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Intention to act towards a local hydrogen refueling facility: Moral considerations versus self-interest

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ABSTRACT

Using hydrogen as a fuel in transport may reduce environmental and societal problems resulting from current fossil fuel use, such as climate change and oil dependency. However, this requires both building hydrogen refueling infrastructure and gaining the acceptance of the citizens living nearby. Knowing what motivates citizens to act in favor of or against hydrogen refueling facilities may help in the development of policies that encourage the use of hydrogen as a fuel. This paper aims to contribute to this by examining whether intention to act in favor of, or against, a local hydrogen refueling facility is more strongly based on moral considerations or on self-interest. To this end, the explanatory value of the Norm Activation Model (NAM) was compared with the explanatory value of the Theory of Planned Behavior (TPB). The analyses were carried out on data collected from a group of Dutch participants who received information about hydrogen as a fuel, hydrogen technology, and the opinion of stakeholders. The group consisted of 800 participants, of which 495 were in favor and 92 against a local hydrogen refueling facility. We found that both NAM and TPB variables significantly explained intention to act for supporters and opponents. The NAM variables explained intention to act more strongly than the TPB variables for both groups. These findings suggest that intention to act both in favor of and against hydrogen refueling facilities was more strongly based on moral considerations than on self-interest. If TPB variables were added to a model that included NAM variables, the explained variance increased for the supporters group, whereas this was not the case for the opponents group. These results indicate that for supporters of hydrogen refueling facilities, self-interest is a secondary goal after moral considerations but that this is not the case for opponents. To validate the findings, the analyses were also carried out on data from a group of participants that did not receive information. This control group consisted of 414 participants, of which 184 were in favor of and 45 against a local hydrogen facility. The same results were found for these supporters and opponents, indicating the robustness of our findings.

1. Introduction

Environmental and societal problems resulting from the current use of fossil fuels in transport have spurred the search for more sustainable transport solutions, such as reducing the need for travel, realizing modal shifts, distance reduction realized by land-use policy measures and technological innovation (Banister, 2008). Technological innovations are often regarded as one of the most effective measures to reduce these problems (Banister et al., 2011; Kennisinstituut voor Mobiliteitsbeleid,

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2011; Ogden, 2006). Important technological innovations have involved the use of energy carriers like electricity and hydrogen in battery electric vehicles, plug-in hybrid electric vehicles and fuel cell electric vehicles (e.g. Thomas, 2012). However, many vehicles are either too big or travel too far to be 'comfortably' powered by batteries. In addition, electricity is still not produced sustainably, so using hydrogen as a fuel is considered an option for reaching stringent reduction targets, such as a reduction of greenhouse gas emissions by 80% by 2050 compared to 1990 (as agreed upon by the EU and G8 in 2009, McKinsey & Company, 2007; Thomas, 2012).

The environmental and societal effects of using hydrogen as a fuel depend on how hydrogen is produced. If hydrogen is produced from renewable energy sources (wind, solar, biogas), it will reduce negative effects of current fossil fuel use in transport, including climate change, air pollution, and energy insecurity (Ball and Wietschel, 2009; Banister, 2000; Yang and Ogden, 2007). If hydrogen is produced from natural gas and used in a fuel-cell vehicle, the efficiency of the fuel cell also results in significantly lower emissions of greenhouse gases compared with direct use of gas or oil in a combustion engine (Ogden, 2006; Thomas, 2012). However, this option retains a dependency on fossil fuels. Independent of the production source for hydrogen, shifting to hydrogen as a fuel would improve local air quality in cities as hydrogen fuel-cell vehicles only emit water vapor. Using hydrogen as a fuel is thus potentially beneficial to both the environment and society. Governments have therefore set up programs to stimulate hydrogen technology, such as in the Netherlands (Hymove, 2010a,b; Rijksoverheid, 2011).

Refueling infrastructure is necessary for hydrogen to be used as a fuel (e.g. Struben and Sterman, 2008; Yang and Ogden, 2007). A crucial factor to the successful implementation of hydrogen refueling facilities is acceptance by citizens (European Commission, 2006; McDowell and Eames, 2006), among others because public acceptance drives political acceptance (Banister, 2008). Knowing what motivates citizens to act in favor of or against hydrogen refueling facilities could enable policy makers to both develop policies that receive public support and improve their communication to the public about the technology and related policy decisions.

While two studies have examined the determinants of being in favor of or against a hydrogen refueling facility in their region (i.e. O'Garra et al., 2008; Thesen and Langhelle, 2008), no studies have investigated the determinants of citizens' intention to act towards a hydrogen refueling facility. Intention to act is a better predictor of actual behavior than mere evaluations of the technology (Ajzen, 1991; Armitage and Connor, 2001). Policy makers can benefit from early knowledge of how people will respond, and thus prior to actual observable behavior, intention to act is useful to study.

In social and environmental psychology there are a number of theories and models available that predict intentions and behavior (Bamberg and Schmidt, 2003). In this paper we test two theories that describe how moral considerations and self-interest are likely to influence citizens' intention to act in favor of or against a local hydrogen refueling facility. The Norm Activation Model predicts the effect of moral considerations on intentions and behaviors (NAM; Schwartz, 1977; Schwartz and Howard, 1981). The Theory of Planned Behavior predicts the effect of personal interests on intentions and behavior (TPB; Ajzen, 1991). The main aim of this paper is to uncover to what extent citizens' intention to act in favor of or against a hydrogen refueling facility is based on moral considerations or self-interest. We do this by testing the effectiveness of each theory to predict intention to act in favor of and against the technology. In addition we compare the explanatory value of the theories and test the combined effect of the theories for opponents and supporters of a local hydrogen refueling facility. In the following section, we discuss the Norm Activation Model and the Theory of Planned Behavior and its application for predicting intention to act in favor of or against a local hydrogen refueling facility.

2. Theoretical background and hypotheses

2.1. The Norm Activation Model

The Norm Activation Model (NAM; Schwartz, 1977; Schwartz and Howard, 1981) explains behavior that is morally based. While the theory was originally used to explain helping behavior, Schwartz suggested that the theory could be used to explain pro-social behavior in general. More recently, the theory has been applied to explain pro-environmental intention and behavior, such as intention to use and actual use of public transport (Bamberg and Schmidt, 2003) and conservation intention and behavior (Kaiser et al., 2005). Pro-environmental behavior is regarded as a specific type of pro-social behavior, because both involve giving up self-interest for someone or something else (Abrahamse et al., 2009). The personal norm towards taking action, which can be defined as a feeling of personal obligation, is the most important predictor of intention to act pro-socially or pro-environmentally. Two important predictors of both personal norm and intention to act are problem awareness and outcome efficacy. Problem awareness concerns awareness of the adverse consequences of not taking action. Outcome efficacy concerns beliefs about the perceived effectiveness of the behavior in solving these adverse consequences (Steg and De Groot, 2010; Huijts et al., 2012).

In the case of hydrogen refueling facilities, moral considerations can lead to intention to act in favor of, or against the technology, depending on whether it is believed that hydrogen as a fuel will be beneficial or detrimental to the environment and to society. In studies in The Netherlands and the UK participants associated hydrogen with environmental and societal benefits, such as 'clean', 'environmentally friendly', 'less emissions' or 'saves fossil fuels' (Hickson et al., 2007; Molin, 2005; Montijn-Dorgelo and Midden, 2008; O'Garra et al., 2005; Zachariah-Wolff and Hemmes, 2006). On the other hand, another UK study (Ricci et al., 2010) shows that some people do not perceive these environmental and societal benefits. Moral