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Innovation, pathways and barriers in Spain and beyond: An integrative research approach to the clean energy transition in Europe

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Abstract

To meet the goals of the Paris Agreement, as well as earlier targets set down in the EU Low-Carbon Road Map, requires a major transformation in the way energy is generated, marketed, and distributed that we call *the clean energy transition*. The clean energy transition is a social process and its success will be determined by the actions of key actors such as policy makers, energy suppliers and businesses. In this paper, we apply integrative research approaches to engage stakeholders in the renewable energy (RE) sector in knowledge co-construction activities for the case of Spain. Established modes of energy production are very resilient and powerful actors are

effectively blocking the energy transition on the basis that it threatens the status quo. Innovation is unlikely unless that veto can be overcome. The work has implications elsewhere, especially for other EU countries, where institutional structures and power relations are similar to those in Spain. To move forward requires a better understanding of the clean energy transition as a social process, and in particular, systematic identification of barriers to innovation and a serious effort to negotiate with the most powerful players.

Keywords:
Integrative research, Clean energy transition, Social actors and power relations, Paris Agreement

Research Highlights

- The clean energy transition is a social process whose success depends on the actions of key actors.
- Integrative research offers a way to understand the complex interactions between these actors.
- Progress in moving towards clean energy systems has been slow and EU member states may not meet their targets.
- In Spain, powerful incumbent actors have moved to block the clean energy transition.
- These dynamics also exist elsewhere, jeopardizing the goals of the Paris Agreement.
- To address this, policy makers must identify barriers and negotiate pathways with key actors.

Introduction

Policy makers across the globe have agreed to ambitious goals to reduce greenhouse gas emissions by transitioning to cleaner energy systems, most recently under the United Nations Framework Conference on Climate Change (UNFCCC), held in Paris in December 2015 (The Paris Agreement). However, progress still needs to be made in the implementation of climate mitigation policies in order to ensure that the ambitious targets can be achieved. The world's largest emitters, the US and China, have been slow to take meaningful action in the past, but have made major advances in recent years (den Elzen et al 2016), though the election of Donald Trump poses a significant risk to this progress. After the US and China, the block of 28 countries that comprise the EU is the world's third largest emitter. Here too, despite a single agreed framework, the Low Carbon Roadmap, and long experience in development of clean energy systems, progress has been slow. Germany, widely celebrated as a leader in the clean energy transition, looks set to meet its RE targets, but not by much (EC 2015), as consumption of brown coal has increased along with the proportion of renewables in Germany's energy mix (Morton and Müller 2016).

The United Kingdom, another major emitter, has made progress on decarbonisation, but has recently cut public support for solar energy (Ofgem 2017). Given the apparently ambitious aims of UK policy makers, progress there has in any case been rather slow (Kuzemko 2016). In the Netherlands, despite important innovations such as crowdfunding of solar panel installations and widespread grassroots support for clean energy, CO2 emissions (measured both in kg per PPP $ of GDP and per capita) were, in 2013, the most recent date available, still higher than most of its neighbours, including Germany (World Bank 2013). Spain, subject of this study, has taken the regressive step of halting new RE developments by cutting subsidies, removing feed-in-tariffs and disincentivising battery storage for grid-connected household consumers[1]. A 2015 report published by the European Commission found that:

[1] RD 1/2012, 27th January, Law 24/2013, 26th December and RD 900/2015, 9th October.

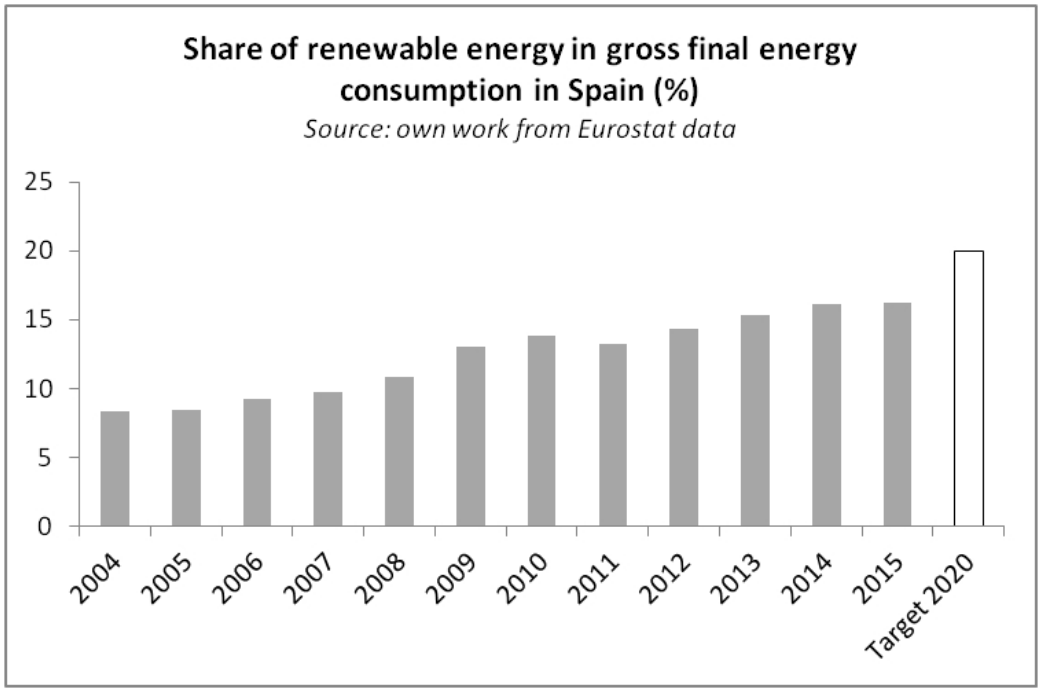
"some Member States, including France, Luxembourg, Malta, the Netherlands and the United Kingdom, and to a lesser extent Belgium and Spain need to assess whether their policies and tools are sufficient and effective in meeting their renewable energy objectives. Achievement of the 2020 renewable energy targets is also not certain in the case of Hungary and Poland: it is only under optimistic assumptions related to the future development of energy demand and country-specific financing conditions that the 2020 renewable energy targets appear achievable." (EC 2015)

While progress has undoubtedly been made, there are good reasons to question whether Europe will be able to achieve its clean energy goals in time.

The aim of the research described here is therefore to explore the reasons behind the slow progress on implementation of clean energy transition by looking in detail at the *social process* that such a transition entails. In particular, our approach has focussed on the role of different social actors, e.g. private energy firms, governments and civil society groups in erecting barriers or helping find pathways to make the transition a reality. Liberalisation and privatisation of the energy sector, which is now very widespread, means that energy policy is no longer the sole prerogative of government. Private sector incumbents like energy suppliers and distributors must play a key role if the clean energy transition is to become a reality. However, adopting sustainable strategies is not without risks to these firms (Augenstein and Palzkill 2015), as their interests often do not align with sustainability criteria. On the other hand, governments may also have ideological or economic vested interests in the status quo, preventing them from stopping powerful actors obstructing progress, and responding preferentially to their concerns over the broader interest of society (Kuzemko 2016). Sustainable energy transitions are thus profoundly political in nature (Meadowcroft 2009), and understanding inequalities of power between actors in the energy system is key to understanding transitions as a whole (Lockwood et al 2017).

In line with this earlier work, our present paper addresses the political aspects of the transition to a low-carbon society by analysing the balance of power between incumbents and other social actors through a detailed case study in Spain, which was once at the forefront of the clean energy transition. Our approach links policy implementation theory (e.g de Boer and Bressers 2011) with action research (e.g. MacIntyre 2008) as a means to elicit information from within the system by engaging with key actors.

Spain was chosen as a case study because of the extraordinary contrast between the rapid level of growth of renewable energy systems achieved before 2011 (see, e.g. Ruíz Romero et al 2012) and the marked slowdown of subsequent years (Figure 1). If such a thing could happen in Spain, we wondered, could it happen anywhere else? What particular conditions could have led to such a rapid shift in energy policy, at precisely the moment when climate mitigation efforts should be accelerating, not going into reverse?



