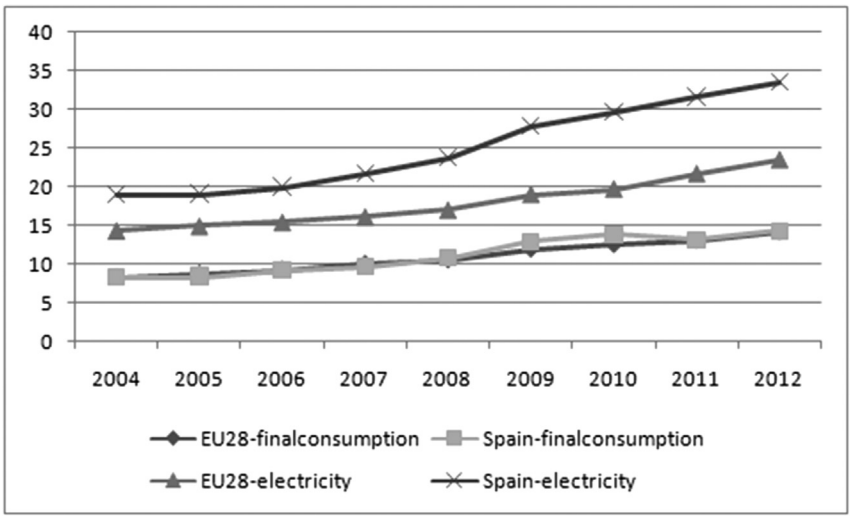

Fig. 1. Indicator "Share of RE in gross final energy consumption" and indicator 2 "Share of renewable energy in gross final energy consumption", Source: Own work, data from Ref. [18].

respectively in 2012 [34]. As can be seen in Fig. 2, other RE sources such as PV, biomass, biogas or thermoelectric are minority sources in terms of energy production.

Both wind and solar energies have been deployed in every Spanish region, but the amount of energy produced in each region varies widely (Table 1).

3. Aims

In this paper, three key aims have been defined:

- Analyse, though bibliographic study and participatory engagement with key stakeholders, the current situation regarding RE development in Spain.
- Examine key regional differences and demonstrate that these differences are not explained only by territorial characteristics, but also by the composition of the stakeholder community involved in RE implementation and the relationship between them at the regional level.
- Search for key opportunities at the regional level to facilitate the emergence of a stable and sustainable (economically, environmentally, socially) approach to RE implementation in Spain.

4. Methods

The methodological framework used in this research (see Fig. 3) comprised two phases; 1) a national scale appraisal of the RE

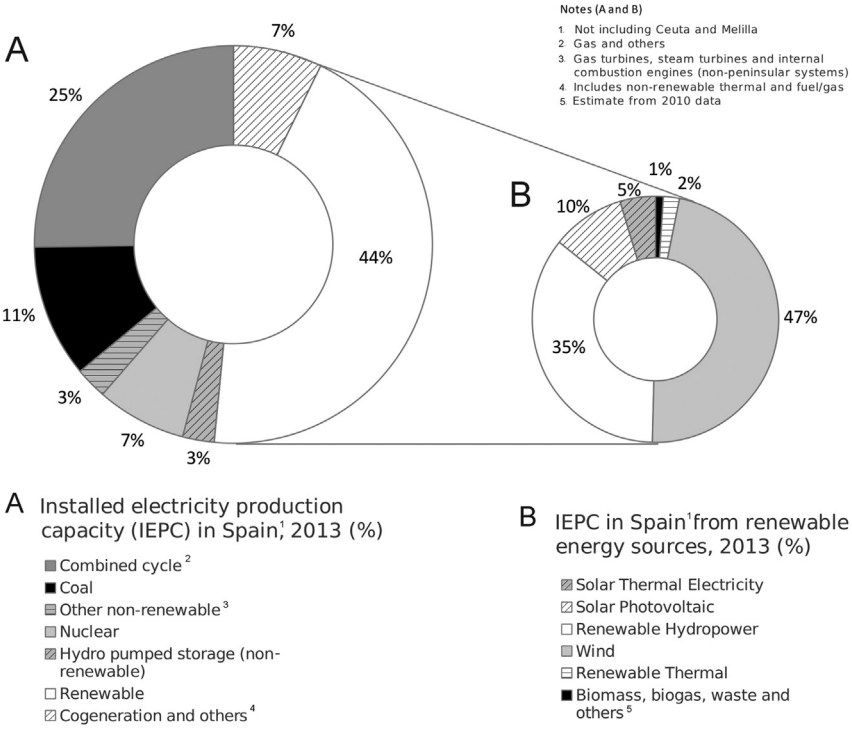

Fig. 2. Structure of Spanish electricity production in 2013. Source: Own work, data from Refs. [35] and [24].

Table 1
Installed power capacity (MW) of wind and solar per region in Spain in 2012.

CCAA	Wind energy			Photovoltaic solar		
	MW	W/inh	W/km2	MW	W/inh	W/km2
Andalusia	3233	382.6	36907,7	838	99.2	9566.5
Aragon	1797	1331.6	37657	164	121.5	3436.7
Canary Islands	145	129.5	19471,1	162	76.5	21753,9
Cantabria	35	58.9	6570.9	2	3.4	375.5
Castille and Leon	5597	2198.3	59399,2	485	190.5	5147.1
Castille-La Mancha	3784	1783.3	47620,3	906	427	11401,7
Catalonia	1284	169.6	40011,8	248	32.8	7728.1
Madrid	0	0	0	64	9.8	7972.4
Navarre	987	1531.3	94991,9	160	248.2	15398,9
Valencia	1193	232.6	51301,9	338	65.9	14534,8
Extremadura	0	0	0	539	486.4	12946
Galicia	3324	1195	112393,4	15	5.4	507.2
Balearic Islands	4	3.6	200.3	77	68.8	15425,7
The Rioja	448	1384.4	88796,4	85	262.7	16847,5
Basque Country	194	88.5	26831,4	27	12.3	3734.3
Asturias	434	402.8	40933,9	1	0.9	94.3
Murcia	263	178.4	23245,7	426	288.9	37652,8
TOTAL	22722	11070,4	686332,9	4537	2400,2	184523,4

Source: Own work, data from Refs. [34] and [25].

Table 2
Responses to indicators I1–I5. I1. Mapping availability: indicator takes value 1 if there is cartographic information on RE infrastructures available by internet, even if it is not available for download and value 0 if there is not. I2. Administrative structure: indicator takes value I if it is an insular autonomous community, value M if it is a peninsular mono-provincial autonomous community and value P if it is a peninsular pluri-provincial autonomous community. I3. Energy mix: number of different RE sources for electricity production. I4. Energy Planning: indicator takes value EP when a regional energy plan is currently in force, G when a regional energy plan focused on a specific RE is currently in force and O when there is no operative regional energy plan. I5. Organizations: existence of organizations with publications or research activities related to RE at the studied region (including magazines, bulletins and other types of grey literature).

