



# Determinants of Southern Italian households' intention to adopt energy efficiency measures in residential buildings<sup>☆</sup>



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## ABSTRACT

Implementing Energy Efficiency Measures (EEMs) in residential buildings is one of the most effective ways of decreasing household energy consumption. The present research adopts an extended version of the Theory of Planned Behavior – which includes attitude, subjective norms, perceived behavioral control, and environmental concern – to investigate the antecedents of households' intention to adopt and willingness to pay for EEMs. The research was conducted in a Southern Italian region that has intensively promoted the adoption of renewable and energy-saving technologies. The results show that attitude is the main determinant of households' intention to adopt and willingness to pay for EEMs. However, subjective norms, perceived behavioral control, and environmental concern have their own positive effects based on the income level, education, and age of household subgroups. The results have practical implications for companies and policy-makers interested in promoting EEM adoption and encouraging sustainable development.

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## 1. Introduction

As the world population expands, energy conservation has risen to the forefront of public discourse, with governments focusing on how to instill the public with greater energy awareness. In Europe, commercial and residential buildings account for almost 40% of citizens' energy consumption (Allouhi et al., 2015). The use of Energy Efficiency Measures (EEMs) – which entails providing the same level of service while using less energy – is one of the most

effective ways to decrease household energy consumption, therefore, ensuring more sustainable cities and regions. The present study focuses on residential buildings, as they represent 75% of the total building stock (Eurostat, 2010). In contrast to energy-saving measures, EEMs require the use of innovative materials and construction methods, as well as the installation of technologies such as solar photovoltaic, micro-wind, solar thermal, heat pumps, biomass boilers, and pellet stoves. They constitute a relatively new system able to foster energy conservation without restricting people's lifestyles, and have seen a rapid diffusion in residential buildings during the past few decades, partly due to the various initiatives promoted by public and private organizations.

Also in Italy several municipalities and regions have launched programs and incentive operations to foster the adoption of technologies aimed at saving energy and facilitating sustainable production. Against this background, this study focuses on Apulia (see Fig. 1), a Southern Italy region which can be considered one of the best examples in the adoption of innovations and EEMs in this area. For instance, the Act No. 13/2008 and the Regional Act No. 14/2009

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have allowed households to increase the volume of existing buildings in exchange for adopting energy efficient technologies. Furthermore, the recent PAN (Puglia Active Network) Project, promoted by the Apulia Regional Government and Enel (an Italian distributor of electricity and gas), has provided large investments aimed to foster the development of energetically sustainable solutions. The diffusion of EEMs in residential buildings represents one of the most sensitive policy issues in this area and Apulia has been the first Italian region able to activate, according to the 2014/2020 European financial programs, an investment of 2 billion Euro for energetically efficient purposes.

Indeed, the local government has allocated 33.6% of its funds toward increasing environmental protection through local development (i.e., Regional Operative Programme, 2014–2020) and has provided several incentives – in the form of subsidies, tax exemption or tax reduction – to stimulate the adoption of EEMs.

However, these incentives have not been as effective at fostering the adoption and diffusion of EEMs as policymakers had hoped (Berardi, 2013). Thus, there is a clear need to design more effective policies, which requires a better understanding of what prompts households to adopt EEMs. However, scholarship has not widely investigated the factors that determine households' intention to use EEMs, nor has it evaluated how companies and policymakers could leverage these factors in their communication strategies.

To help close this gap, this research examines the determinants of households' intention to adopt and willingness to pay for EEMs by employing an extended version of the well-known Theory of Planned Behavior, which has transcended its social psychological origins (Ajzen, 1991) to become a reference framework in several environmentally relevant research settings. Using this theory, scholars can better understand and predict different human behaviors, such as farmers' intention to grow biofuel crops (Guido, 2009; Peluso, 2015), planters' intention to supply oil palm residues (Chin et al., 2016), as well as energy-saving behaviors (Chen,

2016). The Theory of Planned Behavior (Ajzen, 1991) postulates that three main determinants influence individuals' intention to perform a given behavior: the *attitude toward the behavior* – a subjective positive or negative evaluation of the behavior based on the perceived advantages or disadvantages deriving from that behavior; the *social norms* – the perceived social pressure to perform or not perform the behavior based on the subjective perception that others might approve or disapprove of that behavior; and the *perceived behavioral control* – the subjective evaluation of how easy or difficult it will be to perform the behavior based on perceived facilitators of or obstacles to that behavior.

This study extends the basic framework of the Theory of Planned Behavior (Ajzen, 1991) by including another determinant: namely, the *environmental concern*, defined as the degree to which people are aware of problems regarding the environment and support activities aimed to solve them or even engage personally in such activities (Dunlap and Jones, 2002; Fransson and Garling, 1999). Worldwide, an increasing number of people is becoming conscious of the environmental impact of their consumption behavior, and are interested in reducing it (Paul et al., 2016). Because environmental concern was found to significantly influence people's intention to enact sustainable consumption behavior it seems reasonable to hypothesize that it may also determine households' intention to adopt energy efficiency measures.

Therefore, the present research tests a model in which households' intention to adopt and willingness to pay for EEMs are expressed as a function of their attitude toward adoption, subjective norms, perceived behavioral control, and environmental concern. Unlike the adoption of unconstrained behaviors (e.g., energy savings), the use of EEMs requires an investment decision; thus, the inclusion of households' willingness to pay might considerably improve the diagnostic and predictive validity of the tested model. In addition, it has been examined whether and how the relationships between these four antecedents and households' intention to adopt and willingness to pay vary across different levels of income, education, and age (Fig. 2).

## 2. Determinants of households' intention to adopt and willingness to pay for energy efficiency measures (EEMs)

A number of studies have used the Theory of Planned Behavior to examine the *intention to adopt EEMs* (e.g., Abrahamse and Steg, 2009, 2011; Harland et al., 1999). Most of them demonstrate that households' attitudes toward EEMs – and, particularly, the advantages they perceive – drive their decision to adopt these technologies in their residential buildings (Ek, 2005; Ma et al., 2013; Wang et al., 2014; Whitmarsh and O'Neill, 2010). However, prior investigations into specific EEMs (i.e., insulation activity, improved woodstoves, light bulbs, and unbleached papers) have shown that environmental concern (Vlek, 2000) together with subjective norms and perceived behavioral control (Khorasanizadeh et al., 2016; Nyrod et al., 2008) may also exert an influence on individuals' intentions. Previous studies have revealed that environmental concern positively influences consumers' attitudes and intention to purchase energy-saving branded products (Hartmann and Apaolaza-Ibáñez, 2012) and, moreover, it can be deemed to be a relevant determinant of people's intention to keep electricity down (e.g., Ek and Söderholm, 2010; Pothitou et al., 2016). By enlarging the basic framework of the Theory of Planned Behavior (Ajzen, 1991), Chen (2016) found that additional factors regarding the self, in general, and one's moral obligation, in particular (i.e., one's sense of responsibility to act in ways that are morally correct for the self, others or the environment), can help shape individuals' intentions in ethically relevant situations. However, research on the impact of environmental concern on households' intention to adopt



Fig. 1. Location of the Apulia region in Southern Italy.

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