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ABSTRACT OF THE DISSERTATION

“Application of a Two Dimensional Vector Structure for Developing a Method to Optimize Economic Indicators of EV Charging Infrastructure Operators”

dissertation supervisor: prof. dr hab. inż. Marianna Jacyna
assistant supervisor: none

The doctoral dissertation addresses the problem of optimizing the economic performance indicators of electric vehicle (EV) charging infrastructure operators under conditions of variability in market, cost, regulatory, weather-related, and other factors. The focus is placed on analyzing the interdependencies among these factors, their impact on the economics of charging stations, and the possibilities of influencing outcomes through business instruments available to the operator. The result of these efforts is maintaining key economic performance indicators within ranges acceptable from the operator's perspective. Particular attention is devoted to two key economic indicators: the margin on the sales price and the level of utilization of the charging infrastructure (station utilization).

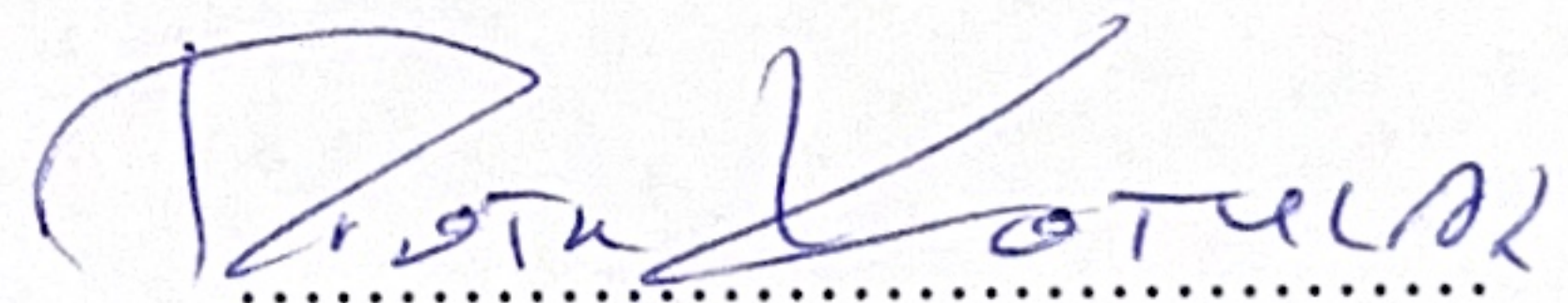
The aim of the dissertation is to develop a method to support the operational and business decision-making of EV charging infrastructure operators. The proposed method enables the assessment of the impact of selected parameters on station margin and utilization while accounting for the variability of environmental conditions over time. The study proposes the use of a two-dimensional vector structure in the margin-utilization space as a tool for organizing and integrating the effects of multiple decision instruments available to the operator, among which pricing policy constitutes one element alongside other operational and business measures.

The developed method is based on representing individual influencing parameters as vectors with defined directions and magnitudes, reflecting their impact on the analysed economic indicators. This approach enables a geometric analysis of the trade-off between

margin and utilization (infrastructure utilization rate) and the determination of the cumulative effect of the operator's decisions in the form of a resultant impact vector.

The dissertation is divided into nine chapters covering theoretical considerations, the development of the method, and its practical application. The theoretical part presents a review of the relevant literature, identifies a research gap, and systematizes issues related to the operation of EV charging infrastructure and the economics of its operation. The practical part contains the developed vector model, the computational algorithm, and its computer implementation, enabling simulation of changes in economic indicators and the determination of their values over a specified period.

The dissertation also outlines directions for further research, including the possibility of extending the proposed structure to multidimensional spaces and its application in a broader context of energy and transport infrastructure management.

A handwritten signature in blue ink, appearing to read 'Petr Kotulak', written over a horizontal dotted line.

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