[Figure 1: Share of renewable energy as a percentage of gross final energy consumption in Spain (source: Eurostat, update of 28th June 2017). While it seems that Spain may just meet the 2020 target, it is also clear that if the growth trajectory up to 2010 had been maintained subsequently, the target would have been easily met a few years ago.

3. Theoretical approach and methods

4.1 Integrative research

The research described here was carried out as part of an international project funded to explore knowledge-based pathways to a low-carbon society in the face of rapid, irreversible systemic change in the climate system. COMPLEX had 17 institutional partners; 16 of them European and one Russian and, in addition to developing a substantial repository of models, databases and modelling tools (Winder, 2017) COMPLEX was actively engaged with stakeholder communities in Norway, Sweden, Italy, Spain and the Netherlands (Winder, et al 2017). The participatory approaches employed as part of this process of stakeholder engagement fall under the definition of integrative research (e.g. Tress et al 2005). There are several 'brands' of integrative method in the literature and a wide range of *ad hoc* strategies, all of which have three features in common. First, everyone actively involved in the project, scientist, facilitator, politician or private citizen, is assumed to be a stakeholder. Second, everyone involved in the project is an expert. Thirdly, the research process is iterative; stakeholders work together around the topic in a process of continuous refinement of knowledge and understanding. The work is initiated by a nucleus of researchers who identify external stakeholders and invite some of them to become participants in a joint venture. As participation widens, professional researchers become, in effect, 'participant observers', responsible for facilitating the work, gathering and processing the data and communicating the results.

4.2 Participatory Contextual Interaction Theory

Specifically, two main approaches were employed, a theoretical framework for the study of implementation policy known as Contextual Interaction Theory (CIT) (Bressers 2009, de Boer and Bressers 2011, de Boer 2012), and a well-known form of action research called Participatory Action Research (PAR) (e.g. Villasante 2001, McIntyre 2008, Geilfus 2008).

Some explanation is merited, since the value of these two approaches, and the connection between them, may not be obvious. Implementation theory is relevant to the study of transitions because of its explicit focus on policy implementation rather than policy formulation, and it is this focus on *action* which allows it to be successfully integrated with action research approaches. Implementation approaches, however, can be excessively reliant on literature study, and tend to lack robust methods for participatory engagement. Action research approaches like PAR, are also highly appropriate for working with societal transitions since they are explicitly political in terms of their interest in power relations between actors. But in contrast to approaches based on implementation theory, action research is strongly oriented towards practice and comes equipped with well-developed participatory tools. However, its theoretical foundations are often rather weak. In particular, its emphasis on the importance of the local scale is not always appropriate. Thus the integration of the two approaches is more than just a marriage of convenience. It provides, through CIT, the overall conceptual framework for understanding the influence of actors on the implementation of RE policies, and through PAR, the robust participatory methods necessary to collect reliable data about these actors.

Practical integration of the two approaches involved: (i) structuring the participatory activities in order to elicit information about the *motivation, cognition* and *resources* of the key actors from the participants, rather than from literature or policy analysis as is more usual in CIT, and: (ii) adding two further actor characteristics, *affinity*, and *power*, which were also evaluated by workshop participants. Thus, in our integrated approach, which we refer to as Participatory Contextual Interaction Theory (PCIT) we looked to understand five characteristics for the key RE implementation actors through the participatory process, as follows:

1) Motivation – the actor's degree of motivation to implement the process for the relevant policy goal;

2) Cognition – the actor's degree of awareness and knowledge that enable them to implement the process for the relevant policy goal;

3) Resources – the resources (monetary or otherwise) at the actor's disposal;

4) Power – the power of the actor with respect to other actors in the model;

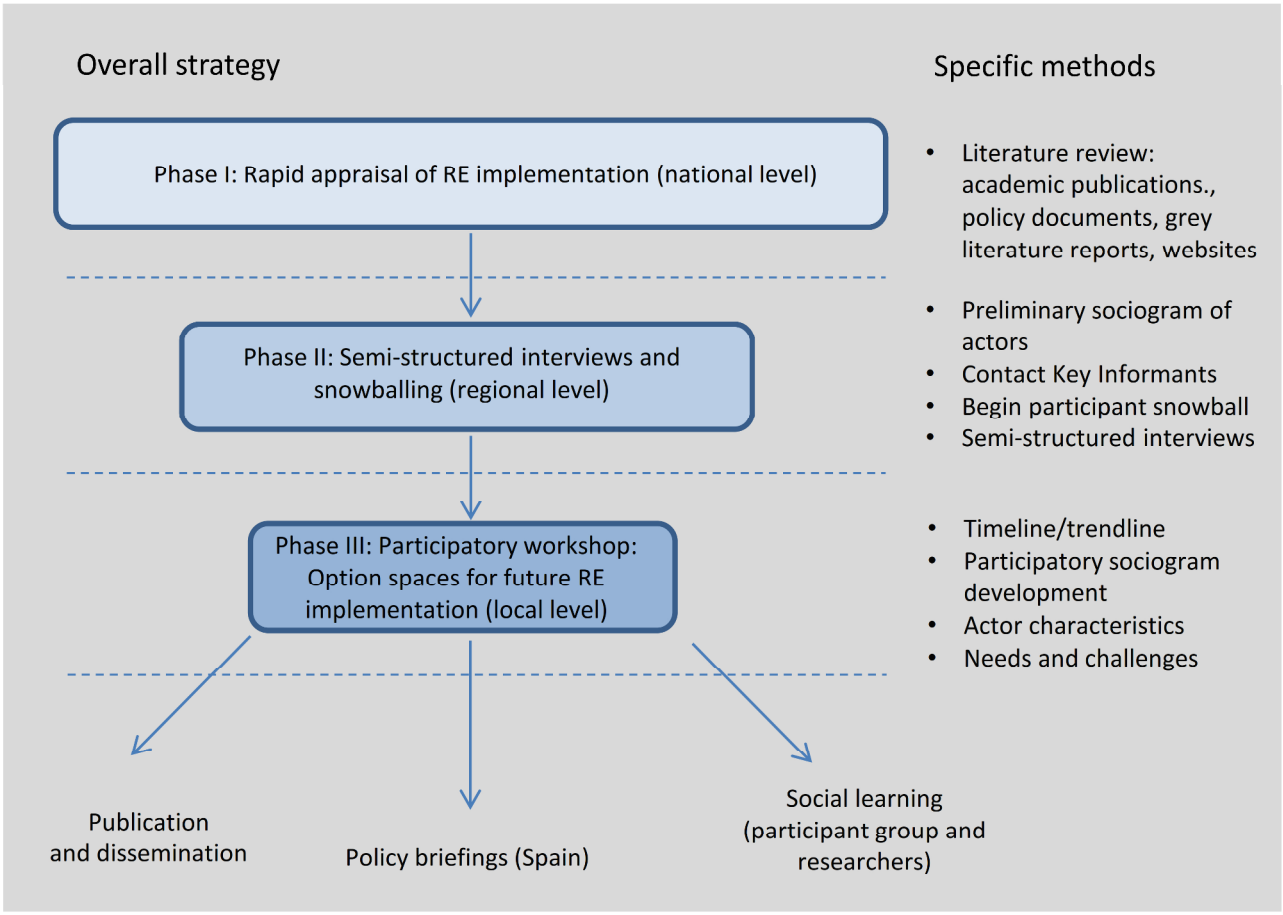
5) Affinity – the degree to which the actor is sympathetic towards implementation of the process for the relevant policy goal.

