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Review

Towards a cross-paradigmatic framework of the social acceptance of energy systems

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ABSTRACT

As the significance of public opinion and practice for energy system change has become more widely understood, an expanding body of work is investigating drivers of social and public acceptance of a wide diversity of energy technologies, both infrastructure and end-user applications. The literature is large and spans multiple contexts, methods, theoretical and disciplinary perspectives and paradigms. While this diversity is in many ways healthy, experience suggests that it can be confusing for those without close knowledge of its constituent parts. Here we set out a framework for thinking about energy technology 'acceptance' that is relatively neutral in normative and theoretical terms, while acknowledging that a full integration of perspectives and complete theoretical neutrality are not possible. We do not claim a comprehensive review base, but draw on our experience to illustrate the diversity of what we regard as the more influential perspectives in the literature.

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1. Introduction

Energy and environmental targets imply significant changes to energy systems. In particular, decarbonising those systems while ensuring sustainable, affordable supply, has major ramifications for publics asked to accept new energy infrastructure and technologies and to change patterns of demand [1]. Related public opinion, perceptions, acceptance, attitudes, behaviour, values and practices have all become matters of importance for governments, the energy industry and academics alike [2–5]. In particular, the way in which some renewable and non-renewable energy infrastructures have faced opposition from the local communities where they are constructed, while others coexist harmoniously with local communities [4,6,7], has contributed to an increasing interest in understanding the factors driving societal and public reactions. In

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general in the energy field, social acceptance has increasingly come to be regarded as a one issue among many that shape the successful implementation of new developments and policies. In a sense, social acceptance has become one of the most policy-relevant social science concepts in the field of energy technologies.

In line with this tendency, a substantial number of sociological and psychological studies have investigated, in the last decades, the levels and drivers of social and public acceptance of a wide diversity of energy technologies and applications. These studies have taken place in multiple contexts, from the country level to the local and household level. Sociological approaches have generally not used or emphasized the term 'acceptance', but the insights gained nonetheless have a strong bearing on understanding energy technology and policy acceptance (e.g. [8]). Often, though, acceptance has been more centrally a part of the researchers' perspective, as in nationally representative or case specific attitude surveys [9,10]. The number of relevant studies is substantial: even the number of nationally-specific studies, i.e. in a single country, can run to hundreds and span public attitudes and levels of acceptance with respect to nuclear energy, hydrogen, CCS, wind, biomass plants and other renewable and low carbon energy technologies [11,12]. Similarly, a wide variety of studies based on different approaches and methodologies, mainly case studies, have been thematically-focused, addressing key elements involved in the interaction between energy developments and host communities [13].

This recognition that public acceptance is an influence on technology development, installation and use has raised many questions about the complexity of processes shaping public responses to energy technologies and infrastructures at different levels [2]. It has also raised questions about its policy and practical implications [14] and about the conceptual, definitional and methodological basis of research on social and public acceptance in this area [15–17]. Although there have been significant contributions in terms of describing the social and public acceptance of various energy technologies in multiple contexts, as well as in terms of understanding the factors influencing this, there arguably remain not only conceptual and analytical issues yet to be clarified and pursued, but also the matter of competing or alternative paradigms has become somewhat vexed in the sense of sometimes becoming polarized in terms of preferred perspectives [18].

Our contribution in this area is intended firstly to be definitional and typological, something that we view as being important for enhancing the effectiveness of acceptance work [19]. This call for a revisiting of definitions of public acceptance of technologies in general is not new [20]: the latter is from 1987, refers to the "significant definitional problems attached to each of the concepts 'public', 'acceptance' and 'new technologies' and the need to provide working definitions of these. Secondly, though, we also aim to set out a simple framework intended to bridge perspectives through its generality, while recognizing that at specific levels of attributed causality and conception, sociological, psychological and technical accounts have marked and ultimately irreconcilable differences [21,22]. Yet despite these differences, there are points of *contextual* connection in sociological and psychological accounts of energy-related behaviour [23–25]. That is, while epistemological and perspectival differences cannot be bridged in their own terms, their referent contexts are shared, even if these are characterized in different ways.

There are other proposals for synthesizing the variety of contextual and psychological factors operative in this context [26,27], both in agreement with each other and built upon here by drawing on Wustenhagen et al. [15]. However we seek to add to such syntheses in several ways. Firstly by emphasizing, distinguishing and classifying in terms of the main levels at which acceptance can be studied, and distinguishing the main classes of referential object, distinctions that are apparently simple, but which nonetheless we consider too often obscured by variable-level and cases-specific detail. Secondly, we provide an overview of a number of theories and perspectives that we believe to be influential, reflecting personal involvement in and perceptions of the field, rather than bibliometric study. Thirdly, we also discuss the differing policy implications of alternative perspectives. For example, while sociological perspectives arguably have considerable explanatory value, they also pose significant policy challenges, ultimately implying wholesale changes to deep social structures [22]. The psychological focus on changing attitudes and behaviour through messaging may be viewed by contrast as insufficiently attentive to structural context, but it is not difficult to see why this may be a more attractive option for those responsible for policy budgets in this context.

It is notable that one of the more pragmatic accounts of practice theory as set alongside other perspectives is [28], which takes a direction towards recognizing the value of multiple levels of analysis that we would encourage, is in the grey rather than academic literature. While there is in general a recognition of the need for more systematic research on social and public acceptance of energy technologies, driven by a perceived need for coherent theoretical frameworks, explicit definitions of concepts and the use of innovative methodological tools [16,15,29–32], it is arguably not straightforward to produce integrative frameworks that are both clear and comprehensible for non-specialists, while also being satisfactory to those either with strong disciplinary affiliations in the social sciences, or to those simply aware of the real differences in the ways in which different perspectives within the social sciences approach 'acceptance' of energy technologies.

With the above in mind, and reflecting the view that it is preferable to set out even a simple framework rather than leave those new to the literature to make their own sense of it over time, the purposes of this paper are: (a) to provide a broadly applicable analytical framework for the study of the social acceptance of energy technologies, infrastructures and applications; and (b) to identify a set of definitional research challenges and questions intended to support further research across paradigms. The intention is to provide an analytic framework that is of broad relevance, rather than to be strongly subscriptive to, or advocative of, any particular theoretical perspective. That said, we are very aware that concepts cannot be wholly theory-free and that this inevitably colours attempts to be integrative, even if this is at a general and referential level.

As the term 'acceptance' would seem to have its origins in the discourse of technology diffusion, we take the diffusion concept of acceptance as a starting point in our discussion of theory below. Overall, the analytic framework aims to encapsulate a broad range of acceptance usage and conceptualization, distinguishing rather than conflating, with a view to aiding specificity. While cautious of advocating the mixing of ontologies [33], we have sympathy for the bricoleur's pragmatic principle of acknowledging value in a range of perspectives [34] and hence the value not only of deploying multiple perspectives and methods to shed different types of light on different aspects of a problem, but also of finding ways by which the knowledge gained thereby can be at least partially integrated.

The paper is structured as follows. In Section 2, we describe our method, introduce the role of social acceptance in technology implementation and adoption and set the scope of the study. Section 3 provides the elements of an analytical framework for studying the social acceptance of energy technologies. Section 4 discusses some of the methodological challenges that, in our view, the psycho-social research on the social acceptance of energy developments faces.