	I1	I2	I3	I4	I5
Andalusia	X	P	6	EP	X
Aragon	X	P	5	EP	X
Canary Islands	–	I	4	EP	X
Cantabria	–	M	4	EP	–
Castille and Leon	X	P	5	EP	–
Castille – La Mancha	–	P	6	G	X
Catalonia	–	P	6	EP	X
Madrid	–	M	5	EP	–
Navarre	–	M	5	EP	–
Valencia	–	P	5	G - Wind energy	–
Extremadura	–	P	6	EP	X
Galicia	–	P	6	EP	X
Balearic Islands	–	I	4	EP	–
The Rioja	–	M	4	0	–
Basque Country	–	P	6	EP	x
Asturias	–	M	5	0	–
Murcia	–	M	6	EP	–

Source: Own work.

implementation process for all Spanish regions leading to selection of 6 Autonomous Communities for in depth-study and regional comparison, and; 2) follow-up study in these 6 regions selected on the basis of the results from the first phase. The techniques employed for the study combined in-depth review of available bibliographic sources (published and unpublished, electronic and otherwise) and a variety of participatory research techniques (see Fig. 4).

4.1. Selection of case study regions

The objective of this step was to create a subsample of Spanish ACs, since resources were not available for detailed study of all 17 regions. At the same time, to ensure representativeness of the subsample, it was important to capture the great diversity in experiences of RE implementation across the regions. Firstly a detailed search of available information from internet sources, grey literature and academic publications was undertaken, detailing the principal RE sources for each of 17 autonomous communities in Spain, the overall energy balance, and the state of the art in terms of policy directives and drivers, as far as was possible to discern from these sources. The availability and accessibility of data were also considered.

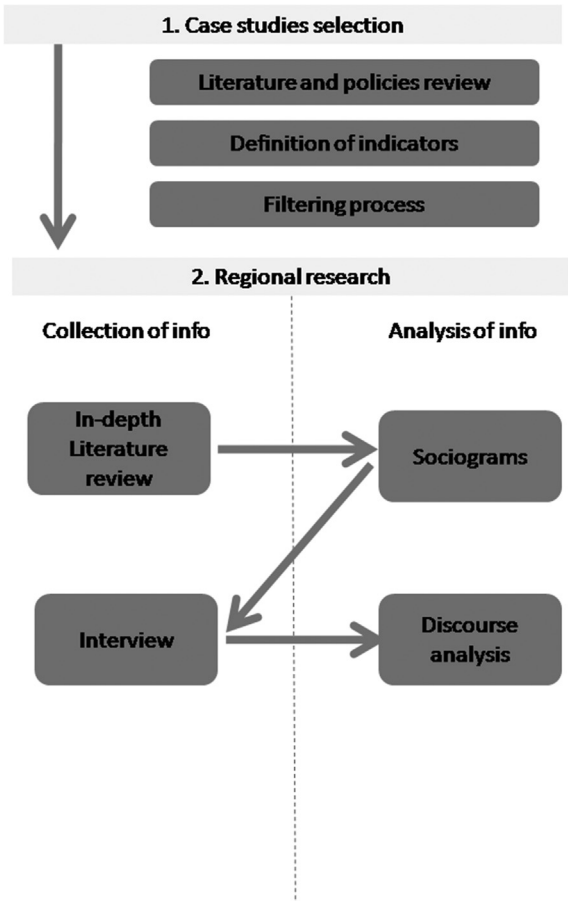

Fig. 3. Methodological approach. Source: Own work.

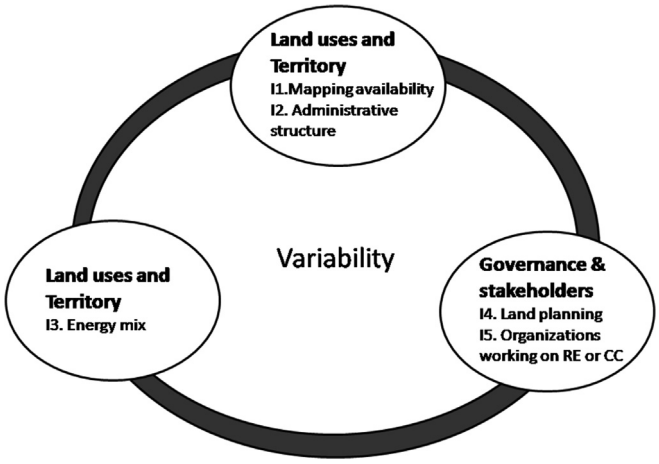

Fig. 4. Indicators used for the case studies selection. Source: Own work.

Subsequently, a filtering process was initiated on the basis of the information obtained in the rapid appraisal. This involved development of a series of indicators in relation with three different criteria intended to maximise the diversity of regions selected and ensure feasibility for study; 1) Availability of cartography and type of AC (single province, multiple provinces or island); 2) Energy mix; 3) Existence of an autonomous energy plan (EP) and organisations working in the region on CC and RE (Table 2).

As lack of cartographic information relating to renewable energy might pose a problem for further analysis in complementary studies focusing on territorial aspects, the first decision to be taken was the selection of the three autonomous regions where cartographic information relating to RE was available: Andalusia, Aragon and Castile-and-Leon. Furthermore, by selecting these regions it was also possible to satisfy the variability criteria for indicator 3 Energy mix, as these three regions contained a wide range of RE types. In order to obtain the full range of variability for indicator 2 Administrative structure, The Canary Islands, Navarre and The Rioja were selected, which also provides the full range of variability for indicators 4 and 5 (Table 2).

Even though there are of course other possible combinations of regions that would also ensure variability of the indicators, the selection that has been made is considered to be representative of the range of different situations likely to be encountered in Spain. (see Fig. 5)

4.2. Case studies

The methodological framework employed for the participatory process was based on participatory approaches typically used under Participatory Action Research (PAR) (e.g. Refs. [3,23]. In particular, three tools taken from PAR were used: semi-structured interviews for the collection of information and sociograms and discourse analysis for the subsequent analysis phase.

4.2.1. Semi-structured interviews

The case study phase was initiated with an in-depth review of the policies and stakeholder communities identified in the first phase of this study. On the basis of this, a semi-structured interview pro-forma was prepared (Appendix A). The interviews were structured around a series of 'open questions', to allow for a more flexible and nuanced response than is possible through closed questions. At a national level and for each region, two stakeholders were selected. Both national and regional level stakeholders were contacted to carry out an open but structured telephone interview. Some stakeholders did not wish to participate; these individuals were substituted by other, related, stakeholders where possible.

Interviews lasted about 50 min each and covered four main issues: RE current situation and tendencies, regional policies, stakeholders involved in the process and cartography availability (necessary for understanding the extent of RE implementation at the level of the region). 10 interviews were carried out in total, at least one per region, and one at the national level (Table 3).

The information collected through both literature review and interviews was analysed by two further techniques: *sociograms*; to understand which stakeholders are involved in the RE policy implementation process both at national and regional level and *discourse analysis*; to organize this information structurally and compare the information from the different interviews.

4.2.2. Sociograms

The objective of a sociogram is to establish the social relations that exist between groups, institutions, or individuals through graphical representations, to illuminate the trusts, misgivings or connections that could be of interest at a given time in a specific sectoral or territorial community [39].

Fig. 5. Spain and the 6 case study regions referred to in this paper.

The first task undertaken was to identify and map the main national and regional stakeholders. These sociograms were constructed based on information derived from both written sources and semi-structured interviews: one sociogram was developed at national level and 6 at regional level, one for each Autonomous Community selected for more detailed study. To do this, graphical representations of stakeholders were compiled using overlapping circles (Venn diagrams). In order to analyse the results of this research, different constellations present at the sociograms are expected to have an effect on the future possibilities for RE reactivation in Spain.

