Energy Policy 109 (2017) 141–153

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Individual and collective socio-psychological patterns of photovoltaic investment under diverging policy regimes of Austria and Italy

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ARTICLE INFO

Keywords:
Alternative energy
Photovoltaic policy
Households
Investment decisions
Austria
Italy

ABSTRACT

Photovoltaic policies show the primary effect of encouraging photovoltaic investments, but also secondary effects of crowding-in/out individuals with specific socio-psychological patterns. To enhance our understanding of such crowding effects, we investigated two comparative study cases with contrasting state support for photovoltaic investments: high financial support in the province of Bolzano/South Tyrol (Italy) versus lower financial support in the province of Styria (Austria). We surveyed individual and collective investors, and as a control group, households who had not invested in photovoltaics at the time of data collection. We first compared crowding effects of diverging PV policies, and afterwards individual and collective socio-psychological patterns to grasp their role for photovoltaic adoption in general. Protecting the environment was found to be the strongest driver for photovoltaic investments. Generous state support in Italy widened demographics, crowded-in economic considerations and persons with an anthropocentric relationship towards nature. However, Italy's high-incentivized photovoltaic policy crowded-out the motivations for collective energy projects and could not sufficiently encourage a sustainable diffusion of photovoltaics, as investments collapsed once state funding was stopped.

1. Introduction

Energy transition from the current, centralized, fossil fuel based, CO_2 emitting energy system towards a decentralized, low CO_2 emitting system based on renewable energy sources is a key challenge to mitigate climate change (Sarrica et al., 2016; Sovacool, 2016). According to Baum and Gross (2016), energy transition is largely perceived as being technology-driven, which is likely to be insufficient, unless it is complemented by changes in people's behavior, thoughts and norms (Nyborg et al., 2016). Thus, a richer explication of the interaction between energy policy and individual determinants of people's behavior and thoughts is needed (Schot et al., 2016). This is however not easy, as human behavior is complex (Eidelson, 1997; Lee and Brosziewski, 2009; Perez and Batten, 2006; Teixeira, 2007), with uncountable influencing determinants (Teixeira, 2007).

Environmental psychologists discuss socio-psychological patterns (e.g. values, worldviews, human-nature relationships [HNR], norms, beliefs, motivation, etc.) as determinants of human behavior (Bamberg and Möser, 2007; Turaga et al., 2010). Stephenson et al. (2010) developed the Energy Culture Framework to investigate how external factors (e.g. policies) may strengthen or weaken individual drivers of energy culture change. Hoff-Elimari et al. (2014) identified a likely association between governance and people's underlying socio-psychological patterns of values. Similarly, Baum and Gross (2016) suggest that policies have not only the primary effect of encouraging behavioral change, but also secondary effects such as crowding effects. Besides the standard direct price effect, monetary incentives also have an indirect psychological effect (Gneezy et al., 2011), in terms of crowding-out specific groups (Nyborg and Rege, 2003) or of reducing intrinsic motivation to contribute to public goods permanently (Thøgersen, 2003). This article aims to contribute to these discourses and investigates primary and secondary effects (Baum and Gross, 2016) of photovoltaic (PV) policies. The basic assumption is that policies do not only encourage PV investments (primary effect), but also motiva-

Abbreviations: CSPP, citizen solar power plant; HNR, human-nature relationships; PV, photovoltaic; PV_{AT}, photovoltaic investors in Austria; PV_{IT}, photovoltaic investors in Italy; nPV_{AT}, no photovoltaic investors in Austria; nPV_{IT}, no photovoltaic investors in Italy; RQ, research question

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http://dx.doi.org/10.1016/j.enpol.2017.06.063
Received 31 October 2016; Received in revised form 7 March 2017; Accepted 29 June 2017

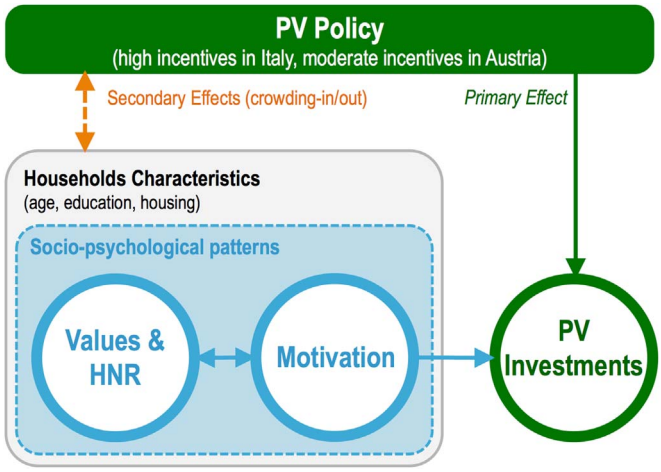

Fig. 1. Research framework to investigate primary and secondary effects of PV policies (adapted from Braito et al. (2017)).

tion crowding, such as crowding-in/out individuals with specific socio-psychological patterns. In the presence of external rewards such effects might be the undermining of altruistic values, ecocentric HNR or the reinforcement of pro-environmental, pro-social motivation (see Fig. 1).

