GENERAL INFORMATION ABOUT THE REPUBLIC OF TATARSTAN

The Republic of Tatarstan is one of the most economically developed regions of the Russian Federation. The republic is located in the center of a large industrial region 800 km east of Moscow at the confluence of the Kama and the Volga rivers.
Tatarstan: total area - 67 836.2 km2, population: 3.8mln people
capital: kazan, total area - 614.2 km2, population - 1.2mln people



KAZAN STATE POWER ENGINEERING UNIVERSITY is one of three power engineering UNIVERSITIES in RUSSIA.
The mission of the university is the formation of structural capital and the development of fundamentally new solutions in the field of energy and related economic sectors



10 000 students,
42 bachelors programs,
29 Masters programs,
13 PhD programs.
Under – and postgraduate students from more than 40 neighbouring countries and beyond study at UNIVERSITY

KAZAN STATE POWER ENGINEERING UNIVERSITY
PETER THE GREAT SAINT PETERSBURG
POLYTECHNIC UNIVERSITY

International Scientific and Technical Conference SES - 2019

P R O G R A M M E

18 — 20 September, 2019

kaspersky

Kazan 2019

ECTIONS

OF THE INTERNATIONAL SCIENTIFIC AND
TECHNICAL CONFERENCE SES-2019

1. ENERGY SYSTEMS AND COMPLEXES
2. ELECTROMECHANICS AND ELECTRICAL APPARATUS
3. AUTOMATION, INSTRUMENTS AND CONTROL METHODS
4. ECONOMICS AND ENERGY MANAGEMENT

COMMITTEE

OF THE INTERNATIONAL SCIENTIFIC CONFERENCE
SES-2019

Program Committee

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Co-Chairmen:
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Corresponding member of RAS, Dr. Sc., Prof., Vitaly Sergeev, Vice-rector for Research of SPbPU

International Scientific Committee

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Invited Chairman:
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SES-2019

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Dr. Sc., Prof., Natalya Chichirova, Head of Department Thermal power stations, Russia, Kazan

Dr. Sc., Prof., Yuri Vankov, Head Industrial Heat Power Engineering and Heat Supply Systems of KSPEU, Russia, Kazan

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PhD, Evgenij Ponomarenko, Assistant Prof., Dean of the Power Engineering Faculty of BSTU the Republic of Belarus, Minsk

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Prof., Christoph Pfeifer, Prof. the University of Natural Resources and Life Sciences, Vienna, Austria

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Prof., Antonio Andreini, Prof. the University of Florence, Italy

SES-2019

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PhD., Prof., Michail Kolcun, Head of the Department of Electrical Power Engineering of the Faculty of Electrical Engineering and Computer Science of the University of Košice, Slovak Republic

Prof., Dr. M., Hakan Hocaoglu, professor, Gebze Technical University, Turkey

Prof., Dan Doru Micu, professor, Technical University of Cluj-Napoca, Romanian

Technical Secretariat

PhD, Elena Kostyleva, Director of Center for Publication Activity KSPEU

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PhD, Anton Semennikov, Assistant at Department of Industrial Electronics and Light Engineering of KSPEU

Timur Petrov, Assistant at Department of Power Supply of Industrial Enterprises of KSPEU

Marina Kuzmina, Engineer at Department of Industrial Heat Power Engineering and Heat Supply Systems of KSPEU

KEY SPEAKERS

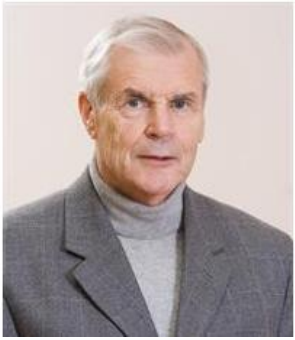
Edward Abdullazyanov



Kazan State Power Engineering University, Russia

PhD (Tech. sci.), Honored Power Engineer of the Russian Federation, Rector of Kazan State Power Engineering University.

Vadim Golenischev-Kutuzov



Kazan State Power Engineering University, Russia

Doctor of Physical and Mathematical Sciences, Honored Worker of Science and Technology of the Russian Federation, holder of the Order of Friendship, head of the scientific school on the features of the electronic structure of nonlinear properties of magneto- and electro ordered materials study.

SES-2019

Pietro Zunino



University of Genoa, Italy

Specialist in Power Engineering, curriculum on Energy and Propulsion. Author of more than 150 international scientific papers on heavy duty gas turbines and aero-thermodynamics of aero-engine gas turbines. Research manager for several research contracts with national industries. Session chairman in International Scientific Conferences. Scientific reviewer for International Conferences and Scientific Journals. Evaluator for the European Commission VI and VII Framework, Aeronautical and Space. Scientific responsible or main investigator of European Commission Research Projects on Gas Turbines.

Gregor Pudlo



BAUR GmbH (Austria)

Sales Director

SES-2019

Ayrat Sabyrzhanov

JSC Tatenergo, Russia

First Deputy General Director-Director of Economics and Finance



Alfred Safin

Kazan State Power Engineering University, Russia



Associate Professor. **Scientific interests.** Optimization problems in the field of electric power industry. Development of software systems for the design of rational schemes of power supply of industrial enterprises.

Development of simulation models of traction drive connection and control circuits in Matlab-Simulink, which will allow to estimate the power consumption of traction motors in different operating modes and determine the optimal control parameters.

Development of three-dimensional models of running parts of electric rolling stock for the purpose of strength analysis and design optimization in CAD-CAE Catia V5 system.

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SCHEDULE

OF THE INTERNATIONAL SCIENTIFIC AND TECHNICAL CONFERENCE SES-2019

Time	Place	Event name
Sept 18, 2019		
08.30 - 10.00	Hall, House D (2 этаж корпус Д)	Registration
09.30 – 09.50	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г-204)	Opening of the Laboratory «Education and research laboratory for cable lines testing and diagnostic» (открытие Учебно-исследовательской лаборатории по испытаниям и диагностике кабельных линий)
10.00 – 12.00	Big Conference hall, House D (Зал заседаний ученого совета Д-223)	Plenary session
12.15-14.30	Dining hall, House D (Столовая корпус Д)	Dinner (Приветственный обед)
15.00-18.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Round table “Modern methods of testing and diagnostics of cable lines” (Круглый стол «Современные методы испытания и диагностики кабельных линий») **Language: ENGLISH/ RUSSIAN**
15.00-17.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 1. **Language: ENGLISH** **1. Energy systems and complexes** **2. Electromechanics and electrical apparatus** **3. Automation, instruments and control methods** **4. Economics and Energy Management**
15.00-17.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 2 **Language: ENGLISH/ RUSSIAN** **1. Energy systems and complexes**
15.00-17.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 3 **Language: ENGLISH/ RUSSIAN** **1. Electromechanics and electrical apparatus**
15.00-17.30	Technopark KSPEU, House G	Section 4 **Language: ENGLISH/**

	(Технопарк КГЭУ, корпус Г)	**RUSSIAN** **1. Automation, instruments and control methods**
15.00-17.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 5 **Language: ENGLISH/ RUSSIAN** **1. Economics and Energy Management**
18.00 – 20.00	Tour of Kazan	Tour of Kazan (Экскурсия по вечерней Казани)
Sept 19, 2019		
9.00-10.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 1. **Language: ENGLISH** **1. Energy systems and complexes** **2. Electromechanics and electrical apparatus** **3. Automation, instruments and control methods** **4. Economics and Energy Management**
9.00-10.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 2 **Language: ENGLISH/ RUSSIAN** **1. Energy systems and complexes**
9.00-10.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 3 **Language: ENGLISH/ RUSSIAN** **1. Electromechanics and electrical apparatus**
9.00-10.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 4 **Language: ENGLISH/ RUSSIAN** **1. Automation, instruments and control methods**
9.00-10.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 5 **Language: ENGLISH/ RUSSIAN** **1. Economics and Energy Management**
10.30-11.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Coffee break
11.00-13.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 1. **Language: ENGLISH** **1. Energy systems and complexes** **2. Electromechanics and electrical apparatus** **3. Automation, instruments and control methods**

		4. Economics and Energy Management
11.00-13.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 2 **Language: ENGLISH/ RUSSIAN** **1. Energy systems and complexes**
11.00-13.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 3 **Language: ENGLISH/ RUSSIAN** **1. Electromechanics and electrical apparatus**
11.00-13.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 4 **Language: ENGLISH/ RUSSIAN** **1. Automation, instruments and control methods**
11.00-13.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 5 **Language: ENGLISH/ RUSSIAN** **1. Economics and Energy Management**
13.00-14.00	Dining hall, House D (Столовая корпус Д)	Dinner
14.00-15.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 1. **Language: ENGLISH** **1. Energy systems and complexes** **2. Electromechanics and electrical apparatus** **3. Automation, instruments and control methods** **4. Economics and Energy Management**
14.00-15.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 2 **Language: ENGLISH/ RUSSIAN** **1. Energy systems and complexes**
14.00-15.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 3 **Language: ENGLISH/ RUSSIAN** **1. Electromechanics and electrical apparatus**
14.00-15.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 4 **Language: ENGLISH/ RUSSIAN** **1. Automation, instruments and control methods**
14.00-15.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 5 **Language: ENGLISH/ RUSSIAN** **1. Economics and Energy Management**

15.30-16.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Coffee break
16.00-17.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 1 **Language: ENGLISH/ RUSSIAN** **1. Energy systems and complexes**
16.00-17.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 2 **Language: ENGLISH/ RUSSIAN** **1. Electromechanics and electrical apparatus**
16.00-17.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 3 **Language: ENGLISH/ RUSSIAN** **1. Automation, instruments and control methods**
16.00-17.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 4 **Language: ENGLISH/ RUSSIAN** **1. Economics and Energy Management**
Sept 20, 2019		
9.00-10.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 1 **Language: ENGLISH/ RUSSIAN** **1. Energy systems and complexes**
9.00-10.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 2 **Language: ENGLISH/ RUSSIAN** **1. Electromechanics and electrical apparatus**
9.00-10.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 3 **Language: ENGLISH/ RUSSIAN** **1. Automation, instruments and control methods**
9.00-10.30	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Section 4 **Language: ENGLISH/ RUSSIAN** **1. Economics and Energy Management**
10.30-11.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Coffee break
11.00-12.00	Technopark KSPEU, House G (Технопарк КГЭУ, корпус Г)	Discussion and conclusion

SES-2019

PROGRAM

OF THE INTERNATIONAL SCIENTIFIC AND TECHNICAL CONFERENCE SES-2019

<table>
<tr><th>Time</th><th>Event name</th></tr>
<tr><td colspan="2">Sept 18, 2019</td></tr>
<tr><td>08.30
–
10.00</td><td>Registration</td></tr>
<tr><td>09.30
–
09.50</td><td>Opening of the Laboratory «Education and research laboratory for cable lines testing and diagnostic»</td></tr>
<tr><td>10.00
–
12.00</td><td>Grand opening,
Introduction by Edvard Abdullazyanov, Rector, KSPEU (Russia, Kazan)
Introduction by Vadim Golenischev-Kutuzov, professor, KSPEU (Russia, Kazan)
Pietro Zunino, professor, University of Genoa (Italy, Genoa)
Gregor Pudlo, Sales Director BAUR GmbH (Austria, Feldkirch)
Ayrat Sabyrzhanov, First Deputy General Director-Director of Economics and Finance JSC Tatenergo (Russia, Kazan)
Alfred Safin, Associate Professor, KSPEU (Russia, Kazan)</td></tr>
<tr><td>12.15-
14.30</td><td>Dinner
(Приветственный обед)</td></tr>
<tr><td>15.00-
18.00</td><td>Round table “Modern methods of testing and diagnostics of cable lines”
Круглый стол (Круглый стол «Современные методы испытания и диагностики кабельных линий»).
Описание: Современные методы обнаружения мест повреждений. Диагностика состояния кабельных линий при помощи анализа коэффициента диэлектрических потерь и частичных разрядов. Экономическая эффективность. Определение статистического остаточного срока службы кабельных линий.
Language: ENGLISH / RUSSIAN</td></tr>
<tr><td>15.00-
17.30</td><td>Section 1.
Language: ENGLISH
1. Energy systems and complexes
2. Electromechanics and electrical apparatus
3. Automation, instruments and control methods
4. Economics and Energy Management

Presentations:
<table>
<tr><th>№</th><th>Authors</th><th>Title</th></tr>
<tr><td>1.</td><td>D M Valiullina,
Yu K Ilyasova and
V K Kozlov</td><td>Diagnostics of the technical condition of transformers according to the color characteristics of transformer oil</td></tr>
<tr><td>2.</td><td>A D Zaripova,
D K Zaripov,
A E Usachev</td><td>Automatic condition monitoring method to find defects in high-voltage insulators using infrared images</td></tr>
<tr><td>3.</td><td>T K Huseynov,
T T Gadirova,
B K Amiraslanov,
N A Abdulova,</td><td>Vibration-amplitude liquids densimeter</td></tr>
</table>
</td></tr>
</table>

		A I Quliyeva and K R Haciyeva	
	4.	M F Sadykov, D A Yaroslavsky, D A Ivanov and M P Goryachev	Inclinometric method for determining the mechanical state of an overhead power transmission line
	5.	A M Sagdatullin	Improving the energy efficiency of oil productionusing identification and prediction of operating modes of production wells based on data analysis methods, machine learning and neural networks
	6.	K Kh Gilfanov, R A Shakirov	Intellectual modeling of surface heat-exchange enhancer based on artificial neural networks
	7.	O S Zueva	Modified method of conductometry data using for calculation of ionic surfactant solutions parameters: Part 1
	8.	O S Zueva	Modified method of conductometry data using for calculation of ionic surfactant solutions parameters: Part 2
	9.	I R Ismagilov, R I Kalimullin, A N Borisov	Increasing the laser-acoustic method efficiency for testing metal products by using 3D visualization
	10.	J V Torkunova, M N Habrieva and L V Plotnikova	Current application issues of IT-technologies in electric power industry
	11.	P I Okley, V K Lozenko, R I Inamov	Methodical approach to assessing the effectiveness of the management system of thermal power plants in Russia