For analysis of the sociograms, the following assumptions and general considerations are relevant:

1) *Overlaps*: The existence of overlaps which represent spaces of common work between different spheres of action implies a more participatory development process in which communication and information exchange between each sphere is stronger. Two of these overlaps seem to be of special importance: a) the link between business and administration, which is important for investor confidence, and b) the link between business and civil society, which ensures widespread diffusion of the RE implementation process throughout all sectors of society, not just amongst the elite. Strong links between organisations as a result of these overlaps may imply a higher level of resilience.

Table 3
Stakeholders Interviewed, institutions and spheres of action.

Region	Institution name	Sphere
National Level	IDAE – Energy Department, National Government	Administration/Quangos
Andalusia	APREAN	Business/Implementation
Andalusia	AEA (Andalusian Energy Agency)	Administration/Quangos
Aragon	Energy Planning Dept, Regional Government	Administration/Quangos
Aragon	CIRCE	Scientifc
Navarre	Land Planning Observatory, Regional Government	Administration/Quangos
Navarre	Energy Department, Regional Government	Adminitration/Quangos
Castille -and- Leon	Valladolid University	Scientific
Canary Islands	ITER	Business/Implementation
The Rioja	Friends of the Earth	Environmental/Social Organizations

2) *The role of the regional administration*: The regional government is important in the RE implementation process. It can act simply as another stakeholder, or it may choose to play a leading role. When it chooses the second option, it is linked to the other spheres of action.
3) *The organization level of the business sector*: As provider of the key financial resources, the business sector also has the potential to play a leading role. If this sector is highly organised around RE, this is likely to be positive for the further development of RE in the region.
4) *Isolation of some spheres of action*: The involvement of all spheres of action in the RE implementation process would contribute to a more complex and dynamic social network around RE. This is likely to increase the chance that the whole stakeholder community would resist the imposed destruction of the system by a single actor, and instead, when the system suffers a shock, try to generate different options for the future.

4.2.3. Discourse analysis

Following the interviews, discourse analysis was carried out to understand stakeholder perspectives on key themes that emerged from the previous research and interviews, for example:

4.2.3.1. Historical trajectory. In some ACs, there has been a high level of involvement of the regional stakeholders in the RE development process, something that seemed to be associated with a higher economic benefit received by the region.

4.2.3.2. Speed of deployment. Slower development facilitates the involvement of civil society in the process and therefore may increase the stability of the new system.

4.2.3.3. Conflicts. Conflicts may be unavoidable initially when a new system is implemented, however, the existence of measures to overcome such conflicts is highly regionally dependent. Regions where conflicts have been successfully overcome may offer valuable lessons for future implementation.

4.2.3.4.. Perspective about the future. When stakeholders are already thinking optimistically about the future and generating new ideas to achieve it, doing so successfully is likely to be easier.

5. Results

5.1. Sociograms: understanding stakeholder communities involved in implementation of RE

5.1.1. National level

5 different spheres of action were defined at national level (Fig. 6). These spheres of action were maintained for the analysis of the regional stakeholders:

➢Business/Implementation: Business and other stakeholders involved in the start up of RE infrastructures in the states or regions selected for the case studies.
➢Environmental/Social Organizations: Environmental and social Non-Governmental Organizations (NGOs) with a branch in the case study regions, that have an active agenda in relation with RE and/or CC.
➢Scientific Organizations: Universities and research centres working on RE and/or CC.
➢Administration/Q: National level government departments in charge of Renewable Energy and Climate Change issues and other Quasi-autonomous non-governmental organizations (Quangos) in which government has devolved responsibility.
➢Media: Trade journals, newspapers, radio, etc with a special focus on Renewable Energy and working at the regional level.

5.1.2. Regional level

The general spheres of action defined at national level were also relevant for classification of the organisations at the regional level. The results for each AC are presented as follows:

5.1.2.1. Andalusia. In Andalusia (Fig. 7), three different spheres of action come together in the form of the Andalusian Cluster for Renewable Energies (CAEERR). This umbrella organisation provides businesses the opportunity of working together with local government organisations such as the Malaga municipal energy agency, and the provincial energy agencies for Cordoba and Granada (though it is interesting to note that the Andalusian government itself is not represented [2]; This would seem to offer a good way of strengthening investor confidence through direct contact with policy makers. The cluster's stated aims relate principally to improving communication and lobby power. The inclusion of scientific organizations in the cluster like CIEMAT (a national technology centre), and the Pablo Olavide University in Seville, potentially offers access to cutting edge RE research and development.

The RE business sector in Andalusia is organized under APREAN, in which small/medium enterprises (SMEs) are included. There is a high number of large firms present in Andalusia which may play a prominent role in influencing policy decisions.

On the other hand, environmental and social organisations with interest in RE development are isolated, which may indicate a low level of civil society participation in the RE development process in Andalusia, something that is likely to decrease the resilience of the energy transformation.

5.1.2.2. Aragon. In Aragon (Fig. 8), no common work space exists similar to CAEERR in Andalusia. However, there are two trans-

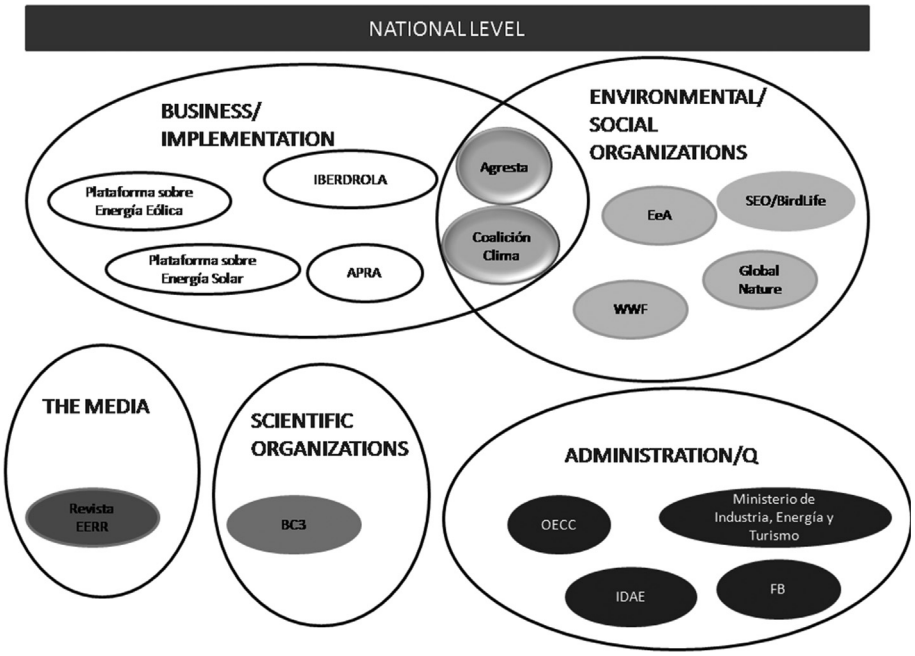

Fig. 6. National level sociogram.

