



Original research article

# When energy policy meets free-market capitalists: The moderating influence of worldviews on risk perception and renewable energy investment decisions

Sylviane Chassot<sup>a,\*</sup>, Nina Hampl<sup>b</sup>, Rolf Wüstenhagen<sup>a</sup><sup>a</sup> Institute for Economy and the Environment (IWÖ-HSG), University of St.Gallen, Switzerland<sup>b</sup> Institute for Strategic Management, Vienna University of Economics and Business, Austria

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## ABSTRACT

Whether or not targets to increase the share of renewable energy will eventually be met critically hinges upon the effectiveness of policies to mobilize private investment. However, just as energy policy can create opportunities, it can also create risk. This paper adds to a growing stream of literature at the intersection of energy research and social sciences that empirically investigates investor perceptions of regulatory risk, and their influence on investment decision-making. Based on choice experiments with 29 venture capital investors from Europe and the United States conducting 1064 investment decisions, we show that high levels of regulatory risk have a negative effect on the likelihood to invest in renewable energy. Furthermore, we find that investors' worldviews moderate the impact of perceived regulatory risk: respondents who expose strongly individualistic "free-market" worldviews are less likely to invest in renewable energy ventures with high regulatory exposure than other investors.

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## 1. Introduction

An extrapolation of current energy trends into the future is not sustainable. A culmination of increasing concerns about climate change, the nuclear accident in Fukushima, and discussions on energy security in a world with growing energy demand have led to a call for increasing the share of renewable energy. Building up a cleaner energy infrastructure requires significant investment. UNEP [1] reports that total global investment in renewable energy was \$214 billion in 2013, which is a decrease of 14% compared to 2012. The main reasons for the decline in investment indicated in this report are twofold: (1) a sharp decline in technology cost, making investments in a given amount of renewable energy capacity cheaper than before, but also (2) the instability in policy support for renewable energy in some key markets in Europe and the United States. While the former is a positive development, the latter raises a serious concern with regard to achieving ambitious policy targets.

The International Energy Agency estimates that \$26 trillion need to be invested in energy infrastructure by 2030 in the New Policies Scenario, and that this number increases to \$36 trillion in the 450-Scenario, which has the goal of stabilizing the atmosphere at below 2 °C temperature change [2]. Thus, government policies to promote renewable energy need to be designed in order to spur the required levels of investment. The absence of such investment-grade policies [3] leads not just to a lack of capital flowing into renewable energy projects, but to continued allocation of capital to conventional sources of energy.

At least two factors have been offered in the energy policy and economics literature to explain the puzzling gap between renewable energy targets and actual levels of investment. First, recent research has pointed to the importance of regulatory risk<sup>1</sup> [4–10] – mirroring the UNEP findings [1]. While policy makers tend to assume that political incentives create opportunities for renewable energy investors, those policies might actually be viewed as a possible source of risk by investors, leading to disappointing levels of capital flowing into the sector. Second, recent work inspired by behavioural economics suggests that a purely rational risk-return

\* Corresponding author at: Institute for Economy and the Environment (IWÖ-HSG), University of St.Gallen, Tigerbergstrasse 2, 9000 St.Gallen, Switzerland. Tel.: +41 71 224 2584; mobile: +41 76 473 0965.

E-mail addresses: [sylviane.chassot@gmail.com](mailto:sylviane.chassot@gmail.com) (S. Chassot), [nina.hampl@wu.ac.at](mailto:nina.hampl@wu.ac.at) (N. Hampl), [rolf.wuestenhagen@unisg.ch](mailto:rolf.wuestenhagen@unisg.ch) (R. Wüstenhagen).

<sup>1</sup> We define regulatory risk as "the risk that regulatory agencies will change policy decisions" [4, p. 654]. In this paper, we use regulatory and policy risk as synonyms.

perspective may fall short of explaining the observed investment behaviour and how it is influenced by energy policy. Real-world investor decision-making in the energy industry seems to be more characterized by bounded rationality [11] leading to path dependence and carbon lock-in [12].

Despite its importance, this bounded rationality view on the role of energy policy and regulatory risk in renewable energy investment is still an under-researched field. Our paper responds to recent calls for more research in this area [13–15]. Focusing on one particular type of investor, venture capitalists, we investigate a specific “behavioural” effect, namely whether investors’ general worldview influences their level of risk perception with respect to regulatory risk, and thus negatively influences investment in renewable energy. Albeit venture capitalists typically do not directly invest in power generation facilities, they provide capital to technology start-ups, who in turn rely on a favourable investment environment in the downstream sector to find demand for their products [16]. Thus, venture capitalists are important gatekeepers for new energy technology, which will then eventually be applied in power generation projects, financed by e.g. institutional investors and banks. Uncertainty related to policy support in the asset finance sector also has an important indirect impact on the sentiment in public markets, which provide growth capital to renewable companies. Venture capitalists that typically exit investments through initial public offerings (IPOs) are thus also sensitive to the overall investment climate in this financial sector. The focus on venture capitalists therefore provides an interesting perspective on energy policy from the upstream and innovation-focused side of the financing continuum. Additionally, understanding venture capitalists’ investment decision-making is particularly in demand, as recent figures show that renewable energy investment in the venture capital/private equity sector dropped by 46% from 2012 to 2013 to levels observed eight years ago [1].

