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Investments in the Dutch onshore wind energy industry: A review of investor profiles and the impact of renewable energy subsidies

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ABSTRACT

The 2020 renewable energy targets have stimulated the debate on the efficacy of policy schemes. Discussion on the efficacy of these schemes has largely been on the growth in the share of renewable energy, and less on the alignment of policies to the needs of investors. However, research in this field has emphasized that 'who is investing' is as relevant as 'how much is invested'. This study aims to identify and better understand 'who is investing', by researching more than 1000 investments by 646 firms that produce electricity with Dutch onshore wind energy. These firms received renewable energy subsidies under Dutch policy schemes between 1996 and 2013. The regression results highlight the type of investors that invest more in wind energy. The results show that firms with a higher wind energy capacity are firms that have more investment experience; are latecomers to the wind industry; have an industrial background in the electricity or wind industry; are medium- or large-sized and are limited liability companies. Data on investments, combined with a document analysis, show that changes in policy schemes affect the perceived risks and expected returns of investors, and that these changes influence the amounts invested and the type of investors in wind energy.

1. Introduction

The consumption and production of renewable energy in the Netherlands have steadily grown over the past decade, but the chances of reaching the 2020 renewable energy target are growing dim. Renewable energy in the Netherlands achieved a 5.8% share of total energy consumption in 2015 [1], but this number still falls short of the policy goal of a 14% share by 2020. Traditionally, wind energy has been an important renewable source, comprising 21% of renewable energy consumption in the Netherlands in 2015 [1]. An overwhelming amount (85.1%) of total wind energy consumption is sourced from onshore wind capacity [1]. In a recent study on the Dutch energy sector, onshore wind energy is estimated to play a crucial role in reaching the 2020 renewable energy target [2]. Meanwhile, private sector investments in renewable energy in the Netherlands are trailing behind the levels required to promote innovations and improve performance [2]. This study focuses on explaining who invests in onshore wind energy in the Netherlands and how Dutch energy policies encourage this investment.

The Dutch government's energy policy is aimed at stimulating the production and consumption of renewable energy. This policy mainly includes the use of economic instruments, such as subsidizing exploitation projects or reducing energy taxes. Discussion on the efficacy of these subsidies and tax reductions has largely been on the growth in the share of renewable energy and less on the alignment of the policy to the characteristics of investors [3]. A better understanding of the characteristics of investors would not only be valuable to establish the effectiveness of the policy, given the diversity of investors in the Dutch wind energy industry, but also to appreciate the feasibility of the policy targets, given the lack of transparency on the contributions of investors to investments in wind energy production [4].

The empirical identification of the investors in renewable energy studies is only a recent issue in a long-standing discussion on the necessity and feasibility of renewable and sustainable energy [4]. In most studies [5,6] on investment in electricity produced from renewable energy sources (RES-E), attention has focused on investment rather than the investor. Although some studies have looked at the perceptions of entrepreneurs in realizing wind energy projects under specific social and institutional conditions [7–9], investors have implicitly been assumed to safeguard the economic efficiency of the investment, and as such, to represent a homogenous group of profit-

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maximizing actors. In the last decade, several qualitative studies have started to explore the diversity among investors, adding to the discussions on the effectiveness of energy policies [10–12]. In an early study, Agterbosch et al. [10] identified different entrepreneurial groups involved in wind energy in the Netherlands. Similarly, Wüstenhagen and Menichetti [11] have made different types of investors an integral part of their conceptual framework, stressing that 'not all investors are the same, and similar investment opportunities are valued differently by different investors' [11, p. 6]. Bergek et al. [12] questioned 'Who invests in renewable electricity production?', completely deviating from the homogenous, unidentified investors in wind energy.

This study aims to identify and better understand the types of firms that invest in the production of Dutch onshore wind energy, and receive a renewable energy subsidy. Regression analyses with data on 646 firms with more than 1000 investments in the Dutch onshore wind industry explain what type of investors invest more in wind energy. Furthermore, by combining data on investments with an analysis of energy policy documents, the article explores how changes in the Dutch energy policy have led to alterations in the behaviour of wind energy investors. This study, therefore, contributes to the literature that argues for a greater emphasis on reviewing the diversity of investors and on determining the impact of energy policy on investment decisions.

In the next section a conceptual framework is introduced based on the literature that portrays the relationships between investors, energy policy, and investments in renewable energy, followed by a description of Dutch renewable energy policies in Section 3. Section 4 presents the methods used for the results in Section 5. Section 6 presents the conclusions and Section 7 lists the limitations of the study and the suggestions for future research.

