OPTIMIZATION OF A THERMOSOLAR POWER PLANT WITH FRESNEL LENS AND STIRLING ENGINE

Teză de doctorat – Rezumat en

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autor ing. Simona ILIE
conducător științific Prof.univ.dr.ing. Dumitru TOADER

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The study of a thermoelectric power plant Fresnel lens and Stirling engine as an alternative source of production of heat and electricity can be a solution that would help us avoid gloomy outlook regarding the reserves of primary energy in Romania and beyond.

The overall aim of the work involves creating an experimental thermo-electric power plant with Fresnel lens and Stirling engine for producing heat and power and to identify opportunities for optimization of the power plant to be produced worldwide by offering information on the results achieved by using the measured values.

Thus, the paper is structured as follows:

Chapter One - Introduction - it is made a description of the energy policies of the European Union and Romania, a brief description of the impact of harvesting on the environment of primary energy resources and a brief description of renewables and our objectives in this respect; a description of the solar potential energy of Romania, mainly in the West. Here it is shown the importance of the study achieved for the thermo-electric power plant with Fresnel lenses and Stirling engine.

Chapter two is dedicated to the study of solar energy, types of Stirling engines and Fresnel lenses and their use in the thermo-electric solar power-plant. Here was also analyzed the solar potential in Western Romania, in order to determine optimal operating parameters of an experimental thermo-solar-power-plant.

The third chapter describes the experimental power plant and equipment that were the basis of research; all prototypes of thermo-electric power-plant with Stirling engine under laboratory conditions with the heat source a butane gas lamp and with Fresnel lens in real conditions which concentrates energy from the Sun on the Stirling engine. This chapter is exposes the procedure for reaching the thermo-electric power plant with Fresnel lenses and Stirling engine from concept to execution facility.

Chapter four presents the analytical and numerical model for the Stirling engine to determine the pressure-volume diagram and the model created in Matlab programming environment, that allows us to analyze from different input parameters, the efficiency of the engine.

In Chapter five, numerical heat transfer within the Stirling engine is realized; the model is created and the steps are described and established the boundary conditions. Also, analyzes of the numerical model for the electric generator and the schematic diagram generator parameters are made.

In Chapter six results of experimental measurements are presented, of various thermo-electric power plants with Fresnel lens and Stirling engine under real conditions and the same facilities but with the hot source a gas lamp in laboratory conditions.

Chapter seven is devoted to economic analysis and optimization solutions of a fleet of

thermal power plants with Fresnel lenses and Stirling engines. The last chapter summarizes the overall conclusions of the study and the proposal of possible future research directions.

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