With empirical evidence from choice experiments with 29 venture capitalists from the United States and Europe conducting 1064 experimental investment decisions, we address the following research question: to what extent is the impact of regulatory risk on the decision to invest in renewable energy moderated by investors’ worldviews? Our results show that high exposure to regulatory risk has a negative influence on investment decisions in renewable energy. We further provide empirical evidence that investors’ worldviews moderate the relationship between regulatory risk and the decision to invest in renewable energy. Investors with an individualistic (“free-market”) worldview perceive risks induced by high regulatory exposure more pronounced than other investors.

## 2. Literature review

### 2.1. Policy makers versus investors – two perspectives on energy policy

A general assumption behind the introduction of renewable energy policies is that investors are more likely to invest in renewable energies in the presence of such policies than they would be in their absence. For example, in the case of feed-in tariffs or investment incentives, policies are designed to provide attractive returns to renewable energy investors. Policy makers tend to pay less attention to the other side of the equation, i.e. the implications of regulatory risk on investments (cf. Fig. 1).

Investors, on the other hand, may have very different views on energy policy. Rather than seeing renewable energy policies as a source of opportunity – as assumed and intended by policy makers – they might interpret them as a source of risk. This alternative view

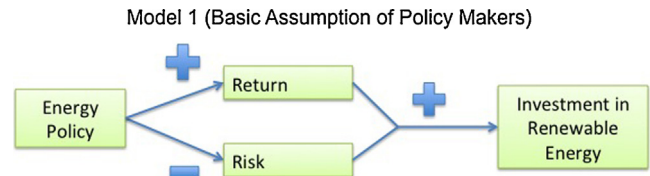


Fig. 1. A simple model of how policies influence renewable energy investment. Adapted from Wüstenhagen and Menichetti [14].

of the policy-investment nexus has been presented as a possible explanation for puzzling findings about renewable energy policy effectiveness [10]. For example, it has been shown that countries with seemingly similar policy frameworks had widely differing outcomes in terms of the amount of new capacity installed [17], and the “price of policy risk” [6] could be a central factor in explaining observed differences.

Energy policy encompasses a rich toolbox of different instruments. In addition to remuneration schemes such as feed-in tariffs or investment subsidies (economic factors), energy policy frameworks are also characterized by so-called non-economic factors such as grid access, legal security and duration of administrative processes [6,7]. Several studies have investigated the impact of economic and non-economic policy aspects on investment decisions by various types of investors [6–8,18,19]. Studies that investigate the attractiveness of different policy schemes show that feed-in tariffs are the most appealing financial support scheme from the investors’ point of view [16]. Feed-in tariffs decrease the price risk for electricity output and have thus emerged as one of the most effective and most prominent energy policy instruments to promote investments in renewable energies. However, if different policy aspects are jointly investigated, studies show that for investment decisions the relative importance of non-economic policy factors such as the administrative process duration or the risk of negative policy changes (regulatory or policy risk) is higher than the level of total remuneration and the type of policy scheme [6,7].

In this perspective, well-designed policies decrease (perceived) regulatory risk in investment decisions, which in turn has a positive influence on renewable energy project developers’ cost of capital [20,21] as it lowers the risk premium [6]. The variations in the risk level that different renewable energy policy frameworks imply are an important indicator for investments – and as a consequence for future installed capacity and policy effectiveness in the longer term [14]. Thus, compared to the policy maker’s point of view on the relation between renewable energy policies and investment, the investor’s perspective actually seems to place a higher emphasis on risk aspects, cancelling out some or all of the intended positive effect of policies (cf. Fig. 2).

### 2.2. Venture capital investment in renewable energy

A variety of investors is involved in financing renewable energy, ranging from venture capitalists investing in early-stage technology firms to project financiers engaging in the later stages of the innovation cycle, i.e. deployment. While later stage investment

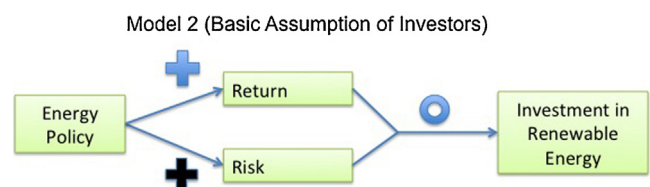


Fig. 2. An alternative model of how policies influence renewable energy investment. Adapted from Wüstenhagen and Menichetti [14].

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