15.00-17.30

Section 2

Language: ENGLISH / RUSSIAN

1. Energy systems and complexes

Presentations:

№	Authors	Title
1.	D B Vafin	Thermal and aerodynamic characteristics of tube furnaces with wall burners of two types
2.	R Zakirullin and I Odenbakh	Smart window for angular selective filtering of solar radiation
3.	R V Vyatkin, A N Tikhomirov and D A Kolesnichenko	Study of auxiliary power system for electroplaters on the thermal engine basis
4.	Y Galerkin, A Drozdov and A Rekstin	Centrifugal compressor impeller loading factor analysis
5.	A N Rogalev, N D Rogalev, V O Kindra, E Yu Grigoriev and B A Makhmutov	The flow path characteristics analysis for supercritical carbon dioxide gas turbines
6.	N V Buyakova,	Integrated modeling of compact

		A V Kryukov and Le Van Thao	power lines

15.00-17.30

Section 3

Language: ENGLISH / RUSSIAN

1. Electromechanics and electrical apparatus

Presentations:

№	Authors	Title
1.	A N Tikhomirov, O B Tikhomirova and M E Gnenik	Estimation of appropriate range extender power for battery electric vehicle
2.	A R Safin,I V Ivshin, T I Petrov	The method of calculation and optimization of the parameters of synchronous electric machines with permanent magnets in the composition of the generating and driving complexes
3.	D D Micu, E I Gracheva and O V Naumov	Calculation of loading ability of power transformers taking into account electromechanical characteristics
4.	G A Belov, S V Abramov, G V. Malinin, A V Salov	Control Unit for Electromagnet Current
5.	A G Rusina, Dzh Kh Khudzhasaidov, O V Naumov and A N Gorlov	Development of an intelligent system for integrated management of hydroelectric cascade modes
6.	V A Trushkin, S V Shlyupikov, M A Levin, S A Kifarak	Moisture content as an important integral parameter of transformer oil quality in power transformers of substations of 10 / 0.4 kV
7.	Yu V Bebikhov, I A Yakushev, A N Egorov, Ya S Kharitonov, N V Golubtsov and R R Gibadullin	The effect of higher voltage and current harmonics on the operation of electrical systems

15.00-17.30

Section 4

Language: ENGLISH / RUSSIAN

1. Automation, instruments and control methods

Presentations:

№	Authors	Title
1.	V A Petrosyan, A V Belousov, A G Grebenik and Yu A Koshlich	The problem of creating an automated system to control growth of sapphire single crystals from melt as a problem of control and monitoring of a complex nonlinear and dynamic system
2.	B V Kavalerov, I Ziyatdinov, Sh D Basargin	Gas turbine unit simplified model adaptive control
3.	M V Talanov, V M Talanov	Software and hardware solution for

			digital signal processing algorithms testing
	4.	M G Bashirov, N N Luneva, I G Husnutdinova, E M Bashirova, N M Zaharov, R R Gaziev	Improving methods for assessing the technical condition and predicting the resource of power equipment based on the use of the electromagnetic-acoustic effect
	5.	K V Epifancev and S A Solovev	Software platform for analysis of data in the field of waste management
	6.	I P Miroshnichenko, I A Parinov, V P Sizov	On Increasing the Noise Immunity of MicroAcoustic-mechanical Gyroscope
	7.	S V Sidorov, V V Sushkov, I S Sukhachev	Development of a method for determining the location of a single line-to-ground fault of an overhead power line with voltage of 6(10) kV considering climatic factors
	8.	I D Gizzatova, V K Kozlov and D.M. Valiullina	Determination of the true water content, the nature of the impurities and their concentration in transformer oil

15.00-17.30

Section 5

Language: ENGLISH / RUSSIAN

1. Economics and Energy Management

Presentations:

№	Authors	Title
1.	N S Volotkovskaya, N N Kugusheva, A S Semenov, I A Yakushev S N Pavlova and O V Kolosova	Structure, condition, and prospects of electrical grids in the Republic of Sakha (Yakutia)
2.	Z Gel′manova, O Pak, G Sivyakova, G Zhabalova, O Lelikova, O Onischenko	The scenario of development of electric power industry in the Republic of Kazakhstan
3.	E S Melekhin, A A Pelmeneva and E S Kuzina	Economic prerequisites for the development of low-energy based on the development of unclaimed hydrocarbon deposits
4.	E A Husainova, L R Urazbahtina, N A Serkina, E A Dolonina and O V Filina Lenka Švecová	Monitoring tools of regional economic security
5.	A I Shinkevich, S S Kudryavtseva, A N Dyrdonova, D Kh Gallyamova, A A Farrakhova, E L Vodolazhskaya	Assessment of the efficiency of energy- and resource-saving technologies in the model of open innovation
6.	A I Shinkevich, T V Malysheva, I A Zaraichenko,	Investigation of energy consumption trends in petrochemical plants for the management of resource saving

		A A Lubnina, G R Garipova, M M Sharafutdinova	
	7.	A P Garnov, O N Bykova and V M Repnikova	Methods of conditioning sustainable growth programs of power generating companies

Sept 19, 2019

09.00 – 10.30

Section 1.

Language: ENGLISH / RUSSIAN

1. Energy systems and complexes

2. Electromechanics and electrical apparatus

3. Automation, instruments and control methods

4. Economics and Energy Management

Presentations:

№	Authors	Title
1.	J V Torkunova, M N Habrieva, B. K. Shapkenov	Qualimetric approach to solving the problems of innovative development of Russian power industry
2.	T G Bondarenko, A I Bolvachev	Methodology For Assessing The Economic Efficiency Of Investment Projects In Petrochemical Companies
3.	N V Puzina, A A Vereteno, E A Luneva and N V Katunina	Management of loyalty in developing a company's brand on the Russian oil and gas B2B market
4.	V K Kozlov, E Kirzhatskikh and R Giniatullin	Differential method for damage location determining in 10 kV distribution networks with isolated neutral
5.	Y Galerkin, A Drozdov and A Rekstin	Centrifugal compressor impeller loading factor analysis
6.	A Rekstin, K Soldatova, Y Galerkin and E Popova	Verification of a simplified mathematical model of centrifugal compressor stages
7.	N I Moskalenko, I R Dodov, M S Khamidullina, Ya S Safiullina	Measuring complex for studies of the composition of the combustion products and the microstructure of the soot particulate sol
8.	N I Moskalenko, S N Parzhin, I R Dodov, M S Hamidullina, A R Akhmetshin	Development of optical-electronic systems for the study of temporal trends in the composition of the atmosphere and temporal variations of the Earth's climate
9.	N I Moskalenko, Yu A Ilyin, O V Zotov, I R Dodov, A R Akhmetshin	Fine structural spectrometry and spectroradiometry of combustion products of energy fuels
10.	A Rekstin, V Semenovskiy, K Soldatova, Y Galerkin and K Sokolov	The simulation of gas-dynamic characteristics of centrifugal compressors in turbo-expander units
11.	R G Khuzyashev, I L Kuzmin, S M Tukaev, L T Tukhvatullin and	Traveling wave fault location algorithms in hybrid multi-terminal lines of the tree like structure

		E G Stepanova	
	12.	A.Yu. Khrennikov, N.M. Aleksandrov	Calculation of the electrodynamic forces causing deformation of the power transformer's windings

09.00 – 10.30

Section 2

Language: ENGLISH / RUSSIAN

1. Energy systems and complexes

Presentations:

№	Authors	Title
1.	A N Rogalev, N D Rogalev, V O Kindra, S K Osipov and A S Zonov	Numerical study of heat transfer in rectangular channels with single pin fin and pin fin-dimple
2.	D O Romanov, Y V Yavorovsky	Investigation of thermohydraulic dispatcher properties and peculiarities
3.	A V Sadykov, D B Vafin	Calculation of temperature fields and velocity in the fur-nace of tubular ovens
4.	Y A Gorinov	Underwater laying of pipesfor heating networks of energy systems
5.	D I Subbotin, S D Popov, E O Serba, N A Charykov, V R Lizander, A V Surov, N V Obraztsov	Fullerenes production by electric arc pyrolysis of methane in an AC three-phase plasma torch
6.	O A Gorbunova, G I Pavlov, P V Nakoryakov, Yu I Khakimzyanova	Relationship between the technical condition of the equipment of heat and power engineering units and the noise level in the environment
7.	E A Tyurina, A S Mednikov, P Yu Elsukov, S N Sushko	Analysis of the efficiency of energy systems of long-distance energy transport
8.	I N Zapolskaya, Yu V Vankov, O I Zverev, R R Rotach	The impact of the transition of hot water "preparation" by means of individual thermal points on the Kazan energy system
9.	K H Gilfanov, N Tien, R N Gaynullin, I Hallyyev	Energy efficient heat supply system for electric power facilities

09.00 – 10.30

Section 3

Language: ENGLISH / RUSSIAN

1. Electromechanics and electrical apparatus

Presentations:

№	Authors	Title
1.	Л Н Токарев	Трансформаторные ЭДС в дифференциальных уравнениях синхронных генераторов
2.	A V Puzakov	Developing the model of normal operation of starter motor traction relays
3.	A N Korkishko, O A Korkishko, A A Kosov	Feasibility study on the use of tubing pipes in constructing intermediate support for high voltage power lines 6-10 kV in the development of oil

			fields
	4.	W Bialy, V E Sovin, V I Zatsepina, E P Zatsepin and O Ya Shachnev	Ensuring efficient operation of electromechanical systems with frequency regulation with periodic voltage sags
	5.	N V Hruntovich, A A Kapanski, D Baczynski, E E Kostyleva and O V Fedorov	The use of variable frequency drive pump working on a water tower
	6.	V A Trushkin, O N Churlyaeva and R V Kozichev	Justification of the active method of protecting the insulation of submersible electric motors
	7.	A L Slavutskiy, L N Vasilieva, V G Grigoriev, S G Chumarov, A V Kartuzov, A I Kitaev	Transients in the load node at power loss: group run-out of induction motors

09.00 – 10.30

Section 4

Language: Language: ENGLISH / RUSSIAN

1. Automation, instruments and control methods

Presentations:

№	Authors	Title
1.	I P Miroshnichenko, I A Parinov, T P Savostina,V P Sizov	Optical Device for Measuring Small Displacements of Control Objects Surfaces with Protection from External Mechanical Loading
2.	I A Sultanguzin, D A Kruglikov, T V Yatsyuk, I D Kalyakin, Yu V Yavorovsky, and A V Govorin	The use of BIM, BEM and CFD technologies for design, construction and operation of energy-efficient houses
3.	Yu V Bebikhov, A S Semenov, M N Semenova, S N Pavlova, M A Glazun and N K Miftahova	The evaluation of the operation of continuous monitoring system control of power quality at mining enterprises
4.	E G Egorov, N Ju Luija, E V Mikhailova, V N Pichugin, R V Fedorov and V M Zbrodiga	Features of switching tests circuit breakers
5.	И М Сафаров, М И Сазгетдинов	Digital energy and automatic control system of digital energy in the Republic of Tatarstan

09.00 – 10.30

Section 5

Language: ENGLISH / RUSSIAN

1. Economics and Energy Management

Presentations:

№	Authors	Title
1.	A I Shinkevich, N V Barsegyan, M V Shinkevich,	Reserves for improving the efficiency of petrochemical production on the basis of ‘‘Industry 4.0’’

			S Sh Ostanina, F F Galimulina, M E Nadezhdina	
		2.	D O Romanov, Y V Yavorovsky	Feasibility study of conventional, DVSP, and THD-based heat supply systems
		3.	V V Avilova, A V Safina and E V Demidova	Diversification of Russian energy exports to Asia-Pacific countries: opportunities and risks
		4.	A V Novichkova, O V Malygina, T V Trofimova, A V Lomovtseva, V V Avdonkina, O S Rybkina	Management innovation through the formation of a model of corporate memory
		5.	E A Husainova, L R Urazbahtina, N A Serkina, E A Dolonina, A A Derbeneva and O V Filina, G Ostapenko	Features of management and factors of economic stability of an industrial enterprise in the region
		6.	N D Chichirova, I G Akhmetova, K V Lapin and A R Gilmanova, ION Ion	Improving of the heat supply energy efficiency in Russian cities through the individual heat points introduction
10.30 – 11.00	Coffee break			
11.00 – 13.00	Section 1. **Language: ENGLISH** **1. Energy systems and complexes** **2. Electromechanics and electrical apparatus** **3. Automation, instruments and control methods** **4. Economics and Energy Management** Presentations:			
		№	Authors	Title
		1.	D A Sorokin, S I Volskiy, Y Y Skorokhod	Three-phase power factor corrector with direct power control and power supply of the unbalanced industrial network
		2.	D I Nabiullin, R N Balobanov	Prediction of the electrical load of the power system using neural networks.
		3.	Yu V Vankov and A K Al – Okbi	Air conditioning system by using unconventional energy sources
		4.	E R Bazukova, T O Politova, E R Khaziakhmetova, A A Medyakov	Destruction of thermal insulation and effectiveness of the thermal energy transfer system
		5.	A Mardikhanov, V Sharifullin, A V Golenishchev-Kutuzov and Sh G Ziganshin	Development of methods for the formation of operation modes of hydropower systems using machine learning methods