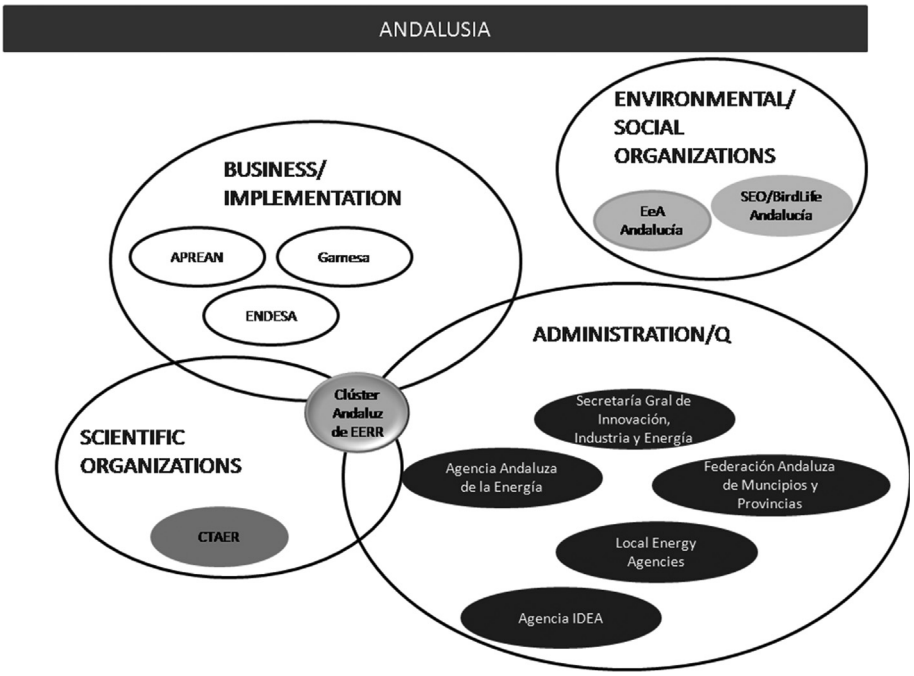

Fig. 7. Regional level sociogram for Andalusia.

sphere organizations that can play an important role moving the spheres of action closer together: The Hydrogen Foundation (Fundación Hidrógeno), which combines tasks from both the Administration and Business spheres, and the research centre for energy resources and energy consumption (CIRCE), which combines tasks from both the Scientific Organizations and Administration spheres.

The regional RE business sector comprises various organizations such as AEA (The association of wind energy businesses in Aragon), and APPA (the Renewable Energy Producers Association, which operates at a national scale but has regional representation in Aragon).

Finally, it can be seen that environmental and social organizations are also isolated in Aragon, which is likely to decrease the resilience of the process.

5.1.2.3. Navarre. The main point to be made about the Navarre sociogram (Fig. 9) is the high level of participation of the regional public sector in the rest of the spheres of action, especially via the existence of organizations that link the Administration with all of

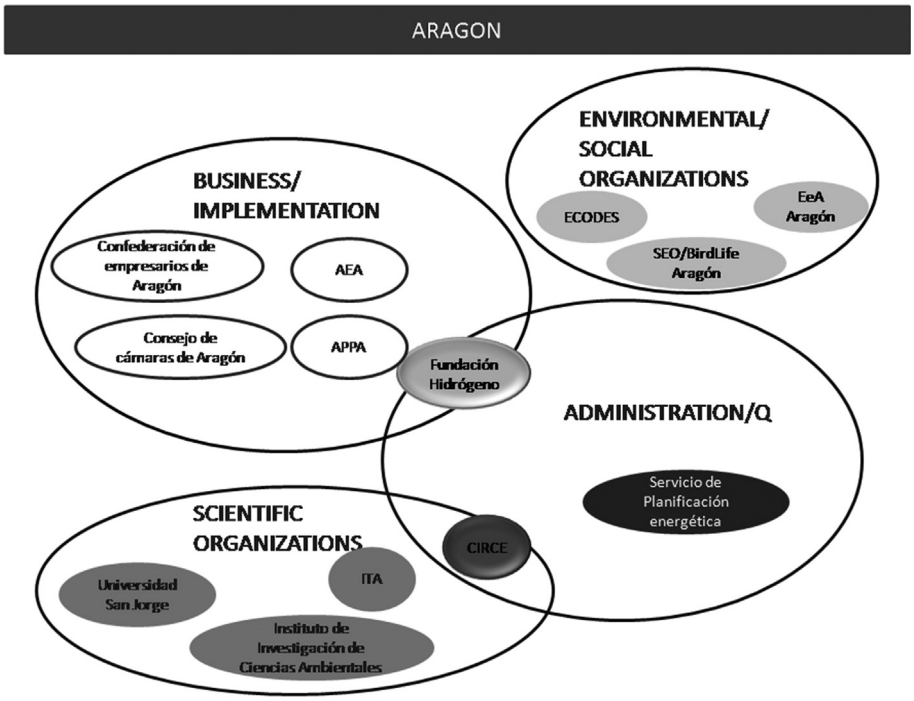

Fig. 8. Regional level sociogram for Aragon.

the other spheres. This is unique amongst the 6 regions studied in this research. Since there is no single workspace that is common to all the sphere of action, this factor is clearly highly significant to the RE development process in Navarre.

The business sphere is robust and well-organized. Several very large businesses such as Acciona, Gamesa and Cementos Portland are present in the sector in Navarre, something that is likely to be influential in determining future RE implementation.

5.1.2.4. Castille-and-Leon. Castile and Leon (Fig. 10) stands out because of the absence of any relationship between the four spheres of action considered, there is neither a common workspace between spheres nor any trans-sphere organization.

Looking at the regional business sector, it is highly organized, with three different organizations active in the RE sector; the Castile and Leon wind energy producers association (APECyL), the wind energy business association (AEE), and the cluster of solar and wind producers.

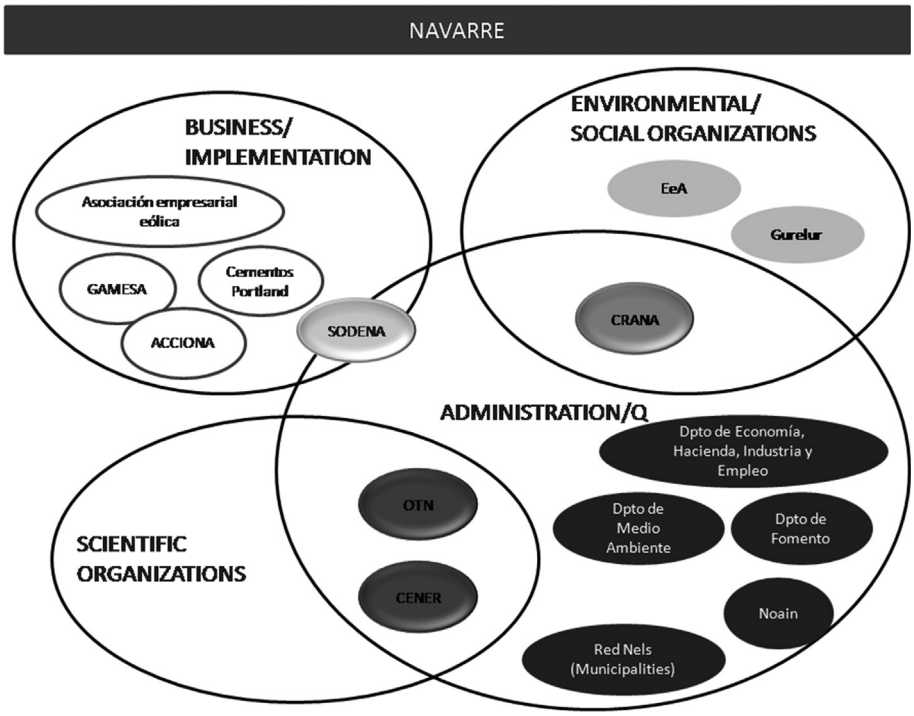

Fig. 9. Regional level sociogram for Navarre.

5.1.2.5. Canary Islands. The Canary Islands (Fig. 11) is the only region where there is a common workspace between the business sphere and civil society (environmental and social organizations), called Cluster RICAM.

