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# Energy Policy

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

## Local authorities in the context of energy and climate policy

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### HIGHLIGHTS

- ▶ Assessment of Local Administration (LA) role in energy and climate policy.
- ▶ Analysis of both short-term and long-term carbon lowering measures.
- ▶ Use of MARKAL-TIMES model generator for long-term energy analysis.
- ▶ 20% primary energy reduction can be reached with short-term energy policies.
- ▶ 30% primary energy reduction can be reached with longer-term energy policies.

### ARTICLE INFO

#### Article history:

Received 15 December 2011

Accepted 6 September 2012

Available online 2 October 2012

#### Keywords:

Local energy planning

Low-carbon initiatives

MARKAL-TIMES

### ABSTRACT

Several measures to boost the energy system towards a low-carbon future can be planned and implemented by local authorities, such as energy-saving initiatives in public buildings and lighting, information campaigns, and renewable energy pilot projects. This work analyzes the public administration's role in energy and climate policies by assessing carbon-lowering measures for properties and services managed directly by local governments in central Italy.

Both short- and long-term schemes were considered in the analysis of local authority energy strategies. The MARKAL-TIMES energy model was applied to long-term energy planning to assess the effect of low-carbon initiatives on public-sector energy consumption up to 2030. Two energy scenarios were built, i.e. a Business As Usual (BAU) scenario based on current or soon-to-be-adopted national policies, and an Exemplary Public Scenario (EPS) including some further virtuous local policies suggested by local authorities.

Our results show that a 20% primary energy reduction can be achieved with respect to the baseline year by means of short-term energy policies (5-year time span), while a primary energy saving of about 30% can be reached with longer-term energy policies (25-year time span), even after taking the increase in energy demand into account.

This work goes to show the part that local governments can play in energy policy and their contribution to the achievement of climate goals.

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## 1. Introduction

Involving the public administration (PA) in the energy markets can contribute to the achievement of the EU's 20% energy saving goal by 2020. The European energy end-use efficiency directive (European Parliament and Council (2006)–Directive 2006/32/EC) has focused on the exemplary role that the PA should have in energy and climate policies by implementing energy-saving measures capable of ensuring the greatest savings in the shortest time span, and informing citizens about the best practices in

order to steer the private sector towards a low-carbon future. PAs can implement several schemes designed to fulfill this exemplary role: (i) improving the energy efficiency of public properties, an approach widely recognized as a high-potential, cost-effective way to reduce primary energy consumption (Yan-ping et al., 2009; Wei et al., 2009); (ii) introducing street lighting energy-saving measures; (iii) producing information campaigns designed to increase their citizens' sensitivity to energy and climate issues; and (iv) adopting new 'clean technologies'. Among the various PAs, the local authorities (LAs) can play a major part in energy and climate policy because they are traditionally active in the energy market both as shareholders in local energy utilities and as public properties owners (Nilsson and Martensson, 2003). The LA's role in the energy planning process has recently been an important

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research issue, and scientists have agreed on the need for both centralized and decentralized approaches to cope with today's challenging climate goals (Beccali et al., 2007; Dhakal, 2009; Keirstead and Schulz, 2010; Sperling et al., 2011). Several municipal energy plans have been developed (Butera, 1988; Holmgren and Henning, 2004; Lin and Huang, 2009; Arteconi et al., 2010; Brandoni et al., 2011; Hou et al., 2011) and market mechanisms capable of strengthening the LAs' involvement in energy market services, such as third-capital financing and carbon-trading, have been identified and assessed (Rezessy et al., (2006); Martersson and Westerberg, 2007; Hanandeh and El-Zein, 2009; Poudyal et al., 2010).

As far as energy production from renewable sources is concerned, several case studies have highlighted the important contribution that local governments can make to the development of renewable energy sources (RES).

Analyzing the Mykonos energy policy, Economou (2010) showed that the proper management of renewables by LAs can contribute both to protecting the environment and to an area's economic development. Söderholm et al. (2007) discussed the obstacles to wind power development in Sweden (a pioneering country in the field of RES with 50% of its electricity generated from renewable sources), and demonstrated that involving LAs in wind farm projects can increase their chances of success. Efficient local governance has been identified as one of the elements capable of explaining Crete's success in renewable energy production; in fact, 50% of Greek RES projects are located in the country's island territories (Michalena and Angeon, 2009). The direct connection between citizens and their LAs is another key factor to consider in order to understand the active role that local administrations can have in developing RES. In actual fact, despite the population's generally favorable attitude to RES, public opposition to the installation of RES facilities is becoming an obstacle (West et al., 2010). Targeted information campaigns driven at municipal level, such as pilot projects developed by LAs, alone or in partnerships, can be a precious tool to help overcome such non-technical barriers (Brandoni and Polonara, 2012a).

