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We choose what we like – Affect as a driver of electricity portfolio choice

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ABSTRACT

Numerous countries are restructuring their electricity systems. Transitioning to electricity systems that are considered acceptable by the public requires that the public's preferences be taken into account. In this study, we investigate the type of energy technology portfolio that people prefer for Switzerland, and why they prefer it, when they are faced with two realistic constraints: (i) the limited domestic potential for the expansion of power plants and (ii) the requirement to not dismantle existing infrastructure. We find that the affect evoked by particular energy technologies is consistently the most important driver of the proportion of those technologies included in an energy portfolio. The regression models for the investigated technologies explain between 14% and 54% of the variance, providing strong support for the affect heuristic. We further find that concerns regarding environmental impacts, costs or climate change play an additional role for portfolio preferences. This is reflected in four different clusters we identified for the German-speaking Swiss population who potentially hold opposing views as to what they consider the best electricity mix. For policymakers, our findings suggest that positive affective reactions towards energy technologies are necessary, although concerns must also be considered if the implementation is to be widely accepted.

1. Introduction

Similar to many other countries worldwide, Switzerland is currently in the process of restructuring its energy system. Following the nuclear accident in Fukushima in 2011, a new Swiss energy policy was developed, which includes the phasing-out of nuclear power. The first major hurdle to this new policy has now been overcome, since the new energy law was finally approved in a referendum vote[1] by the Swiss population in May 2017 (FC, 2017; SFOE, 2017). The second, now impending, step in the process involves implementing the national policy in a way the public accepts. Policymakers therefore need to identify the most desirable and acceptable energy mix for the year 2035, which is a milestone in the Swiss energy transition (SFOE, 2013). Determining people's preferences in terms of energy technologies as well as the factors that drive those preferences can help policymakers with the implementation of the law.

The focus of previous studies has been public acceptance of individual electricity technologies (Greenberg, 2009; Greenberg and Truelove, 2011; Visschers and Siegrist, 2014). Their findings indicate that the public commonly prefers solar and wind power over non-renewable technologies such as coal, natural gas or nuclear power. However, from a technical standpoint, electricity cannot always be provided using a single technology. Rather, there exist certain limitations on the composition of the future electricity mix. One major constraint is the limited potential to increase domestic power production for certain technologies. In Switzerland, for instance, neither solar power (Assouline et al., 2017; Kienast et al., 2017) nor hydropower (SFOE, 2012) can cover the entire domestic electricity demand on their own, which demonstrates their limited technical capacities. Moreover, some of the electricity supply is already ensured through power plants that will still be operational in 2035. Dismantling this existing infrastructure would be extremely costly. We therefore suggest that it is important to examine the type of energy technology portfolio that the public prefers for power generation, as well as why they prefer it, when faced with two realistic constraints: (i) the limited domestic potential for the expansion of power plants and (ii) the requirement to not dismantle existing infrastructure.

The present study investigates the portfolio choices associated with energy technologies, with a focus on the type of electricity mix people would prefer to see implemented in the future in order to meet Switzerland's electricity demand. The aim is to examine those factors driving the portfolio choice that have been shown to be associated with

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[1] Referendum votes represent a means of direct democracy. Changes to the constitution always require a referendum vote in Switzerland, while changes to the law can be subject to a facultative referendum, under the condition that it has been requested by 50,000 voters or eight cantons within a 100-day period following a parliamentary decision (Stykow, 2007).

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the acceptance of the same set of energy technologies. As members of the public might differ with regards to their preferences for energy technologies (Greenberg and Truelove, 2011), a sub-aim of the study is to explore whether the examined sample of individuals exhibit dissimilar preferences in relation to the future electricity mix as well as whether their preferences are compatible with the new energy law.

1.1. Acceptance vs. portfolio choice

Acceptance can be, and indeed has been, investigated at the national, community or individual/organisational level. These levels respectively correlate with the object of acceptance, i.e. the type of energy technology, infrastructure project or on-site energy applications (Upham et al., 2015). We focus on the problem scope of technology acceptance at the country level, thereby shedding light on the types of energy technologies that are accepted in various countries. In general, renewable energies are preferred over nuclear power and fossil fuels in both Switzerland (Rudolf et al., 2014; Visschers and Siegrist, 2014) and elsewhere (Ansolabehere and Konisky, 2014; Bronfman et al., 2012; Ertör-Akyazı et al., 2012; Greenberg and Truelove, 2011). However, the way acceptance is operationalised differs across these studies. Some studies measure preferences for an increase or decrease in electricity produced by a certain technology (Ansolabehere and Konisky, 2014; Greenberg, 2009; Greenberg and Truelove, 2011), while others focus on the degree of being in favour of or opposed to local energy systems (Noppers et al., 2014) or the building of new power plants (Sütterlin and Siegrist, 2017). Similarly, acceptance has also been determined as the degree of accepting the expansion of a given energy technology (Peters and Slovic, 1996; Tampakis et al., 2013; Visschers and Siegrist, 2012, 2014; Visschers and Wallquist, 2013) or accepting the replacement of existing technologies (Keller et al., 2012). When determining the acceptance of separate energy technologies, no trade-offs have to be made between the different energy technologies. Theoretically, an individual can accept the expansion of all energy technologies or be opposed to the building of any new kind of power plant. While these acceptance measures provide us with a generic insight into public acceptance, they fail to deliver insights into preferences for realistic energy portfolios. We contend that it is thus necessary to take into account the requirements and constraints of the electricity system in order to ensure that realistic portfolio preferences are indicated.