	6.	A Fedotov, R Misbakhov, N Chernova, K Bakhteev, A Akhmetschin and T Dzhunuev	Calculation of electrical loads for decentralized power supply systems and the choice of power gas piston installations which use electrochemical energy storage
	7.	U M Strelkov, O V Radaykin, L S Sabitov, A V Akhmerov	Computer modeling of the wind power unit constructions with power over 2 MW
	8.	A I Ivanov, A S Kritchenkov and M Yu Egorov	Arguments for tightness testing of nuclear system pipeline parts, attached to pressureless tanks
	9.	E A Shakhova, P P Rymkevich, A S Gorshkov, M Yu Egorov and A S Stepashkina	Energy processes with natural quantization
	10.	E A Konnikov, K V Osipova, N A Yudina	The prevalence of renewable energy in the Russian energy market
	11.	D Köppen, O V Vladimirov, T A Musaev and O V Fedorov	A method for choosing the optimal quantity of short-circuit indicating devices to enhance power supply reliability

11.00 – 13.00

Section 2

Language: Language: ENGLISH / RUSSIAN

1. Energy systems and complexes

Presentations:

№	Authors	Title
1.	K Kovalev, V Poltavets, I Kolchanova	Superconducting technologies for renewable energy
2.	A B Loskutov, E N Sosnina, A I Chivenkov, E V Kryukov and A P Shashkin	Research of experimental hybrid energy complex with fuel cells operating on biogas
3.	J V Karaeva, V O Zdor, A I Kadyirov, E V Shamsutdinov	Jet mixing when heating oil and fuel oil in storage tanks
4.	N S Kochev, B P Zhilkin, L V Plotnikov	Improving the technical and environmental performance of piston engines by upgrading the fuel system
5.	L V Plotnikov, Yu M Brodov, M O Misnik	Heat transfer intensity of pulsating gas flows in the exhaust system elements of a piston engine
6.	F Gazizov, I Ahmetova	The main indicators of choosing the scheme of providing hot water supply in cities
7.	D S Balzamov, I G Akhmetova, E Yu Balzamova, G I Oykina	An analysis of the viability of implementing steam screw machines at the facilities of energy generation enterprises to reduce the energy costs for their own need

	8.	A V Sadchikov	Use of combined fermentation technology to improve the efficiency of the energy complex of the MSW landfill
	9.	A A Filimonova, N D Chichirova, A A Chichirov and A A Batalova	Express method for determining of organic substances matter in the production water of energy-technological complexes of thermal power plant – petrochemical enterprise

11.00 – 13.00

Section 3

Language: ENGLISH / RUSSIAN

1. Electromechanics and electrical apparatus

Presentations:

№	Authors	Title
1.	W Biały, A R Safin, V I Zatsepina, E P Zatsepin, P I Skomorokhov	Improving the reliability of operation of electromechanical devices by means of ionistor-battery backup
2.	N V Hruntovich, N V Hruntovich, A A Kapanski, I V Petrov and E E Kostyleva	Vibration diagnostic of electric motor roller bearings
3.	A V Vinogradov, A V Vinogradova, V E Bolshev, M O Ward, N V Makhiyanova, M S Garifullin	Justification for creating a mobile complex to assess electric energy loss in power transformers during the operation process
4.	A V Vinogradov, A V Vinogradova, M O Ward, A N Kharkhardin, A I Psaryov, M S Garifullin	Choice of commutation device and development of the scheme of a universal sectionalizing point with automatic load transfer function for the 0.38 kV electric network
5.	A V Golenishchev-Kutuzov, T V Tabachnikova and G T Merzadinova	Simulated model of electric installation of electric centrifugal pump with submersible of individual compensation installation
6.	N Yu Zaitsev, Yu M Zaitsev, E V Mikhailova, D S Sazanov, G P Svintsov and B M Adrianov	Trigger low-voltage devices electromechanical apparatus
7.	A E Auhadeev, R S Litvinenko, V P Fandeev, P P Pavlov, V M Btakov and A R Litvinenko	Research of reliability of urban electric transport system
8.	K V Bykov, N M Lazareva and V M Yarov	Dynamic modes of operation of a three-level LLC-converter with phase-impulse control

11.00 – 13.00

Section 4

Language: ENGLISH / RUSSIAN

1. Automation, instruments and control methods

Presentations:

№	Authors	Title
1.	A N Bogdanov, I A Ryabykh, A I Galiev	Improving education quality using by automated virtual reality system
2.	T A Akhmetshina, G I Il'in, A G Il'in and R R Fayzu	On the peculiarities of the behaviour of the instantaneous frequency of the APSK-N-signal at the linear selective system output in the presence of strong ISI
3.	A V Chupaev, R S Zaripova, R R Galyamov, A Y Sharifullina	The use of industrial wireless networks based on standard ISA-100.11a and protocol Wireless HART in process control
4.	I V Ivshin, A R Safin, A N Tsvetkov, T I Petrov, V Yu Kornilov and L V Dolomanyuk	Adaptive control system of the pumping unit
5.	A M-N Alzakkar, I M Valeev, N P Mestnikov and E G Nurullin	The Artificial Power System Networks Stability Control by Using the Technology of Neural Network

11.00 – 13.00

Section 5

Language: ENGLISH / RUSSIAN

1. Economics and Energy Management

Presentations:

№	Authors	Title
1.	I G Akhmetova, A A Derbenyova, R R Dyganova and E A Husainova, Jaromír Veber	Management organization accounting for the responsibility centers
2.	Y N Zatsarinnaya, A G Logacheva, R N Gaynullin, S F Alekseeva and D I Amirov, COMAN Gelu	Solution for renewable future
3.	V Y Bauer and D G Shuvalova	Development of a method for monitoring and control of the process of production localization regarding power engineering
4.	O V Shemelova, E V Yakovleva, T G Makuseva, I I Eremina and O N Makusev	Solving optimization problems when designing power supply circuits
5.	A N Dyrdonova and T S Lin'kova	Principles of petrochemical cluster' sustainability assessment based on its members' energy efficiency performance
6.	N V Varlamov	The analysis of international

			experience in the energy market formation and economic mechanisms for management of the gas supply systems development
	7.	N V Varlamov, I A Kirshina	Natural gas supply for industrial enterprises in the conditions of the Russian market: current state and development trends

13.00–14.00 Dinner

14.00 – 15.30

Section 1

Language: ENGLISH / RUSSIAN

1. Energy systems and complexes

Presentations:

№	Authors	Title
1	R R Safin, N R Galyavetdinov, S R Mukhametzyanov, G F Ilalova, I A Valeev, A V Safina	Effect of preparation of wood raw materials and some processing modes on the output of liquid pyrolysis products
2	S O Gaponenko, A E Kondratiev, R Z Shakurova	Improving the efficiency of energy complexes and heat supply systems using mathematical modeling methods at the operational stage
3	S O Gaponenko, R Z Shakurova, A E Kondratiev	Improving the methodology for assessing the technical condition of equipment during the transportation of energy carrier in energy systems and complexes
4	S V Mitrofanov, D K Baykasenov, A U Nemaltsev	Operational experience of a Solar Power Plant with a Dual-Axis Solar Tracking System in the conditions of the Southern Urals
5	L V Plotnikova, I I Chilikova, E V Khramova and V V Plotnikov	Information model of the structure of the heat and power system of pulp and paper production and a systematic approach to its improvement
6	L V Plotnikova, A A Faizullin, A S Gavrilov and N M Hacıbalayev	Demonstration and laboratory complex for the production of heat energy using sources of unconventional and waste energy
7	Yu N Zvonareva, Sh G Ziganshin, E V Izmaylova, A S Gavrilov, A V Moryashev	Efficiency of systems of heat supply at introduction of the automated individual thermal points
8	M Savina, G Mingaleeva	Energy technological system coal based
9	A A Filimonova, N D Chichirova, A A Chichirov, A I Minibaev	Industrial experiment on electrodialized separation of highly concentrated multicomponent technological solutions at thermal

			power plants
	11	A R Sadrtdinov, T Kh Galeev, I Yu Mazarov, R G Safin, V A Saldaev, V G Gusev	Efficiency of biomass and solid waste energy processing based on the cogeneration plant with plasma heat source
	12	A A Sharipov, Y V Vankov, K G Sadikov and E R Saifullin	The influence of catalysts on the combustion of petroleum coke in the stationary fluidized bed mode

14.00 – 15.30

Section 2

Language: ENGLISH / RUSSIAN

1. Electromechanics and electrical apparatus

Presentations:

№	Authors	Title
1.	N A Malev, A I Mukhametshin, O V Pogoditsky and W M Mwaku	Method of analysis and control of parameters of an electromechanical converters based on a linear
2.	O A Filina, A N Tsvetkov, P P Pavlov, V M Butakov and Radu Dumitri	Vibration model as a system of coupled oscillators in a direct current electric motor
3.	A E Auhadeev, R G Idiyatullin, P P Pavlov, V M Butakov, L N Kisneeva and D I Tukhbatullina	Elaboration of the methodological foundations of the theory and calculation methods of rational operating modes of traction electrical equipment of urban electric transport
4.	E I Gracheva, V N Petrov, N V Russova, D V Samuilov, G P Svintsov, I V Pro-tosovitski	To modeling the dynamics of a single-winding forced valve electromagnet in a circuit with a ballast resistor
5.	F A Hassan and A Sidorov	Study of power system stability: Matlab program studying data from Zahrani power plant (Beirut, Lebanon)
6.	D Y Alekin, O S Popkova, N G Yagovkin	Model of efficient operation of operating personnel in an emergency during the process of an electric power facility
7.	A V Serebryannokov, D V Zinovev, G A Kravchenko, A G Kalinin, D V Ilin and L A Ilina	Principles of reducing the phase shift between instantaneous analogue and discrete signals and the corresponding values in the SV stream in a digital substation

14.00 – 15.30

Section 3

Language: ENGLISH / RUSSIAN

1. Automation, instruments and control methods

Presentations:

№	Authors	Title
1.	A V Golenishchev-Kutuzov, V A Golenishchev-	Effect of partial discharges on the operating condition of high-voltage insulators

		Kutuzov, D A Ivanov, G D Mardanov, AV Semennikov and L V Ahmetvaleeva	
	2.	M A Safin, E I Gerasimov	Automated management system of technological process of installations of closed water supply for fish cultivation
	3.	A R Zagretdinov, R B Kazakov, A A Mukatdarov	Control the tightness of the pipeline valve shutter according to the change in the Hurst exponent of vibroacoustic signals
	4.	M Yu Vasil'eva, I I Ismagilov and V V Plotnikov	Building fast Walsh transform algorithms and their application in automated control systems
	5.	D I Gataullin and R R Vildanov	The use of automated systems to improve quality control of energy consumption

14.00 – 15.30

Section 4
Language: ENGLISH / RUSSIAN
1. Economics and Energy Management

Presentations:

№	Authors	Title
1.	E K Nikolaeva, N A Yudina, T U Dunaeva, S A Livshits, S R Enikeeva, T.F. Mantserova	Improving economic performance through the implementation of energy efficient technologies
2.	N Ketoeva, N Soldatova and S Ilyashenko	Lean manufacturing as a tool for increasing labor productivity at the enterprise
3.	T D Syanevets and T V Sudakova	Organizational loyalty as a characteristic of management quality for energy company
4.	Y Zhilkina, A Akhmetshin	Risks in the energy sector: the analysis of management practices in the electricity market
5.	E V Alekina, O S Popkova, G N Yagovkin	Working conditions as a socio-economicsignificant category
6.	D R Peskova, J P Vasileva and U A Nazarova and Z F Sharifyanova	World and Russian fuel and energy market development perspectives and drivers

15.30 – 16.00

Coffee break

16.00 – 17.30

Section 1
Language: ENGLISH / RUSSIAN
1. Energy systems and complexes

Presentations:

№	Authors	Title
1.	L V Plotnikova,	Computer model of the power system

		I I Chilikova, S Y Sitnikov, V E Ukhlin and G I Efremov	with inclusion of a heat pump in the process of separation
	2.	E R Zvereva, F I Burganov, R V Khabibullina, L O Zverev and E G Sheshukov	The scheme of dosing additives to fuel oil and evaluation of the effectiveness of its implementation at the enterprises of the fuel and energy complex
	3.	R N Valiev, E V Izmaylova, E Sh Kharisov, M R Rotach and A V Busarov	Management of technical condition of heat and power facilities based on a risk-oriented approach
	4.	D I Mendeleev, Yu Ya Galitskii, G E Marin and A R Akhmetshin	Study of the work and improving the efficiency of combined-cycle gas turbine plants
	5.	G E Maryin B M Osipov and D Mendeleev	Research of the effect of fuel gas on energy characteristics of gas turbine
	6.	M A Taymarov, R V Akhmetova, Ye G Chiklyayev, Y V Lavirko, E A Akhmetov, A O Garifullina	Study of the speed of flame distribution in the combustion of methane-hydrogen fractions
	7.	A L Kulikov, A A Loskutov, M Mitrovic	Improvement of the technical excellence of multiparameter relay protection by combining the signals of the measuring fault detectors using artificial intelligence methods
	8.	D T Nguen, D N Pham, G R Mingaleeva, O V Afanaseva and Pietro Zunino	The assessment of effectiveness and prospects for the use of hybrid thermal low-capacity power plants in the Republic of Vietnam
	9.	M Borodin, A Psarev and T Kudinova and R Mukhametzhanov	Improving power quality by calculating voltage losses

16.00 – 17.30

Section 2

Language: ENGLISH / RUSSIAN

1. Electromechanics and electrical apparatus

Presentations:

№	Authors	Title
1.	M O Ward, V A Chernyshov, A E Semenov, V E Bolshev, R P Belikovand M S Garifullin	The method of extending drone piloting autonomy when monitoring the technical condition of 6-10 kV overhead power lines
2.	S A Livshits, N A Yudina, T U. Dunaeva,	Identification of areas of emergence of critical flow regimes of nonlinear

		E K Nikolaeva, S R Enikeeva, B.E. Umirzakov	viscous liquids in a tubular reactor
	3.	D D Micu, I V Ivshin, E I Gracheva, O V Naumov and A N Gorlov	Influence of value of resistance contact units of switching devices on losses of the electric power in shop networks of low tension
	4.	V N Meshcheryakov, D V Lastochkin, A G Logacheva, S Valtchev	Energy saving system of cascade variable frequency induction electric drive
	5.	V N Meshcheryakov, V V Danilov, Sh R Khasanov and S Valtchev	Minimization of the stator current in induction motor with defined load on the shaft by maintaining optimum absolute slip

16.00 – 17.30

Section 3

Language: ENGLISH / RUSSIAN

1. Automation, instruments and control methods

Presentations:

№	Authors	Title
1.	A R Mirgaleeva, K.H. Gilfanov	Automated process control system of regional substations retrofit
2.	M A Safin, A R Shaykhutdinova	Protection of greenhouses by improving the automatic control system
3.	N K Andreev	Influence of sensitivity and specifity of measuring methods on their informativity and hardware requirements
4.	R N Khizbullin, R N Khizbullin	Ways to improve safety in the power industry: automated hardware system for pre-shift inspection of personnel of power enterprises
5.	M A Safin, O V Borisova and A S Marchenko	Automating the process of creating the climate for growing strawberries in the winter time
6.	N K Andreev	Influence of sensitivity and specifity of measuring methods on their informativity and hardware requirements
7.	G M Safiullina, N V Bogdanova and D R Gilyazov	Relevant issues of fuel supply paths modernization at Ekibastuz B. Nurzhanova State District Power Station (SDPS) -1 by automated process control systems

16.00 – 17.30

Section 4

Language: ENGLISH / RUSSIAN

1. Economics and Energy Management

Presentations:

№	Authors	Title
1.	O V Novikova, A E Erastov, S A Livshits	Efficiency of the electric power enterprise
2.	Y Zhilkina, D Vodennikov, I Maslov	Mechanism of business entities innovative development management

			(organizational and economic approaches)
	3.	N Ponomareva, A Zvereva, E Golubtsova, S Ilyashenko and G Ivanov	Certain economic instruments as a factor of realizing the potential of using alternative energy sources in Russia
	4.	I P Saleeva, A V Sklyar, T E Marinchenko, M V Postnova, A V Ivanov and A I Tikhomirov	Efficiency of alternative electric power industry of poultry farming
	5.	I P Saleeva, A V Sklyar, T E Marinchenko, M V Postnova, A V Ivanov and A I Tikhomirov	Feasibility study on innovative energy-saving technologies in poultry farming
	6.	O V Luskatova, M V Roberts and E N Dolzhenko	Comparative analysis of options for project financing of energy projects based on renewable sources
	7.	O V Luskatova, R A Eyvazov and M M Haytanova	Priority lines of the energy sector development in the Republic of Turkey
	8.	V Elistratov I Kudryasheva	Regimes, management and economics of energy complexes on the basis of renewable energy sources for autonomous power supply
	9.	L Rodina	Risk management of the alternative energy
	10.	O K Lukhovskaya, T S Kochetkova and Y E Zhukova	The regional consumer market as a factor of structural shifts in energy resources consumer economy of the region
	11.	L Švecová, G Ostapenko, J Veber and Y Valeeva	The Implementation Challengers of Zero Carbon and Zero Waste Approache?

Sept 20, 2019

09.00 – 10.30

Section 1
Language: ENGLISH / RUSSIAN
1. Energy systems and complexes

Presentations:

№	Authors	Title
1.	I Fomin, R Belikov, V Zelyukin, T Mukhametgaleev	Improvement of power supply reliability by means of remote control of the automatic repeated switching-on of sectionalizing circuit-breakers
2.	E V Izmaylova, E V Garnyishova, R B Kazakov and V V Serov	Determination of the sediments thickness on the heat-exchange surfaces by free vibration method
3.	E N Sosnina, O V Masleeva, E V Kryukov, N I Erdili	Comparative life cycle assessment of mini combined heat and power plants

	4.	T O Politova, Sh G Ziganshin, E R Bazukova, A V Busarov	Improving the heating networks efficiency by implementing instrumental methods of control
	5.	O S Sirotkin, A M Pavlova, R O Sirotkin and A E Buntin	On a new approach to assessing the energy characteristics of substances
	6.	P S Sokolov, A V Bannikov, M V Kozlova	Experimental research of the operation of self-sufficient desalination setup of vapor-air type
10.30 – 11.00	Coffee break		
11.00 – 12.00	Discussion and conclusion		

SES-2019

KAZAN STATE POWER ENGINEERING UNIVERSITY
PETER THE GREAT SAINT PETERSBURG
POLYTECHNIC UNIVERSITY

International Scientific and Technical Conference SES - 2019

BOOK OF ABSTRACTS

18 — 20 September, 2019

Kazan
2019

ENERGY SYSTEMS AND COMPLEXES

D B Vafin

THERMAL AND AERODYNAMIC CHARACTERISTICS OF TUBE FURNACES WITH WALL BURNERS OF TWO TYPES

Abstract: Tube furnaces of the petrochemical and oil refining industries are energy-intensive devices. The differential method for calculating the complex heat transfer in the furnaces is used to study the flow fields and the temperature of the combustion products in the radiation chambers of technological tube furnaces with two types of wall burners, which are placed on several levels on the sidewall. In a furnace designed for the conversion of methane mixed with steam in the reaction tubes, acoustic burners for burning natural gas near the wall are installed in three tiers on the side lined sidewalls of the radiation chamber. In the primary reforming furnace of natural gas for the production of ammonium nitrate, wall-type burners are installed on six levels. The method used is based on the joint numerical integration of the two-dimensional differential equations of energy transfer by radiation using the S_2-approximation of the discrete ordinate method, the energy conservation equations, the equations of turbulent motion of a gas mixture, the *k*-e turbulence model and the two-stage gas fuel combustion model. The calculated fields of temperature and flue gas flow obtained with the help of a computer program implementing the proposed method are discussed.

R Zakirullin and I Odenbakh

SMART WINDOW FOR ANGULAR SELECTIVE FILTERING OF SOLAR RADIATION

Abstract: A new approach to angular selective filtering of the solar radiation without using the sunlight redistribution devices is proposed. Parallel strips of chromogenic materials on two surfaces of the pane(s) form an optical filter having angular selective light transmission. Clarified methods to calculate the optimum slope angle of the strips on the pane(s), their widths and relative position on two surfaces considering the seasonal and daily change in the solar radiation, the location of the building and the window's azimuth are presented. Such a smart window blocks the direct radiation in a preset angular range and transmits the scattered and reflected radiation that is provides comfortable daylighting indoors.

N V Buyakova, A V Kryukov, and Le Van Thao

INTEGRATED MODELING OF COMPACT POWER LINES

The aim of the research presented in the article is to develop methods and means for integrated modeling of compact expanded capacity power lines. Algorithms for determining electrical energy systems modes were used based on phase

coordinates based on application of elements models in form of lacelike equivalent networks with fully-meshed topology. These models and methods were implemented in Fazonord-APC software application, ensuring modeling of EES stationary modes, and determining strengths of electromagnetic field generated by different design power lines. Results of modes and electromagnetic fields modeling on routes of 220 kV compact overhead power supply lines (COPL) with horizontal positioning of wires. For the purpose of comparison, similar calculations were performed for typical overhead power line (TOPL).
The modeling results allowed formulation of the following conclusions: when overall section of COPL and TOPL is equal, the losses of active power in compact OPL are significantly lower; thus, when transmitted power is 375 MW, the losses in COPL are reduced by 45% compared with typi-cal 220 kV OPL; at compact OPL receiver end a lower unsymmetry is observed; COPL ensure bet-ter electromagnetic safety conditions; electrical field strength at a height of 1.8 m for COPL axis is approximately less than a similar index for TOPL by 1.5 times; magnetic field in the same point is reduced to 60%.

A N Rogalev, N D Rogalev, V O Kindra, E Yu Grigoriev, and B A Makhmutov

THE FLOW PATH CHARACTERISTICS ANALYSIS FOR SUPERCRITICAL CARBON DIOXIDE GAS TURBINES

Abstract: Rising carbon dioxide concentration in the atmosphere is probably the main reason of global warming. The development of the oxy-fuel combustion cycles is a possible way to decrease the energy sector contribution in the emission process. However, an unusual composition and thermodynamic parameters of the working fluid cause the necessity of revision of the main equipment characteristics, especially for the supercritical carbon dioxide gas turbine. This study presents the method and the results of the flow path preliminary analysis for the new generation gas turbines working on carbon dioxide. The flow path shape with a constant root diameter of seven stages was chosen as the most reasonable due to cheap manufacturing. Influence of reaction degree of stages and velocity ratio on stage geometric parameters are revealed. It was found that the optimal reaction degree and velocity ratio are equal to 0.25 and 0.36 correspondingly. Thermal and constructive stages characteristics of the 350 MW turbine are determined.

I N Zapolskaya, Yu V Vankov, O I Zverev, R R Rotach

THE IMPACT OF THE TRANSITION OF HOT WATER "PREPARATION" BY MEANS OF INDIVIDUAL THERMAL POINTS ON THE KAZAN ENERGY SYSTEM

Abstract: The result of the implementation of technical solutions should be evaluated in terms of the effect of the power system as a whole. At the same

time, the main task is to obtain a socio-economic effect registered by the consumer of energy resources, as a key figure of the energy system. The article considers the influence of modernization of hot water supply systems (HWS) by transferring the function of hot water preparation to individual thermal points (ITP) in apartment buildings from the central thermal points (CTP) with their subsequent liquidation, as well as the elimination of hot water networks. The expected result of the activities is the reduction in heat energy and loss in heat carrier agents in heating networks, as well as improving the quality and reliability of the hot water system and the possible reduction of energy consumption by residents in apartment buildings. The effect on the operation of the heat supply sources will not be provided by ITPs themselves, but by automatic controllers, installed together with them. This, in its turn, will make it possible for the Central Heating and Power plants (boiler) in a timely manner to get modernized in operation, to improve its efficiency. Computational studies were carried out in order to assess the impact of the transition from ITP to hot water supply on the energy system.

D O Romanov, Y V Yavorovsky

INVESTIGATION OF THERMOHYDRAULIC DISPATCHER PROPERTIES AND PECULIARITIES

Abstract: Application of thermohydraulic dispatcher (THD) for district heating systems is, to some extent, limited due to insufficient information about its properties and features. At the same time this device has a potential to solve the problem of mutual dependence of heat consumers and to decrease electricity consumption in heat supply systems. This paper deals with experimental research and numerical simulation of THD with the aim of increasing the range of knowledge about its properties. Presented results describe already known properties such as near-to-zero differential pressure at THD and flow rates independence which were checked. Some new properties and peculiarities of THD were obtained during the investigation as well. Among them is differential pressure “variability”, hydrodynamic separation under higher velocities, similarity of thermohydraulic processes inside THD under similar velocities, absence of thermal stratification in mixing regime, supply temperature dependence from the height level and return temperature.

A N Rogalev, N D Rogalev, V O Kindra, S K Osipov and A S Zonov

NUMERICAL STUDY OF HEAT TRANSFER IN RECTANGULAR CHANNELS WITH SINGLE PIN FIN AND PIN FIN-DIMPLE

Abstract: The heat transfer and hydraulic performance of a new pin fin-dimple in a rectangular cooling channel are evaluated in comparison with pin fin using three-dimensional Reynolds averaged Navier-Stokes equations. The fluid flow and heat transfer were analysed using the shear stress transport turbulence model

in the Reynolds number range of 8000–70000. The research results indicate that the averaged Nusselt number and the averaged friction factor with the pin fin-dimple were respectively 7–13% and 7–12% higher than with the pin fin. The reason for the heat transfer intensification is an occurrence of high-intensity vortex around the pin fin-dimple leading to an increase of the near-wall turbulent mixing level.

K H Gilfanov, Nguyen Tien, R N Gaynullin, I Hallyyev

ENERGY EFFICIENT HEAT SUPPLY SYSTEM FOR ELECTRIC POWER FACILITIES

Abstract: The aim of the work is to confirm the possibility of creating an energy-saving heat supply system for power facilities by using computer modeling, analysis of the potential use of heat losses of electromagnetic energy in magnetic circuits and windings of transformers of substations, as well as the development of schemes for heat recovery losses for heat supply of power facilities. Computer simulation of electromagnetic and thermophysical processes in the power oil-filled transformer is carried out. Energy losses in windings, hysteresis and eddy currents in the magnetic circuit, as well as temperature and heat flux fields in the longitudinal and transverse sections of the oil-filled power transformer in idle and short-circuit modes were determined. The transformer performance in terms of heat recovery losses was evaluated. The possible volumes of heat extraction for heat supply depending on the power of the transformer are determined. The automated oil-water system of heat recovery of the transformer for heating of electric power facilities is proposed. The significance of the obtained results for the construction industry is to confirm the possibility of creating an energy-saving heat supply system for electric power facilities while maintaining the operational characteristics of the transformer based on computer modeling; the significant potential of using the heat loss of power transformers of substations is shown, an automated heat supply system for electric power facilities is proposed.