It is important to emphasize that this framework was treated as a loose operating strategy for structuring information, not as a straightjacket, we recognize that other participatory approaches may be equally appropriate (see: e.g. Lemon et al 1994, Barreteau et al 2003). However, we feel that complementing existing structured approaches to policy analysis, like CIT, with a systematic participatory methodology, like PAR does help to facilitate their practical application, bringing political science and action research communities closer together in the process. For our part, both policy scientists and action researchers in our team found working together an enjoyable learning experience, despite neither group having any practical experience of the other's approach prior to the start of the project.

In practice, two limitations of this approach emerged. Since PAR and CIT come from different epistemic communities, there was some overlap between them. For example, it was pointed out to us that motivation (from CIT) and affinity (from PAR) are quite closely related. However, we would argue that looking at the same aspect of actor behaviour from two different angles is not necessarily a disadvantage. With respect to the practical application of CIT in a workshop situation, we found cognition difficult to usefully determine from our participant's observational knowledge of the actors, and this actor process variable was not eventually used.

198 **4.3 Structure of the work**

199 To maximize the effectiveness of the resources at our disposal, we adopted a multi-level filtering
200 approach in which work at each level culminated in definition of the case study regions for the
201 subsequent level (Figure 2).



202

203 [Figure 2: Research method]

204 *Phase I: Rapid appraisal of RE implementation (national level)*

205 To begin our work, a desk-based assessment was conducted in which published, unpublished and
206 internet sources were analysed for the whole Spanish territory (17 autonomous regions and 2
207 autonomous cities). This initial survey revealed a great diversity of plans, policies, approaches and
208 implementation success stories that threatened to overwhelm the research team's capacity, so a
209 filtering process was initiated to identify 6 key regions that were representative of this diversity for
210 further study. At this point it was possible to identify key actors in RE in Spain, in terms of four
211 very broad sectors (Business, Education/Research, Civil Society and Public/Administration) using

212 the sociogram technique (Fig 2). These, the researchers' own, very broad approximations, were
213 modified in consultation with stakeholders in Phase II, and by stakeholders themselves in Phase III.
214
215 *Phase II: Semi-structured interviews (regional level) and snowballing*
216 Subsequently the team identified prospective key stakeholders both at National level and in each of
217 the 6 identified regions and contacted them by telephone. A "snowball" process was initiated
218 whereby stakeholders contacted facilitated access to additional, more appropriate or knowledgeable
219 stakeholders. The process culminated with a series of detailed semi-structured telephone interviews
220 with these key stakeholders for each region and at national level. This part of the research identified
221 the importance of the regional level for RE implementation and, in particular the need to establish
222 strong cross-sectorial lines of communication between actors.
223
224 *Phase III: Participatory workshop - option spaces for future RE implementation (local level)*
225 On the basis of the telephone interviews, the region of Navarre was defined for detailed case study.
226 Individuals representative of key actors in this region (e.g. Cooperatives, Environmental groups,
227 Energy companies etc.) were invited to participate in a workshop, which was held in Pamplona in
228 March 2013 (Table 1). The key objectives of this "problem-framing" workshop were to understand
229 historical RE development in Navarre, to analyse characteristics and behaviour of key actors in
230 Navarre with respect to RE, and to define future challenges for RE implementation. This
231 information was elicited through 4 structured activities; 1) Creating a Timeline (Figure 3); 2)
232 Creating a Trendline; 3) Defining key stakeholders and relationships using sociograms (Figure 4);
233 and 4) Needs and challenges in RE implementation. For a complete description of the methods used
234 please see: de Boer et al 2014 (freely available online).
235
236
237

238 [Table 1: List of workshop participants by organization]

Organization	Stakeholder Group
GOIENER	Social Movement-Energy Cooperative
BC3	Research Institution
ANSOLAR	SME
Navarre Regional Government (Industry, Energy and Innovation Department)	Public Institution
Navarre Regional Government (Rural Development, Environment and Local Administration Department)	Public Institution
Navarre Regional Government(Rural Development, Environment and Local Development Department)	Public Institution
Foundation CRANA	Environmental Public Institution
CENIFER	Public Institution
Noain Town Council – Local Agenda 21	Environmental Public Institution
Territorial Observatory for Navarre	Public Institution
Foundation MODERNA	Public/Private Partnership Institution
Pamplona Town Council – Energy Agency	Public Institution
Navarre University	Public Institution
Hidrosolar	SME
Navarre Regional Government (Land Planning Department)	Public Institution
Navarre Regional Government (Climate Service)	Public Institution
Foundation Sustrai Erakuntza	Environmentalist Group
Pamplona town Council – Energy Agency	Public Institution

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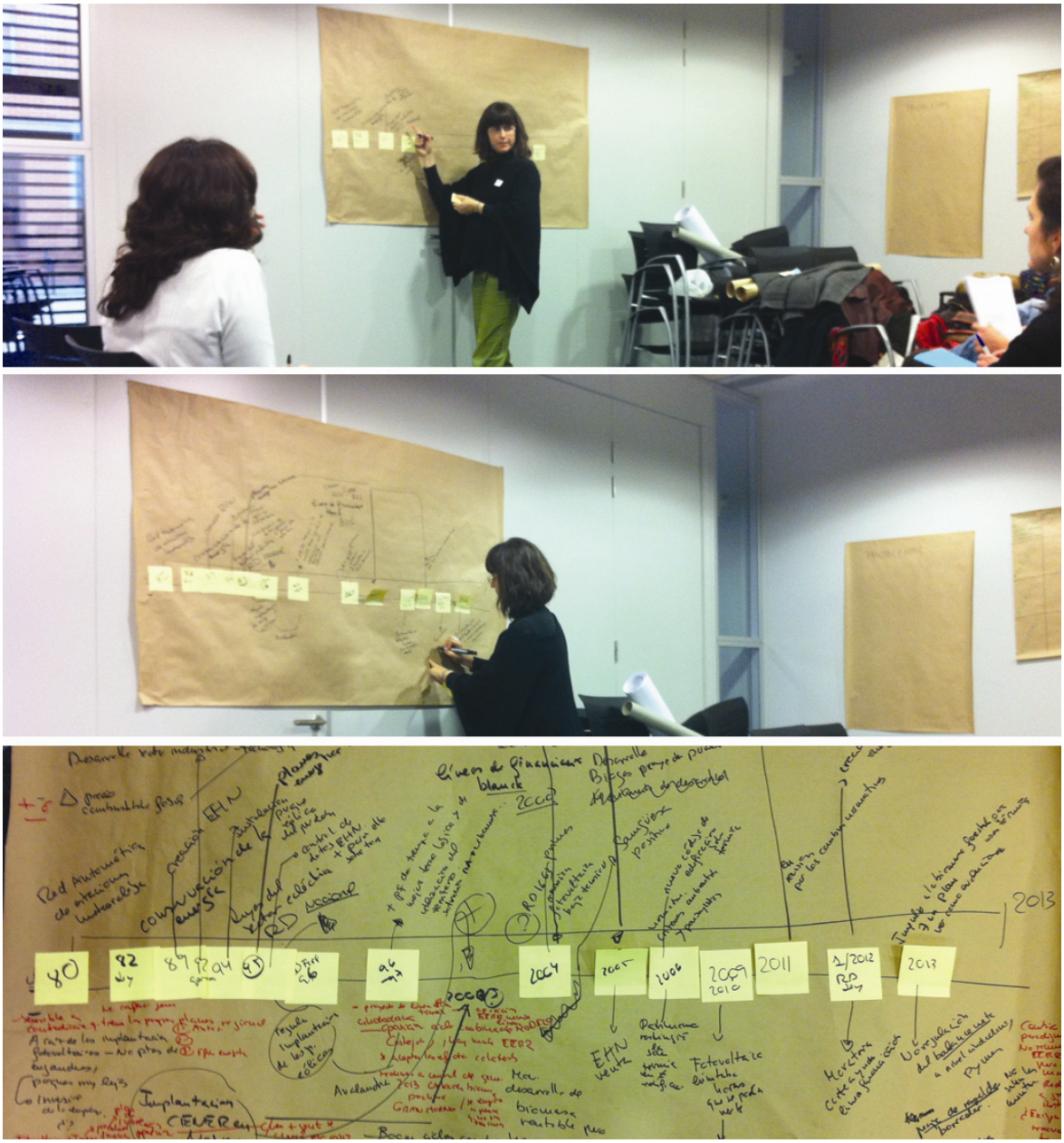
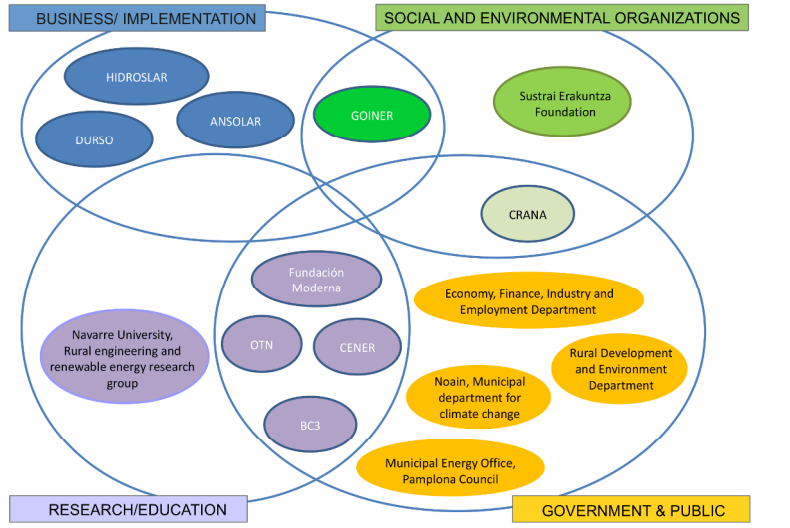


