

An important area of reducing energy consumption and negative impact on the environment is the introduction of energy-saving traffic modes.

*Conclusions.* to increase energy efficiency of existing motor-car rolling stock, it is necessary to use modern equipment and on-board energy storage systems, as well as to introduce energy-saving algorithms for traction system strategies, algorithms and train movement.

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## **MULTICRITERIAL, MULTIPARAMETER OPTIMIZATION OF AXIAL RECYCLING TURBO-EXPANDER UNITS**

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*Abstract.* The national energy independence and autonomous power supply of critical infrastructure facilities directly contributes to strengthening of the national security and independence. The turboexpander development and implementation, which corresponds to the level of world achievements, using ASTM (American Society for Testing and Materials) requirements and harmonized with API (American Petroleum Institute) 617 standards, utilizing cutting-edge methodologies and advancements in science and technology, represent a pivotal contemporary challenge. This study gathered key parameters from 93 gas distribution stations and proposes conducting scientific research to explore the feasibility of employing multicriterial multiparameter optimization for the flow components of axial turbines, considering operational conditions, and leveraging existing operational turbo-expander units. Using new methods and methods of modern achievements of

science and technology is a key task for today's moment. The main parameters of 93 gas distribution stations have been collected. It is proposed to carry out scientific research work on finding the possibility of using multicriterial multiparameter optimization of the flow parts of axial turbines taking into account the operating modes, on the basis of utilization turbo-expander units that are already in operation.

*Keywords:* optimization, turboexpander, multicriterial, multiparameter.

#### *Introduction.*

*Topicality.* Energy security is paramount for a nation's progress. The inclusion of autonomous turboexpander power plants within Ukraine's gas transportation system is increasingly pivotal in contemporary circumstances. The deployment of such power plants directly enhances the nation's security and sovereignty, ensuring the autonomous supply of power to critical infrastructure assets.

*The object* of research is utilization expander power plant.

*The subject* of the study is an multicriterial multiparameter optimization of the flow parts of axial turbines.

*The purpose* of the work is to study the optimization of the flow parts of axial turbines.

*The objectives* of the research are the analysis of variations in quality attributes in response to alterations in external parameters.

*The novelty* lies in the utilization of modern optimization techniques to strive for an unprecedented efficiency factor of 92% for the turbine.

#### *Presentation of the main research material.*

Designing axial recycling turbo-expander units is a multifaceted and intricate endeavor. Currently, various application programs exist at nearly every design level, facilitating optimization tasks through diverse mathematical tools. Nonetheless, the crucial aspect of information coherence between these levels is often lacking, thereby complicating the optimal design process for turbo-expander units as intricate technical systems.

Efficiently addressing a broad spectrum of mathematical models and enabling seamless information exchange with neighboring subsystems across levels can be achieved by employing a block-hierarchical representation of the design process. This approach organizes the effective utilization of these tools into a unified, coordinated complex for the optimal design of complex technical systems. Integrating these tools into a singular information space allows effective resolution of the challenges pertaining to information and system unity across various mathematical models, methods, techniques, and information models of design objects.

Moreover, it's noteworthy that turbo installations commonly operate in modes divergent from nominal conditions. Hence, incorporating operating

modes into optimization tasks can significantly enhance turbine unit efficiency.

It is proposed the application of multicriterial multiparameter optimization for the flow components of axial turbines, considering operational modes, based on the utilization of existing turbo-expander plants in Ukraine. To assess the theoretical optimization results of axial turbine flow components and validate their actual compliance, a unique test rig was developed. Located within the production division of PrJSC "TURBOGAZ," this test rig facilitates the evaluation of actual parameters, characteristics, reliability, and operational efficiency of turbo-expander units and ancillary equipment.

The complexity of designing intricate technical systems arises from the necessity to explore and evaluate numerous alternative design options. Most design challenges involve complex multiparameter and multi-criterial optimization dilemmas. However, the diversity of applied mathematical methodologies and the absence of informational coherence among tasks impede systematic utilization in design practices.

Enhanced decision-making validity and shortened design cycles can be attained by amalgamating design procedures into a cohesive system of interdependent optimal design problems. This approach, conducted in a dialogic manner within Computer-Aided Design (CAD) environments, should consider the heterogeneous nature of employed mathematical models and ensure accessibility to optimal solutions at each design level.

*Conclusions.* The turbine construction department offers ideal conditions for dissertation work. Equipped with specialized software suites like AxStream and TurboOptProject, comprehensive computational studies related to the dissertation topic can be conducted. TurboOptProject, developed in-house at the department, boasts an open-source code, facilitating customization for the analysis and optimization of turbo-expander flow components. Additionally, the department is furnished with state-of-the-art computers acquired in 2021, affirming the availability of requisite resources for dissertation research.

The dissertation topic aligns with a primary focus of the turbine construction department's scientific endeavors. Through this research, enhancements will be made to mathematical models governing thermal and gas-dynamic processes, alongside the refinement of optimal design methodologies for complex technical systems. Furthermore, novel designs of axial utilization turbo-expander power plants, featuring elevated efficiency metrics and accounting for operational modes, will be developed as a result of this study.

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## **DEVELOPMENT OF AN ANTI-CRISIS PROGRAM OF THE ENTERPRISE ON THE BASIS OF DIGITAL MARKETING**

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*Abstract.* Since 2019 the World have witnessed significant changes, not only within Ukraine but globally, notably the impact of the COVID-19 pandemic. Some of these effects continue to persist even after four years. For Ukraine, the situation has been particularly challenging, exacerbated by a two-year full-scale invasion that has posed unprecedented challenges for small and medium-sized businesses. According to a survey conducted by the European Business Association as part of Unlimit Ukraine, SMEs' sentiment dropped to the second-lowest value in the entire six-year study, reaching 2.4 points out of a