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Investments in renewable electricity production: The importance of policy revisited

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ABSTRACT

Finding ways to encourage investments in renewable electricity production is crucial to reach a transition to a sustainable energy system. While in the energy policy literature, investments are usually explained by economic or regulatory policies, recent studies have suggested that some investors are boundedly rational and may respond differently to policies. In this paper, a framework is proposed to make a more complete analysis of the institutional demands influencing emerging investors in renewable electricity production. Based on 35 cases, both formal and informal demands were identified and their impact on emerging investors' behavior was analyzed. Results show that besides formal institutional demands, emerging investors were influenced by their task environment and by various informal demands which originated in investors' collective and internal contexts. However, different investors were affected by different institutional demands. They also responded in different ways to the same demands; while some perceived a specific demand as imposing, others regarded it as inducing. These findings provide a better understanding of the institutional forces affecting emerging investors in renewable electricity. The paper suggests new policies to handle the heterogeneity of investors and opens up for a new panorama of informal policy channels, where network effects can be utilized to trigger emerging investors' decisions.

1. Introduction

In recent years, a large number of actors have invested in renewable electricity (RE) production,[1] including not only established electricity producers, such as big utilities and municipal or regional energy companies, but also emerging investors such as individuals and households, cooperatives, project developers, farmers and companies diversifying from other industries [2,3]. Considering the limits to government investment budgets, such investors are important in order to achieve a transition to a more sustainable energy system [4].

In the energy policy literature, this trend is explained by referring to the energy policy instruments that are in place in many countries today; actors are believed to invest either because economic incentives such as feed-in tariffs or tradable green certificates make RE production competitive with conventional electricity production or because they are forced to invest by renewable performance standards or other types of regulations [e.g. [5]]. Among the economic incentives currently used, some are technology-specific (e.g. the feed-in tariffs used in Germany and in France), and other generic, i.e. aimed at all renewable energy technologies (e.g. the tradable green certificate system used in Sweden where certificates are obtained (and traded) by RE producers for each produced MWh).

Although it might seem intuitively reasonable to explain the emergence of new types of RE producers by the presence of energy policies, this explanation only provides part of the picture. According to institutional theory, formal institutions such as economic and regulatory policy instruments are indeed likely to influence actors' investment decisions, but informal institutions such as norms and values matter as well [6]. Norms and values are a

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[1] In line with the Renewable Energy Directive [1], we define renewable electricity production as electricity "from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases". As will be explained later, all these are, however, not included in the empirical parts of this paper.

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result of network and group belonging [e.g. [7]] and it is therefore particularly relevant, given the heterogeneity of the emerging investors group with regard to networks and industry belonging, to assume that different informal institutions may affect them. This implies that a complete institutional analysis, including both formal and informal institutions, is needed in order to understand what role current energy policy instruments actually play in the investment decisions of emerging investors.

In this paper, we study emerging investors in RE production in Sweden with the purpose of identifying how their investment decisions were influenced by various formal and informal institutional demands.

2. Theoretical framework

2.1. Economic rationality vs. institutional demands

Why do firms and other actors invest in RE production and what influences their investment decisions? In the energy economics literature, investors are generally assumed to behave in an economically rational way, i.e. to make a specific investment only if the expected economic return on that investment is positive and higher than on other investments [2]. Similar assumptions are also implicit in much of the energy policy literature, especially in discussions on how to promote RE production, where it is emphasized that RE production is not yet competitive with conventional energy production and that policy measures to level the playing field therefore is needed to attract investors [4,8–15]: "no binding targets, no active policies and reliable instruments mean no markets" [5, p. 15].

This assumption can, however, be criticized. It has, for example, been argued in previous literature that rationality is "bounded" by informational and cognitive constraints [16,17] and, in consequence, that "perceptions matter" for energy investments [18 p. 6]. More important for the purpose of this paper, it has also been argued that the assumption of economically rational behavior largely ignores the influence of social forces on decision making [19,20] and neglects the presence and power of other types of institutions than codified regulative elements [21]. These two arguments indicate that a broader perspective is called for in order to understand why and how investors act in relation to RE production.

