Chapter 3.7
Comprehensive Energy Systems Analysis Support Tools for Decision Making

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ABSTRACT

Sustainability of energy systems is a common priority that involves key issues such as security of energy supply, mitigation of environmental impacts - the energy sector is currently responsible for 80% of all EU greenhouse gas emissions (European Environment Agency, 2007), contributing heavily to the overall emissions of local air pollutants - and energy affordability. In this framework, energy planning and decision making processes can be supported at different stages and spatial scales (regional, national, pan-European, etc.) by the use of comprehensive models in order to manage the large complexity of energy systems and to define multi-objective strategies on the medium-long term. This Chapter is aimed to

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outline the value of model-based decision support systems in addressing current challenges aimed to carry out sustainable energy systems and to diffuse the use of strategic energy-environmental planning methods based on the use of partial equilibrium models. The proposed methodology, aimed to derive cost-effective strategies for a sustainable resource management, is based on the experiences gathered in the framework of the IEA-ETSAP program and under several national and international projects.

INTRODUCTION

Climate change mitigation as well as sustainable, secure and competitive energy supply are high Community priorities and a need for each Member State, as outlined also by the EU common Energy Policy adopted by the European Council on 9 March 2007 that proposes the following targets and objectives (Commission of the European Communities, 2007):

- Reducing greenhouse gas emissions from developed countries by 30% by 2020; the EU has already committed to cutting its own emissions by at least 20% and would increase this reduction under a satisfactory global agreement.
- Improving energy efficiency by 20% by 2020.
- Raising the share of renewable energy to 20% by 2020.
- Increasing the level of biofuels in transport fuel to 10% by 2020.

Interrelations between sustainable development and energy planning are very strong thus a decisive step for translating the EU's political directions into concrete actions is to work in the direction of promoting sustainable energy systems, capable of fulfilling an increasing and more differentiated market demand but guaranteeing, at the same time, reduced impacts of energy production and use.

Pursuing this aim involves an in depth medium long-term analysis of energy systems and public intervention to boost investments in energy efficiency, renewable energy and new technologies, to increase the capacity of existing infrastructures and to limit demand growth.

It is therefore necessary to foster the adoption of energy planning methods based on analytical tools as well as to promote the implementation of best practices at local, national and supra-national scale, fostering consensus building among the stakeholders.

This chapter is aimed to provide a summary of the rationale of strategic energy planning, to discuss the main features of the proposed methodology and the reference analytical tools as well as to describe some exemplificative results of a real case study.

BACKGROUND

Decision making concerning policy issues aimed to address major energy challenges is a complex process, consisting of many steps and often involving different groups of interest, with different backgrounds, roles and ambitions. Usually, a huge amount of data is managed to describe the current situation as well past trends and future constraints/opportunities and a deep understanding of the pathways along which new energy systems can emerge and develop over time is required (International Institute for Applied Systems Analysis, n.d.).

A wide range of software tools and database is available to support different aspects and aims of energy analysis, in particular, addressing the two main aspects: information management and decision-making. Therefore many tools and methods based on geographic information systems (GIS) and linear programming techniques have been developed to respond to the necessities of energy modelers (Wierzbicki *et al*., 2000). In this