ABSTRACT

The explanatory note consists of 120 pages and includes 13 figures, 83 tables, 2 appendices and 43 references.

Topicality. The work examines the problem of improving the process of analysing solar power plants and energy storage systems by using real operational and weather data together with machine learning methods. The relevance of this research is determined by the need to simplify the assessment of system performance, reduce operational losses and increase the energy efficiency of users. The proposed mobile software complex provides a portable analytical tool that expands the possibilities of monitoring and optimisation beyond traditional theoretical or desktop solutions.

The aim of the study. The main target is to improve the analysis of solar power plants and energy storage systems by developing a portable software complex that uses real data and machine learning algorithms to detect anomalies and provide optimisation recommendations.

The object of research: the process of analysing the operation of solar power plants and energy storage systems.

The subject of research: tools and methods for integrating machine learning technologies and analytical modules into a mobile software complex for designing and analysing solar power plants and energy storage systems based on historical and real-time weather and operational data.

To achieve this goal, the **following tasks** were formulated:

– analyse existing modern approaches to evaluating the efficiency of solar power plants;

– determine the key factors that influence the performance of PV systems and energy storage systems;

– design the structure of the application and define its software modules and requirements;

– develop algorithms for data analysis and processing using machine learning methods;

– implement integration of weather and operational data into the application;

– evaluate the accuracy and practical applicability of the developed software complex.

The scientific novelty of the results of the master's dissertation is the justification of the applicability of machine learning methods for analysing the operation of energy storage systems based on real operational and weather data, as well as the implementation of a portable solution capable of automatically detecting deviations in system behaviour and generating recommendations for improving performance.

The practical value of the obtained results is the development of a mobile software complex that enables users to locally analyse the performance of energy storage systems, obtain system condition assessments and receive recommendations for optimisation. The tool can be used in residential, commercial and educational contexts to improve the efficiency and reliability of energy systems.

Relationship with scientific programs, plans, topics. The work was performed at the Department of Informatics and Software Engineering of the National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute».

Approbation. The scientific provisions of the dissertation were tested at the scientific and practical conference of young scientists and students “Software Engineering and Advanced Information Technologies” (SoftTech-2025).

Publications.

The scientific provisions of the dissertation were published in:

1) Karvanskyi N.R., Holovchenko M.M. Software Complex for Designing and Analysing Energy Storage Systems // Software Engineering and Advanced Information Technologies (SoftTech-2025 Autumn): Proceedings of the V All-Ukrainian Scientific and Practical Conference of Young Scientists and Students (Kyiv, November 26–28, 2025). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2025.

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