



Research paper

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



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ARTICLE INFO

Keywords:

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

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.

1. 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 [1], 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 [2], as consumption of brown coal has increased along with the proportion of renewables in Germany's energy mix [3].

The United Kingdom, another major emitter, has made progress on

decarbonisation, but has recently cut public support for solar energy [4]. Given the apparently ambitious aims of UK policy makers, progress there has in any case been rather slow [5]. 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 [6]. 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:

“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

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

energy targets appear achievable.” [2]

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 [7], 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 [5]. Sustainable energy transitions are thus profoundly political in nature [8], and understanding inequalities of power between actors in the energy system is key to understanding transitions as a whole [9].

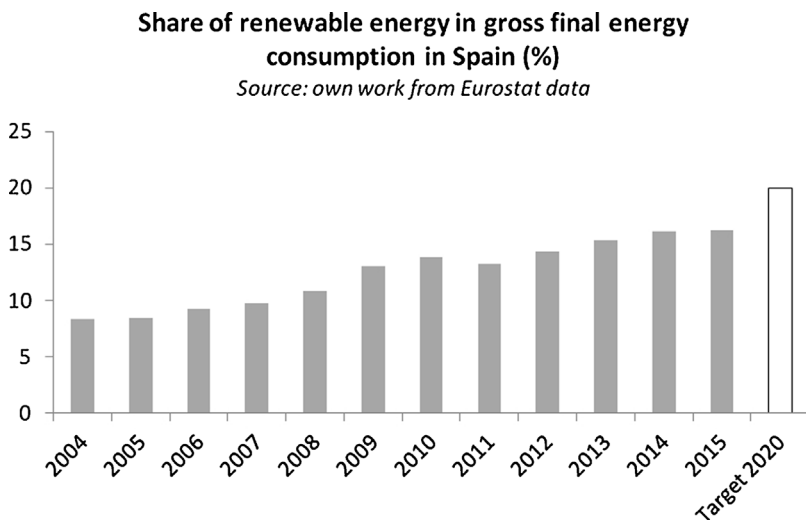
In line with this earlier work, our present paper addresses the political aspects of the transition to a low-carbon society by analysing the balance of power between incumbents and other social actors through a detailed case study in Spain, which was once at the forefront of the clean energy transition. Our approach links policy implementation theory (e.g. [10]) with action research (e.g. [11]) 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. [12]) and the marked slowdown of subsequent years (Fig. 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?

2. Theoretical approach and methods

2.1. 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 [13] COMPLEX was actively engaged with stakeholder communities in Norway, Sweden, Italy, Spain and the Netherlands [14]. The participatory approaches employed as part of this process of stakeholder engagement fall under the definition of integrative research (e.g. [15]). 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.

2.2. 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) [16,10,17], and a well-known form of action research called Participatory Action Research (PAR) (e.g. [18,11,19]).

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,

Fig. 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.

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