Requirements in this regard are most commonly related to the need to expand power generation and therefore current capacities so as to meet the growing electricity demand (Ansolabehere and Konisky, 2014). In the case of Switzerland, the electricity demand for the year 2035 is estimated to increase between 7.1% and 25.3% when compared to the year 2000 (SFOE, 2013). The need to construct new power plants is further amplified by the phasing-out of existing nuclear power plants, which currently account for 30–35% of domestic electricity production (SFOE, 2016). Moreover, constraints derive from the limited potentials ascribed to the expansion of the different types of power plants (SFOE, 2012, 2013). This can be due to potential conflicts with other services (habitat protection, groundwater protection, landscape services, etc.) (Kienast et al., 2017), limited resources, as in the case of biomass (Panos and Kannan, 2016), or limited adequate siting possibilities for solar panels on rooftops (Assouline et al., 2017).

We draw on the literature concerning the development and testing of decision support frameworks in order to elicit public preferences regarding the energy system (change) (Bessette et al., 2014, 2016; Demski et al., 2017; Mayer et al., 2014; Pidgeon et al., 2014). In contrast to the approach applied in the acceptance literature, here the respondents are asked to generate their preferred portfolios based on a set of different energy technologies or conservation measures. The portfolios are required to meet a certain electricity demand, which is sometimes combined with CO_2 reduction targets (Mayer et al., 2014). Further, the amount that a given technology can contribute to a portfolio is constrained, since only a limited number of power plants from each energy technology can be selected (Bessette et al., 2014, 2016; Mayer et al., 2014). This approach ensures that realistic options are chosen and trade-offs between technologies are made. The present research does not include information about the attributes of the different technologies, for example, their cost or their contribution to air pollution. This is in contrast to the approach adopted by Bessette et al. (2014) and Mayer et al. (2014), who focus on delivering decision-making support in complex decision contexts. When information was provided regarding a negative attribute of a given energy technologies it significantly decreased the level of acceptance when compared to the more general level of acceptance seen when no such information was provided (Sütterlin and Siegrist, 2017). Information can, at least during independent evaluations of energy technologies, influence the public's level of acceptance. Although these findings underline the relevance of investigating the impact of information on portfolio choice in environments wherein such information can be compared across technologies, the present study focused on the predictive power of prior attitudes with regards to portfolio choice. Hence, comparable to what Sütterlin and Siegrist (2017) term public acceptance at an abstract (general) vs. concrete level (i.e. mention of negative attributes), we intend to assess portfolio choice at an abstract level, where no information concerning the attributes of different energy technologies are provided. We investigate the relationship between portfolio choice and the explanatory factors that have previously been shown to be significant in relation to the acceptance of individual energy technologies.

1.2. Explanatory factors – the role of concerns

People's individual values influence their acceptance of energy technologies (Perlaviciute and Steg, 2015). For instance, environmental values increase the acceptance of solar, wind and natural gas power plants, although such values slightly decrease the acceptance of nuclear power. They also find that valuing energy security increases the acceptance of nuclear power, while it decreases the acceptance of other power sources (Visschers and Siegrist, 2014). Demski et al. (2015) identify public values in relation to the UK's energy system transition, including “environment and nature” or “security and stability” (p.64). We see such values as goals for a future energy system, that is, they are states that should be reached following the transformation of the current energy system. We contend that concerns arise if the achievement of these public values is perceived to be threatened and therefore unlikely.[2] Concerns about climate change, the environment, energy security and the economy all appear to be relevant to the acceptance of energy technologies.

1.2.1. Concern about climate change

Concern about climate change has often been studied as an explanatory variable for acceptance in the context of nuclear power. Climate change mitigation, when perceived as a benefit of nuclear power, positively influences public acceptance of nuclear power plants (Visschers et al., 2011). If nuclear power is framed as mitigating climate change, public acceptance of it is higher (Pidgeon et al., 2008). Moreover, people who believe that nuclear power helps to mitigate climate change exhibit a lower level of concern about climate change and the environment, and they ultimately show a more positive evaluation of nuclear power (Spence et al., 2010). However, increased support for

[2] The public considers certain consequences and features of the future electricity system to be important, for example, the capacity to achieve a secure and stable energy supply. In the context of energy system change, these considerations have been termed public values (Demski et al., 2015). However, if the public perceives that these valued outcomes will not be achieved, then concerns regarding certain consequences of the electricity system might arise. Hence, we consider that such concerns about perceived negative consequences reflect the opposite of what people value in a future energy system.