Energy use in Urban Transport sector within the Sustainable Energy Action Plans (SEAPs) of three Italian Big Cities

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Abstract

Promising Renewable Energy solutions could be installed in cities, but they require specific morphological conditions as well as architectural integration. Transport sector is still neglected from a strong policy initiative. A first attempt along with a defined framework to attract economic resources as well as interested stakeholders is the Covenant of Mayors (CoM). Within this agreement, the Municipality has to design a plan, the so-called Sustainable Energy Action Plan (SEAP). The plan must contain a clear outline of the strategy and relative actions to be taken by the local authority to reach its commitments in 2020, in terms of sustainability goals set by EU 20-20-20. The aim of this paper is to discuss and evaluate the differences of fuel usage and transport sector interaction in Italian urban scenarios, taking into account geographical and morphological constraints, and to compare the forecasts for 2020 and 2030 scenarios, in accordance with European and National laws in force.

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1. Introduction

Changes in urban policies by means of law-driven Renewable Energy Sources (RES) deployment deal with infrastructural and architectural constraints. So, high care should belong to any policy and act which affects urban special areas such as natural zones, protected areas, cultural heritage or, simply, existing and well-established built-up areas. Nowadays, in Europe even if the environmental crisis is taken seriously, a huge request for more
environmental and energy resources is rising. Cities play as the main requester for planning the consumptions and its allocation, especially in the transition towards future scenarios [1]. Large Research frameworks (Horizon and strategy documents, i.e. Energy Union Package) are dealing with the energy topic in the cities. Furthermore, Recent research lines investigated on role of municipal energy efficiency plan [2] together with tools for profitable renewables use along with the required fossil fuel share in the transition scenario[3].

Metropolities have high importance since their size and concentration of energy producers and users as well as networks and facilities. High renewables penetration scenarios are studied at this level and their results are then scaled up to national framework [4]. Promising technologies such as wind energy could contribute to achieve sustainability levels even when they require specific auxiliaries such as the improvements of wind turbine installations [5] and environmental issues related to big scale such as effects on ecosystems [6] call for a dedicated and wise energy planning instrument. Furthermore, new attention to human wellbeing in built environment requires performance indicators to be taken into account for monitoring innovative energy systems applications [7], effects of new materials on building energy performance [8] as well as impact on urban energy networks connected to the neighborhoods [9].

Conventional urban policies are not able to answer those multi-disciplinary questions since their complexity belong to new demands: an economically sustainable integration of renewables at building scale [10], the preservation of cultural heritage as well as restoration by using natural high-performance materials [11], even simulating the damages coming from established pollution [12], the de-carbonization of existing building stock by means of cutting-edge technologies [13], even in the field of listed buildings, no more excluded for minimum interventions of energy retrofitting [14].

Energy infrastructures are not directly mentioned in urban planning tools. So, only recently, the voluntary initiative of Covenant of Mayors represents the first attempt to fill this gap in planning tools. Moreover, transport is not even considered an urban issue within a mobility plan but just a traffic one. That means the only vehicles’ flows are analyzed rather than associated energy and pollution quantities.

Energy Union Package, National energy strategy acts, regional energy and environmental plans are too high-level documents to regulate and drive local energy transition in metropolitan contexts. The Covenant of Mayors collects more than 6,000 signatory municipalities. Each one to participate to it, designed the so-called Sustainable Energy Action Plan (SEAP). It consists of a Baseline Emission Inventory (BEI), the strategy and the actions to be taken.

The BEI takes a picture of the consumption, production and emissions in the municipal context and in a chosen reference year. Starting from this status, the City elaborated how to achieve the EU 20-20-20 targets and, where possible, to go beyond them. Quite recently, a new aspect became part of this process: the adaptation strategy. The SEAP involves the adaptation and mitigation measures to cope with climate change and subsequent risk disaster. For instance, emergency program could be decisive to make a city ready for environmental resilience and its management [15].

The strategy is based on three pillars: energy efficiency (EE), Renewable energy sources (RES) greenhouse gas emission reduction which is measured in equivalent carbon dioxide emissions (CO₂).

This study addresses a specific framework able to consider transport energy use in order to consider this further emission activity more than a simple vehicles flows. Indeed, SEAPs programs, monitoring, implementation and actions could be the codified tool to consider the aforementioned aspects as well as to identify the potential for achieving the EU 20-20-20 requirements. The above-mentioned framework starts from Italian context analysis since half of submitted SEAPs in Europe are from those municipalities.

Three Cities were considered and analyzed: Milan, Palermo and Rome. They are the right mix of all the Italian urban governance characteristics and the related Regions represent large part of climatic and road conditions. Therefore, Lombardia, Lazio and Sicily are located in the North, Central and South Italy, respectively accounting for all the general cities layouts of the Country.

2. Materials and methods

Urban morphology, climatic conditions and economic structure affect the emission inventory of each city. The reference year and scenario are shown in Table 1 along with the reduction target by 2020.
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