[Figure 3: From top to bottom: The workshop facilitator invites participants to contribute information to the timeline, which she writes on post-it notes and adds to the wall chart; workshop facilitator writing down explanations and remarks; final timeline at the end of the activity. The activity began with a single line on the wall chart and no other information. This activity served as an "ice-breaker". Participants were initially seated, but became more animated and involved as the timeline developed.]



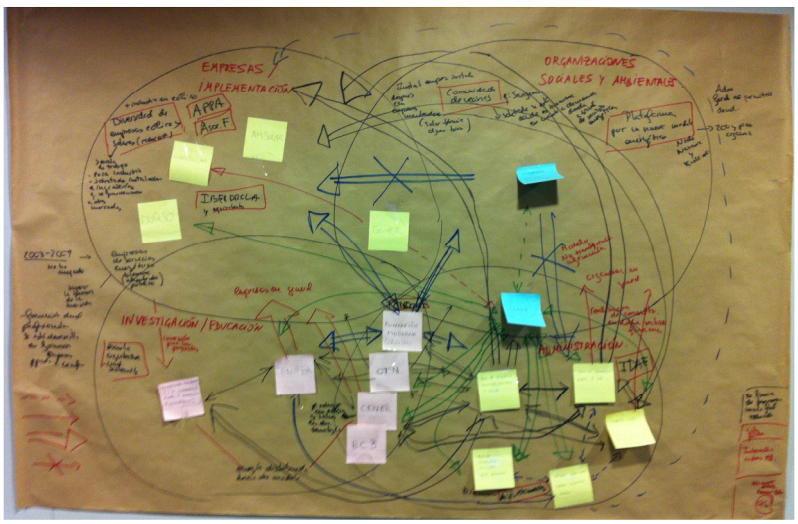


Figure 4: From top to bottom: The preliminary sociogram prepared by the research team for the workshop; Stakeholders completing the sociogram during the workshop; final sociogram at the end of the activity]

4 Results

4.1 Results of interviews with regional level stakeholders

Full treatment of the early phases of the work is given by Alonso et al (2016). One of the most important findings to emerge from this phase was the difference between Spanish regions. According to the stakeholders we interviewed, regions like Navarre have moved rapidly ahead in RE deployment, while other regions, e.g. The Rioja or Aragon have made much slower progress. In general, this was thought to be mostly due to the regional differences in the implementation process, and in particular, the configuration of the most important actors in RE identified in the sociograms; the business community, the regional administrations, scientific organisations and civil society (Alonso et al 2016). However there were some exceptions. In Castille-and-Leon, for example, wind power had developed rapidly since 2000, yet the process seemed mostly to have been driven by big business, with little connectivity between institutions. In both Navarre and the Canary Islands, strong links were found between different sectors and common workspaces between civil society and business were identified. In both these regions the regional administration was also an active participant in RE development. However, while Navarre had emerged as a clear leader, The Canary Islands, with some of the highest energy prices in Europe, a strong dependence on imported energy, a similar configuration of actors as found in Navarre and almost ideal natural conditions for renewables development, progress had nonetheless been disappointing. One possible reason could be the fragmented (rather than decentralised) electricity infrastructure, with 6 separate electricity grids. However, some sources have suggested that progress is being deliberately blocked because the current system is profitable to insiders (El Diario 2014).

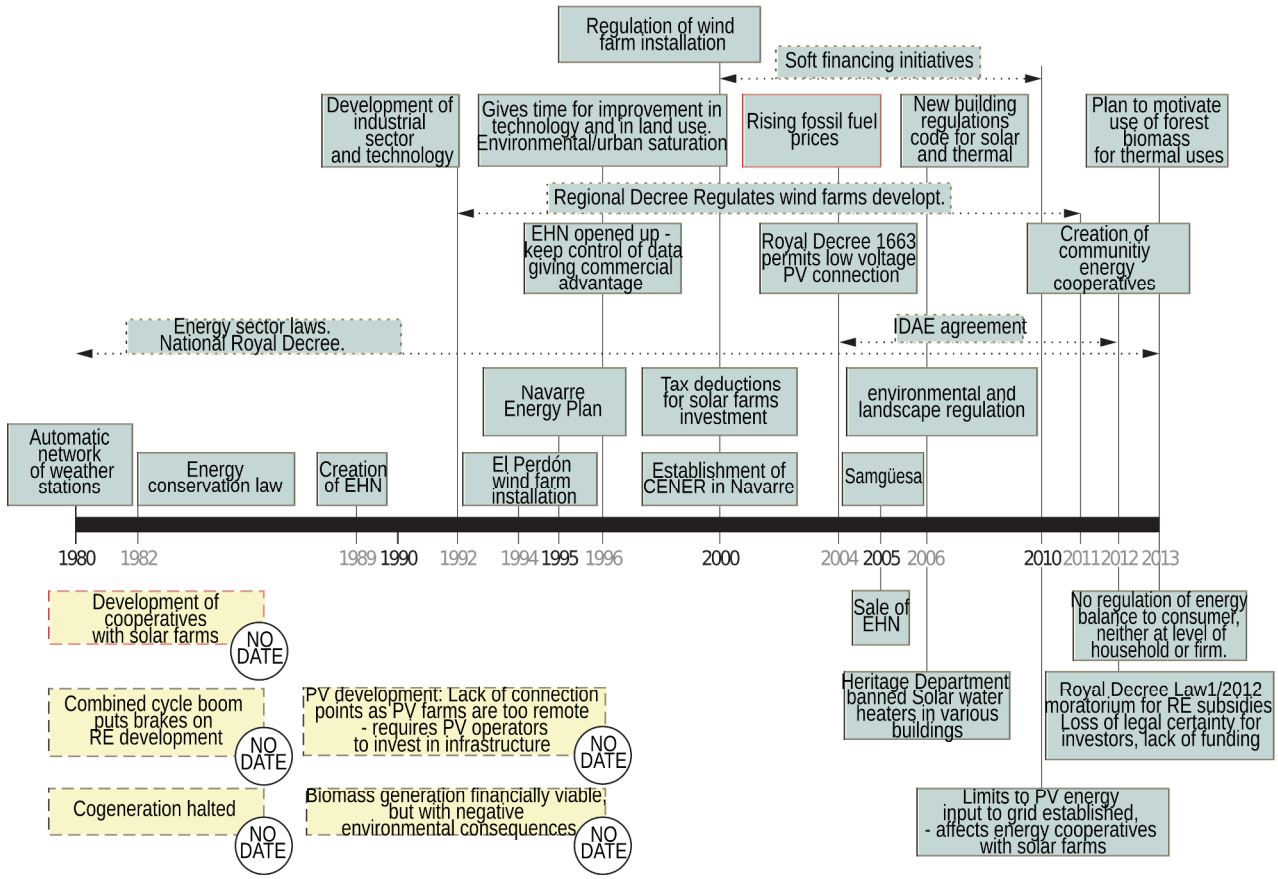
The first stages of work also enabled some key areas of conflict around RE development to be identified, some of which also subsequently emerged in the workshops. In particular, interviewees identified tensions between neighbouring regional administrations, e.g. Castille and Leon and Cantabria, over the inter-visibility of large wind farm developments across regional borders, as well