Additionally, there is a high level of involvement from the regional government with other spheres, both Business and Scientific organizations. The two entities that cross these domains, ITER (Technology and Renewable Energy Institute) and ITC (The Canary Islands Technological Institute), play a leading role in the RE development process.

Finally, the high level of organization of the business sector is also noteworthy, with two different associations in operation: APPA (the renewable energy producers association, with regional representation in the Canary Islands) and ACER (the Canary Islands association for renewable energies).

5.1.2.6. The Rioja. In The Rioja (Fig. 12), only factors likely to be restrictive for further RE development were found. The four spheres of action considered are isolated, with neither a common workspace nor any trans-sphere organization.

In addition, there is no organization that represents the collective interests of the regional RE business sector, and no specifically dedicated scientific organisation.

5.2. Discourse analysis: results of telephone interviews

Verbatim results from telephone interviews with stakeholders are presented for each theme in Tables 4–6. The results are summaries of stakeholders' verbatim responses in translation except where interpretation was needed to clarify the meaning of the response.

5.2.1. The current situation and the RE development process in the past

Stakeholder responses for this theme are presented in Table 4. A number of points can be made. Firstly, respect to past RE development, national level factors such as subsidies and the electricity grid were given greater weight by interviewees in all ACs studied. Stakeholders were able to inform about the significant difference between the development of wind and solar energy. Wind energy was the first to be implemented, and its development was quite slow in every region analysed. In the case of solar energy, stakeholders noted very little development prior to the year 2000; nevertheless its expansion through the Spanish territory was spectacularly fast, much more so than in the case of wind energy. Despite the fact that most of the factors influencing RE development in the past are quite similar between regions, it is notable that the Canary Islands would receive greater economic benefit from the implementation of RE than other ACs studied, due to the special characteristics of its electricity grid.

5.2.2. Conflicts related to the RE implementation process

Stakeholder responses for this topic are presented in Table 5. Conflicts highlighted by stakeholders can be grouped as follows:

a) conflicts related to ecosystem modification and landscape impacts due to RE installations. These are either related to visual landscape concerns, especially at regional boundaries (e.g. between Castille-and-Leon and Cantabria) where policies differ, or direct environmental impacts. Conflicts over direct environmental impacts have occurred between environmentalists' groups and regional authorities, most notably in The Rioja but also other areas (e.g. Navarre);
b) conflicts related to the distribution of economic benefits of RE implementation
c) conflicts related to policy and competence issues such as division between stakeholders of the same sector (e.g. one environmentalist group, Friends of the Earth, supports RE, while another, Ecologistas en Acción, opposes them), serious opposition to national government policy by regions (even of the same political party) or difficulties in contract adjudication (corruption) identified in some regions (e.g. Canarias).

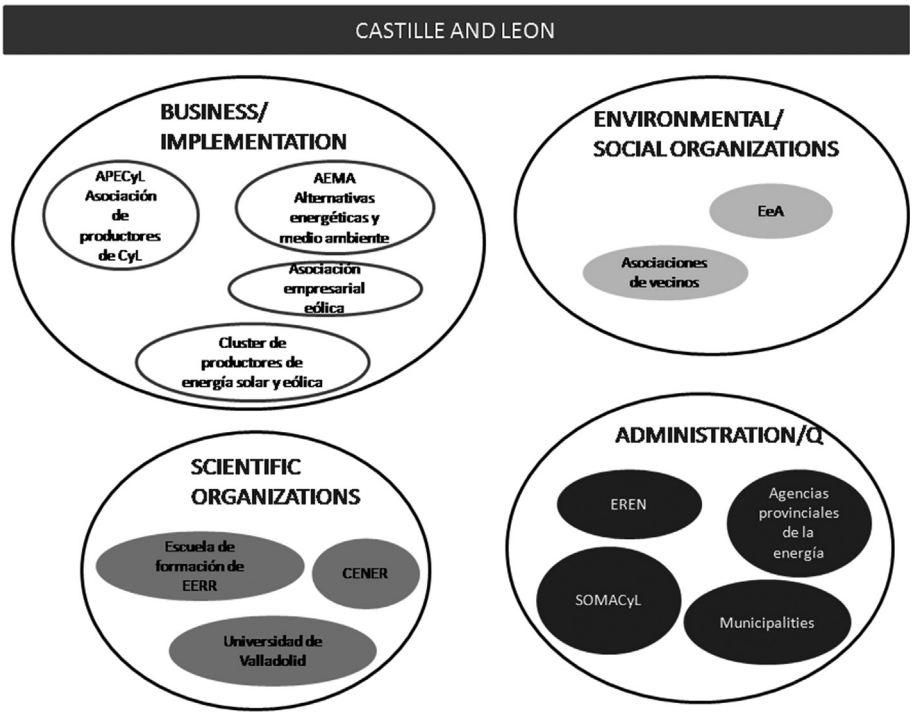

Fig. 10. Regional level sociogram for Castille-and-Leon.

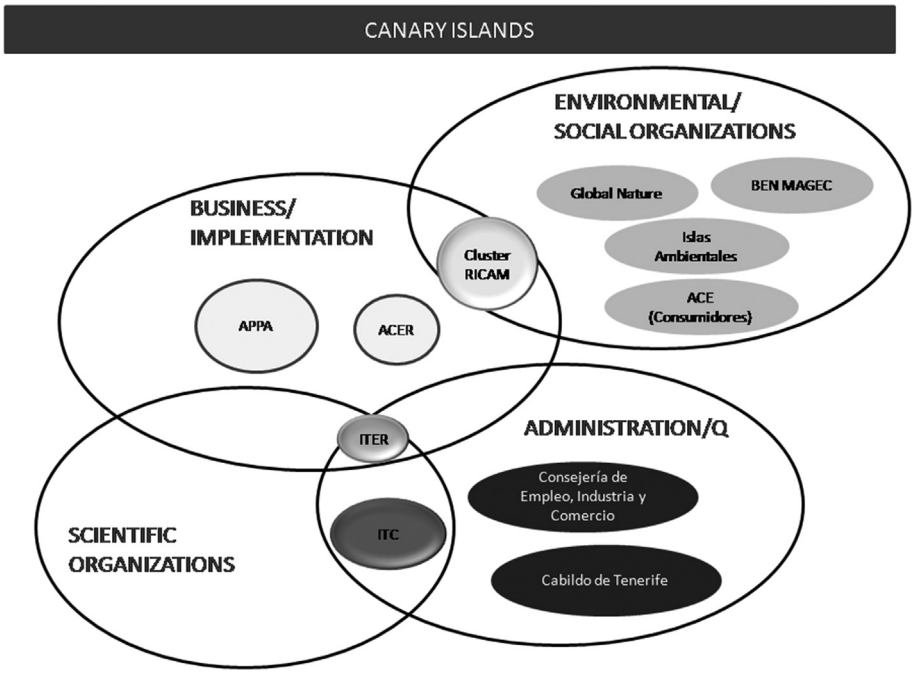

Fig. 11. Regional level sociogram for Canary Islands.