Herein, we specifically look at the household adoption of PV. This technology does not only contribute to a low emission energy future (del Rio and Burguillo, 2008), but it also belongs to those renewable energy sources that can be adopted in a decentralized way by citizens, either individually or collectively. Moreover, a variety of energy policies have emerged in recent decades to support the diffusion of PV (De Boeck et al., 2016). We investigated crowding effects of policies in two comparative study cases with contrasting PV programs for investments at the household level: high financial support in the province of Bolzano/South Tyrol (Italy, IT) versus lower financial support in the province of Styria (Austria, AT). While policies for the diffusion of PV differ, both regions are similar in terms of geography, history, culture, language, and socio-economic aspects.

The empirical base of our study was a questionnaire survey conducted in 2014 and 2015, including participants and non-participants of diverging PV programs at the household level. We first compared crowding effects of the two PV policy regimes. We assumed that besides encouraging PV diffusion in the short term, PV policies implicitly triggered crowding in/out effects, such as undermining self-motivation or groups with interest in collective action. Second, we analyzed how individual and collective PV investors differ from non-investors in terms of demographics and social-psychological patterns. To our knowledge, this is the first study that compares individual and collective socio-psychological patterns of PV investment in diverging policy regimes. Ultimately, understanding secondary effects of policies for energy transition can help to assess the overall efficacy of policies (Rode et al., 2015).

2. Research framework and questions

To investigate secondary effects of PV policies, we addressed individual determinants of human behavior that are widely studied to grasp human behavioral decisions (Poortinga et al., 2012; Steg et al., 2014; Klöckner, 2013), or PV adoption in particular (Fleiß et al., 2017; van der Werff and Steg, 2016; Wolske et al., 2017). Universal frameworks to investigate human behavior (for an overview see Bamberg and Möser, 2007) are the Theory of Planned Behavior by Ajzen (1991), the Value-Belief-Norm by Stern et al. (1999), or the Norm-Activation Model by Schwartz (1977). Braito et al. (2017) merged these theories in their conceptual framework and introduced HNR as an additional variable (see also Muhar et al., 2017). Considering PV investments as a type of environmental behavior we applied this framework, which suggests linearity and internal, sequential triggering of psychological patterns that lead to behavioral decisions (Braito et al., 2017). We simplified the framework to investigate crowding effects of PV policies (see Fig. 1) in our cross-sectional study. Simply put, *PV Policies* are designed to encourage household's *PV Investments* (primary effect, solid arrows in Fig. 1), but might also crowd-in/out specific *Household Characteristics* (age, education, housing condition) or individuals with specific socio-psychological patterns (*Values* & *HNR, Motivation*) (secondary effects, dotted arrows in Fig. 1). Values and HNR are more abstract principles that people strive for in their lives. In contrast, motivations are defined as generalized classes of goals (Kleinbeck, 2017) and have a situational effect on the willingness to invest or not to invest in PV. In a cross-sectional study design we first compared crowding effects of diverging PV policies, and afterwards socio-psychological patterns that reinforced individual and collective PV investments.

Most common investigated determinants of PV adoption are related to economic and technological considerations (De Boeck et al., 2016; Sarasa-Maestro et al., 2013; de la Hoz et al., 2012; Badcock and Lenzen, 2010; Dusonchet and Telaretti, 2010). But beyond the standard direct price effect, monetary incentives are expected to have secondary effects such as attracting or excluding specific groups (Baum and Gross, 2016; Rode et al., 2015; Gneezy et al., 2011; Nyborg and Rege, 2003). They might reduce self-motivation for behavioral change in the long run (Thøgersen, 2003) as they implicitly promote self-enhancement values or anthropocentric HNR, which in turn support short term thinking and reduce the awareness of bigger-than-self problems or the willingness to engage in collective action (Evans et al., 2013). Therefore, we sought to better understand crowding-in/out effects of PV policies with our first research question (RQ1): *How do socio-psychological patterns of PV investors differ under lower (Austria) and higher (Italy) incentive regimes?*

Scholars typically study individual and collective behavior separately, and consequently give policy recommendations of unilateral character. Moreover, Kastner and Stern (2015, p. 85), concluded that "[...] too many studies have been measuring variables that are easy to measure rather than ones that seem likely to have predictive power". Scholars usually focused on socio-demographics, education, location or social pressure when studying acceptability or adoption of small-scale renewable energy (Karakaya et al., 2015; Kastner and Stern, 2015; Schaffer and Brun, 2015). Similarly, Sovacool et al. (2015) claim that a thorough understanding of the role socio-psychological patterns play in energy related decision processes is still missing. We addressed these knowledge gaps with our second research question (RQ2): *Which socio-psychological patterns differentiate PV-investors from non-investors?*

3. Study case description

To investigate our RQs, we selected the provinces of South Tyrol (Italy) and Styria (Austria) as our two study contexts. Both have a similar Alpine setting, but are located in different countries and thus belong to diverging policy contexts. South Tyrol, the northern province of Italy, was part of the Austro-Hungarian Monarchy until 1920, and shares a common historical and cultural development with Austria, and is mainly German speaking.

Italy introduced its financing program 'Conto Energia' to support PV investments in 2005, which lasted until the program ended in July 2013 (Orioli and Di Gangi, 2015). In Austria, households could apply only once a year for limited PV funds (on New Year's Eve, the ceiling was reached within minutes), whereas in Italy there was no cap during the funding period. Austrian financial support was moderate (FiT,[1]

[1] Feed-in Tariff (FiT): For a specific time period the public energy authority guarantees to purchase electricity generated from renewable energy sources at a rate per kWh somewhat higher than the retail electricity rates being paid by the customer.