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C O N T E N T S

G. KOKHREIDZE, Z. GACHECHILADZE, GOCHA KOKHREIDZE, G.QADAGISHVILI.

High voltage direct current power transmission and development of technologies for converting non-traditional renewable energies into electrical energy and their integration into the grid.

"Energy". №2(110). 2024. Tbilisi. p. 5-10. geo. sum geo. engl.rus.

This scientific-engineering paper presents the electrical schematic of a bipolar direct current (DC) transmission line with dual-converter systems containing IGBT-transistor modules [1]. The study examines the following operational modes: operation without any regulators; operation with an inverter extinguishing angle regulator; operation with a current control regulator and an inverter lock angle regulator. The basic scheme involves the sequential connection of two single-converter transformers and the equalization of linear voltages on the secondary sides of two corresponding three-phase transformers. The system achieves a highly efficient 12-phase conversion, resulting in a three-phase voltage system that is offset by 30° relative to each other. Consequently, the applied voltage exhibits harmonics that are multiples of 12. In each coil's balanced voltage (2k+1).6, where k=0,1,2,3,..the order harmonics are in opposite phases, canceling each other out and thus do not appear in the total voltage of the two coils. The ground serves as the return path for current in the scheme. The distribution patterns of DC and alternating current (AC) in the ground differ significantly. The paper also introduces a hybrid autonomous power system based on non-traditional and renewable energies (solar, wind) and discusses the development of the theory for the calculation, management, and optimization of its operational modes during parallel operation with the grid. This advancement facilitates the effective implementation of technologies for converting and utilizing non-traditional and renewable energy sources in the fields of power engineering and electrical engineering.

Ill. 2, bibl. 4.

T. MUSELIANI, I. VAKHTANGADZE, B.JINTCHVELEISHVILI.

Analysis Of The Selection And Location Of Battery Energy Storage Systems In The Distribution Network.

"Energy". №2(110). 2024. Tbilisi. p. 11-23. geo. sum geo. engl.rus.

The use of electricity collection systems instead of modernization of existing power transmission networks makes it extremely important to correctly calculate the parameters and determine the switching point of the given device in the distribution system. Incorrect selection of battery energy storage systems can lead to economic inefficiency of its use. Improper placement of storage systems can lead to reduced capacity of the distribution network.

The selection of the energy storage system is mainly based on the determination of the rated output power, the duration of the regulatory impact on the nominal energy capacity. Very important are the regulatory, technical, organizational and methodological documents that determine the requirements for the selection of battery energy storage systems, their location, performed functions or design.

The analysis of scientific and technical journals devoted to the review and practical application of the functional possibilities of energy storage systems showed the lack of justified selection methods of storage subsystems of the electrochemical type of energy storage systems and their locations. The article proposes a choice of energy storage parameters for optimization of enterprise power supply systems according to economic parameters.

Ill. 1, bibl. 10.

G. KOKHREIDZE, G. KHORBALADZE, GOCHA KOKHREIDZE, G.QADAGISHVILI.

Development Of Universal Methods For Mathematical And Computer Modeling Of Processes In Controlled Rectifier And Inverter Units For Railway Power Supply.

"Energy". №2(110). 2024. Tbilisi. p. 24-29. geo. sum geo. engl.rus.

This article presents part of the scientific-engineering work conducted on the development of universal methods of mathematical and computer modeling for managing the operation processes

of automatically regulated asynchronous short-circuited rotor traction motors in locomotives, based on direct current (DC) traction substations. The study developed modernized electrical circuits of a unified converter system and performed comprehensive mathematical and computer modeling of electromagnetic and electromechanical transients, as well as steady-state processes within this system. To achieve accurate engineering results in the study of traction motor operation processes, the following were considered in the mathematical and computer modeling: the high-voltage network with its primary parameters; active resistances, leakage, and mutual inductances of the power three-phase transformer; cathode and anode reactors; main three-phase controlled and reverse controlled units required for reactive power compensation; an inverter unit for three-phase voltage frequency regulation; three-phase star-connected capacitor banks for excitation of the asynchronous machine in generator mode; parameters of the contact and track circuits; and high-speed IGBT-insulated gate bipolar transistor modules, where the commutation angle is negligible and therefore not considered during phase-to-phase switching. The study determined the waveform diagrams of the phase voltages in the primary and secondary windings of the receiving network and the traction power transformer under conditions of traction, and recuperative braking modes of the electric rolling stock; developed pulse control algorithms for the IGBT-transistor modules; and provided generalized expressions for n-order harmonics of the relevant commutation functions based on currents and voltages.
Ill. 1, bibl.2.

