

MULTI OBJECTIVE OPTIMIZATION IN ENERGY SYSTEMS: THE CASE OF LESVOS ISLAND

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EXTENDED ABSTRACT

The process of decision-making determines the choice of a possible course of action amongst a wide variety of available alternatives. The difficult point in decision-making is the multiplicity of the criteria set for judging the alternatives. The decision maker needs to attain more than one objective in achieving the final goal set, while satisfying constraints dictated by the environment, processes and resources. All problems that deal with energy issues are of a multiple objective nature. The environmental impact of hydrocarbon fuels has led to a major research effort in finding other means for energy production; renewable energy systems seem to have the potential to give solutions to environmental problems. However their availability (i.e. the density in which these sources are found) in the environment and the cost of exploiting the vast abundance of solar, wind and other renewable energy sources, require specific tools that will find and give a solution that satisfies all constraints.

Various renewable energy sources can be found on Lesvos and could be exploited to satisfy part of the needs of the island's economy. These resources must be examined from all aspects and a case study can be performed for the island of Lesvos that would involve application of specific mathematical tools that will lead to a set of energy solutions (Pareto set). These solutions will concern the use of various energy sources that will satisfy a multiplicity of criteria, such as environmental, demand, cost and resources constraints.

The research for this mathematical model has led to the creation of a system with two objective functions that work reversely. Considering the constraints mentioned above, a series of solutions is derived providing decision makers the flexibility to choose the appropriate solution with respect to the given situation. The application of the mathematical model in the case of Lesvos shows that the Renewable Energy Sources (RES) that are available on the island can satisfy the local demand in electricity without the contribution of other sources e.g. diesel oil. However the demand in energy for space heating can be satisfied by combining the existing conventional system and a system operating on RES.

The application of one of the derived solutions, to technologies that concern the use of renewable energy resources, indicates that although these technologies are still under development, they can still operate at a sufficient level of efficiency. The economics study of the system shows that the present RES technologies, in spite of the high cost of purchase and installation, can be a part of the viable development of the island, since the damping time corresponds to half of the systems' total life cycle.

Key words: viable development, renewable energy sources, environmental economics