2. Theory on investments in renewable energy

An emergent stream in the renewable energy policy literature [11,13] recognizes the importance of strategic decisions in energy policy design. A major tenet in this stream of literature is that a policy design that considers the risk for investors will effectively influence the deployment of renewable energy [11]. This article adopts the conceptual framework offered by Wüstenhagen and Menichetti [11], which takes perceived risk and expected return as pivotal concepts and adapts them to the Dutch wind energy investments (see Fig. 1).

Within this framework, the investments in wind energy are explained in terms of perceived risk and expected return. As in any business venture, the risk is an essential feature that lies at the heart of all investment decisions [13]. Drawing on Wüstenhagen and Menichetti [11] and Forlani and Mullins [13], this study argues that perceived risk underlies the firm's investment decisions on wind energy. Similarly, expected returns of energy investments are largely based on the firm's expectations of future developments. Both perceived risk and expected return are estimates at the investor's level, and therefore allow for a bandwidth of different risk-return combinations [11]. In the Wüstenhagen and Menichetti framework, the differentiation in the estimates and decision-making of investors can be attributed to investor profiles[3] [11,14]. An investor profile is largely informed by the prior investments of an investor in renewable energy and by the type of investor (Fig. 1). This study focuses on prior investments and the type of investor to explain an investor's total investment in onshore wind energy in the Netherlands. It is assumed that perceived risk and expected returns are influenced by the investor profile. Fig. 1 also shows that these are also influenced by energy policies.

[3] Wüstenhagen and Menichetti [11] refer to 'cognitive aspects' based on decision-making under bounded rationality.

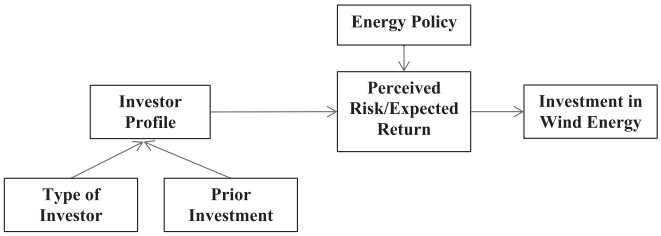

Fig. 1. Conceptual framework (adapted from Wüstenhagen and Menichetti [11]).

2.1. Impact of investor profiles on investments

2.1.1. Prior investments

Previous research [15,16] has shown that firms with investment experience display a higher level of accuracy in predicting the probabilities of outcomes. Experienced investors are also able to make more accurate risk estimates. Kaufmann et al. [17, p. 325] have argued that "knowledge about risk can be acquired through *experience*, through feedback about the outcomes of previous decisions." This experience and knowledge about risk may lead to a lower risk perception, in particular with small probabilities of loss [17], which in turn may lead to larger investments.

2.1.2. Type of investor

Bergek et al. [12] have argued that investors in renewable energy act as those '...who invest in renewable electricity production (e.g. utilities and farmers) rather than as actors who finance such investments, e.g. banks, funds. [...]. The former initiate the idea for a new plant, mobilize resources to realize it and take ownership of the plant once it is in place. Electricity production then becomes a part of their business' [12, p.573]. Given the different stages of investment in renewable energy, from early-stage technology and early-adopters to mature technology and large-scale deployment, the group of investors in renewable energy can be categorized in a variety of ways, illustrating the heterogeneity of the group [12]. Wüstenhagen and Menichetti [11] argue that future research should review the heterogeneity of these investors, and categorize them into different types to explain their behaviour towards investments in renewable energy. Based on previous research [12,18], this study analyses different types of investors by studying (1) their age, (2) industrial background, (3) size, and (4) legal form. Following conventional wisdom, it is assumed that investors in RES-E are risk averse [19].

(1) In their review on risk taking by firms, Skromme Baird and Thomas [18] show that the firm's age is one of the variables affecting risk perceptions. The sustainability transitions literature [4,20] argues that first movers (the older firms in an industry) experience more uncertainty than latecomers (the younger firms in an industry). First movers provide positive external economies to later firms in that they make visible new business opportunities and reduce uncertainties [21]. Latecomers perceive less risk and are therefore likely to invest more than the older firms.
(2) Bergek et al. [12] distinguish between investors by describing their main area of business activity, which they measure by looking at their industrial background. The industrial background will impact the perceived risk and expected return of investments, and consequently the level of investment. If a firm invests in its main activity, it will have valuable knowledge in that area, which it can use to solve problems and detect opportunities in a more effective way [22]. These firms will have better insights into the potential risks and returns and will invest more, compared to the firms that invest in technologies that are not related to their main activity.
(3) Based on several other studies, Skromme Baird and Thomas [18] argue that firm size is also an important determinant of risk perception by firms. Wüstenhagen and Menichetti [11] mention