N S Kochev, B P Zhilkin, L V Plotnikov

IMPROVING THE TECHNICAL AND ENVIRONMENTAL PERFORMANCE OF PISTON ENGINES BY UPGRADING THE FUEL SYSTEM

Abstract: The article presents the results of an experimental study of the dispersion of superheated water through cylindrical channels and nozzles of piston internal combustion engines under different initial conditions. The advantages and disadvantages of modern diesel engine fuel systems are discussed in the article. The process of explosive boiling in relation to the fuel system of a piston engine is formulated and briefly described. A description of the laboratory setup and methods of conducting experiments is given in the

article. The results of the visualization of sprayed superheated water through a cylindrical channel and through a diesel engine nozzle of 21/21 dimension are presented. The original scheme of the fuel system for a diesel engine using the effect of explosive boiling is proposed. Preliminary estimates have shown that the use of such a fuel system will increase the reliability of the combustion chamber elements of a piston engine, reduce specific fuel consumption (up to 2%) and reduce the amount of harmful substances in exhaust gases (an average of 12% compared with traditional fuel systems).

L V Plotnikov, Yu M Brodov, M O Misnik

HEAT TRANSFER INTENSITY OF PULSATING GAS FLOWS IN THE EXHAUST SYSTEM ELEMENTS OF A PISTON ENGINE

Abstract: Internal combustion engines are the most common sources of energy among heat engines. Therefore, the improvement of their design and workflow is an urgent task in the development of world energy. Thermal-mechanical perfection of the exhaust system has a significant impact on the technical and economic performance of piston engines. The article presents the results of experimental studies of gas-dynamics and heat exchange of pulsating gas flows in the exhaust system of a piston engine. Studies were carried out on a full-scale model of a single-cylinder engine. The article describes the instrument-measuring base and methods of experiments. The heat transfer intensity was estimated in different elements of the exhaust system: the exhaust pipe, the channel in the cylinder head, the valve assembly. Heat transfer studies were carried out taking into account the gas-dynamic nonstationarity characteristic of gas exchange processes in engines. The article presents data on the influence of gas-dynamic and regime factors on the heat transfer intensity. It is shown that the restructuring of the gas flow structure in the exhaust system occurs depending on the engine crankshaft speed, this has a significant impact on the local heat transfer coefficient. It has been established that the heat transfer intensity in the valve assembly is 2-3 times lower than in other elements of the exhaust system.

F Gazizov, I Ahmetova

THE MAIN INDICATORS OF CHOOSING THE SCHEME OF PROVIDING HOT WATER SUPPLY IN CITIES

Abstract: In the article the basic indicators defining the choice of this or that scheme of the organization of the closed hot water supply of the cities (further – HWS) using open schemes of HWS are considered. Block diagrams of boundary conditions and independent variables are presented. A pyramid of conditions affecting the level of capital and annual costs for the maintenance of heat supply systems for the useful life (25 years) of the equipment is proposed. The main provisions of the method and the program of choosing the most appropriate

scheme of transition to the closed circuit of preparation of hot water with the calculation of weight coefficients are formulated.

D S Balzamov I G Akhmetova, E Yu Balzamova, G I Oykina
AN ANALYSIS OF THE VIABILITY OF IMPLEMENTING STEAM SCREW MACHINES AT THE FACILITIES OF ENERGY GENERATION ENTERPRISES TO REDUCE THE ENERGY COSTS FOR THEIR OWN NEED
Abstract: Reducing the energy consumption for the own needs of energy sources is an urgent task that can be solved by organizing our own energy sources by using the potential energy of water vapor in steam screw machines. The article discusses some options for installing steam screw machines at the facilities of generating companies and identifies factors affecting the return on steam screw machines in the current operating conditions.

A V Sadchikov
USE OF COMBINED FERMENTATION TECHNOLOGY TO IMPROVE THE EFFICIENCY OF THE ENERGY COMPLEX OF THE MSW LANDFILL
Abstract: The article analyzes the existing problems associated with the degassing of landfill and the use of landfill gas as an energy resource. Issues related to the composition of the landfill gas are considered. The main reasons for the high nitrogen content in landfill gas are shown. The main measures are highlighted that make it possible to increase the economic attractiveness of the use of landfill gas. A fundamentally new technology of combined fermentation has been proposed, combining the fundamentals of the technologies of "dry" and "wet" fermentation of various substrates. The paper presents the results of using the technology of combined fermentation to increase the efficiency of the active decontamination system of the MSW landfill of WSC Vodino LLC. A significant improvement in the composition of landfill gas was noted, first of all, an increase in the volume fraction of methane and an increase in the average daily volume of recoverable landfill gas by 22%. As a result, the daily production of heat and electricity at the site during the experiment increased by 79.6%. As a side effect in the experiment, a decrease in the height of the horizon of the landfill body was noted by 12.5% and, as a consequence, an increase in the useful capacity of the landfill.

A A Filimonova, N D Chichirova, A A Chichirov and A A Batalova
EXPRESS METHOD FOR DETERMINING OF ORGANIC SUBSTANCES MATTER IN THE PRODUCTION WATER OF ENERGY-TECHNOLOGICAL COMPLEXES OF THERMAL POWER PLANT – PETROCHEMICAL ENTERPRISE

Abstract: For a quantitative analysis of the organic matter content in the production waters of the energy-technological complexes of the Thermal Power Plant - petrochemical enterprise, a simple, effective, affordable and very fast method was developed. Its essence is to determine the optical density at a 400 nm wavelength on a device such as a colorimeter. The correlation with the permanganate oxidation method is 98-99%. According to the presented method, the quantitative composition of organic substances in the alkaline spent regeneration solution of anion-exchange filters of the Thermal Power Plant (TPP) water treatment plant and in the return condensate from petrochemical enterprise was determined. For each water type, its own calibration schedule was constructed due to significant differences in the qualitative composition of organic impurities.

A V Sadykov, D B Vafin

CALCULATION OF TEMPERATURE FIELDS AND VELOCITY IN THE FUR-NACE OF TUBULAR OVENS

Abstract: This paper presents the results of calculations of velocity and temperature fields in the radiation chamber of an energy-intensive technological tubular oven during the combustion of methane in air using acoustic burners of floor flame. The calculation method is based on the joint numerical solution of difference analogs of three-dimensional equations of energy transfer by radiation, convection and turbulent thermal conductivity, the movement of flue gases and the methane combustion model in the air. The radiation selectivity of flue gases is taken into account using a six-band model. The paper contains a diagram showing the organization of a three-dimensional modeling of acoustic burners. It also represents the isotherms of combustion products, the lines of the velocity vectors in the radiation chamber, distributions of surface densities of heat fluxes to the heating surface.

R R Safin, N R Galyavetdinov, S R Mukhametzyanov, G F Ilalova, I A Valeev, A V Safina

EFFECT OF PREPARATION OF WOOD RAW MATERIALS AND SOME PROCESSING MODES ON THE OUTPUT OF LIQUID PYROLYSIS PRODUCTS

Abstract: Today, the limitations of traditional energy sources based on oil, natural gas and coal are becoming obvious. Therefore, the search for new sources of energy is a pressing issue both for modern Russia and for the whole world. The alternative sources of energy, based on the use of bioenergy of biomass, begin to play a significant and growing role in the world energy industry.

The article presents the curves of changes in the mass yield of products obtained during the pyrolysis of biomass, thermally pre-treated in the temperature range

of 180-270 °C without access of oxygen. It has been experimentally proved that pre-heat treatment reduced the total liquid yield in the pyrolysis process: with an increase in the processing temperature, the mass yield of the liquid decreased, but the mass yield of charcoal and gas changed slightly. At the same time, it was found that the temperature affected the yield of the elemental composition of biomass: as the temperature increased, the content of elemental carbon in the biomass increased, while the content of hydrogen and oxygen decreased.
It is concluded that the preliminary heat treatment of biomass can improve the quality of the final liquid biofuel by reducing the water content in it and by increasing the heat of combustion. It is also found that pressure reduction during the pyrolysis process increased the yield of the liquid fraction of decomposition products.

S O Gaponenko, A E Kondratiev, R Z Shakurova

IMPROVING THE EFFICIENCY OF ENERGY COMPLEXES AND HEAT SUPPLY SYSTEMS USING MATHEMATICAL MODELING METHODS AT THE OPERATIONAL STAGE

Abstract: Improving the efficiency and energy saving of energy complexes and heat supply systems is one the most important areas of modernization of the Russian economy. In the field of industrial heat and power engineering, the increasing energy efficiency is an urgent task both at the design stage and at the equipment operation stage. For these purposes, numerical modeling methods are actively used. The paper presents the developed mathematical model of the pipeline located in the soil, which allows to improve the efficiency of energy systems and heat supply systems at the stage of operation, also this paper presents the results of laboratory studies, namely, the informative frequency ranges of the investigated pipeline for further assessment of its technical condition.

S O Gaponenko, R Z Shakurova, A E Kondratiev

IMPROVING THE METHODOLOGY FOR ASSESSING THE TECHNICAL CONDITION OF EQUIPMENT DURING THE TRANSPORTATION OF ENERGY CARRIER IN ENERGY SYSTEMS AND COMPLEXES

Abstract: The stable and uninterrupted work of the energy sector enterprises largely determines the economic development of the country. At the same time, the reliability of energy systems and complexes depends on the technical condition of the energy transportation equipment. In this regard, there is an urgent need to monitor the technical condition of the equipment. Currently, there are various types of non-destructive testing used for diagnostics, but none of them is universal, and many of them only allow to find defects of a certain type. In this connection, there is a topical issue of improving the methods for

assessing the technical condition of equipment during the transportation of energy carriers in energy systems and complexes. This paper presents an information and diagnostic complex that implements the proposed technical solution and tests the methodology.

S V Mitrofanov, D K Baykasenov, A U Nemaltsev

OPERATIONAL EXPERIENCE OF A SOLAR POWER PLANT WITH A DUAL-AXIS SOLAR TRACKING SYSTEM IN THE CONDITIONS OF THE SOUTHERN URALS

Abstract: The paper substantiates the need for the introduction of solar tracking systems for photovoltaic plants and presents a brief review of the scientific and technical literature on the development of solar trackers. Principal scheme of a heliostation with a dual-axis solar tracker of Orenburg State University has been designed. A comparative analysis of the generated electricity by a statically located solar module and a solar module with the dual-axis solar tracker is represented. Data for analysis have been obtained in Orenburg (Russia) using the developed automated system for remote diagnostics and monitoring of photovoltaic system parameters and a wireless weather station HP2000. The use of a dual-axis heliotracker for the solar plant in the conditions of the Southern Urals has allowed to increase the generation of electricity by 34.7% compared to a statically located PV panel.

Y.A. Gorinov

UNDERWATER LAYING OF PIPES FOR HEATING NETWORKS OF ENERGY SYSTEMS

Abstract: The article is devoted to the development of a new pipe-laying technology for heating networks of energy systems when crossing water barriers. In this paper a piping structure consisting of a carrier steel pipe enclosed in composite material for heat insulation and ballasting with an outer protective polyethylene casing is described. Theoretical and experimental studies of the structure are presented, mathematical models of the physicomechanical properties of the proposed composite material are developed, a technical-and-economic assessment is carried out.

L V Plotnikova, I I Chilikova, E V Khramova and V V Plotnikov

INFORMATION MODEL OF THE STRUCTURE OF THE HEAT AND POWER SYSTEM OF PULP AND PAPER PRODUCTION AND A SYSTEMATIC APPROACH TO ITS IMPROVEMENT

Abstract: The stages of the system analysis of an industrial energy system with a complex structure are considered by the example of pulp and paper production. The software of the structural and thermodynamic stages of the analysis is presented. The results of thermodynamic calculations of the elements of the

energy system by the optimal sequence are given. A variant of the system modernization using a heat pump is presented.

L V Plotnikova, A A Faizullin, A S Gavrilov and N M Hacıbalayev
DEMONSTRATION AND LABORATORY COMPLEX FOR THE PRODUCTION OF HEAT ENERGY USING SOURCES OF UNCONVENTIONAL AND WASTE ENERGY
Abstract: The description of the work of a laboratory unit for the production of thermal energy that simulates the use of solar energy and the use of wastewater energy is presented. The installation includes a heat pump, solar collector and waste water tank. Presents options forwiring elements of the unit.

Yu. N. Zvonareva, Sh.G. Ziganshin, E. V. Izmaylova, A. S. Gavrilov, A. V.Moryashev
EFFICIENCY OF SYSTEMS OF HEAT SUPPLY AT INTRODUCTION OF THE AUTOMATED INDIVIDUAL THERMAL POINTS
Abstract: Article is devoted to issues of increase in efficiency of systems of heat supply. Results of researches and the analysis of dependences of indicators of overall performance of systems of heat supply at various percentage equipment of consumers are presented by the automated individual thermal points.

M V Savina, G R Mingaleeva
ENERGY TECHNOLOGICAL SYSTEM COAL BASED
Abstract: The paper proposes a flow chart of an energy technology complex based on thermochemical processing of solid fuels with a consistent removal of separation products. The scheme is designed for the use of coal and other solid fuels, thanks to the developed methodology for modeling processes occurring during the thermal decomposition of the organic mass. Calculations of the circuit elements shown that the thermal efficiency is increased by implementing successive exhaust coal products separation.

D I Subbotin, S D Popov, E O Serba, N A Charykov, V R Lizander, A V Surov, N V Obraztsov
FULLERENES PRODUCTION BY ELECTRIC ARC PYROLYSIS OF METHANE IN AN AC THREE-PHASE PLASMA TORCH
Abstract: The article deals with a high-voltage three-phase AC plasma torch working as a part of a plasma-chemical facility. The plasma torch consists of three electric arc channels and three rod copper electrodes. The initial breakdown occurs with high voltage (10 kV) provided by a high voltage power supply. The electric arc plasma oxygen-free pyrolysis of methane was realized on the facility. The fullerene-containing fraction was extracted from the

carbonaceous material by extraction with orthoxylene. The produced carbon-black and the selected extract were analyzed by modern methods of physical and chemical analysis: scanning electron microscopy, X-ray phase analysis, IR spectroscopy.

