

Sustainable energy action plans of medium-sized municipalities in north Greece

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Abstract. The covenant of Mayors initiative includes the commitment of the municipalities-signatories to reduce voluntarily the greenhouse gas emissions over 20% by 2020 within their boundaries and obligates them to develop and submit an energy consumption analysis and a sustainable energy action plan within a year from the adhesion. The present paper discusses the energy profile of three medium-sized north-eastern Greek Municipalities (Kavala-MoK, Alexandroupolis-MoA, Drama-MoD) through the analysis of their municipal energy balance. The results of the total final energy consumption per capita include 14.10MWh/capita, 14.24MWh/capita and 12.91MWh/capita for MoK, MoA and MoD respectively. The analysis highlighted the increased energy consumption of the private sectors, namely residential and tertiary buildings and private transport. The assessment of the municipalities' energy profiles along with examination of national regulations and action plans and investigation of best available practices within the Covenant of Mayors shaped the development of the sustainable energy action plans of the examined municipalities that is presented in this paper. The proposed pathway towards low-carbon municipalities can be considered a representative case study and a starting point for other municipalities with similar characteristics.

Keywords: municipal energy planning; energy consumption analysis; policy development

1. Introduction

Within the European Union (EU), more than 75% of the population lives in urban areas, which corresponds to approximately 390 million of people (Eurostat 2014a). Additionally, approximately 70% of the total primary energy is consumed within cities (IEA 2008). It is therefore apparent that mobilizing local authorities of urban regions to take action towards energy consumption and CO₂ emissions reduction is crucial for the future of EU climate and energy policy. Energy planning at municipal level is also significant for sustainable development since municipalities constitute the closest authority to the final consumer. The strategic role of municipalities in the energy-planning process has been extensively assessed (Brandoni *et al.* 2012).

The energy profile of cities or municipalities constitute an important subject for researchers and

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policy-makers in order to assess possible sustainable energy action plans towards a low-carbon energy future (Morlet *et al.* 2013). However, the energy profile of each city within a country and across countries is different, due to economic structure, climate and energy markets. The examination of the energy profile is necessary in order to develop an efficient sustainable energy action plan. The analysis of energy consumption from particular sectors of municipalities' energy balance, as well as from the total municipal energy system has been investigated providing with insights regarding the sectors in general and the municipal facilities in comparison with increased energy consumption (Oliver-Sola *et al.* 2013, Fiaschi *et al.* 2012, Brandoni *et al.* 2012). Sperling *et al.* (2011) underline more specifically the importance of municipalities, as local energy planning authorities, to contribute to the achievement of Denmark's national target of 100% renewable energy sources (RES) and highlights the necessity for simultaneously centralised and decentralised approaches within a strategic energy planning system. Rogero Pitt (2010) pinpoints that energy planning results in successful climate mitigation policies when the municipalities engage communities and neighbourhoods in their decision-making processes.

In this paper the energy profile of three north-eastern medium-sized Greek municipalities is assessed and is extensively examined. The objective is to analyse the energy profile of these municipalities and compare the findings between them and among other Greek and/or European municipalities with similar characteristics (building stock, climate, etc.). The understanding of the energy profile requires an appreciation of the differences in the energy system of each municipality. The detailed analysis of energy profiles of more than one municipalities and the comparison with other municipalities is expected to provide valuable insights regarding the methodological approaches adopted for the development of the energy profiles, as well as the development of actions to reduce final energy consumption within the municipal energy system.

Recognising the importance of local energy planning, many studies have investigated possible energy policies to reduce the final energy consumption within the boundaries of a municipality or a region from all public and private sectors responsible for energy consumption (Comodi *et al.* 2011, Chwieduk 2003). Several municipal energy plans have been developed (Brandoni *et al.* 2011, Hou *et al.* 2011). Fiaschi *et al.* (2012) presents an action plan to reduce energy consumption and integrate renewable energy sources in buildings and utilities of a small Italian city. Additionally, several studies have pinpointed the importance of local authorities to promote and develop renewable energy sources locally (Sperling *et al.* 2011, Economou 2010). Tozer (2013) discusses the success and the barriers of the implementation of community energy plans in five Canadian cities. Roosa (2009) concludes that energy conservation and energy efficiency techniques can lead to sustainable urban development.

Since the importance of local energy planning has broadly been accepted, several initiatives within Europe have been launched in an attempt to promote the development of energy plans from local and regional authorities (MangEnergy 2014, Smart Cities 2014, ICLEI 2014). One of the most successful initiatives in Europe regarding the development of sustainable energy action plans is the Covenant of Mayors (CoM). The participating municipalities, usually called "signatories", are voluntarily committed to increase energy efficiency and renewable energy production within their jurisdiction above the European targets by 2020 (CoM 2014a). The "signatories" are obligated to submit to the Covenant of Mayors office within 12 months from the adhesion, a Sustainable Energy action Plan (SEAP). The development of SEAPs of municipalities within the Covenant of Mayors constitutes a planning tool to promote strategies towards reduction of energy consumption and CO₂ emissions and increase of renewable energy production. The number of SEAPs currently submitted accounts for 3,619, of which 2,083 were accepted by the Joint