as the environmental impacts of large scale developments, which one interviewee (member of an environmentalist group in The Rioja) felt had not been adequately addressed. Finally, several interviewees felt that the distribution of economic benefits of RE implementation had not received sufficient attention at the planning stage. In particular, stakeholders objected to the way in which communities living in the vicinity of large scale RE developments, were expected to put up with their negative impacts but were not entitled to any of the benefits, e.g. from cheaper energy.

4.2 Results of the participatory workshop

Structured Activity 1 & 2: Timeline/Trendline

The completed timeline is shown in Figure 5. The complete information elicited from participants during this activity is can be found on p.58-9 of Boer at al. 2014 (freely available online). The results can be summarized as follows:



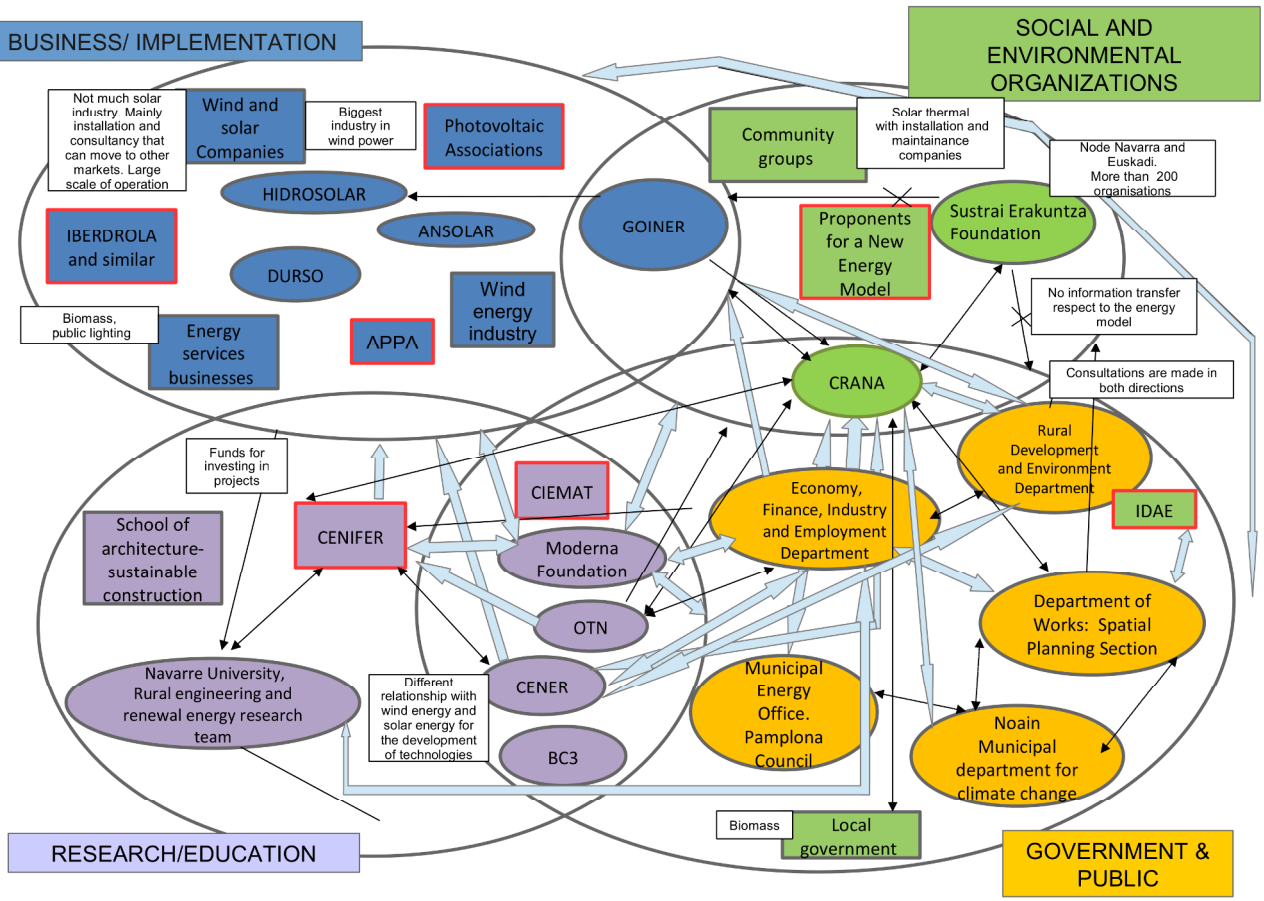
[Figure 5: The digitized version of the timeline for RE development in Navarre. Red borders

294 indicate that participants were uncertain as to whether the event in question was positive or negative
295 of RE development.]
296
297 RE in Navarre is a historic process that is fully embedded in territory and society, and has achieved
298 widespread general acceptance. However, conflicts are clearly present. Past development has
299 mainly been focused on large scale installations not on small-scale energy innovation at household
300 level. Participants were found to be strongly in favour of continued RE development in general, but
301 opposed to further large-scale windfarm development, which they regarded as having reached
302 "saturation point". Solar farms were viewed more positively, perhaps because they have less visual
303 impact than wind and their development is at a less advanced stage, but also because of the recent
304 emergence of small-scale solar cooperatives which offer more direct, responsible and equitable
305 energy supply to consumers than the conventional model in which very large multinationals
306 predominate.
307
308 Important structural changes have been made to the way that energy is produced and supplied to the
309 consumer through liberalization of the energy sector. Stakeholders highlighted the privatization of
310 the regional energy company EHN in 2005, which they considered a negative step, since the region
311 no longer has autonomy over its energy production. On the other hand, Navarre enjoys considerable
312 fiscal independence through the right to collect its own taxes, so could, in theory, continue to
313 incentivize RE production or offset the per kWh connection tariff for household RE producers
314 (introduced by the Law RD 900/2015 of 9th October) with its own resources. All participants were
315 strongly opposed to introduction of this tariff, which they saw as an intentionally erected barrier to
316 self-sufficiency. The increasingly centralized control of energy generation, distribution and supply
317 was strongly criticized by stakeholders, who proposed precisely the opposite, namely a
318 decentralized, distributed energy supply model with stronger local and regional public controls and
319 higher citizens' involvement. Such a model would imply an end to unpopular large-scale

developments in rural areas, and a stronger focus on developing energy installations on brownfield sites or areas already occupied by other uses. Distributed systems would decrease reliance on centralized network supply, reducing the grid loading and losses in transmission. Such a model would also imply loss of power, control and revenue for large energy suppliers. However, we note that the unanimous criticism of current policy by our stakeholder group is difficult to balance with any contrasting opinion due to the difficulty we experienced in engaging any stakeholder who might have supported these measures.