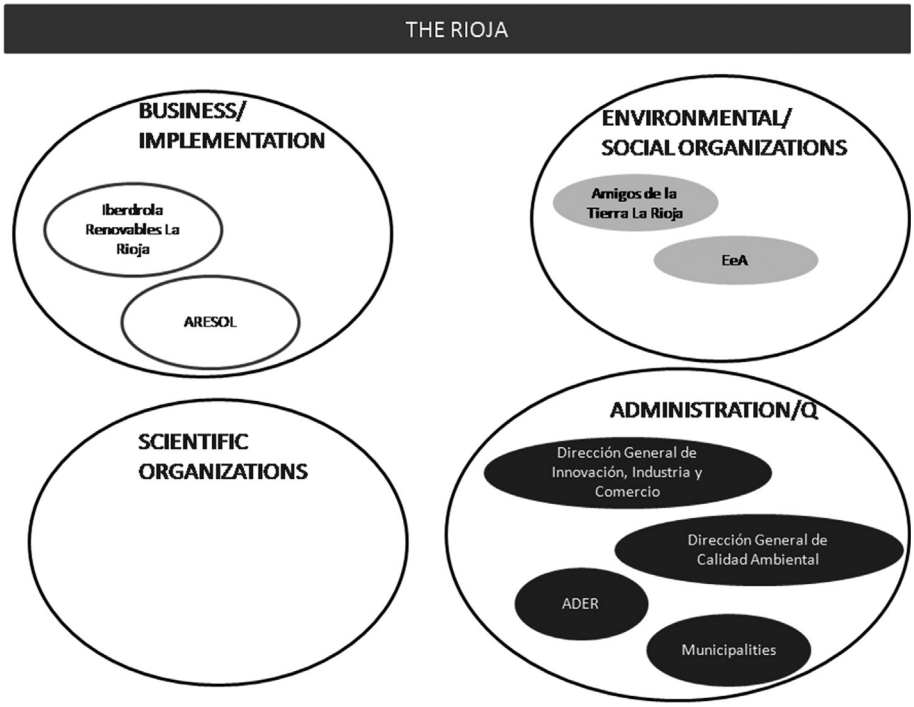

Fig. 12. Regional level sociogram for The Rioja.

When RE installations were first developed on a large scale, some conflicts did emerge, mainly associated with the environmental impacts of these infrastructures. Many of these conflicts seem now to have been overcome. Conflicts in some areas remain, for example, in Navarre, due to excessive development of RE infrastructures (large scale wind) and in The Rioja, where environmentalists felt that environmental concerns had not been taken into account in RE development planning.

At present, coastal regions (Canary Islands and Andalusia in this research) face conflicts related to the offshore RE development.

In other regions such as Aragon and Castille-and-Leon, conflicts were not identified inside the region itself, rather with neighbouring regions, due to visual impacts on landscape.

5.2.3. *Future opportunities for further RE development*

Stakeholder responses for this theme are presented in Table 6.

Table 4
Results from telephone interviews with stakeholders about the current situation and the past RE development process.

National level
Wind energy has evolved very gradually, but has been strongly developed since the year 2000.
For PV energy, 2007 was a turning point due to the regulatory framework
RE development has entailed both a regulatory framework combined with technological breakthroughs.
"Poor legislation" implemented by the previous government.
January RD 1/2012
Andalusia
Wind energy begun to be profitable in the 90s.
PV energy was rapidly developed between 2007 and 2010 due to increase in subsidies.
With elimination of subsidies in 2012 development ceased.
Both stakeholders agree on the fact that regional administration is supporting RE development in the region, but under the current national legislation further development would be quite difficult.
Aragon
Wind energy infrastructures were the first type of RE to be implemented.
Wind energy implementation process was slower than in the case of solar PV.
PV took off in 2004–2005, and specially between 2007 and 2010.
When the national legislation framework changed, Aragon was less prepared than the other CA.
Electricity network capacity is the key element impeding the development of RE in Aragon.
Canary islands
Limited by the size of the territory and the nature of electricity supply and distribution (6 independent electricity networks)
Much more advantage could be taken of this important and renewable resource.
Land planning for energy infrastructures is now being prepared.
Bureaucracy was a key factor in delaying the development of solar energy when legislation was favourable.
Announcement of tendering processes has been very conflictive (due to corruption and Environmental Assessments)
Red Eléctrica has recently modified its energy distribution planning.
Since 2012 situation is uncertain.
The price paid [for energy] has gone down.
A Working Group (Ministry and Regional authorities) has been created to analyse the specific situation of Canary Islands in relation to energy prices.
Castille and Leon
Wind energy implemented everywhere in the region since 2000.
In 1999 a regional plan drawn up for wind with the objective of achieving 7000 MW. Now, it is producing 5200 MW.
At present, development is slower.
Solar PV was developed between 2008 and 2010. Before and after this interval only small local investors.
Navarre
A semi public business (EHN) had a big impact in the regional wind energy development.
High level of public acceptance.
CENER (Research on RE) was created in 2000 and CENIFER (education on RE) in 2003.
The Rioja
Ecological values in the AC have been negatively impacted ("destroyed") by RE infrastructures.
Factors influencing RE development are mainly subsidies and electricity network capacity.

The perception of the opportunities for the RE sector in the future could determine the actions of the main stakeholders at the present time. Although all the regional stakeholders interviewed agree on the fact that the future of the RE sector is highly dependent on the decisions taken at the national level, and the present situation of paralysis was generally regarded as negative, most regional stakeholders seemed to share an optimistic vision of the future for RE development. A stakeholder interviewed for the Canary Islands offered a series of recommendations (Table 6) to bring the moratorium situation to an end and stimulate further RE development.

5.3. Limitations of the study

Due to the complexity of the information solicited, the decision

Table 5
Results from telephone interviews with stakeholders about conflicts related to the RE implementation process.

National level
Andalusia
Stakeholder felt that RE-related conflicts have been overcome. Conflicts highlighted in the past: landscape, with environmental groups (impacts on birds) and with other groups such as hunters.
Conflicts currently in existence: offshore
Aragon
There were conflicts in the beginning, 10 or 12 years ago.
Nowadays, main conflicts are with the neighbouring regions.
Canary islands
With the environmentalists' groups. These groups have big impact in the region.
Castille and Leon
No major conflicts.
Wind: Some conflicts with the neighbouring CA (i.e. Cantabria) over landscape (visual impact)
Also conflicts relating to the distribution of the economic benefits: services for the whole municipality or for those areas located next to RELF?
Navarre
OTN: No conflicts associated with RE in Navarre. There were some in the first years: landscape impacts, impacts on birds and path construction.
Government: Some conflicts with environmentalists' groups due to the excessive wind energy development and impacts on birds.
The Rioja
There have been some conflicts with hunters' associations, but not many.
Conflicts with the environmentalist group interviewed due to the environmental impacts and the lack of environmental planning.

Table 6
Results from telephone interviews with stakeholders about Future opportunities for further RE development.

