Application of SWOT analysis in the energy sector: A case study of a district heating plant

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Abstract

- Strengths (S) Weaknesses (W) Opportunities (O) and Threats (T) analysis is one of the most well-known analyzes in strategic management. It is used to explore internal and external influencing factors on different questions. It plays a significant role in defining development strategies and can be applied in different sectors.

- Based on the gathered information and interviews with employees of this company, strong aspects of the company are identified and those aspects where the company has problems. Opportunities that come from the external environment and threats that can put the company at risk are perceived.

- **Results** of the research identified 24 elements of SWOT analysis, 4 belonging to the company's strengths, 7 elements identified as weaknesses, 6 potential development opportunities and 7 environmental challenges seen as threats.

Case study

- In this paper, SWOT analysis is used in energy sector in the case of Public Utility Company "Toplana" Bor, which is responsible for the production and distribution of heat for the purposes of district heating.

	Total
Population	34,710
Number of households	12,420
Number of households connected to the district heating system	11,352
Percentage of households connected to the district heating system (%)	91.4
Total heating area of the residential units connected to the district heating system (m²)	624,612
Total heating area of other establishments, institutions and business units connected to the district heating system (m²)	134,819
Total heating area (m²)	759,431
Total installed power of the heating units of residential units connected to the district heating system (MW)	105
Total installed power of the heating units of other units connected to the district heating system (MW)	24
Total installed power consumption (MW)	129

TABLE I. GENERAL INFORMATION ABOUT DISTRICT HEATING IN BOR, SOURCE: Business Association of the District Heating Companies of Serbia

Introduction

Energy development is an important task in achieving growth and development of an economy. The reason for performing the analysis in an energy system is to define the existing situation in the system and beyond, which initiates the first step towards achieving sustainable development of the system and maximizing its energy efficiency.

The use of sustainable energy sources is present in district heating systems and it requires sustainable energy management SWOT analysis used in this paper is a powerful management tool which is usually used in the process of investigating a specific situation by observing it from multi-level perspective (internal and external influential factors).

Findings

	Strengths (S)	Weaknesses (W)
INTERNAL	A satisfactory level of production capacity	Obsolete Equipment
	Built district heating system	Low level of automation
	Large number of users	Many failures
	Expert staff	Lack of financial resources
		Inadequate maintenance system
		High preparation costs
		Use of nonrenewable energy sources
	Opportunities (O)	Threats (T)
EXTERNAL	Heating price regulation	Increase in energy prices
	Specialized funds	Reduction of coal use
	Renewable energy sources	Reducing the number of users
	Gasification	Change of legislation
	Public-Private Partnership	Lower investment by state
	Cooperation with the EU	Outflow of skilled labor and unemployment
		Climate change

TABLE III. SWOT ANALYSIS FOR PUBLIC UTILITY COMPANY "TOPLANA" BOR

- **Internal factors** include Strengths and Weaknesses which directly influence on the specific situation.
- **External factors** are Opportunities and Threats that come from the environment and systems cannot directly influence on them but can adopt preventive measures and well-designed strategies to react.
- **The main objective** of this paper can be defined as an idea of implementing SWOT analysis in a specific energy system, based on listing all 4 elements of the analysis in order to identify current situation in the system, main problems and strengths so adequate development strategies could be defined.

Influence level	Factor
Internal	Technical resources
	Human resources
	Financial resources
External	Government
	Customers
	Competition
	Suppliers
	Environment
	Other stakeholders

TABLE II. INTERNAL AND EXTERNAL INFLUENTIAL FACTORS

Concluding remarks

- According to the results of the analysis, the **advantage** of the company is that it has a large number of users arising from the built heat network that covers the entire city.
- However, there are a number of **problems** in the work process and the most important are outdated equipment and insufficient financial resources. Lack of investment has led to the inadequate maintenance of this large energy system and the increased number of network breaks during the heating season causing high costs and customer dissatisfaction.
- **Threats** from the environment are numerous and, above all, relate to an important issue today - the use of renewable energy.
- At the same time, the use of renewable energy sources is the greatest **potential** the company has to harness which is in accordance with the Energy Development Strategy of the Republic of Serbia.

Future research.

- Results of this analysis provide the base for generating strategies that utilize opportunities, relying on the strengths of the company and take action against the identified threats and weaknesses. Defined SWOT analysis will be used in further author's research in improving investigated energy system using a multi-criteria decision method.
- Bearing in mind that PUC "Toplana" Bor is an outdated energy system in terms of production technology which is used, it is necessary to devise a strategy of switching to the use of clean energy sources such as biomass, which will be further investigated by the author.

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