



ELSEVIER

Contents lists available at ScienceDirect

## Energy Policy

journal homepage: [www.elsevier.com/locate/enpol](http://www.elsevier.com/locate/enpol)

# Enhancing energy efficiency in public buildings: The role of local energy audit programmes



Eleonora Annunziata<sup>a,\*</sup>, Francesco Rizzi<sup>a,b</sup>, Marco Frey<sup>a</sup>

<sup>a</sup> Institute of Management—Scuola Superiore Sant'Anna, Piazza Martiri della Libertà 33, 56127 Pisa, Italy

<sup>b</sup> Università Europea di Roma, via degli Aldobrandeschi 190, 00163 Roma, Italy

## HIGHLIGHTS

- Public procurement supports the deployment of the energy efficiency of buildings.
- Energy audits and other factors influence energy efficiency in public buildings.
- Econometric analysis applied to data from 322 municipalities in Northern Italy.
- Municipalities need to overtake the “plucking of low-hanging fruit”.
- Knowledge management should be associated with removal of budget constraints.

## ARTICLE INFO

### Article history:

Received 26 August 2013

Received in revised form

14 February 2014

Accepted 15 February 2014

Available online 4 March 2014

### Keywords:

Energy efficiency

Energy audit

Knowledge management

## ABSTRACT

In the objective of reaching the “nearly zero-energy buildings” target set by the European Union, municipalities cover a crucial role in advocating and implementing energy-efficient measures on a local scale. Based on a dataset of 322 municipalities in Northern Italy, we carried out a statistical analysis to investigate which factors influence the adoption of energy efficiency in municipal buildings. In particular, the analysis focuses on four categories of factors: (i) capacity building for energy efficiency, (ii) existing structure and competences for energy efficiency, (iii) technical and economic support for energy efficiency, and (iv) spill-over effect caused by adoption of “easier” energy-efficient measures. Our results show that capacity building through training courses and technical support provided by energy audits affect positively the adoption of energy efficiency in municipal buildings. The size of the municipal authority, the setting of local energy policies for residential buildings and funding for energy audits are not correlated with energy efficiency in public buildings, where the “plucking of low hanging fruit” often prevails over more cost-effective but long-term strategies. Finally, our results call for the need to promote an efficient knowledge management and a revision of the Stability and Growth Pact.

© 2014 Elsevier Ltd. All rights reserved.

## 1. Introduction

As reported in the European Energy Efficiency Plan (2011) (European Commission, 2011), buildings are *energy intensive* and hold one of the greatest potentials for energy saving. According to a number of studies, energy efficiency measures in the building and construction sector could be promoted through the design and implementation of adequately balanced policy instruments (Ürge-Vorsatz et al., 2007; Chidiak, 2002; Rietbergen et al., 2002; Georopoulou et al., 2006; Meijer et al., 2009; Annunziata et al., 2013).

Such measures explicitly imply the involvement of all stakeholders of the sector (Lovins, 1992)—particularly public authorities who cover a multifunctional role as regulators, as building owners, tenants and developers and, lastly, as boosters for market suppliers of energy-efficient products and services (Rezessy et al., 2006; UNEP, 2007). The public procurement markets account for 19.7% of Gross Domestic Product (GDP) in EU-27 countries (European Commission, 2010). Therefore, an effective driver to foster sustainability and particularly energy efficiency could be represented by the Green Public Procurement (GPP), that is “a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured” (European Commission, 2008). Because buildings are a

\* Corresponding author. Tel.: +39 050882782; fax: +39 050883936.

E-mail address: [e.annunziata@sssup.it](mailto:e.annunziata@sssup.it) (E. Annunziata).

product group representing one of the biggest shares of the GPP budget, the public procurement associated in this field can influence the overall building and construction sector (Kahlenborn et al., 2011).

### 1.1. Energy efficiency in buildings: A decentralized activity

Despite the crucial involvement of central public authorities, the implementation of energy efficiency measures is especially a decentralized activity in which local authorities, such as municipalities, cover a key role (Laponche et al., 1997; Fleming and Webber, 2004; Radulovic et al., 2011; Hoppe et al., 2011). The development of energy efficiency at local level follows the process that began with the “Local Agenda 21” (LA21) back in 1992, during the United Nations Earth Summit held in Rio de Janeiro; such document advocates the implementation of local sustainability strategies with the support of municipalities. In such an effort, the European legislation takes care in guiding public authorities (and particularly local authorities such as municipalities) towards the implementation of energy efficiency measures starting from buildings. In particular, the Directive on Energy Performance of Buildings (EPBD) in 2002 (Directive 2002/91/CE, 2002) and its recast in 2010 (Directive 2010/31/EU, 2010) highlighted that public authorities should be first in setting the example by implementing energy efficiency measures in their public buildings. Furthermore, the recast of EPBD requests the support of local authorities in the development of energy efficiency. The European Energy Efficiency Plan (2011) (European Commission, 2011) and the new Directive on energy efficiency (2012) (Directive 2012/27/EU, 2012) confirm public authorities and local authorities as drivers to boost the markets related to energy efficiency. A tangible initiative of the European Commission, which involves the municipalities, is the Covenant of Mayors agreement. This agreement promotes an increase in energy efficiency and – more in general – a sustainable energy planning. As a matter of fact, Covenant signatories should draw up its Sustainable Energy Action Plan (SEAP), including actions that improve energy performance in municipal buildings. This initiative shows how municipalities can significantly influence energy management and sustainable development (Radulovic et al., 2011). Moreover, since 2001 the European Commission has been promoting the adoption of GPP practices as a key-tool to decrease environmental impacts and improve energy efficiency of the whole economy (European Commission, 2001) and in particular in the building and construction sector (Kahlenborn et al., 2011).