National level
There is a question mark over the future of RE due to the economic crisis and fall in the consumption on energy.
Since 2012, no new RE systems implemented because they cannot compete on price with conventional sources.
"Spain has already achieved its target of 20% of energy consumption coming from RE sources". [this assertion is not supported by official statistics, see Fig. 1]
Andalusia
RE has a future due to its basis on natural resources and has social support and regional authority support.
Future is conditioned by legislation at national level. Optimistic due to the national and international agreements that are in place.
Aragon
Optimistic. Currently stalled, as a result of prevailing circumstances.
The only risk could be the emergence of a new more competitive energy source.
Canary islands
In the short term, dark future due to the economic crisis. Solar PV: Risk for small business from bankruptcy.
RE on the buildings will probably be developed in the medium term.
In order to stimulate RE development It will be necessary to work on costs, net balance legislation for private individuals and bringing the national moratorium to an end.
Castille and Leon
Optimistic because Castille and Leon is a big and depopulated territory and much of this area could be dedicated to RE production.
Navarre
Optimistic, because RE is considered as strategic sector for regional economy.
In the near future it is complicated because of the economic circumstances and national legislation is no longer promoting RE.
The Rioja
RE development is likely to be blocked for the next 5 years with only some small projects with private investment implemented.

was taken to carry out a few in-depth interviews, rather than a larger quantity of less detailed interviews. For this reason, the number of stakeholders interviewed was relatively small (10). This has the disadvantage that highly personal or unrepresentative views of one or two stakeholders could lead to significant bias in the results of the interviews. To mitigate against this, care has been taken to present interviewees statements verbatim (Tables 4–6) as far as possible and to use them to infer general tendencies rather than take them at face value. For example, while one interviewee from the Rioja region referred to the "destruction of ecological values" (the stakeholder's own words) associated with RE development, this is regarded only as evidence for conflict between stakeholders, since the alleged environmental damage is something the researchers were unable to independently verify. It is also important to stress that the work presented in this paper does not rely exclusively on the results of interviews; rather, they are used to support researchers' analysis of the literature and vice-versa. In addition. the sociogram approach reinforces the interview process by situating stakeholders in their context relative to the whole community of actors.

6. Discussion

As the research presented here has shown, the RE implementation process has been quite different in each region. In fact, no two ACs are alike. The marked difference in RE implementation success stories evidenced by comparing, for example, Navarre, with the adjacent Rioja region, is due precisely to these regional differences in the implementation process; above all, the configuration of the most important players in RE identified in the sociograms, the business community, the regional administrations, scientific organisations and civil society. The different characteristics of each regional implementation process determine where new developments will take place and what form they will take. Understanding this information could help policy makers to cure the RE paralysis that Spain is currently experiencing.

6.1. The structure of Spanish RE policy implementation

6.1.1. Stakeholders from different administrative levels have different, and opposing, perspectives

Currently, stakeholders coming from the national and regional levels hold polarized views of the current situation regarding RE in Spain. At the regional level, stakeholders argue for the recovery of the RE support system whereas at the national level, stakeholders defend the current RE moratorium legislation arguing that such a step was necessary to reduce state expenditure. This polarization seems to be linked to the different administrative responsibilities between National legislators and the different Autonomous Communities, rather than pure political ideology, since these highly polarized viewpoints were observed even where the regional authority belongs to the same party as the National Government (e.g. in Castille-and-Leon). Some authors (e.g. Ref. [32] also highlight problems of bureaucracy and coordination between regional and national administrations.

6.1.2. Regional level stakeholders are optimistic about future RE development, yet reliant on key national level actors

The general optimism about the future for the sector expressed by regional stakeholders rests on the international Climate Change mitigation agreements signed by Spain, on the high level of social acceptance that these types of energy production have found in most parts of Spain, and on Spain's high dependence on energy produced abroad (e.g. natural gas imported from Algeria). This positive and optimistic outlook about RE development in Spain seems to be at odds with the need for a constant political will to support RE that stakeholders identified as essential to further RE development.

6.1.3. Powerful actors can sabotage the system simply by removal of key elements

The main argument used by national institutions to paralyse the previous model of support for RE development is the high cost of the subsidies to the public purse and the necessity of limiting public expenditure. However, in order to obtain the expected benefits from development of RE sources, it would be necessary to maintain the public support that was promised, since the sudden withdrawal of the subsidy regime affects investor confidence and could cause a stampede of investment capital away from RE, as in fact seems to have happened. Indeed, the stable legislative conditions and the careful handling of investor confidence are frequently cited reasons [4,9,15,36] for the success of RE development in Spain. This is so widely known that it seems plausible that policy makers have deliberately crashed the system, possibly on behalf of, or with the collusion of some insiders. Large energy companies, with parallel investments in non-renewable energy sources, may have exerted a

powerful lobby pressure to obtain this result. Given the seriousness of the Climate Change threat, the power and influence of these companies is a major concern and something that needs to be addressed at a European level. Clearly, that a few powerful actors can sabotage the system by removal of some key pieces indicates that the RE implementation process is non-resilient.

6.1.4. European level policy makers are not openly critical of a national energy policy that does not comply with EU objectives on climate change

Spain has not yet achieved the EU "road map" 2020 objectives in relation to the production of energy through RE. Withdrawal of the subsidy regime and destabilisation of the entire RE implementation process seems an unlikely way to advance towards these objectives. It is remarkable that what effectively amounts to an abrupt withdrawal from a key EU Climate Change commitment by such an important member state (the EU's fifth largest economy) has not brought louder criticism from EU policy makers. This may suggest that the actions of the Spanish government have found support on some level inside the EU itself.

6.1.5. Changes to the production-consumption ratio of the energy system has far-reaching consequences

Spain currently produces and has commercial commitments for more energy that it needs, due to the decline in energy consumption that has accompanied the economic crisis [19]. As a result, if the proportion of RE in the total energy mix is to be increased, it would be necessary to close down existing non-RE plants. This is the explanation for the apparently surprising observation made by the representative of the government of Aragon, that a growth in energy demand is a prerequisite for further RE development. This demonstrates how easily stakeholders can become fixed on achieving the European road map objectives without considering the wider aims for the policy. Development of the RE sector has been seen as an economic opportunity and stakeholders at all levels are paying much more attention to RE development than to the reduction of energy consumption. This could become an important obstacle in achieving a low carbon economy.

6.2. Perspectives from the regional level

As the sociogram exercise shows, there are important differences in the **configuration of stakeholder communities** across regions. In fact, a wide diversity of situations exists, which can be approximately grouped as follows: a) The Canary Islands and Navarre, with well-established links across spheres of action, common workspaces between civil society and business and active participation of the regional administration; b) large regions such as Andalusia or Aragon where communication routes between stakeholders from different spheres of action do exist, but the RE implementation process has been mainly driven by big business. However, the high level of communication and involvement of the regional government in RE gives these two regions good potential to move to a resilient implementation structure with higher stakeholder involvement across spheres. Next, c) Castille-and-Leon, a very large region with no relationship between stakeholders from different spheres of action where, even though RE development has been quite important in recent decades, it has not been translated into strong links between civil society and the RE sector. Here RE development has been driven by big business and, consequently, further development is not expected until economic conditions improve or national policy becomes more favourable. Finally, d) The Rioja is a small region where a close relationship between stakeholders might be expected, but no such relationship was detected. Further development of the sector seems unlikely unless this situation changes.

By looking in detail at the **conflicts** that have occurred between stakeholders over the last three decades of RE development in Spain, it is possible to identify future areas of disagreement and define strategies that avoid or minimize possible conflicts. Most stakeholders interviewed perceive conflicts related to the deployment of RE infrastructures as a problem that has already been overcome. Two explanations for this fact can be found; firstly, that citizens' opposition tends to be stronger when people feel that changes can still be avoided. Another possibility is that different stances have become closer and opposing parties have reached a compromise through information sharing and negotiation. This may explain why protests against wind energy deployment due to ecosystem impacts (on birds in particular) have become less vociferous, while opposition to newer technologies such as off shore wind energy has come to the fore.

With this in mind, the Canary Islands and Andalusia would be expected to face problems in the future related to off shore energy development. However, both these regions have experience from previous phases of development that might allow serious conflicts to be avoided by adopting more integrative and participatory strategies.