Structured Activity 3: Defining key stakeholders and relationships using sociograms

This process completed the transition from the preliminary sociogram developed by researchers to the participatory sociogram in which our widened community of participants were able to record their own knowledge of institutions and actors and the relationships between them (Figure 6).



[Figure 6: The final participatory sociogram.]

During the previous phase researchers had tried to engage the private sector. Five energy company representatives were invited to participate, all expressed polite interest, but none provided an interview or attended the workshop. In Figure 6 (at top left), one can see that workshop participants could identify relevant private sector organisations, but were unable to establish links between them. This is not, presumably, because no links exist, but rather because we were unable to involve any knowledgeable insider from the private sector in our process.

The most important organization linking the government and public sphere to civil society (social and environmental organizations sphere) was the publicly-funded Navarre Centre for Environmental Resources (CRANA), whose vision is ostensibly to promote "a new culture of sustainability" (CRANA 2016). However, stakeholders informed us that budget cuts and internal reorganisations had brought this institution to the point of closure. At the time of writing (July 2016), CRANA still maintains a program of work, offices and a small team, but it's not clear whether it is really an active concern. This seemed like a worrying development, since virtually all of the links between the public sphere and the social and environmental organizations sphere seemed to pass through CRANA. Relationships of conflict were identified between an environmental organization, the Sustrai Erakuntza foundation and the public and business spheres in general. In general, workshop participants with a professional interest in environmental issues expressed concern about the negative environmental impacts of RE development in the past and the lack of consideration given to the environment in renewable energy development.

The Navarre region is unusual in comparison with other Spanish regions in having such strong connections between the spheres of action involved in RE, especially between business and implementation, scientific or educational organizations, and the public sector. These robust and open lines of communication and information sharing across spheres of action seemed to be the most probable explanation for Navarre's pioneering role in Spanish RE development.

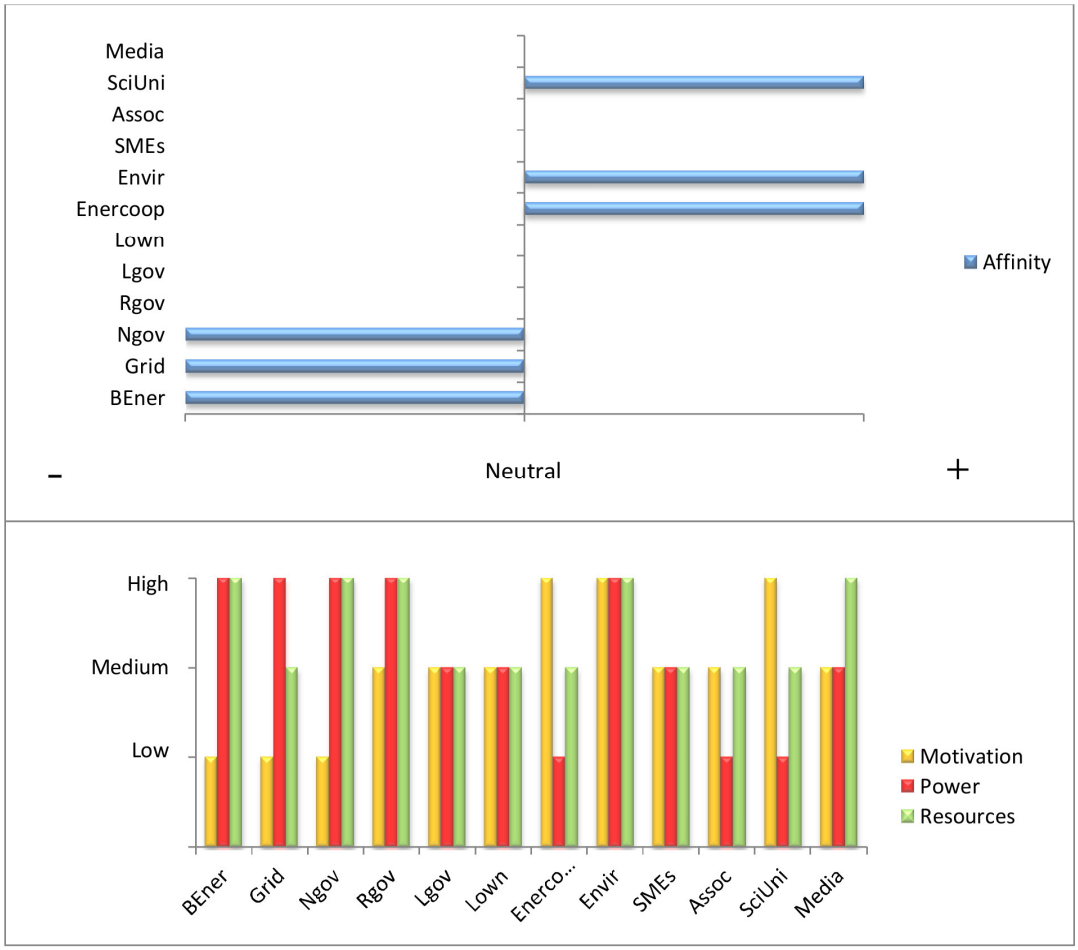
Structured Activity 4: Needs, challenges and actor characteristics

Stakeholders identified 8 priorities for implementation of RE (Table 2). Unsurprisingly, given the national government's decision to abolish subsidies for RE in 2012, and the subsequent paralysis in RE implementation, legislation and legislative stability came top of the list. Second, stakeholders considered that a long term strategic national energy policy should be developed to insulate the system from uncomfortable policy shocks. Third, the powerful energy lobby represented by the large energy generators, suppliers and distributors should be seriously addressed by policy makers. Priorities 5, 6 and 7 all related in various ways to what participants considered to be a lack of information in the system – either deliberate misinformation from the energy lobby, for example, the much circulated idea of RE as intrinsically higher cost than fossil sources[2], or absence of trustworthy information from reliable sources to counter the lobbyist's claims. Participants identified a general lack of awareness towards energy efficiency of the various options, presumably a reference to the continuing attempts by lobbyists to paint RE as inefficient and unreliable. Finally, participants felt that insufficient legal support was available to energy entrepreneurs, such that private investors could (and indeed did) find themselves facing closure and heavy losses as a result of government policy U-turns.

[2] In fact this depends on a large range of factors, e.g. type of subsidy model, existing subsidies for fossil fuels, length of time in operation of an installation etc., such that, in many cases, RE may actually lower costs – see, e.g. Bean et al 2017. It is also important to be clear whose costs we are referring to – e.g. government, investor or consumer.

PRIORITY	PROBLEMS IDENTIFIED BY STAKEHOLDERS
1	Legislation
2	Lack of a strategic national energy policy in the long term
3	Energy lobby (oligopoly)
4	Centralised model of distribution
5	Bad press for RE coming from energy lobby
6	Lack of trustworthy information on RE (publicity campaigns)
7	Lack of awareness about energy efficiency
8	Lack of legal support

[Table 2: Stakeholders' 8 priorities for implementation of RE, reduced down from 30+ problems identified.]



[Figure 7: Characteristics of key actors in the renewable energy sector in Navarre, according to workshop participants.]

The results of stakeholders' analysis of actor characteristics are summarized in Figure 7, and presented here by actor:

Regional Government (RGov)

Stakeholders identified the regional government (Rgov) as a powerful actor (on account of its ability to use legislative instruments or policy to promote renewables development), with plentiful resources, but neutral in affinity, and only moderately motivated to promote further RE implementation. This pessimistic analysis can be supported by the decision to withdraw funding from CRANA, the only major public body in Navarre actively promoting renewable energy linking to civil society (Fig. 6).

