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Exploring integrated energy action plans for a sustainable transition of the municipality of Cesena

Rocco De Miglio[a]*, Alessandro Chiodi[a], Sofia Burioli[b], Elena Giovannini[b], Maurizio Gargiulo[a]

[a]*E4SMA S.r.l., Turin, Italy*
[b]*Municipality of Cesena, Italy*

Abstract

An application of the innovative city planning method, developed within the EU FP7 project InSMART, is applied to the municipality of Cesena (Italy). A multi-model approach is used to explore and rank alternative plans (combinations of actions and measures) towards the sustainable development of the municipality, with a particular focus on the residential and transport sectors. On the basis of the possible space of decisions of the municipality (which can be seen as "urban planner", as "regulator", as "provider of support and information", as "consumer" and as "supplier" of energy), alternative planning hypotheses have been prepared and tested making use of a city-energy system model and scenario analysis. Scenarios are built around different themes with the aim of exploring the potential benefits (or drawbacks) of the combination of specific "competitive" projects, actions, standards, targets. A reference development of the local system is assumed to be modified through six combinations of actions and measures aiming at representing six pillars of alternative pathways towards the sustainability. Figures below report the key themes and hypotheses taken into consideration in the planning exercise. Once the dynamic pictures of the urban system are produced (one per each alternative), a multi-criteria method is used to determine the ranking of the options, evaluated against a set of elements (technological, social, environmental, economic). This stage is still ongoing and will generate the whole dataset (weights, preference functions) required to rank the alternatives in the next few months. All these alternative strategies are designed with the involvement of the municipality of Cesena, to directly respond their needs of knowledge about potential impacts of different action plans. Compared to the existing city strategic energy action plans, the advantage of the outputs of this approach is the fact that multiple future energy scenarios are analysed and cross-compared and "integrated" strategies ranked.

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* Corresponding author. Tel.: (+39) 011.225.7351
E-mail address: rocco.demiglio@e4sma.com

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1. Introduction

This paper presents an application of the innovative city planning approach, developed within the EU FP7 project InSMART, for the municipality of Cesena.

Cesena is situated in Northern Italy within Emilia-Romagna Region. At about 15km from the Adriatic coast, the proximity to the sea favors a moderate and temperate climate. Together with Forlì it is the capital of the Forlì-Cesena Province. Cesena itself has a population of about 97131 inhabitants (ISTAT, 2013).

Based on a data collection oriented to the preparation of decision support system tools (quantitative data gathered making use of ad-hoc surveys and local GIS-maps), a multi-model approach is used to explore and rank alternative plans (combinations of actions and measures) towards the sustainable development of the municipality of Cesena, with a particular focus on the residential and transport sectors. A city-specific model, integrating the "key" decision variables of the residential and private transport sectors, tests different pathways towards the sustainability for the municipality, and provides a set of "alternative dynamic pictures" of the urban system for a multi-criteria analysis. MCDA tool is used in cascade to generate the final ranking on the basis of a set of elements against which the alternatives are evaluated (technological, economic, environmental and social criteria).

Local stakeholders are engaged to participate in the design of alternatives, in the identification of criteria, in the weighting stage, and in the analysis of uncertainties and responses. The final outcome (ranking) depend on the individual preferences of decision makers captured in the model.

2. Methodology

The urban area is represented by "zone", and each zone as a subsystem characterized by a certain number and type of energy service demands (space heating, water heating, cooling, lighting, etc.), building types and activities (detached, semidetached, blocks, hospitals, schools, etc.), potentials for renewables (e.g. PV solar), and routes connecting zones. The number and the borders of subsystems within the urban area are defined on the basis of homogenous zones (15 zones have been identified in Cesena for the analysis) for the planning exercise.

Each zonal sub-system is then characterised by stacks of "individual" behaviours (productions, consumptions, etc.) of all the agents acting in the zone. The "key" agent of the model is placed in the *dwelling* (household) for which several energy needs are modelled, and to which investments decision variables (key element of the model) are assigned. Energy consumptions and demanded services are decoupled: efficient technologies (boilers, refrigerators, lighting bulbs, cars, etc.) can be chosen by the final consumers to lower the consumption by keeping the same service level. Few quantitative information used in the model are reported below.

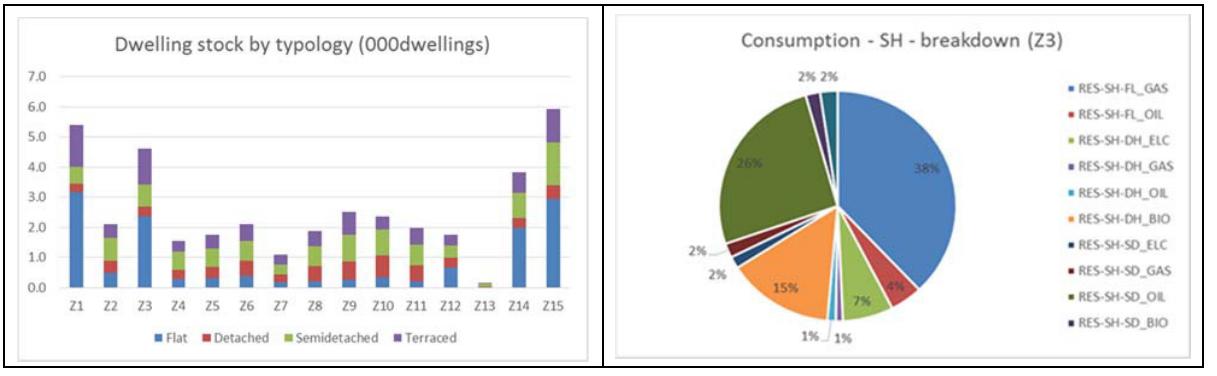

Fig. 1. Dwelling stock by typology and zone, and share of heating system by fuel in zone 3 of Cesena