N. TINIKASHVILI, G. KHORBALADZE, Z. GACHECHILADZE, I. CHOMAKHIDZE, G. KOKHREIDZE.
The Organization Of The Electricity Grid And Current Challenges.
"Energy". №2(110). 2024. Tbilisi. p. 30-34. geo. sum geo. engl.rus.

In article examines the legislative framework for organizing the electricity grid. This includes identifying grid-owning entities and establishing the criteria for grid affiliation. Furthermore, it focuses on three main challenges within the system that must be successfully resolved for effective organization of the electricity grid.
Bibl. 5.

I. VAKHTANGADZE.
Assessment Of Generation Adequacy Using Antares Software.
"Energy". №2(110). 2024. Tbilisi. p. 35-39. . geo. sum geo. engl.rus.

One of the methods for assessing the adequacy of electricity generation used by transmission system operators in different countries is considered. Various assessment indicators and factors influencing its process are presented. In addition, both technical and economic information included in the reporting model is provided and the results obtained are discussed. A similar type of modeling is usually performed by the transmission system operator, which shows short-term, medium-term and long-term estimates of the expected energy deficit or surplus in the power system. Such studies are important because they allow stakeholders to make effective decisions on power system planning. There are several main adequacy indices (LOLE, LOLP, EENS) commonly used to assess the above requirement. For the corresponding analysis, deterministic and probabilistic methods have been developed and. Antares computer software was used. The mentioned program makes it possible to cover the total load, taking into account the least-cost optimization and the main indicators of the power system adequacy.
Ill. 4, bibl. 1.

T. KOKHREIDZE.
Ideological Basis For Constructing A New Generation Superconducting Eleric Power System Based On Direct Current.
"Energy". №2(110). 2024. Tbilisi. p. 40-44. geo. sum geo. engl.rus.

The ideological foundations of construction of a new generation superconducting electric power system on direct current are created. The following system is considered: a contactless direct current generator - a superconducting direct voltage transformer with a rotating magnetic excitation field increasing in the mode - a superconducting direct current cable - a

superconducting direct voltage transformer with a rotating magnetic excitation field decreasing in the mode - load. A superconducting direct voltage transformer with a rotating magnetic excitation field is connected to the power take-off system. An electric circuit of a contactless direct current generator with a controlled semiconductor switch has been developed. An electric circuit of a superconducting direct voltage transformer with a rotating magnetic excitation field has been developed. Controlled semiconductor switches are made on the basis of gate turn-off thyristors - GTO. It is shown that a new generation superconducting direct current electric power system is characterized by a significant decrease in weight and size parameters, high reliability and technical and economic indicators.
Ill. 3, bibl. 1.

T. KOKHREIDZE.
Mathematical Model Of The Skin Effect.
"Energy". №2(110). 2024. Tbilisi. p. 45-49. geo. sum geo. engl.rus.
To obtain a mathematical model of the skin effect, the basic equations of the electromagnetic field are used. The issue of how the electric current is distributed in the cross section of a cylindrical conductor when high-frequency alternating current passes through it is discussed. The electric field of the surface layer of the conductor at high frequency is investigated. It is shown that the phase of the electric vector and the current density change linearly when moving into the depth of the conductor, and their amplitudes decrease exponentially. As an example, the skin effect in an asynchronous motor with a squirrel-cage rotor is considered.
Ill. 1, bibl. 1.

R.MIKAUTADZE, G.ARABIDZE, M.ARABIDZE.
The Importance Of The Black Sea Submarine Cable For Georgia.
"Energy". №2(110). 2024. Tbilisi. p. 50-55. geo. sum geo. engl.rus.
The paper discusses the Black Sea underwater cable project and its significance for Georgia. Georgia's important geopolitical location in the South Caucasus region provides the country with the opportunity to become a hub for renewable energy sources and ensure the transit of energy produced by renewable sources from East to West. Since Georgia's eastern partners are focused on utilizing renewable energy sources, this project will allow them to market renewable electricity in a market where the demand for green energy sources is constantly growing. The article presents the technical parameters of the Black Sea underwater cable, its role in diversifying the export and import of electrical energy. This project will benefit Georgia's economy as well as the energy sector and strengthen regional cooperation with the European electricity distribution network.
Ill. 1, bibl. 4.