Since the 1990s, several action plans have been launched to encourage a bottom-up approach to the development of energy plans such as *Agenda 21*, an action plan on sustainable development supported by the United Nations, and the *Covenant of Mayors*, the mainstream EU movement of local and regional authorities committed to increasing energy efficiency.

Another element confirming the recent interest in a decentralized approach is the development of new energy models, or the application of already-known solutions, on a local scale. For instance, Rolfsman (2004) and Fahlén and Ahlgren, (2010) developed an optimization model based on mixed linear integer programming to analyze a municipal district heating system. Cormio et al. (2003) used the energy flow optimization model (EFOM) to identify the optimal combination of technologies for the Apulia region in Italy. Østergaard et al. (2010) applied the EnergyPLAN model, already amply used to assess Denmark's energy policy (Lund, 2007; Lund and Mathiesen, 2009), to the municipality of Ålborg to study whether it could become independent from fossil fuels. In the present study, the MARKAL-TIMES model was used to assess the effects of long-term energy policies in reducing public sector energy consumption in the municipality of Pesaro, an Italian urban area.

Regional and municipal scenarios have already been developed with MARKAL, but not with TIMES. For instance, Salvia et al. (2004) and Pietrapertosa et al. (2003) published region-based studies, while Cosmi et al. (2003) analyzed the feasibility of introducing renewable technologies in an urban area on a municipal scale.

A broader overview of the policies developed for the private and public sectors was conducted by some of the present authors

(Comodi et al., 2012), who also discussed the adequacy of MARKAL-TIMES as a tool for analyzing municipal-scale scenarios.

The present paper analyzes the contribution in terms of primary energy savings and lower CO<sub>2</sub> emissions of RES (particularly solar collectors and PV panels) and a greater energy efficiency in final energy uses, i.e. lighting, thermal insulation of public buildings, high efficient boilers, cooling systems and micro-cogeneration (CHP [combined heat and power]) systems.

Short- and long-term initiatives were assessed and the results demonstrate that both are important for the proper identification of an LA's energy policy targets. Short-term planning identifies the most suitable actions based on the best technologies available on the market, while long-term planning investigates achievable future environmental targets. The targets for long-term planning are assessed by estimating technological improvements in energy devices already available on the market and new technologies that may still be immature for the time being, but could have a strong impact on the future energy system.

Long-term guidelines are needed to achieve important goals and lend stability to the clean-tech market. Awareness of the contributions coming from new technologies can also prompt public governance initiatives capable of overcoming barriers to their market entry. To give an example, defining standard building regulations to promote the use of micro-CHP devices can help to create a critical mass of customer demand sufficient to bring down the related costs (International Energy Agency, 2009).

This paper is organized as follows: Section 2 provides an overview of low-carbon initiatives that can be managed by LAs; Section 3 analyzes short- and long-term energy planning strategies in a case study to assess the potential role of local governments and their contribution to the achievement of energy and climate targets; and Section 4 contains some conclusive comments.

## 2. Low-carbon actions on municipality-owned property

Several measures can be managed directly by LAs for municipality-owned properties to encourage the development of a low-carbon society, such as: (i) cutting the energy consumption of municipal buildings; (ii) introducing energy-saving measures for street lighting; and (iii) developing clean-tech and renewable projects.

These actions, as well as contribute to reduce the administrative exercise expenditure, have an important indirect effect, as following discussed, such as, for instance, steering the private sector in the direction of green-economy, encouraging private initiatives, supporting business network to exploit renewable sources.

### 2.1. Energy efficiency initiatives for public buildings and lighting

Building consumption accounts for an important percentage of total energy consumption, and has become one of the fastest-growing sectors. In developed countries, it is responsible for 20–40% of total energy use and exceeds consumption by industry and the transport sector in the EU and USA (Pérez-Lombard et al., 2008). To date, several specific programs have been discussed and adopted to improve energy efficiency in buildings, emphasizing the PA's exemplary role. In the United States, a federal program calls for energy- and water-saving measures in congressional office buildings, energy end-use monitoring, public procurement of energy-efficient products, and demanding energy standards for federal buildings. On the matter of public buildings, the first EC directive on the energy performance of buildings (European Parliament and Council 2002–Directive 2002/91/EC) required:

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