The dynamics of renewable energy investment risk: A comparative assessment of solar PV and onshore wind investments in Germany, Italy, and the UK

Florian Egli, ETH Zurich – Swiss Federal Institute of Technology, E-mail: florian.egli@gess.ethz.ch

Overview

Keeping climate change within safe limits and achieving the goals of the Paris Agreement require fast and ample redirection of financial flows towards low-carbon technologies [1]. The corresponding investment needs exceed current Nationally Determined Contributions of the signatories to the Paris Agreement and need to stem from private sources [2]. On the supply side, solar photovoltaics (PVs) and wind are the two most important technologies for an energy transition, combined set to becoming the largest source of electricity by 2030 in a 2 degree compatible energy system [3]. In private investment decisions, expected return and the associated risk are the most important decision metrics. However, RET risk premium are difficult to observe because RET project typically use project finance structures and are therefore not quoted publicly. Albeit the lack of data, the few papers, which have looked at RET project-level data [4]–[6], find a country- and technology-specific risk premium that changes over time.

This paper provides a conceptual framework, which links the observed changes in risk premium to underlying investment risk perceptions. It uses investor interviews to provide country-, technology- and time-specific investment risk assessments – both on the general RET investment risk and on the relative importance of different types of investment risk. Lastly, it uses the interview data to link types of investment risks to underlying drivers in order to understand the reasons behind the changes and country- or technology-specific variation. The paper therefore aims to contribute to a better understanding of private investment decisions in order to design effective policies and to consider implications of support policy phase-outs. It is further an attempt to discover the dynamics (i.e., changes over time) of risk perceptions and its variation depending on technology and policy context.

Methods

The study proceeds in four steps and uses 40 investor interviews, including 17 debt providers (13 commercial banks and 4 investment banks), 15 equity providers, 7 public actors (4 public utilities and 3 public investment banks) and 1 former researcher. Interviews took approximately 60 minutes each and were conducted over the phone between September 2017 and January 2018. In a first step, investors were asked to recall utility-scale projects that they had realised or analysed in the past. For each project, they were asked to indicate the debt-to-equity ratio (leverage), the cost of debt and the cost of equity. We hence compile a project-level data set for Germany, Italy and the UK to show the evolution of the cost of capital over time. In order to triangulate those findings, we ask the investors for a comparable asset class[1] to solar PV or wind onshore in 2009, 2013 and 2017. Following the literature on retroactive sense-making biases, we evoke an anchoring event for each year to make it easier for the interviewees to remember the point in time [7]. In a second step, we use the literature on (RET) investment risks to identify the most frequently discussed risk types. We triangulate the selection of risk types in exploratory interviews (N = 4) and define the five most important RET investment risk types. In a third step, we let investors rank the risk types for each year. Depending on their investment experience, investors were free to indicate whether their assessment was applicable to both technologies in all countries, differed in either aspect, or excluded some combinations. We aggregate risk ranks using the Borda count method. In a fourth and last step, we ask investors about the drivers behind the changes in overall investment risk (step 1) and specific risk types (step 3). Investors were free to name reasons and drivers they deem important. We transcribe all interviews and code statements using grounded theory to describe and classify the drivers. Using the software MaxQDA, we code statements according to the risk involved, the country (if specified), the technology (if specified), the time (if specified), the direction of change (increasing, constant, decreasing), and the risk dimension (impact or probability). For each statement (N = 869), the coder then assigns a driver (if applicable). This procedure is termed open coding, or the unconstrained comparison of incident (i.e. statement) to incident to generate categories (i.e. of drivers) and then comparing new incidents to the categories. It is therefore an iterative procedure to identify common patterns identical to developing categories inductively via recursive cycling among different investor interviewees [8].

[1] From least risky to riskiest: 10-year government bond, low-risk infrastructure investment, corporate bond of an established and listed company, stock of a listed company, early stage venture capital investment.

Results

From the first step, we find that the technology-specific cost of capital decreased for Germany, Italy and the UK over time, with a stronger effect for solar PV compared to onshore wind. This empirical observation is matched by declines in perceived investment risk. In the second step, we identify technology risk, resource risk, curtailment risk, price risk (e.g., wholesale price exposure), and the risk of retroactive policy changes as the five most important risk types. In the third step, we identify stark changes in relative importance among the risk types. For example, technology and policy risks became less important, while curtailment and price risks became more important over time. The relative importance of risks varies dependent on the technology and the policy context (i.e., country). In the fourth and last step, we use the co-occurrences of codes to identify links from risk types to drivers. Figure 1 shows these links for the most important drivers, which we describe in detail (including different components of each driver) using the qualitative interviews.

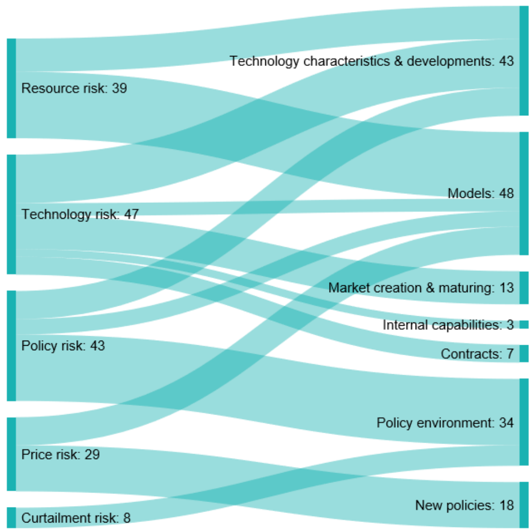

Figure 1: Flow chart depicting the connections between risk types (left) and risk drivers (right)

Conclusions

We show that the cost of capital for RET projects decreased in Germany, Italy and the UK over the past 10 years, thus providing evidence that the effect identified in Egli et al, 2018 is not confined to Germany only. We bring to the attention of policymakers that these changes are mainly due to changes in five risk types and that the importance of these risk types varies according to technology maturity, technology complexity and the policy environment. Importantly, as policymakers in Europe consider phasing out support policies for RETs (and phasing in market risks), the consequences on investment risk and hence future deployment may not be underestimated. As a consequence, policymakers should pay attention to phasing out policies step by step without changing all the risk levers at the same time, which could risk to create a RET investment and deployment slump.

References

[1] F. Polzin, “Mobilizing private finance for low-carbon innovation – A systematic review of barriers and solutions,” *Renew. Sustain. Energy Rev.*, vol. 77, pp. 525–535, 2017.

[2] IRENA, *Unlocking Renewable Energy Investment: The Role of Risk Mitigation and Structured Finance*. 2016.

[3] OECD/IEA and IRENA, “Perspectives for the energy transition – investment needs for a low-carbon energy system,” 2017.

[4] C. W. Donovan and J. Li, “Do Listed Clean Energy Infrastructure Shares Make Financial Sense for Investors ?,” *SSRN Electron. J.*, no. August, pp. 1–44, 2018.

[5] F. Egli, B. Steffen, and T. S. Schmidt, “A dynamic analysis of financing conditions for renewable energy technologies,” *Nat. Energy*, vol. 3, pp. 1084–1092, Dec. 2018.

[6] Ecofys, “The impact of risks in renewable energy investments and the role of smart policies,” 2016.

[7] B. C. K. Choi and A. W. P. Pak, “A catalog of biases in questionnaires.,” *Prev. Chronic Dis.*, vol. 2, no. 1, p. A13, Jan. 2005.

[8] K. M. Eisenhardt and M. E. Graebner, “Theory Building from Cases : Opportunities and Challenges,” *Acad. Manag. J.*, vol. 50, no. 1, pp. 25–32, 2007.