A A Filimonova, N D Chichirova, A A Chichirov, A I Minibaev

INDUSTRIAL EXPERIMENT ON ELECTRODIALIZED SEPARATION OF HIGHLY CONCENTRATED MULTICOMPONENT TECHNOLOGICAL SOLUTIONS AT THERMAL POWER PLANTS

Abstract: The main source of highly concentrated multicomponent technological solutions at TPPs are water treatment plants. Analysis of the operation of the ion-exchange water treatment plant at the Nizhnekamsk Thermal Power Plant - 1 showed that half of the alkali supplied to the regeneration of the anion-exchange alkali filters is not used, but is discharged for neutralization and then to wastewater. Due to the fact that the cost of alkali used in technological processes is quite high, it is economically feasible to carry out the alkaline waste with the alkali extraction and its reuse in the production cycle. The article presents the experimental results on the electro-membrane separation of alkaline waste regeneration solutions and wash water after anion-exchange filter regeneration. In connection with the revealed differences in the selectivity of the various ion transfer through the electrodialysis apparatus membranes, depending on the time and amount of transmitted electricity, the possibility of obtaining an alkaline solution purified from impurities has been established.

A R. Sadrtdinov, T Kh. Galeev, I Yu. Mazarov, R G Safin, V A Saldaev, V G Gusev

EFFICIENCY OF BIOMASS AND SOLID WASTE ENERGY PROCESSING BASED ON THE COGENERATION PLANT WITH PLASMA HEAT SOURCE

Abstract: The urgency of the use of low-grade organic fuels and wastes, in particular municipal solid (MSW), is due to recent developments in energy saving and energy efficiency. This directly relates to the direction of renewable energy, responsible for involving all wastes, such as MSW, in fuel energy balance to provide heat and electricity to decentralized power supply areas. This paper presents the process of high-temperature thermal decomposition of MSW in the steam-air medium of plasma under excessive pressure to generate electrical energy. The high enthalpy and great reactivity of the plasma gasifying agent makes it possible to carry out the process of thermal decomposition in the autothermal mode. The high-temperature mode and the use of plasma blast provides a high degree of conversion of waste into combustible components (CO, CH4, H2), the resulting gas mixture. The technological process significantly reduces the formation of potentially hazardous substances that

affect the kinetics of the process. After generating electrical energy, the exhaust gases are subjected to complex purification from the products of combustion and cogeneration of residual thermal energy. In particular, purification from toxic nitrogen oxides (NOx) occurs, the formation of dioxins, furans and other dangerous derivatives of chloride compounds is prevented. Thermal energy, discharged at various sites of the plant, is almost completely used for the needs of the cogeneration plant and its units, which allows to achieve a total efficiency of at least 86%. The ability of the cogeneration plant to work on various types of solid waste gives a wide range of applications and operational capabilities.

A A Sharipov, Yu V Vankov, K G Sadikov and E R Saifullin
THE INFLUENCE OF CATALYSTS ON THE COMBUSTION OF PETROLEUM COKE IN THE STATIONARY FLUIDIZED BED MODE
Abstract: It is known that petroleum coke, a product of deep processing of oil, can be used as fuel in power boilers. The method of petroleum coke burning in a fluidized bed is the most optimal to complete its combustion. To improve the combustion characteristics of this fuel, a study was made of the effect of catalysts on the petroleum coke burning in the simulation mode of a stationary fluidized bed. The laboratory setup is described. The results of the experiments are given.

L V Plotnikova, I I Chilikova, S Y Sitnikov, V E Ukhlin and G I Efremov
COMPUTER MODEL OF THE POWER SYSTEM WITH INCLUSION OF A HEAT PUMP IN THE PROCESS OF SEPARATION
Abstract: The results of computer simulation of industrial processes of separation of substances with the inclusion of a heat pump are presented. Designs of heat pumps of closed type, open type, like “pipe in pipe” are considered. In the simulation software Aspen HYSYS, the adequacy of the computer model of the “rectification unit – closed type heat pump” system was checked. The results of computer simulation of the “rectification unit – open-type heat pump 'pipe in pipe' ” system are presented. This system allows to increase the efficiency of the unit by 9% compared with the system of separation of substances with the inclusion of an open-type heat pump and by 14% compared with a system with the inclusion of a closed-type heat pump.

E R Zvereva, F I Burganov, R V Khabibullina, L O Zverev and E G Sheshukov
THE SCHEME OF DOSING ADDITIVES TO FUEL OIL AND EVALUATION OF THE EFFECTIVENESS OF ITS IMPLEMENTATION AT THE ENTERPRISES OF THE FUEL AND ENERGY COMPLEX

Abstract: Additives are actively used to improve the quality of liquid fuels.Effective mixing of the additive with fuel with high reliability andefficiency of the boiler is ensured by the choice of technological dosing schemeliquid additive which will allow to organize automaticallypreparation of the additive, adding it to the oiland stirring.

А. К. Апажев, А. Г Фиапшев, Ю. А. Шекихачев, Л. М. Хажметов, А. Л. Хажметова, Х. Х. Ашабоков

ЭНЕРГЕТИЧЕСКАЯ ЭФФЕКТИВНОСТЬ СОВЕРШЕНСТВОВАНИЯ ТЕХНОЛОГИИ ВОЗДЕЛЫВАНИЯ СЕЛЬСКОХОЗЯЙСТВЕННЫХ КУЛЬТУР И ОПТИМИЗАЦИИ КОМПЛЕКСА МАШИН

Abstract: Для обеспечения продовольственной безопасности Российской Федерации одним из приоритетных направлений экономической и продовольственной политики государства является поэтапное снижение зависимости отечественного агропромышленного комплекса от импорта технологий, машин, оборудования. При подготовке почвы к посеву зерновых культур часто используются машины и агрегаты, выполняющие одну конкретную операцию. Их многократные проходы по поверхности обрабатываемого поля повышают энергетические затраты, приводят к уплотнению почвы, возникновению и развитию эрозионных процессов. В связи с этим требуется дальнейшее совершенствование технологий возделывания, машин и агрегатов для подготовки почвы к посеву и посева сельскохозяйственных культур. Для решения данной проблемы предложена усовершенствованная технология и оптимизирован комплекс машин, обеспечивающий вспашку, измельчение почвенных глыб, мульчирование верхнего слоя почвы и посев. Использование предложенной технологии и оптимизированного комплекса машин при возделывании озимой пшеницы в Центральной части Северного Кавказа обеспечили снижение: прямых энергетических затрат на 33,5%; затрат живого труда на 31,7%; удельной энергоемкости МТА на 41,7%; овеществленных затрат энергии на 50%; затрат энергии на посеве на 7,7%. В итоге полные энергетические затраты снизились на 34%.

S A Livshits, N A Yudina, O V Novikova and D B Katz

DETERMINATION OF THE CONDITIONS OF SPONTANEOUS COMBUSTION OF A RHEOLOGICALLY COMPLEX MEDIUM INSIDE THE CONTINUOUS INFINITE CYLINDER IN CONVECTIVE HEAT TRANSFER CASE

Abstract: We obtain the dependence of the relative temperature of a rheologically complex medium depending on the distance to the center of the cylinder. The conditions of spontaneous combustion and the stability of the solutions obtained were investigated, and the approximations of the expressions

obtained were carried out. The results obtained in this work allowed us to determine the areas of occurrence of critical flow regimes inside a hollow cylinder under thermal boundary conditions of the 1st and 3rd kind.

R N Valiev, E V Izmaylova, E Sh Kharisov, M R Rotach and A V Busarov
MANAGEMENT OF TECHNICAL CONDITION OF HEAT AND POWER FACILITIES BASED ON A RISK-ORIENTED APPROACH
Abstract: Ensuring the uninterrupted production of electric and thermal energy is a priority in the generating equipment operation. Nowadays the management of the equipment state at most of Russia's energy enterprises is based on a system of scheduled preventive maintenance. This system does not allow taking into account the economic component of technological impacts, which, in turn, leads either to “under maintenance” or to “over-servicing” of equipment. All energy companies are faced with the task of optimizing equipment costs, while ensuring the required level of reliability. To solve this problem, production asset management systems are used. The main task of managing production assets is to ensure a balance between equipment costs and the risks of its failure. The result of the implementation of asset management systems is the formation of balanced plans for repairs, replacements, upgrades and maintenance of equipment.

D I Mendeleev, Yu Ya Galitskii, G E Marin and A R Akhmetshin
STUDY OF THE WORK AND IMPROVING THE EFFICIENCY OF COMBINED-CYCLE GAS TURBINE PLANTS
Abstract: The purpose of the paper is to study and analyze the possibility of increasing the power output of a combined-cycle gas turbine (CCGT) unit during the period of positive ambient temperatures.
The first task is to analyze the operation of a 110 MW combined-cycle power unit at various ambient temperatures and to obtain alterations in the main CCGT characteristics when the ambient temperature changes. The other task is to study the usage of an absorption refrigeration machine in a CCGT cycle to increase its energy efficiency. Calculations of the thermal scheme of a gas turbine were carried out using mathematical modeling, the steam turbine was calculated based on guidelines. The conducted studies allow to conclude that the use of an absorption refrigeration machine in the cycle of a combined-cycle plant can improve the efficiency of the unit, increasing profits from power generation, and reducing penalties for non-compliance with the load schedule.

O A Gorbunova, G I Pavlov, P V Nakoryakov, Yu I Khakimzyanova
DETERMINATION OF THE DEPENDENCE OF THE TECHNICAL CONDITION OF THE EQUIPMENT OF HEAT AND POWER

ENGINEERING OBJECTS ON THE NOISE LEVEL IN THE ENVIRONMENT

Abstract: The problem of environmental noise pollution from large-city centralized heating systems is considered. Based on the analysis of acoustic characteristics and vibration parameters of district boiler house power plants, the main reasons for the generation of increased noise, having a systemic nature, are identified. On the basis of the obtained results in determining the dependence of the noise level in the environment on the technical condition of power equipment, buildings and structures, the possibility of developing complexes of technical measures to reduce noise pollution adjacent to the district boiler houses of the city is shown. When optimizing the selected variants of noise and vibration protective complexes, it seems promising to use a calculated model of the noise field.

G E Marin, B M Osipov and D I Mendeleev

RESEARCH OF THE EFFECT OF FUEL GAS ON ENERGY CHARACTERISTICS OF GAS TURBINE

Abstract: The purpose of the paper is to study and analysis of the gas turbine engine and the thermodynamic cycle of a gas turbine. The article describes the processes of influence of the composition of the working fluid on the parameters of the main energy gas turbines, depending on the composition of the fuel gas. The calculations of the thermal scheme of a gas turbine, which were made using mathematical modeling, are given. As a result of research on the operation of the gas turbine installation GE PG1111 6FA with different gas compositions, it was established that when the gas turbine is operating on different fuel gases, the engine efficiency indicators change. The gas turbine performance indicators were determined for various operating parameters and fuel composition. The effect of fuel components on the operation of the equipment is revealed.

E A Tyurina, A S Mednikov, P Yu Elsukov, S N Sushko

ANALYSIS OF THE EFFICIENCY OF ENERGY SYSTEMS OF LONG-DISTANCE ENERGY TRANSPORT

Abstract: The article presents the results of the comparative efficiency of energy systems for the transfer of natural gas energy over long distances from large deposits to final consumers. The result of the research is the limits of competitiveness of systems based on direct current transmissions, gas pipelines, a promising technology for converting natural gas to synthetic liquid fuel (SLF) - methanol - on installations of combined production of SLF and electricity based on their detailed mathematical models.

M A Taymarov, R V Akhmetova, Ye G Chiklyayev, Y V Lavirko, E A Akhmetov, A O Garifullina

STUDY OF THE SPEED OF FLAME DISTRIBUTION IN THE COMBUSTION OF METHANE-HYDROGEN FRACTIONS

Abstract: At present, natural gas of the Urengoyskoye field is burned in boilers of thermal power plants (TPP) to generate electricity. At the same time, refineries and petrochemical plants deepen the processing of fossil liquid hydrocarbons. The final product of processing is not only motor fuels, ethylene glycols, plastics, accompanying inert gases such as argon, but also a large amount of combustible secondary gaseous mixtures of the methane series. The composition of these mixtures is quite wide in content of combustible components. Among these mixtures is the methane-hydrogen fraction, which is characterized by a fairly high hydrogen content. A distinctive feature of the use of hydrogen as a fuel is the high rate of flame propagation and the relatively low heat of combustion [1, p.6-8]. The methane-hydrogen fraction due to the volatility of the composition and a wide range of changes in the heat of combustion was recently used in refineries for its own needs as an insignificant additive to combusted natural gas in process furnaces [2-5]. If you cannot use the methane-hydrogen fraction in As fuel in these furnaces, it was burned in flares. Due to the increase in oil refining volumes and the increase in the amount of methane-hydrogen fraction produced, it became realistic to use this gaseous fraction as the main fuel for power boilers of thermal power plants located near petrochemical plants. In the near future, it is planned to use the methane-hydrogen fraction as an additive to the natural gas for 20 power steam boilers of the Nizhnekamsk CHP-1 with a total thermal capacity of these boilers of 6000 MW. The supplier of the methane-hydrogen fraction is the TAIF NK oil refineries. Depending on the technology of oil refining, the hydrogen content in the methane-hydrogen fraction ranges from 10 to 27% (by weight). The concentration limits of hydrogen ignition in a mixture with air have been experimentally studied by many researchers [6–8] mainly on bench or laboratory installations. A feature of the oxidation of hydrogen by air oxygen is the fact that there is a difference between the spread of the flame in limited volumes and in large volumes of the furnace space of energy boilers [9]. In small volumes, when the flame front collides with the wall, oxidation reactions are interrupted, and this does not occur in large volumes. Therefore, the study of flame propagation speed and concentration limits of ignition of methane-hydrogen fractions mixed with air in relation to the conditions of furnace volumes of power boilers is relevant. In the present work on the created programs [2-5]. calculations were made to determine the burning rate for various compositions of mixtures of methane-hydrogen fractions (IMF) with Urengoi natural gas. It was found that the flame propagation rate of the IMF, compared with hydrogen (see Table 2), decreases 1.76 times. For a mixture of the IMF with Urengoi gas with thermal

fractions of the IMF of 12% and 25%, the flame propagation rate increases, respectively, 1.4 times and 1.78 times compared with burning Urengoi gas.