National Government and Big Energy (NGov, BEner)

Both the national government (NGov) and the large energy companies (BEner) were also regarded by stakeholders as very powerful, currently opposed to further RE development and therefore unmotivated to implement it. The conclusion of our participant group that the government is opposed to RE development can be corroborated from a number of separate sources:

Firstly, the telephone interview carried out as part of phase II of our research (Alonso et al 2016) with a representative from the Institute for Diversification and Energy Savings (IDAE) of the Ministry of Industry, Energy and Tourism was revealing. The interviewee confirmed that RE subsidies had indeed been removed, citing the previous government's "poor legislation" as the motive, but stated that the government recognised the need for RE to have appropriate economic incentives under the current National Renewable Energies Plan [2011-2020]. The interviewee also stated that new RE systems are not being installed because they cannot compete on price. Since no

409 replacement regime has emerged, in spite of the apparent recognition that it is necessary, it must be
410 suspected that the government is not greatly interested in promoting RE.
411
412 Secondly, the secretary of state for energy, addressing the 2015 meeting of the Spanish Energy
413 Club, made it clear that promoting renewable energy is not a government priority. This is because,
414 he asserted, that renewable energy is expensive and intermittent and that to achieve 100% RE by
415 2050 (sic) is inviable (Club Español de la Energía 2015, p. 16).
416
417 Thirdly, in addition to law 1/2012 of the 27th January, removing direct subsidies to RE, two further
418 laws on RE have been deployed. The first of these, Law 24/2013 of the 26 of December makes
419 prosuming[3] inviable by abolishing the feed-in-tariff (FIT) (and replacing it with a per kWh charge
420 known as the "peaje" or toll). FIT is regarded as an effective tool for encouraging rapid and
421 sustained deployment of RE (Couture and Gagnon 2010), and was certainly one of the key pillars of
422 the Spanish renewables boom (e.g. del Río González 2008, but see also Dinica 2008) so it's hard to
423 see how the government could have intended to promote RE development by removing the FIT. The
424 second, RD 900/2015 of 9th of October substantially increases charges to grid-connected
425 consumers with accumulation (battery storage). So it seems that the government doesn't want to
426 encourage self-consumption either, since the consumer who cannot sell their energy to the grid and
427 cannot store it has little alternative but to buy from the market. These laws seem largely aimed at
428 shoring up consumer demand and raising revenue to reduce the government debt to the electricity
429 companies, known as the tariff deficit[4], rather than promoting RE.
430
431

[3] *Prosumers* are citizens or organisations who both produce and consume energy, typically householders with RE installations who "feed-in" to the electricity grid.
[4] The tariff deficit (*déficit tarifario*) is a source of much controversy. It refers to the difference between the price the government allows the electricity companies to charge the consumer and the price that electricity companies claim they need to charge to be profitable. This exists as a government debt to the electricity companies and appears as an asset on companies' balance sheets.

National Electricity Grid (Grid)

The characteristics of BEner and NGov were shared by the national electricity grid (Grid), perceived by participants as having fewer resources at their disposal than BEner.

Environmentalists' Groups (Env)

The only powerful actors regarded as supportive of further RE implementation belonged to the Environmental sector (Env). Despite the high motivation and availability of resources attributed to these groups, environmentalists' organizations suffer from the difficulty of establishing a common position, for example, while "Big Green" organisations like Greenpeace and Friends of the Earth are supportive of renewables, regional groups like Sustrai Erakuntza are likely to oppose specific projects on the basis of their landscape impacts.

Land owners (Lown)

Land owners were regarded by stakeholders as indifferent, with moderate power, motivation and resources. This is because it is difficult to generalise – land owner behaviour would depend on individual motivation, influenced by characteristics like land quality and type, size of holding and location.

Local government (Lgov)

This actor was also considered to have moderate power, motivation and resources. In fact, our research demonstrated considerable variety in motivations between individual municipalities, and, as with land owners, it is difficult to generalise. Specific municipalities like Noáin, in the suburbs of the regional capital Pamplona, have shown how clear leadership on renewables from the local government, combined with strong support from citizens can be transformative at local scale. However, in other areas such as the Pyreneen region of Navarre, municipalities may be wary of large-scale renewable development on account of its visual impact on traditional landscapes.

458 Stakeholders in these areas have also criticised the "extractive" mentality of developers, where
459 municipalities are given payoffs, but no control over energy supply nor any cut of the profits, which
460 all go to external, often multinational, private interests.
461
462 *Energy cooperatives (Enercoop)*
463 Energy cooperatives like GOIENER (Enercoop) were perceived as supportive of further
464 (sustainable) RE implementation, but these actors were considered to have little power.
465
466 *Community groups (Assoc)*
467 *Assoc* were considered to lack power and to be indifferent to the objective, though clearly this
468 would depend on context and individual cases.
469
470 *Research and Education*
471 The research and education sphere, while considered to be strongly motivated in favour of further
472 renewable development and moderately well-resourced, was perceived as lacking power.
473
474 *RE sector SMEs*
475 RE sector SMEs, also considered to have little power, were also identified as indifferent to the
476 achievement of the objective, which seemed surprising since their business model would depend on
477 it. It may be that participants emphasized the difference between sustainable implementation of RE
478 and simple implementation in this case – SMEs in many cases are likely to be motivated by the
479 need to generate income, rather than environmental or sustainability criteria.
480
481 *Media*
482 Finally, the media were perceived as well-resourced, with moderate power and motivation, but
483 largely indifferent to further RE implementation. Again, there is likely to be a great difference

484 between local and national media. Nonetheless, the stakeholders' analysis chimes with the well-
485 known tendency of media in general to tailor information to what is most likely to please their
486 target market – a perceived indifference to RE implementation may be representative of the attitude
487 of the population as a whole.
488
489 **5 Discussion**
490 The integrative case-study we have just described was one of several undertaken by the COMPLEX
491 team. Parallel studies with different methods, aims and stakeholder communities were undertaken in
492 Norway, Sweden, Italy and the Netherlands with a view to preparing a comparative report on
493 opportunities and obstacles of a range of methods and research contexts. In addition to this work,
494 COMPLEX was required to build a repository of 'techno-economic modelling tools' and databases.
495 Our principal stakeholder, DG Research of the EU, is strongly committed to a technocratic
496 approach to systems management and change. However the global financial crisis of 2007-8 and the
497 need to move quickly in order to achieve a transition to clean energy resulted in a strong emphasis
498 on stakeholder engagement, political turbulence and rapid, irreversible change.
499
500 In this closing section, therefore, we will reflect on the case-study just described from two
501 perspectives. In 5.1 we will consider the Region of Navarre in its Spanish and International settings
502 and try to draw on insights from other COMPLEX activities. In 5.2, we will switch perspective, to
503 look at the Spanish case study from a technocratic perspective. Given that COMPLEX is a
504 technocratic project, has our preoccupation with unacknowledged stakeholders and widened
505 participation provided substantial value-added?
506
507 **5.1 The clean energy transition in the Navarre region**
508
509 In the 1980s Spain embarked on a process of RE development that encouraged many to hope for an

innovation-cascade. The citizens of Navarre were enthusiastic and the region is still one of the most progressive regarding RE in Spain. However the momentum has been lost. Participants identified a wide variety of challenges for 2020 and 2050, at national and regional level that must be overcome if Spain's energy transition is to be successfully completed. The most important factors are likely to be the legislative stability and judicial security needed to encourage investors to return to RE, along with a much stronger involvement of civil society, in particular the energy cooperatives, which are an emerging force in Spanish society (Capellán-Pérez et al 2016).

Our work in Spain led us to make a number of suggestions, which we believe would redistribute adaptive potential and allow unacknowledged stakeholders to contribute more productively to a true clean energy transition. These include:

Decentralisation of energy production and distribution

Strong top-down control of energy production and energy distribution by a small group of commercial actors is inimical to RE development. Under the prevailing, liberalised model, democratic governments have no control of either energy production or energy distribution, and their power is limited to subsidy or veto. The Spanish grid operator, Red Eléctrica Española, a private firm with protected “sole transporter and operator” status, is simultaneously unaccountable to the public and immune to competition. In the opinion of our stakeholder group, RE development in Spain requires a decentralized model of energy production and distribution. Decentralization continues to be a key issue in other countries, e.g. Germany (Fuchs et al 2012, p. 23-5).

