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Risks and risk management of renewable energy projects: The case of onshore and offshore wind parks



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ABSTRACT

Wind energy is among the most relevant types of renewable energy and plays a vital role in the projected European energy mix for 2020. The aim of this paper is to comprehensively present current risks and risk management solutions of renewable energy projects and to identify critical gaps in risk transfer, thereby differentiating between onshore and offshore wind parks with focus on the European market. Our study shows that apart from insurance, diversification, in particular, is one of the most important tools for risk management and it is used in various dimensions, which also results from a lack of alternative coverage. Furthermore, policy and regulatory risks appear to represent a major barrier for renewable energy investments, while at the same time, insurance coverage or alternative risk mitigation is strongly limited. This emphasizes the need for new risk transfer solutions to ensure a sustainable growth of renewable energy.

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1. Introduction

According to the projected energy mix for 2020 in Europe, which aims to supply 20% of energy consumption from renewable energy, wind and solar energy will become increasingly relevant as a key element of future power generation.¹ To achieve these goals, considerable investment volumes are needed by federal, institutional and private investors. For instance, the European Wind Energy Association ([15], p. 3) estimates that investments in European offshore wind parks alone may reach a total of USD 90 to USD 124 billion during the period from 2013 to 2020, wherein private and institutional investments are expected to be the most relevant sources of finance.² Drivers of renewable energy growth include policy incentives by means of support schemes (e.g., feed-in tariff) as well as improved and more reliable technology.³ However, the risks to investments in renewables are also becoming increasingly complex and the availability of adequate insurance and risk management instruments is vital to de-risk cash flows, which is especially relevant for institutional investors like insurers and pension funds, and to thus ensure a sustainable growth of renewable energy.⁴

In particular, wind energy plays a major role for the energy turnaround due to the higher efficiency of energy production originating from lower electricity generation costs in the long-run.⁵ Besides the further growth of well-established onshore wind energy, particularly in recent years, the wind energy industry has increasingly moved towards offshore wind parks, aiming to achieve stronger and more stable wind speeds.⁶ However, especially offshore wind parks are associated with considerable risks due to their higher complexity and still limited insurance solutions.⁷ In this regard, emerging markets such as China, one of the fastest growing wind power industries, require adequate insurance and risk management services. This is one of the upcoming large future markets for wind energy insurance solutions.⁸ According to Turner et al. [43, p. 14], the growth of renewable energy along with increasing market risk exposures, a more complex financing situation and changing regulations (support schemes) will also imply an increase in the estimated annual expenditure on risk management services including insurance solutions of up to USD 3.7 billion in 2020.

Against this background, the aim of this paper is to contribute to the literature by comprehensively presenting and assessing the current risks and risk management solutions for wind park projects from the investor's perspective with focus on the European

market based on a review of the present academic and industry literature and to identify critical gaps in risk transfer, which concern policy and regulatory risks in particular.⁹ We explicitly differentiate between onshore and offshore wind parks and discuss insurance solutions, full service agreements, alternative risk transfer including financial derivatives, and other (qualitative) risk mitigation approaches. Based on a comparative analysis of industry surveys, we further obtain insights regarding which risks are particularly critical from the industry's perspective. The analysis is of high relevance when considering the importance of wind development in Europe. Furthermore, by focusing on Europe as a mature market with respect to onshore and offshore wind, our work is also intended to inform emerging (and potentially much larger) markets with respect to risks and risk management solutions.

Our analysis shows that policy and regulatory risks, in particular, are among the most significant risks from the industry experts' viewpoint with only limited risk transfer opportunities. Furthermore, apart from insurance, diversification is currently one of the most important risk mitigation techniques and is used in various dimensions, also in part, due to a lack of alternative coverages. In addition, in regard to political, policy and regulatory risks, insurance coverage is still limited due to several challenges. Private political risk insurance mainly covers risks such as expropriate breaches of investor's rights, while public policy risk insurance may become a vital alternative instrument for risk mitigation.

In the literature, various papers deal with the risks and risk management of renewable energy projects, thereby mainly focusing on individual or specifically relevant aspects. For instance, Montes and Martín [36] study the profitability of wind energy in Spain and discuss major short-term risk factors, while Jin et al. [28] focus on the current status and challenges for the wind insurance market in China. In addition, other works focus on the impact of policy support schemes on the attractiveness of wind park investments (e.g., [4,5,7,24,29,50]), resource risks resulting from wind volatility (e.g., [33]) or curtailment risk (e.g., [26]). With focus on renewable energy technology in developing countries, Waissbein et al. [45] provide a comprehensive framework for policymakers to select the most cost-effective portfolio of public instruments (intended to reduce investor risk) based on a quantitative comparison of the different instruments using various performance metrics. Industry studies include Watts [46], who conducts a survey regarding the management of risks associated with renewable energy projects and finds that insurance plays a major role as a part of the risk mitigation strategies of senior executives. Turner et al. [43] focus on risk management approaches for solar and wind energy projects in six different markets and find that managing these risks will become increasingly important, as market risks, and also construction and operation risks, will generally increase. A detailed overview of technical risks and the technological status quo of renewable energies, including onshore and offshore wind energy, are provided by the German Insurance Association [21]. In addition, EWEA [14] discusses key

¹ [3, p. 1373, 13, p. 46].

² [14, p. 21].

³ [43, p. 6].

⁴ [20, 43, pp. 8,9,13].

⁵ [43, p. 6]; in a worldwide ranking, China (91,424 MW) and the US (61,091 MW) are the countries with the most capacity installed by the end of 2013, followed by Germany (34,250 MW), Spain (22,959 MW) and the UK (10,531 MW) [22].

⁶ [43, p. 5, 34, p. 3547].

⁷ [34, p. 3548].

⁸ [28, p. 1071].

⁹ Note that we use the terms policy and regulatory risks as synonyms.

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