A L Kulikov, A A Loskutov, M Mitrovic
IMPROVEMENT OF THE TECHNICAL EXCELLENCE OF MULTIPARAMETER RELAY PROTECTION BY COMBINING THE SIGNALS OF THE MEASURING FAULT DETECTORS USING ARTIFICIAL INTELLIGENCE METHODS
Abstract: There have been proposed methods of organizing the logical part of multiparameter relay protection. It increases the sensitivity, reliability and speed depending on the requirements for the protection of energy facilities. The statistical data of the modes of operation of the electrical network based on simulation in the Matlab/Similink software package were obtained. As an example, the use of artificial neural networks, decision tree and their combination were analyzed to combine the signals at the outputs of five different measuring faults detectors to improve the technical perfection of multiparameter relay protection.

D T Nguen, D N Pham, G R Mingaleeva, O V Afanaseva and Pietro Zunino
THE ASSESSMENT OF EFFECTIVENESS AND PROSPECTS FOR THE USE OF HYBRID THERMAL LOW-CAPACITY POWER PLANTS IN THE REPUBLIC OF VIETNAM
Abstract: The growing demand for energy and fossil fuels creates more and more difficulties, while the use of renewable energy sources is still small all over the world, including in Vietnam. In this article hybrid thermal power plants based on gas turbine plants, the increase in efficiency of which is achieved by heating the air after the compressor in solar air heaters are discussed. The basic design equations and the results of evaluating the efficiency and fuel consumption for two thermal power plants of 4.6 MW and 11.8 MW depending on the intensity of solar extraction for the climatic conditions of the Ninh Thuan province of the Republic of Vietnam are presented.

M Borodin, A Psarev, T Kudinova and R Mukhametzhanov
IMPROVING POWER QUALITY BY CALCULATING VOLTAGE LOSSES
Abstract: The problem of improving power quality (PQ) in the integrated power grid of Russia is an urgent task. The article analyzes the number of power consumers' calls to Kromskiye District Power Networks "Orelenergo", a branch of the PJSC "IDGC of the Center" for the issue that power quality indices go beyond the standards established in the regulations. The most common complaints of power consumers are low voltage, high voltage, voltage fluctuations. This is primarily due to physical and obsolete depreciation of the

main power grid equipment of the power supply organization, disinterest of consumers and the power supply organization in maintaining power quality at the level of regulations, as well as the lack of power supply or-ganization's software products that allow real-time voltage loss calculations and offer measures to improve the power quality. The presented algorithm, based on calculations of voltage losses, suggests measures to improve the power quality. The application of the proposed algorithm of the program will allow to increase PQ by means of timely determination of voltage losses.

I Fomin, R Belikov, V Zelyukin, T Mukhametgaleev

IMPROVEMENT OF POWER SUPPLY RELIABILITY BY MEANS OF REMOTE CONTROL OF THE AUTOMATIC REPEATED SWITCHING-ON OF SECTIONALIZING CIRCUIT-BREAKERS

Abstract: An important direction in improving the technical and economic level of technologies and agricultural production machinery is to ensure high reliability of power supply. Power interruptions cause damage to both agricultural consumers and power supply organizations. Therefore, obtaining on-line information about the occurrence of emergency operating conditions, and, therefore, minimizing the time for making operational decisions on their elimination, is an urgent task. Known methods and technical control means are complex, expensive and not effective enough. At the same time, they have both advantages and disadvantages. In this respect, it is very important to work out efficient technical means of remote control of power line sectionalizing circuit-breakers of the agro-industrial complex on the basis of innovative methods of monitoring. The proposed control method is implemented in a device for remote control of the overhead line circuit-breaker operation based on an analog-to-digital converter, with subsequent software-based processing of the received data on a computer. This method implementation of circuit breaker opening remote control will improve power supply reliability of agricultural consumers.

E V Izmaylova, E V Garnyishova, R B Kazakov and V V Serov

DETERMINATION OF THE SEDIMENTS THICKNESS ON THE HEAT-EXCHANGE SURFACES BY FREE VIBRATION METHOD

Abstract: Sediments on the heat exchangers surfaces reduce the heat transfer coefficient, heat exchange efficiency and lead to significant energy losses. The paper discusses the method of express control of the sediments thickness on heat-exchange surfaces. The method is based on the analysis of the attenuation of free oscillations parameters of the controlled product. Studies were conducted on models of the heat-exchange equipment surface – steel plates of 400 mm long, 160 mm wide and 2 mm thick, with different sediments thickness of 0, 1.0, 1.5, 2.0, 2.5 mm. There was used the Wilcoxon's rank sum test to determine the dynamics of the spectra changes. Studies have shown that the free vibration

method allows to determine not only the presence of deposits on the heat-exchange surfaces, but also their thickness.

K Kovalev, V Poltavets, I Kolchanova

SUPERCONDUCTING TECHNOLOGIES FOR RENEWABLE ENERGY

Abstract: The main trends in the development of modern wind-mills are increasing of the output power and efficiency which led's to the increasing of their weight and sizes. The application of high temperature superconducting (HTS) technologies can solve these problems. The article describes of the designs 1 MVA superconducting synchronous generator and 5MJ flywheel energy storage systems (FESS) with HTS magnetic suspension for autonomous wind power engineering.

A B Loskutov, E N Sosnina, A I Chivenkov, E V Kryukov and A P Shashkin

RESEARCH OF EXPERIMENTAL HYBRID ENERGY COMPLEX WITH FUEL CELLS OPERATING ON BIOGAS

Abstract: The article deals with the development of a hybrid energy complex (HEC) based on solid oxide fuel cells (SOFC) operating on biogas. Low maneuverability of SOFC prevents a widespread use of such power installations in consumers' power supply systems. The authors have developed the design of the HEC and an active-adaptive control system that allows solving the problem of SOFC low maneuverability. An experimental HEC consisting of a SOFC generation system, an accumulation system, a coupling system and a control system have been created. The research of the experimental HEC characteristics and the possibility of developing emergency situations during its operation has been carried out. The results of the charge and discharge characteristics of the accumulation system research, as well as the current and voltage dependences of the HEC coupling system are presented. The conducted studies have proved the effectiveness of the developed scientific and technical innovations.

E N Sosnina, O V Masleeva, E V Kryukov, N I Erdili

COMPARATIVE LIFE CYCLE ASSESSMENT OF MINI COMBINED HEAT AND POWER PLANTS

Abstract: The article presents the results of an environmental study of the mini combined heat and power plants (mini-CHPs) life cycle with gas engines operating on natural gas and biogas, and with diesel engines. The calculation of material and energy flows, the environmental impact on the atmospheric air, water basin and soil has been carried out. The largest mass of harmful substances in wastewater has been observed with the account of the life cycle assessment (LCA) for the mini-CHPs in biogas, the smallest mass - in diesel mini-CHPs. During the operation of biogas, gas piston and diesel PI, significant greenhouse gas emissions have taken place because of the fuel combustion. The

article considers the issues of thermal pollution in the environment. It has been revealed that the life cycle of the bioenergy installations has a maximum impact on the environment, with the account of the fuel combustion in mini-CHPs with diesel engines. Biogas mini-CHPs have a greater advantage considering the processes of the operation and fuel combustion. The conducted research can help in choosing the type of the engine when designing a mini-CHP.

T O Politova, Sh G Ziganshin, E R Bazukova, A V Busarov
IMPROVING THE HEATING NETWORKS EFFICIENCY BY IMPLEMENTING INSTRUMENTAL METHODS OF CONTROL
Abstract: Problems of increasing the reliability and efficiency of heating networks operation are closely related to the reduction of costs for the repair and restoration activities. The high cost of installation and emergency restoration work in the conditions of a shortage of funds dictates the need to develop and implement new methods of maintenance. Diagnostics of heat networks allows to determine their technical condition, to identify the most decrepit sections of pipelines for the purpose of repair work.

J V Karaeva, V O Zdor, A I Kadyirov, E V Shamsutdinov
JET MIXING WHEN HEATING OIL AND FUEL OIL IN STORAGE TANKS
Abstract: This paper presents the research results of jet mixing and heating processes of crude oil of the Zachebashskoe field (Republic of Tatarstan) and fuel oil M100 in a tank with a capacity of 2000 m3. Circulation systems with nozzle inclination in the range from -25° up to 125° are considered. The presence and washing out of bottom sediments in the tank are modeled. The time required for removing the bottom sediments and for heating the tank to the optimum temperature is determined. The best heating for the tank with oil and fuel oil was observed at the nozzle inclination in the range from -25° up to 60°. The optimal nozzle inclination was 115° for washing out the bottom sediments in the oil tank. To remove sediment in a tank with fuel oil it is recommended to use the same nozzle inclinations as for heating.

Y Galerkin, A Drozdov and A Rekstin
CENTRIFUGAL COMPRESSOR IMPELLER LOADING FACTOR ANALYSIS
Abstract: The loading factor performance modelling is an important part of centrifugal compressor performance calculation. The presented information on model stages' test data confirms the fact that the loading factor versus flow coefficient at an impeller exit is a linear function independent of Mach number (subsonic flow). The test data and the design characteristics of the series of 10 model stages are compared with the calculation of an inviscid flow and with

calculations done using the NUMECA software. Math models offered by the authors, and inviscid calculations solve the problem of a primary design. The CFD-calculation for final solution is non-satisfactory. If the loading factor is calculated by total temperature difference and flow coefficient is calculated by a continuity equation, the performance is not quite linear and lies much higher. For the considered stages CFD-calculation inaccuracy is + (0,06 … 0,12). CFD-calculated flow coefficient is inside 0,96 … 0,98 of the measured and of the calculated by the Math model.

A Rekstin1, K Soldatova, Y Galerkin1 and E Popova

VERIFICATION OF A SIMPLIFIED MATHEMATICAL MODEL OF CENTRIFUGAL COMPRESSOR STAGES

Abstract: To calculate the efficiency of a centrifugal compressor, it is sufficient to know the design parameters and similarity criteria: flow rate coefficient, loading factor, relative hub ratio, Mach number. The effect of the inlet nozzle and the diffuser type is also taken into account. The original simplified model was successfully used for calculation of compressors' candidates in computer programs of the Universal Modelling Method. Recently, the model has undergone significant revision and been remade. The modernized model is used in the program for primary design of centrifugal compressors. The authors verified the new model, comparing the calculated efficiency with the measured efficiency of several dozens of model stages 21CV family and low flow rate model stages. In total, calculations were carried out for more than thirty model stages. The range of design parameters of analysed model stages is quite wide: flow rate coefficient 0.00564 – 0.0676; loading factor 0.384 – 0.742; hub ratio 0.258 – 0.466.

N I Moskalenko, I R Dodov, M S Khamidullina, Ya S Safiullina

MEASURING COMPLEX FOR STUDIES OF THE COMPOSITION OF THE COMBUSTION PRODUCTS AND THE MICROSTRUCTURE OF THE SOOT PARTICULATE SOL

Abstract: A measuring complex of spectral instrumentation for the study of the ingredient composition, optical characteristics and microstructure of the dispersed phase of the combustion products of energy fuels and atmospheric anthropogenic emissions is discussed. The measuring complex includes in its composition a multi-pass cell with external and internal electric heating, which makes it possible to change the temperature of the radiation propagation medium in a multi-pass cell in the temperature range of 300–800 K, pressures of $1*102 \leq P \leq 3*106$ Pa with optical path L = 2, 4, 6, ... 30 m. Registration of spectra is performed by an upgraded spectrometer IKS-31 with interchangeable sources and radiation receivers, interchangeable diffraction gratings and cut-off light filters, interchangeable windows made of quartz, CaF2, LiF, MgF2, IKS-25,

KRS-5, ensuring they operate in the spectral region of 0.2–100 μm with the spectral resolution limit $\Delta\nu$ = 0.2 cm-1. The measuring complex has a complete metrological assurance. The obtained data on the spectral dependences of the effective cross sections for absorption, scattering, and attenuation of radiation are used to restore the microstructure of the dispersed phase of the combustion products. Analyzed atmospheric emissions of combustion products of wood, industrial energy, air carriers, decomposition products of asbestos-cement slabs during their calcination.

N I Moskalenko, S N Parzhin, I R Dodov, M S Hamidullina, A R Akhmetshin

DEVELOPMENT OF OPTICAL-ELECTRONIC SYSTEMS FOR THE STUDY OF TEMPORAL TRENDS IN THE COMPOSITION OF THE ATMOSPHERE AND TEMPORAL VARIATIONS OF THE EARTH'S CLIMATE

Abstract: Optical-electronic systems for the registration of the atmospheric composition in order to identify the influence of anthropogenic emissions into the atmosphere on its optical properties and the Earth's climate on a planetary scale are considered. Anthropogenic emissions into the atmosphere increase due to the growth of the population of the planet and the expansion of its economic activity. The increasing scale of the influence of anthropogenic emissions of various ingredients into the atmosphere requires studying their optical properties and carrying out research on the atmospheric composition of the atmosphere in order to identify temporal trends in the concentrations of small and trace components of the atmosphere and their influence on changes in the Earth's climate.