Legislative stability

Legislative stability, our stakeholders argued, was a prerequisite of a successful energy transition. If governments have the power to overturn previous initiatives through the ordinary legislative process, then investors will lose confidence and development will stall. Major national policy

changes that reduce compliance of climate change obligations should not go unnoticed. It is hard to see how this can be reasonably addressed without compromising the subsidiarity principle on which successful European cooperation depends. But, at present, there is no widely agreed mechanism to punish freeriders, though this question is likely to become more pertinent following the withdrawal of the US from the Paris Accord.

Lobby power of Big Energy

Declining energy demand combined with over-capacity in fossil energy sources seems to have caused lawmakers to take fright and establish a series of counter measures to put a brake on the energy transition. The explanation that nearly all stakeholders give is that the large energy companies, fearful of losing their monopoly power and vulnerable to falling energy demand have exerted powerful lobby pressure. They found a sympathetic ear in a big-business-friendly government happy to make renewables an early victim of their austerity policy. This factor, the power of the large energy companies, was signalled by stakeholders as a particularly important challenge. The dominance of a handful of large companies in the Spanish energy markets has long been a matter of concern (e.g. Barquin et al 2006, Ciarreta et al 2016), and changes in the structure of wholesale electricity markets arising from the introduction of renewables affects utility profitability, giving large generators and suppliers a plausible motive for wanting the brakes applied to renewables (Lockwood et al 2016). However, since no representatives from Big Energy were present, this hypothesis, although plausible, must necessarily remain in the realm of speculation. Our process however, remains open, and we are keen to hear from private sector stakeholders who can offer a counter-argument that explains this sudden policy shift.

Austerity economics

As an earlier COMPLEX paper (Hasselmann et al, 2015) has explained, most cost estimates for climate-change mitigation lie in a range between 1 and 4% of GDP, so it is surprising that the strong

562 international consensus established in the run-up to the Paris Accord did not produce more
563 impressive results. One of the key reasons for the declining interest in renewable energy following
564 the 2007 crash has to do with economic choices made by business-as-usual actors, who were, in
565 effect, political incumbents whose policies had contributed to the crash in the first place.

566 Most of those incumbents were strongly committed to a *laissez-faire,* Milton Friedman style of
567 economics that became influential in the 1980s and gradually replaced the older model of a
568 regulated market, with targeted Keynesian stimuli used in periods of recession. To these actors, an
569 austerity approach was the obvious solution. The reasoning is quite simple. Institutions must
570 balance the budget by reducing government spending and increasing taxes. That will slow the
571 market down, reducing demand, and suppliers will be obliged to reduce prices, resulting in an
572 internal devaluation driven purely by market forces. That is the theory; in practice, however,
573 companies often respond to reduced demand by laying workers off and holding prices steady. The
574 result is a financial ratchet that deepens recession and aggravates social exclusion. As the real
575 economy shrinks, governments unable to service their debts are forced to borrow more to meet the
576 shortfall. Banks print more money, which they lend to polities that have no hope of balancing their
577 budgets on terms of ever-deepening austerity.

578 A more co-operative, Keynesian response would have been possible, but attempts to devise a
579 suitable policy were frustrated by manifest conflicts of interest between northern and southern
580 Europe. Had the stronger economies of northern Europe chosen to invest in renewable energies as a
581 means to rebuild the shattered economies of the south - a Green Marshall Plan - instead of pouring
582 money into unpayable loans to rescue inviable financial institutions, some of these conflicts of
583 interest could have been overcome (Creuzig et al 2014, Hasselmann et al 2015).
584
585 Although these opportunities were missed in the later noughties of the 20th century, a reversal of
586 these austerity policies is still possible, but incumbent actors are now defending entrenched

587 positions. The emergence of anti-austerity parties in Southern Europe, the recent Brexit vote and the
588 US claims to have withdrawn from the Paris Accord, all suggest that policy change, if it comes, will
589 involve substantial political and institutional turbulence. It could even see Europe sliding into war
590 or nation-states driven to political revolution.
591
592 **5.2 The integrative approach and techno-economic models**
593 The integrative process we trialled here enabled us to build a model of the actor community around
594 RE by snowballing information obtained through conventional desk-based research and telephone
595 interviews. As our understanding of the stakeholder community developed, we widened
596 participation, trying to create a larger team to represent it. We believe that most, if not all, of the key
597 stakeholders have now been identified, and the interaction between them with respect to the process
598 of energy transition under investigation is well understood. This benefit alone must be sufficient to
599 justify recommending integrative approaches to other research teams, particularly those interested
600 in 'participatory modelling' exercises, where external stakeholder communities work with natural
601 scientists to develop models that adequately reflect the diversity of viewpoints and perspectives.
602 From a purely scientific perspective, the additional effort involved in mounting an integrative study
603 was fully justified.
604
605 The method allowed us to define stakeholder characteristics in terms of motivation, resources,
606 affinity and power. We found it particularly helpful in Phase I, the conventional, desk-based social
607 science approach, to invest time and energy in constructing a defensible understanding and
608 maximizing stakeholder diversity. Phases II and III, in which participation was widened, provided
609 valuable opportunities to extend, revise and rebuild this conceptual model, a process that enabled all
610 of us, researchers and external stakeholders alike, to achieve a sense of confidence in these insights
611 that could not have been won by simply parachuting modellers in, grabbing data and building a
612 conventional hard-science model.

5.3 Conclusions

Our project, drawing on earlier literature and modelling work carried out by other members of the COMPLEX team, has emphasized the importance of economic policy instruments like feed-in tariffs and carbon taxes (see, for example, Dinica 2003, 2008, Ruiz Romero et al 2012, Voinov & Filatova, 2014). However our own work suggests that economic incentives and policy instruments will only help if institutional conflicts of interest are resolved. The impression we have obtained from this exercise has been that the national and supra-national agencies exhorting us to innovate and setting hard targets for RE development and carbon emissions in 2020 and 2050 are critically dependent on multi-nationals, utilities and economic processes whose resilience these innovations would undermine. To put it starkly, it is as though the process of RE development is being driven by political institutions with one foot on the accelerator and the other on the brake. Both pedals are flat on the floor and there is little movement. If the brakes were to fail, the process would accelerate rapidly and political institutions would lose control. If the engine were to stall, the process would fail completely.

This combination of economic accelerator with political brake has destroyed the resilience of RE implementation in Spain. Here the green energy "transition" shattered into fragments when the financial crisis of 2007 initiated a chain-reaction of defensive responses and economic collapse. We need to engage with all the actors involved in the energy sector, from citizens and local cooperatives to the energy giants, but this seems unlikely to happen unless a more appropriate balance of power and accountability can be negotiated between incumbent and non-incumbent stakeholders.

In our experience, participatory processes like those we describe here, in which value judgements about the usefulness and quality of information from certain types of stakeholders are suspended in order to achieve greater understanding about a common problem, are rare. Policy makers in

particular prefer to keep the circle closed, limiting consultations to powerful business leaders and establishment accredited experts, while scientific experts and policy analysts sometimes imagine that nothing can be done unless they are speaking directly to power. The result is a council of wise heads who all agree with each other but miss all but the most obvious bumps in the road. This kind of groupthink leads to serious failures at the policy implementation stage, and if left too long, can lead to political turbulence and catastrophic change.

Despite the pessimistic outlook generally, the motivation of regional level stakeholders remains high, something that was also found in some other regions studied which suggests that, given a change of political climate, renewed development could be achieved. The desire for innovation is strong, but potential innovations are suppressed and vetoed by institutions anxious to protect the resilience of traditional economic structures. We suspect that, if this veto were to soften, an innovation-cascade would be much more likely. To soften this veto, it is necessary to tip the balance of power away from existing incumbents and towards smaller scale, more flexible social structures and institutions.

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