It is useful to first distinguish the task environment from the institutional environment [22]. The task environment includes "normal" business aspects related to the development and production of products that actors exchange in the market, e.g. sources of input, markets for outputs and competitors [22]. It primarily exerts demands (or pressures) on actors in the form of requirements on efficiency and effectiveness [22], for example customers bargaining to get higher-quality products or lower prices [23]. Institutional environments, in contrast, include regulations, social norms and social expectations that individuals and organizations have to comply with in order to secure legitimacy, resources and power [6,24,25]. Demands from the institutional environment come in the form of prescriptions regarding "the right thing to do" (in a legal, moral or cognitive senses) and the right way to do things (e.g. acceptable types of organizational forms for a particular task [22]).

In this paper, we are primarily interested in complementing the techno-economic focus of previous energy policy literature by focusing on institutional demands, but at the same time we fully acknowledge that demands from the technical environment matter as well for investments.[2]

[2] It should also be acknowledged that markets at least to some extent are institutionally constructed [21].

2.2. Institutional demands on investments in RE production

A main argument of the institutional literature is that even though people and organizations can and do act in their own self-interest and to the purpose of achieving set goals, their behavior is also heavily influenced by internal and external institutions [6,21,26–28].[3] Among other things, institutions influence what information people select, how they interpret it and what criteria they use to evaluate different action alternatives [28] and shape perceptions about the potential and limits of technologies, markets and firm-specific capabilities [29] – all which influence investment decisions. Even for economically oriented actors, institutions influence what is considered "an 'appropriate' kind of economic behavior" in a specific time, space and social network [30].

In previous literature, two main sources of institutional demands are emphasized:

- *Formal institutions* include regulations, laws and other types of policies as well as infrastructural constraints and bureaucratic requirements [21,28]. They tend to be related to monitoring and sanctioning activities [21] and actors conform to them because they fear punishment or because it is in their self-interest to do so [31,32].
- *Informal institutions* include on the one hand values and norms that define what behavior is preferred or considered proper and prescribe how things are to be done [21,28,31], and on the other hand cognitive rules, such as cultural frames and routines, which actors use to make meaning of reality [21].[4] Actors conform to informal institutions because of a social (or moral) obligation [31,32], because it is expected of them [20,21,34] or because they cannot think of any other option [21,34].

Judging by previous literature on investments in RE production, formal institutional demands, in the form of various energy policy instruments, are the dominating influence on investors. However, some previous literature also indicates that informal institutional demands might influence actors' decisions to invest in RE production. For example, researchers have found that social interactions, perceptions and expectations have influenced decisions and intentions to adopt PV systems in the US, Germany and Sri Lanka [35–38] and the willingness to pay for microgeneration technologies in Ireland [39]. Other studies have underlined that drivers and motives for investing in RE production differ among emerging investors and that emerging investors are more subjected to informal institutions than more established investors, such as utilities and energy companies [40,41]. We have, however, not found any studies that consider formal and informal institutional together in order to understand what influences emerging investors' decisions. This leads us to formulate the following research question:

RQ1: What formal and informal institutional demands influence emerging investors in RE production?

In the literature on formal institutions, in particular energy and environmental policy, it has been highlighted that they can exert two main types of influence. They can either *impose* potential investors to invest, e.g. by mandatory targets [8] or quota obligations [42], or *induce* them to do so, e.g. by fixed feed-in prices, price premiums, tradable green certificates, investment subsidies,

[3] For an extensive literature review, see Ref. [6].

[4] In the institutional literature, a distinction is often made between normative and cognitive institutions. However, in reality "the normative and cognitive dimensions … are not always easily separated – actors are guided in what they think is right and what they want to do by what they know and are able to do" [33, 577].