

Chapter 17

Making Sustainable Energy Communities a Reality: The “MPC⁺” Decision Support Framework

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ABSTRACT

The aim of this chapter is to present a decision support framework for local energy planning, entitled “MPC⁺ (Map - Plan - Choose - Check)”. The proposed framework incorporates the development of the baseline emissions inventory, the identification and modelling of renewable energy and rational use of energy actions, as well as the creation of alternative Scenarios of Actions at the city level. The evaluation of alternative Scenarios is based on a multi-criteria ordinal regression approach. In addition, an extreme ranking analysis method is used, in order to examine robustness problems, estimating the best and worst possible ranking position of each Scenario. The MPC⁺ framework contributes to the selection of the most promising Scenario of renewable energy and rational use of energy actions, supporting the local - regional authorities in creating Sustainable Energy Communities (SEC). Finally, the “Methodological Approach for Monitoring SEC Targets” is introduced.

INTRODUCTION

This chapter presents a decision support framework for local energy planning. The overall philosophy of the proposed framework aims to support the local and regional authorities in the development, implementation and monitoring of the Sustainable Energy and Climate Action Plan, especially within the framework of the Covenant of Mayors’ initiative. More specifically, the proposed framework “MPC⁺ (Map - Plan - Choose - Check)” integrates the following four components:

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- **“Map”**: This component is the starting point of the Action Plan’s development process. It involves the mapping of the current status within the region, emphasizing on the development of energy and baseline emission inventory. The results at this stage are the basis for the formulation of a comprehensive Action Plan and the monitoring and control of targets set.
- **“Plan”**: This component focuses on the design of alternative Scenarios of Actions, namely a set of appropriate measures and actions for implementation at local - regional level. The design of scenarios is achieved through the modeling of measures and actions, the assessment of future trends in CO₂ emissions at local - regional level and the participation of local stakeholders.
- **“Choose”**: This component aims to support decision makers in the process of identifying the most promising Scenario of Actions for the region. It includes the evaluation of the alternative Scenarios of Actions using multi-criteria analysis and robustness analysis.
- **“Check”**: This component is related to the monitoring of the targets set in each activity sector of the municipality. In this way, the monitoring and assessment of the progress towards sustainable development in economic, social and environmental context is achieved.

Apart from the introduction, the paper is structured along six sections. Section 2 provides a description of the overall technical framework of the proposed “MPC+” approach. Sections 3-6 are devoted to the presentation of the four components of the proposed approach, namely “Map”, “Plan”, “Choose” and “Check” components. Finally, the last section just summarizes the key issues that have arisen in this paper.

Technical Framework

The proposed framework includes individual components, which are described in Figure 1:

- **“Map” Component:**
 - **Baseline Year:** Selection of the year for which the energy and emission baseline inventory will be developed.
 - **Characteristics:** Some basic information and statistics are required for the municipality (e.g. population, number of dwellings, land uses, etc.). These data are used both in the development of energy and emission baseline, as well as in the design of alternative Scenarios of Actions.
 - **Energy Balance:** Calculation of energy balance at the local-regional level with the use of alternative methods.
 - **Local Energy Production:** Data on the local electricity production and local heating / cooling systems. These data are used for the calculation of regional CO₂ emission factors.
 - **Baseline Emissions Inventory:** The last stage includes the development of the baseline emission inventory, taking into consideration the energy balance and emission factors per energy use (national and local).
- **“Plan” Component:**
 - **Actions’ Modelling:** First of all, a number of renewable energy and rational use of energy actions have been identified for the following sectors, as proposed by the Covenant of Mayors’ guidelines (CoM, 2017):

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