6.2.1. Stakeholders' perception of the future

One important element that emerged through the discourse analysis is the claim by the interviewee at the national government level that Spain has already achieved its objectives for 2020. As shown earlier in this paper (see Fig. 1 and Fig. 2), these objectives have been achieved for electricity only; achieving 20% of total final energy from RE, as required by international commitments, is still some way off. As [37] have noted, the dissemination of this idea amongst the population can easily dilute the social support for further public investment on RE in Spain and therefore jeopardise the attainment of a low carbon economy.

At the regional level, stakeholder discourse has shown how the regions are dealing with the new situation. The Canary Islands interviewee seemed to have made a deeper analysis than some other stakeholders for ways to improve the currently rather low level of RE development in this region.

The strong links observed between different stakeholder groups is probably at least partly responsible for the successful uptake of RE in some regions – for instance, linkages are strongest in Navarre, which has been a clear leader in RE implementation in Spain. This assertion is supported by the analysis of authors such as [9] and Rio and Unruh (2007) who have emphasized the key role played by partnerships between private sector groups like energy producers and turbine manufacturers and public bodies like the regional administrations. However, some exceptions can be identified. In Canary Islands, our research identified a common workspace between the business sphere and civil society, a high level of involvement from the regional government with other spheres of action, and an apparently well-organized business sector. Yet in this region, RE diffusion has been disappointing. Conversely, in Castille and Leon, which has seen very strong development of both wind energy and solar PV, the different spheres of action were found to be unconnected.

The reason for this apparent discrepancy, as noted by stakeholders interviewed in these regions (Table 4) is probably one of infrastructure. Canary Islands is an archipelago almost 1000 km away from the Spanish mainland, comprising 7 islands and 6 different electricity networks. Castille and Leon, a vast territory occupying the northern half of the Spanish *meseta* and linking the Spanish capital with the Northern regions like Asturias, Cantabria and the Basque Country, is by contrast, well served by the main peninsular electricity grid. It seems likely that the logistical,

infrastructural and administrative complications implicit in the management of a variety of insular networks has exerted an important brake on RE development in Canary Islands. Additionally, in Castille and Leon, the business sector was notably well-organised – strong impetus seems to have been achieved for RE development relying only on standard formal relationships with public institutions (applying for planning permission and subsidies). Clearly, it is also possible that relationships between public and private sector groups do exist in Castille and Leon, but that the stakeholders interviewed were unaware, or not at liberty to publicly declare them.

7. Policy recommendations

Further to the analysis given in the preceding sections, we provide a series of policy recommendations that we hope may allow the strong progress made by Spain before 2012 toward a transition to clean energy to be restarted in the near future.

7.1. Regional level

Overall, the main policy goal at regional level should be to encourage more of the key actors in the RE sector to build links and work together. Common workspaces to facilitate this, like the CAEERR in Andalusia, could be established in other ACs, particularly in Castille-and-Leon and The Rioja. In Andalusia and in Aragon, which, along with Navarre, are in a strong position to develop RE further, policy should be directed at enhancing the involvement of civil society in renewables. Bottom-up initiatives like crowdfunding solar panel installations (successful in the Netherlands), promotion of citizen-business partnership schemes and public awareness campaigns could help build public confidence and increase knowledge transfer. Navarre is likely to need little additional help beyond the clarification of the legislative framework that seems a precondition for further development anywhere in Spain (see below).

Regions characterized by a more interlinked stakeholder network may be open to a more resilient and participative structure for future RE development. Small community-based projects could offer a way forward here, provided that these are not used as a fig-leaf to cover up the abandonment of the wider goals by the responsible authorities. However, as noted by the stakeholder interviewed in the Canary Islands, RE is currently very unattractive to small investors and private individuals; removing the cost disadvantages and allowing householders to sell energy generated back to the grid would be an important step forward. It is not certain that this could be easily accomplished at a regional level without national support. The Canary Islands has strong potential to further develop RE, as a number of important requirements converge in this region, for example, a solid base of social support for RE, and the strong engagement of the regional administration. Such development would represent an excellent economic opportunity for the region [26] due to its extreme isolation from the Spanish mainland and the low development of RE up to the present moment. Unfortunately, some rationalisation or improvement of the Canary Islands electricity infrastructure is probably necessary first. In regions like Castille-and-Leon or The Rioja, where RE has been developed, but without the involvement of regional businesses, the regional government or other regional stakeholders, are not expected to see much further development in the sector unless subsidies are reinstated and economic conditions improve. The developments seen in these regions have been mostly driven by big business and are much more dependent on national level decisions.

7.2. National level

Clearly, while the national administration remains opposed to further development of RE, little action is likely to be taken to promote it. So the key priority at the national level should be to abolish the draft law RD/2012/1 and related decrees whose only purpose seems to be to block further progress in the sector. If this can be achieved, other national level policy objectives can follow. These could include support for small investors and private consumers as well as the establishment of a national conflict resolution process to look into diverse concerns related to RE implementation, including environmental impacts (visual and direct impacts, both onshore and offshore), disagreements about the share of profits of RE between communities, landowners, private companies and local authorities, and legal/political issues like problems caused by legislative instability.

7.3. European level

Since the paralysis of RE development in Spain puts the country at serious risk of failing to achieve its European Climate Change commitments to 2020 and 2050, the fact that this abrupt change of direction has passed entirely unremarked at European level suggests a level of tacit agreement within the EU. Invoking the Subsidiarity Principle (the lowest competent authority is always that best placed to take decisions) is a poor excuse for allowing national decisions to take precedence on an issue of global concern like Climate Change. In reality, slashing subsidies to RE probably seems reasonable to EU policy makers firmly wedded to the idea of deficit reduction at all costs. Since other EU member states are in the process of adopting similar strategies that are highly unfavourable to RE development (e.g. the UK), it seems necessary for European institutions to take a firmer line on the energy policy adopted by member states where this policy clearly jeopardises previously agreed targets. However, strong intervention may not be desirable - recent events in Greece have shown an interventionist EU at its draconian worst. Perhaps the best that can be hoped for from policymakers in Brussels is some gentle encouragement for national policies that promote the transition to clean energy at the same time as offering struggling European economies a way out of recession. We believe that the continued development of RE is one such opportunity.

If the EU cannot be expected to intervene directly in member states' national policy (and we believe it cannot), this does not mean to say that nothing can be done. One key area where European policymakers can, and should, step in, relates to the power of the large energy companies. The Spanish government's decision to paralyse RE development is very likely strongly related to a loss of interest in RE development, and even direct lobbying against it, by the large energy companies. The economic crisis which Europe, and particularly southern member states, have been suffering since 2007, has led to falling energy demand across the entire EU, hitting energy companies' profits. Under such a scenario, and taking into account that RE has reduced the cost of energy to the consumer, it is easy to see why Big Energy might have lost interest in investing in European RE. EU policmakers need to seriously consider whether a completely liberalised energy market is really in the best interests of its citizens, and whether the lobbying power of Big Energy ought to be curtailed.

8. Concluding remarks

In order to comply with the international Climate Change commitments set down in the EU roadmap, regional characteristics

and civil society support for the RE sector are likely to play a key role. Some regions have developed particular characteristics that may make them more likely to progress with RE developments in spite of the adverse economic situation, intensive lobbying by the energy giants, and the (probably related) unfavourable government policy. It may be possible to increase system resilience and reduce the vulnerability of the energy transition to system shocks by building on the experiences of these regions. However, if progress is to be made at the required speed, a change of direction at the national level is also required.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.renene.2015.12.004.

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