Risk-Optimized Pooling of Intermittent Renewable Energy Sources

Gerke Gersema, David Wozabal

PII: S0378-4266(17)30075-4
DOI: 10.1016/j.jbankfin.2017.03.016
Reference: JBF 5120

To appear in: *Journal of Banking and Finance*

Received date: 20 May 2016
Revised date: 2 February 2017
Accepted date: 25 March 2017

Please cite this article as: Gerke Gersema, David Wozabal, Risk-Optimized Pooling of Intermittent Renewable Energy Sources, *Journal of Banking and Finance* (2017), doi: 10.1016/j.jbankfin.2017.03.016

Risk-Optimized Pooling of Intermittent Renewable Energy Sources

Gerke Gersema[a,*], David Wozabal[a]

[a] *Technische Universität München (TUM), Arcisstraße 21, 80333 München, Germany*

Abstract

Many photovoltaic and wind generation capacity owners gain access to power markets by signing up with virtual power plants. Power generation from these renewable sources of electricity is inherently uncertain and, consequently, revenue is random, which induces a risk for the owner. In this study, we investigate to what extent pooling different technologies and locations in the portfolio of a virtual power plant can reduce aggregate risk. To this end, we develop stochastic models for factors driving the assets' underlying market and volume risks on which we base a model for risk-optimized pooling. Using the German market as an example, we demonstrate that optimal portfolios have a clearly better risk/return profile than the market portfolio. This finding holds in the case without subsidies as well as the case with feed-in tariffs.

JEL Classification: Q210; Q420; Q470

Keywords: Market integration of renewables, Power markets, Intermittency, Variable renewables, Wind and solar power, Virtual power plant

1. Introduction

Driven by declining capacity prices and generous subsidy schemes, the number of photovoltaic (PV) and wind power plants around the world has been growing rapidly over the last 10 years. This trend is likely to continue due to the urgent need to decarbonize the world's energy generation and thereby reduce greenhouse gas emissions and minimize

* I am corresponding author – phone number: +49 175 3182374
Email addresses: gerke.gersema@tum.de (Gerke Gersema), david.wozabal@tum.de (David Wozabal)