Dmytro O. Bosyi , Denys R. Zemsky: **Increasing Power Supply Efficiency for "Two Wire-Rail" Line Consumers**

The article is devoted to the problem of non-traction consumers power supply of AC railways. The low efficiency of energy transfer is caused by the design of a non-traction power supply line. The absence of bilateral power is typical for non-traction network 27,5 kV which consist of "two wire-rail" lines. This line is outdated technology, which does not correspond to modern requirements on the power quality, but used on AC railways with three-phase traction transformers. The purpose of the article is to investigate the methods of power supply improvements for non-traction consumers in terms of voltage unbalance, harmonic distortions and energy losses. Connection of the phasing device to delta winding traction transformer for bilateral supplying non-traction customers from network 27,5 kV is suggested in the article. The implementation of a method to increase the efficiency of electricity transmission in the non-traction network power supply allows to reduce power losses from 720 MWh / year to 441 MWh / year, the voltage unbalance from 1,9% to 1,3% and the total harmonic distortion from 8 % to 6 % respectively. Additionally, investment attractiveness of the decision was evaluated.

Keywords: non-traction customers, two wire-rail line, phase coordinates, AC railway, power quality

Anna Butor, Krzysztof Labisz: **Reduction of Life-cycle Costs of Locomotives by Leaning Maintenance Process**

Increasing the role of rail in balancing the transport of goods is a big challenge all over the world nowadays. Statistics clearly show a large disproportion of the volume transported by various means of inland transport where the railway business is still in the minority. One of the reasons is the cost of transported goods. It is important to know how costs affecting the final price of transported goods by rail are divided in order to reduce them. This paper presents the possibility of using life cycle costs of the product in order to take productivity to the next level and save considerable amounts of time, money, and resources. The aim of this article is to define what are Life Cycle Costs and if lean tools may be applied in transport companies. The research has been conducted over the number of years in one of the largest rail freight operator in Poland. The main goal of the investigation was to analyze costs of the diesel locomotive maintenance process in a whole lifecycle and investigate the impact of using lean tools on those costs. In this project lean tools such as: Standard Work Combination Sheet, Spaghetti diagram, Visual Management, Cause and Effect Diagram, PDCA, 5S, standardization cards were used. For better analysis Voice of the Customer and Critical to Quality tools were added. The results of this analysis are presented in this paper and prove the big impact on reducing time, improving product quality as well as integrating people, data, processes and business systems. The use of lean is deliberate because it can lead to 50% cost reduction of the P1 maintenance level on diesel locomotives with a significant reduction of working hours up to 60%. The outcome of this analysis should help the company to achieve a significant reduction in the cost of maintaining locomotives, which will contribute to a lower cost of transporting goods by rail.

Keywords: lean management, life cycle costs, locomotive maintenance process

Piotr Lesiak: **Inspection and Maintenance of Railway Infrastructure with the Use of Unmanned Aerial Vehicles**

The paper discusses the application areas of UAVs and their regulations. Particular attention is paid to the inspection and maintenance of railway infrastructure. The use of UAVs in many railway networks around the world is reviewed. The implementation of autonomous solutions is highlighted. The safety of UAVs on railways is analysed and directions for their implementation at PKP PLK S.A. are indicated.

Keywords: UAVs, inspection, infrastructure, railway, security

Andrii M. Mukha, Oleh I. Bondarr: **Reactive Power Compensation for Non-Traction Railway Consumers**

This paper deals with the problems of power supply efficiency for non-traction railway customers. Unlike public distribution networks, the non-traction power supply network is within the zone of influence of electromagnetic fields and the conductive influence of the distorted traction current. As a result, poor power quality and additional losses are typical for non-traction railway networks. Subsequently, conflicts due to the low quality of electricity may arise between the railway and its customers powered by the distribution networks of the railway. The influence of a reactive power compensation device on the voltage drop in a non-traction power line is investigated in the article. The implementation of reactive power compensation allows voltage losses during its transmission to the final consumer to be reduced by almost 5% and electricity losses by 3%.

Keywords: non-traction consumer, power factor corrector, reactive power compensator, graph of electric network, nodal analysis

Janusz Poliński, Krzysztof Ochociński: **Digitization in Rail Transport**

Digital transformation in the railway industry is an important element in the development of railways and should benefit commuters, railway operators, infrastructure managers and rolling stock manufacturers. The process of digitization applies to two domains, i.e. customer service and railway companies' operation. This paper aims to present previous eff orts regarding the use of digital technologies in customer relations and in the field of operations and maintenance, which translates into the quality of services provided. This paper highlights important concepts of this domain with respect to passenger and freight transport, infrastructure, railway rolling stock and railway traffic management. It is also argued that the process of digitization needs properly trained staff . Examples of innovative initiatives of Polish and European railway companies are covered.

Keywords: railway transport, digitization, digitization of the railways

Janusz Poliński: **Diagnostics of Track Infrastructure as Part of the Digitisation of Russian Railways**

Technical diagnostics is an integral part of the railway maintenance process. Through timely maintenance, in addition to ensuring the safety, functional and technical reliability of the infrastructure, maintenance costs are reduced and downtime losses, due to failures or premature repair requests, are eliminated or reduced. The track infrastructure diagnostic tools have evolved. This is related to, among others, the miniaturisation of instruments, reading

accuracy during motion, as well as upgraded measurement automation and result analysis. Currently, data obtained from multifunctional diagnostic tools is the basis for the developed Russian railway infrastructure maintenance and operation digital model. The strategic development of mobile diagnostic labs is the gradual transition to solutions with advanced digital analysis, supported by artificial intelligence, monitoring and forecasting. The article presents the development of mobile labs for the railroad infrastructure condition diagnosis up to the current solutions, in which measurements take place without human intervention and the obtained information is transmitted in real time to the analysis and decision centres.

Keywords: rail transport, measuring wagons, digitisation of railways, Russian railways