T.SHUBLADZE, K.MCHEDLIDZE, M.JIKHVADZE.
The Role Of Hydrogen In Synthetic Fuel Production Strategies.
"Energy". №2(110). 2024. Tbilisi. p. 56-60. geo. sum geo. engl.rus.

This paper examines the role of hydrogen H_2, carbon emissions and their global warming and economics. Furthermore, the article underlines the importance of hydrogen H_2 production as a basis in the development of synthetic fuels and future energy development. Hydrogen H_2 from renewable sources has the potential to be used with carbon to produce synthetic liquid fuels. Although H_2 production technology can be considered with emissions, sustainable H_2 production techniques can contribute to low carbon.
Ill. 1, Bibl. 3.

T.KOKHREIDZE.
Superconducting Inductive Energy Storage Of The New Generation.
"Energy". №2(110). 2024. Tbilisi. p. 61-63. geo. sum geo. engl.rus.
Based on a superconducting transformer with a rotating magnetic field, a toroidal superconducting inductive energy storage (SIES) and a frequency converter are considered. It is

shown that SIES can be used to improve the static and dynamic stability of electric power systems, cover peak loads, maintain voltage at certain points in networks, and store electrical energy. Expressions for calculating the inductance of a toroidal winding are obtained. An equivalent electrical circuit and SIES equations in transient processes are compiled. An analysis is carried out both in stationary and transient processes.
Ill. 2, bibl. 2..

K.KIGURADZE, IV.GRDZELIDZE.
Correlation-regression analysis of energy consumption of an industrial enterprise.
"Energy". №2(110). 2024. Tbilisi. p. 64-71. engl. sum geo. engl. rus.

In order to assess the background technical condition of the enterprise, the raw (unprocessed) data on the manufactured products and the corresponding consumed energy have been analyzed. The basic model of electricity consumption has been developed using the one-factor correlation-regression method of the data. Based on a complete statistical analysis, recommendations were developed, which were implemented in the enterprise, and data monitoring for the next 6 months of the year was carried out.
Ill. 3, tabl. 4, bibl. 5.

L.PAPAVA, T.ISAKADZE, M.RAZMADZE, G.GUGULASHVILI, G.KHARSHILADZE.
Using Energy Efficient Technology To Obtain Neon And Helium With High Purity.
"Energy". №2(110). 2024. Tbilisi. p. 72-76. geo. sum geo. engl.rus.

The classical technology for processing neon and helium concentrate is considered and the possibility of reducing specific energy costs for the production of light inert gases is shown. When processing a flow of mixed gases of neon and helium, reserves for reducing operating costs were identified. It is proposed to include a membrane module in the processing scheme, in which the helium flow is simultaneously separated and the mixture is enriched with helium. The efficiency of helium and neon production technology is increased by increasing the operating cycle of cryogenic adsorbents and simultaneously reducing the number of compressors.
Ill. 2, tabl. 1, bibl. 10.

L.KHUNTSARIA, M.GOGBERASHVILI, J.KHUNTSARIA.
Cost-Effective Lossless Coding Of Data Based On Walsh Transform.
"Energy". №2(110). 2024. Tbilisi. p. 77-82. geo. sum geo. engl.rus.
In order to use linear orthogonal transformations for lossless economic coding of data, a comparative analysis of different types of transformations has been conducted. In particular, on the basis of mutual comparison of discrete cosine and Walsh transformations, the possibility of using only Walsh transformation is justified, since it ensures 100% accuracy of the restored data. It is shown that this circumstance is due to the representation of the elements of the base matrices of the Walsh transformation with integers (+1 and 1) When using the discrete cosine transform, the data is recovered with an accuracy of 0.1%, which is unacceptable for lossless coding systems.
Bibl. 6.

S. JANELIDZE.
Blockchain And Its Use In The Energy Sector.
"Energy". №2(110). 2024. Tbilisi. p. 83-89. geo. sum geo. engl.rus.

The article discusses the role and potential of blockchain technology in the energy sector. Based on the analysis of the key features of the technology, such as decentralization, transparency and data inviolability, it is shown how blockchain technology can improve energy processes and market relations. The article reviews potential areas of blockchain use, such as peer-to-peer trading, microgrids, and renewable energy certification. The article also discusses the challenges associated with the practical implementation of blockchain and possible benefits for the energy sector.
Ill. 1, bibl. 8.