The European Union (EU) approach shows the importance of an adequate energy efficiency governance, in which political authority, institutions, and resources are jointly employed by decision-makers and implementers to achieve energy efficiency target (Jollands and Ellis, 2009). Therefore, an effective implementation of energy efficiency governance needs a multi-level perspective, which considers interactions between different levels and systems of governance (Bulkeley and Betsill, 2005; Smith, 2007), and develops relationships between public authorities and citizens (Gross, 2001). In this context, municipalities in the role of building owners contribute to energy efficiency target dealing with some critical issues, which influence the improvement of energy performance in their buildings.

### 1.2. “Preconditions” for energy efficiency in public buildings

Since the importance to implement energy efficiency, several scholars have shed some light on the mechanisms hindering the development of energy efficiency in buildings. In particular, some studies investigated the several kinds of barriers (e.g. financial barriers, information barriers, behavioral barriers, etc.) to the overall process of achieving energy efficiency in buildings (Intrachooto and Horayangkura, 2007; Nässén et al., 2008; Ryghaug and Sørensen, 2009; Karkanias et al., 2010), while others have analyzed the adoption of energy efficiency improvements in the residential

sector (Amstalden et al., 2007; Elias, 2008). All these studies have emphasized the relevance of information barriers, or rather of the widespread lack of information about technical and economic benefits associated with energy efficiency measures on behalf of both individuals and organizations which obstacles investments towards improvement in energy efficiency. These findings thus confirm knowledge to be crucial in decision-making process. Therefore, it is necessary the adoption of a suitable knowledge management, defined as “the process of capturing, distributing, and effectively using knowledge” (Davenport, 1994). Accordingly, it is worth investigating the knowledge management in organizations such as public authorities, which are constituted by multiple and competing interests (Quinn, 1983; Rainey, 2003; Ring and Perry, 1985; Rohrbaugh, 1981) and more and more take decisions to improve energy performance in their buildings. Moreover, a suitable knowledge management can improve institutional capital (i.e. knowledge, resources, leadership and learning) which can make local authorities effective and proactive entities (Evans et al., 2005).

Another strand of research identifies and analyses “preconditions” for successful local environmental policies (Hoppe et al., 2011; Barrutia et al., 2007; Coenen et al., 1999; Evans et al., 2005; Nijkamp and Perrels, 1994). Hoppe et al. (2011) classified these preconditions in organizational (motivational and resource/power characteristics) and inter-organizational (relations between local authorities and other actors) factors and then verified the influence on the ambition of energy efficiency in renovation project in residential site. Barrutia et al. (2007) emphasized the positive effect of a local support network in implementing LA21. Coenen et al. (1999) concluded that the promotion of LA21 is supported by high levels of local governments. Evans et al. (2005) underlined that local authorities play a crucial role in developing long-term prospects for civil society engagement in environmental policy processes. Such contributions confirmed the importance of identifying and analysing organizational and inter-organizational factors that characterize the choices of local authorities as regulators, but they did not consider the influence of these factors on the effectiveness of actions carried by local authorities as actor, e.g. as building owner.

### 1.3. Aim and research setting

The paper aims to investigate the factors that can influence the improvement of energy efficiency in public buildings at municipal level as components of energy efficiency governance, by taking into account the process of knowledge management in municipalities.

Specifically, the choice of analyzing Italian municipalities was based on 5 main reasons: (i) Italy is one of the EU countries with the largest building stock (Raya et al., 2011) yet the slowest annual rate of new constructions compared to European average (Meijer et al., 2009); thus as other EU member states, it must deal with huge challenge of improving energy efficiency in existing buildings; (ii) the Italian non residential sector (included public buildings) has steadily increased its energy consumption since 1995 (by passing from 9.5 Mtep in 1995 to more than 20 Mtep in 2010) (ENEA, 2012); (iii) the Italian public building stock is old and considerable in relation to the overall building stock (CRESME, 2011); (iv) Italian municipalities have to face strong budget constraints in order to respect the national and European rules to cut public expenses (Stability and Growth Pact) (ANCI-IFEL, 2013)—in fact, these budget constraints caused a decrease of 33% in their overall investments in the period 2007–2011, passing from 240 to 160 EUR per capita (IFEL, 2012); (v) since Italian municipalities have the authority to regulate building codes, an increasing number of municipalities use the introduction of stricter energy standards in their building codes for the residential sector in order to foster the development of energy efficiency, but there is still a great potential of improvement (CRESME and Legambiente, 2013).

Download English Version:

<https://daneshyari.com/en/article/992913>

Download Persian Version:

<https://daneshyari.com/article/992913>

[Daneshyari.com](https://daneshyari.com)