



Who buys New Energy Vehicles in China? Assessing social-psychological predictors of purchasing awareness, intention, and policy



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ABSTRACT

This paper investigates the salience of social-psychological factors in explaining why drivers purchase (or fail to purchase) New Energy Vehicles (NEVs)—including hybrid electric vehicles, battery electric vehicles, and fuel cell electric vehicles—in China. A questionnaire measuring six dimensions (including attitudes, subjective norms, perceived behavioral control, personal norms, low-carbon awareness and policy) was distributed in Tianjin, where aggressive policy incentives for NEVs exist yet adoption rates remain low. Correlation analysis and hierarchical multiple regression analyses are applied data collected through 811 valid questionnaires. We present three main findings. First, there is an “awareness-behavior gap” whereby low-carbon awareness has a slight moderating effect on purchasing behavior via psychological factors. Second, subjective norms has a stronger influence on intention to purchase New Energy Vehicles than other social-psychological factors. Third, acceptability of government policies has positive significant impact on adoption of New Energy Vehicles, which can provide reference potential template for other countries whose market for New Energy Vehicles is also in an early stage.

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1. Introduction

There has been a growing interest concerning the relationship between climate change and transportation in China (Schwanen, Banister, & Anable, 2011). There, transportation has the fastest annual growth rates of both energy use and resulting greenhouse gas emissions (Du, Liu, Southworth, et al., 2017). For instance, transportation accounted for about 365 million tons of national Chinese CO₂ emissions in 2010, an amount more than twice that of 2005.¹ This doubling of emissions was mainly due to a rapid growth of vehicle ownership. China's private vehicle population has expanded rapidly with an average annual growth rate of 14.7% over the past two decades. Since 2009, China has been the world's largest car market, and car ownership per thousand persons escalated beyond 100 for the first time in 2014. Thus, vehicle emissions have become a

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¹ Edition Committee of China's National Assessment Report on Climate Change. China's National Assessment Report on Climate Change. Unpublished results.

major source of Chinese air pollution (Peng, Du, Ma, Fan, & Broadstock, 2015). According to national statistics,² personal light duty vehicles emitted 34.39 million tons of carbon monoxide (CO) in 2013, 4.31 million tons of hydrocarbons (HC), 6.40 million tons of nitrogen oxides (NOx), and 0.59 million tons of particulate matter (PM) in 2013.

To lessen greenhouse emissions, the Chinese government has announced its intention to reduce carbon emission intensity per unit GDP in 2020 by 45% compared to 2005 levels. To achieve this goal, planners have begun to endorse and incentivize New Energy Vehicles (NEVs) in China, a term that includes hybrid electric vehicles, battery electric vehicles, and fuel cell electric vehicles. Fig. 1 shows the sales volume of automobiles and NEVs in China between 2009 and 2014. As it indicates, 2014 saw a significant spike in the total sales of NEVs (about 75,000), but these numbers still pale in comparison to conventional automobiles (about 2.5 million in 2014).

These low uptake rates are unfortunate, to say the least, given that China has attempted to accelerate NEVs adoption through a variety of tools including demonstration projects, city development and transport planning policies, advanced research, and tax credits. However, these tools taken should be based on a thorough understanding of the drivers' social-psychological factors on purchasing NEVs. Moreover, psychological factors aimed at influencing intention have not yet been considered by policymakers in China (Wan, Sperling, & Wang, 2015). Therefore, prior to developing policies, it is necessary to analyze the current relationship between the people's perceptions of NEVs and social low carbon behavior.

Previous literature has suggested that several psychological factors can affect purchasing patterns and behavior for NEVs. Some studies narrowly argue that intention is a major predictor of actual behavior (Bamberg & Schmidt, 2001; Schuitema, Anable, Skippon, & Kinneer, 2013). But we take a more complex view, proposing that purchasing behavior will be conditioned by a series of social-psychological factors such as attitudes towards NEVs, subjective norms, perceived behavioral control and personal norms (Kim & Rasouli, 2014; Ajzen, 1991). Also, we argue that symbols and notions of self-identity that emerge from low-carbon awareness can also considerably influence pro-environmental behavior such as purchasing NEVs or favoring mass transit (Carley, Krause, Lane, & Graham, 2013; Egbue & Long, 2012; Geels, Schwanen, Sorrell, et al., 2018; Krupa et al., 2014; Lane & Potter, 2007; Nielsen, Hovmøller, Blyth, & Sovacool, 2015; Skippon & Garwood, 2011).

Moreover, this paper further explains whether environmental awareness is necessarily related to intention or behaviors, which has been an ongoing debate by previous literature (Abrahamse, Steg, Vlek, & Rothengatter, 2005; Ozaki & Sevastyanova, 2011). Most of the existing research explains this debate by comparing levels of awareness and behavior (Owens & Driffill, 2008; Van Raaij & Verhallen, 1983), Bai and Liu (2013) even argue that a low-carbon awareness-behavior gap exists between motivation and barriers. Although such an awareness-behavior gap has been found in numerous previous studies, less literature exists which explains how the gap is formed or relates to low carbon awareness. Therefore, we regard low-carbon awareness as a moderating variable (Zhang & Zhou, 2016) and explain how it influences behavioral intention via social-psychological factors in the field of NEVs. Low-carbon value, low-carbon subjective knowledge and low-carbon objective knowledge are presented to measure moderating effect of low-carbon awareness on the intention to purchase NEVs in this paper.

In proceeding on this path, our study makes at least two contributions to the literature. First, we show how social-psychological factors can exert both direct and indirect influence on purchasing patterns. We find that extended TPB variables have significant direct influence on intentions to purchase NEVs. And low-carbon awareness has a moderating effect on purchasing behavior via psychological factors. Also, our study illustrates how the attitudes towards NEVs, subjective norms, and perceived behavioral control will be different among consumers based on varying levels of low-carbon awareness. The relationship between attitude and behavioral intention is strengthened with higher low-carbon awareness. On the contrary, higher low-carbon awareness weakens the relationship between subjective norms/perceived behavioral control and behavioral intention. Many studies ignore these dimensions and interactions altogether, including those that analyze the relationship between government policies and NEVs purchasing intention (Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Such studies generally focus on the intersection between awareness and adoption of vehicles, and thus they either ignore China or focus on only one class of vehicle, such as Kang and Park's (2011) work on fuel cell vehicles, Chandra, Gulati, and Kandlikar's (2010) study on hybrid flex-fuel vehicles, or Lin, Wells, and Sovacool's (2017) work on e-bikes, rather than NEVs in a comparative and holistic manner.

Second, drawn from previous psychological theories (Helveston et al., 2015; Thøgersen, 2006), we posit that subjective norms are strongly correlated with pro-environmental behavior. We propose and test an extended Theory of Planned Behavior (TPB) research model which includes personal norms and government policies to examine NEV purchasing intentions. Thus, we shed light on two central research questions: (1) what are the major factors affecting intentions to purchase NEVs, and (2) how does low-carbon awareness affect those factors?

2. Theoretical framework

The theory of planned behavior are representative theories in the study of pro-environmental behavior. The following paragraphs summarize recent literature on each influential variables in the context of behavioral intentions towards

² MEP, Ministry of Environmental Protection. Environment Statistical Annual Report 2013. (http://zls.mep.gov.cn/hjtj/nb/2013tjnb/201411/t20141124_291867.htm), November 24, 2014.

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