N I Moskalenko, Yu A Ilyin, O V Zotov, I R Dodov, A R Akhmetshin

FINE STRUCTURAL SPECTROMETRY AND SPECTRORADIOMETRY OF COMBUSTION PRODUCTS OF ENERGY FUELS

Abstract: The results of experimental studies of the fine structure of the spectra of molecular absorption and emission of combustion products of energetic fuels and their application in solving problems of radiative heat transfer in structurally inhomogeneous multicomponent media are considered. The methods of determining the parameters of the spectral absorption lines from the experimental emission spectra of the flame in the combustion products of gas fuel the identification of optically active ingredients in the combustion products and anthropogenic emissions into the atmosphere are analyzed. Attention is drawn to the fact that the emission of gas components is selective and the methods for calculating the radiative heat exchange in the combustion chambers

of power units must take into account the acute selection of the molecular absorption spectra of radiation.

A Rekstin, V Semenovskiy, K Soldatova, Y Galerkin and K Sokolov
THE SIMULATION OF GAS-DYNAMIC CHARACTERISTICS OF CENTRIFUGAL COMPRESSORS IN TURBO-EXPANDER UNITS
Abstract: Prof. Y. Galerkin and his team have developed and completed designs of 19 single-stage centrifugal compressors for turbo-expander packaged units applying Universal Modeling Method for the company "Turbokholod JSC" since 2005. The most powerful compressor is 6500 kW. The highest delivery pressure is 12 MPa. One hundred fifteen turbo-expander packaged units with total capacity 400 000 kW were manufactured, installed and were in operation in December 2018. The gas-dynamic characteristics of compressors comply with technical specification when operated within given range of initial temperatures and initial and final pressures - up to 16 combinations for some compressors. The dimensionless characteristics of the compressor stages vary within the range of design parameters: flow rate coefficient 0.0278-0.0697, loading factor 0.43-0.71.The simulation of gas-dynamic characteristics of one of the designed compressors by the newest version of mathematical model is presented as an example, demonstrating the simulation features and effectiveness.

R G Khuzyashev, I L Kuzmin, S M Tukaev, L T Tukhvatullin and E G Stepanova
TRAVELING WAVE FAULT LOCATION ALGORITHMS IN HYBRID MULTI-TERMINAL LINES OF THE TREE LIKE STRUCTURE
Abstract: Traveling-wave methods of the fault location prove their practical efficiency for the power transmission lines (TL) with an arbitrary configuration of any voltage class. This paper formulates algorithms to automate the process of the fault location in the TLs with a tree-like structure. The error of the simplified traveling-wave fault location (TWFL) algorithm based on the average propagation velocity of the transient signals (TS) is analyzed. A tabular algorithm for TWFL, which considers different propagation velocities of the TS in different segments of a hybrid network is proposed. An adaptive TWFL algorithm that considers the registration of the TSs with known places of their occurrence is proposed, to reduce the impact of the inaccuracy of the initial different network segments' lengths and TS's propagation velocity determination.

D I Nabiullin, R N Balobanov
PREDICTION OF THE ELECTRICAL LOAD OF THE POWER SYSTEM USING NEURAL NETWORKS.

Abstract: Prediction of the electrical load schedule of an electrical system is an important aspect for determining electrical loads, which ensures the correct selection and cost-effective operation of reactive power compensation devices and voltage control devices, as well as relay protection and automation. This article discusses methods for predicting electrical load using an artificial neural network. The problems of choosing the optimal architecture and algorithm of neural network training are considered. The methods of the best forecast accuracy are determined. A genetic algorithm based on the group method of data handling was chosen as the main calculation.

Yu V Vankov and A K Al – Okbi

AIR CONDITIONING SYSTEM BY USING UNCONVENTIONAL ENERGY SOURCES

Abstract: In the world in general the subject of energy saving is becoming necessary, where excessive consumption of energy leads to the consumption of a larger amount of fuel and increase environmental pollution and affect on the ozone layer. In Iraq, in particular, the demand for central air conditioning systems and home air conditioners with high electrical capacity has become increasingly clear in summer in recent years. Because of the desertification, high temperature, air pollution and population increase, resulting in increased consumption of electric power and pressure on power plants and thus made the power cut continuously, air conditioning systems within residential and public buildings and government facilities is a must for good internal comfort. With the aim of using renewable energies, the proposed system is to use solar collectors as an auxiliary solar thermal compressor and integrate them with air conditioning systems to increase the efficiency of the cooling system, reduce electricity consumption and reduce pollution.

E R Bazukova1, T O Politova, E R Khaziakhmetova, A A Medyakov

DESTRUCTION OF THERMAL INSULATION AND EFFECTIVENESS OF THE THERMAL ENERGY TRANSFER SYSTEM

Abstract: The work is devoted to improving the efficiency of the system of thermal energy transportation. The results of determining the thermophysical properties, such as the coefficient of thermal conductivity, water absorption, vapor permeability, the percentage of structural changes in the fibers during heating and exposure to vibration, basalt super thin fiber and other thermal insulation materials are presented. The results of thermal imaging testing control of basalt super-thin fiber mats are presented. The effect of the degree of thermal insulation aging on the increase in the heat flow density is shown.

A Mardikhanov, V Sharifullin, A V Golenishchev-Kutuzov and Sh G Ziganshin

DEVELOPMENT OF METHODS FOR THE FORMATION OF OPERATION MODES OF HYDROPOWER SYSTEMS USING MACHINE LEARNING METHODS

Abstract: Describes the method of finding a compromise solution in the formation of the operation modes of hydropower systems (cascade of hydropower plants). Based on the developed methodology, the software solution "Energy system of the HPP cascade" (http://hydrocascade.com) was implemented. In the existing model, in order to improve the accuracy of forecasting the parameters of the generating equipment of hydroelectric power plants and hydraulic structures, machine learning methods were used. The new forecast model has increased the accuracy of the forecasts data by an average of 3.67%.

U M Strelkov, O V Radaykin, L S Sabitov A V Akhmerov

COMPUTER MODELING OF THE WIND POWER UNIT CONSTRUCTIONS WITH POWER OVER 2 MW.

Abstract: The aim of the work was to evaluate the effectiveness of the system "steel tower - reinforced concrete foundation - ground of the basis" of a wind power unit with power more than 2 MW using computer simulation in ANSYS. For this purpose, a example of a wind power unit is taken from the previous work, but in this case the lower part of the tower up to height 20 m was filled with concrete of class B60. The second distinctive feature of the wind power unit that there was the use of a collapsible foundation, which is manufactured according to our patent. The simulation takes into account the spatial reaction of the elements of the structural system and the physical nonlinearity of the materials from which they are made. In this case, the theory of strength of von Mises was used for steel, Williams-Varnack for concrete, and Drucker-Prager for ground base. Comparison of the received results with the data of the previous work showed that the breaking load of the tower has increased by 57% due to fill concrete the lower part of the tower, which indicates the effectiveness of the proposed solutions.

A I Ivanov, A S Kritchenkov and M Yu Egorov

ARGUMENTS FOR TIGHTNESS TESTING OF NUCLEAR SYSTEM PIPELINE PARTS, ATTACHED TO PRESSURELESS TANKS

Abstract: Actual standard, namely Rules for design and safe operation of equipment and pipelines of nuclear power installations (2015) does not regulate strength and tightness testing of pipeline parts, located between valves and pressureless tanks of nuclear systems at nuclear power plants. This paper

introduces arguments for strength and tightness test conduction of such areas of nuclear power plant pipelines, designed in accordance with Russian standards. It was also proposed some amendments for the norm aimed to improve safety and reliability of nuclear power plant systems with radioactive contamination. It was suggested to apply the result of current study to Leningradskaya-2 in order to improve safety and decrease the number of failures of the liquid radioactive waste storage system.

E A Shakhova, P P Rymkevich, A S Gorshkov, M Yu Egorov and A S Stepashkina

ENERGY PROCESSES WITH NATURAL QUANTIZATION

Abstract: The paper shows that the quantum-mechanical approach is applicable to most macro processes occurring in nature include the power industry. The mathematical apparatus of the isomorphic Heisenberg algebra is proposed. A non-commutative ring is constructed within which the commutation relations are given. The transition from quantum to classical theory is shown

R V Vyatkin, A N Tikhomirov and D A Kolesnichenko

STUDY OF AUXILIARY POWER SYSTEM FOR ELECTROPLATERS ON THE THERMAL ENGINE BASIS

Abstract. The article describes the design and testing of an auxiliary power system for a light commercial electric vehicle. In paper sescribed research about load modes of auxiliary power system for maintaining performance of electric vehicle under low-charge conditions . The article describes the design work and the installation of the necessary components for the research. The authors describe the experiment of charging the traction battery from an auxiliary power source. The results of the study are presented, including an assessment of the effectiveness of using auxiliary power systems.

O S Sirotkin, A M Pavlova, R O Sirotkin and A E Buntin

ON A NEW APPROACH TO ASSESSING THE ENERGY CHARACTERISTICS OF SUBSTANCES

Abstract: Within the unified model of chemical bonding and methods of quantitative assessment of components of mixed chemical interaction between the elements in compounds,developed by the authors, a new approach was developed to assess the structural and energy characteristics of substances and fuels. It comprises establishing a correlation between the difference of bonds' chemical components of reactants and end products. Changes in the chemical bond components affect such characteristics of chemical reactions as the heat of formation of the reaction products, their redox properties, whether reaction is endo- or exothermic, as well as the heat of fuel combustion reactions. This approach is an additional reserve for improving the methods for assessing the

energy characteristics of fuels and increasing the efficiency of energy production technologies.

P S Sokolov, A V Bannikov, M V Kozlova

EXPERIMENTAL RESEARCH OF THE OPERATION OF SELF-SUFFICIENT DESALINATION SETUP OF VAPOR-AIR TYPE

Abstract. The growing global shortage of freshwater resources can be partially offset by the desalination of mineralized ocean and marine waters. The most common methods of desalination today are distillation, based on phase transformations of water, and reverse-osmosis, which consists in passing sea water through semipermeable membranes. The distillation method of desalination is characterized by significant thermal energy needs. In the process of desalination by the reverse-osmotic method, there is a need for the periodic replacement of expensive membranes, the creation of high pressure, which leads to significant energy consumption. In this regard, the actual problem is the study of vapor-air desalination method, based on the law of equilibrium state of vapor-gas-liquid mixtures. The efficiency of devices based on the vapor-air method is a significant increase in productivity due to the additional generation of steam, which reduces the energy costs for heating water in the installation. The purpose of this work is to determine the main factors affecting the performance of the vapor-air type installations. As a result of an experimental study of the operation of aself-sufficient steam-type desalination setup, it was found out that the initial water and air temperatures in the bubbling zone have a key impact on the performance. The high energy efficiency of devices implementing this method, with the quality of the condensate that complies with regulatory requirements, makes the vapor-air desalination method very future-oriented.

ELECTROMECHANICS AND ELECTRICAL APPARATUS

A R Safin, I V Ivshin, T I Petrov

THE METHOD OF CALCULATION AND OPTIMIZATION OF THE PARAMETERS OF SYNCHRONOUS ELECTRIC MACHINES WITH PERMANENT MAGNETS IN THE COMPOSITION OF THE GENERATING AND DRIVING COMPLEXES

Abstract: New methodical solutions have been developed in the field of creating energy-efficient synchronous electrical machines with permanent magnets, designed to generate electrical energy as part of autonomous power plants and to drive various mechanisms.

V A Trushkin, S V Shlyupikov, M A Levin, S A Kifarak

MOISTURE CONTENT AS AN IMPORTANT INTEGRAL PARAMETER OF TRANSFORMER OIL QUALITY IN POWER TRANSFORMERS OF SUBSTATIONS OF 10 / 0.4 KV

Abstract. The main element characterizing the efficiency of a transformer is the state of its isolation, and above all, operating oil, which can perform its functions for a long time with timely restoration of its properties. Transformer oil is the main dielectric in contact with the external environment, interacting with solid insulation and carrying a large amount of diagnostic information. Analysis of the development of transformer insulation damage showed that the main catalyst for accelerating the aging process of the oil is the appearance of moisture in it. This effect is enhanced by oxygen, temperature, the catalytic action of metals, oxidation and other factors. To confirm the effect of moisture content in the oil on the deterioration of its properties, a statistical analysis of the oil sample test protocols was carried out. The obtained data allowed us to determine the moisture content as an important integral parameter of oil quality. Recommendations are given on the inclusion of a moisture content parameter in a number of mandatory requirements, in particular, for consumer transformer substations of 10 / 0.4 kV equipped with silica gel air dryers.

V A Trushkin, O N Churlyaeva and R V Kozichev

JUSTIFICATION OF THE ACTIVE METHOD OF PROTECTING THE INSULATION OF SUBMERSIBLE ELECTRIC MOTORS

Abstract: The article provides an analysis of the properties of the working environment of submersible electrical equipment. The influence of the operating parameters of electrical equipment on the physical properties of the fluid (its electrically conductive properties) is considered. Mathematical confirmation of the implementation of electroosmosis in the capillaries of the insulation of submersible electric motors is given. The rationale for the active method of

protecting submersible electrical equipment from reducing insulation resistance and preventing electrical breakdown is given.

A N Tikhomirov O B Tikhomirova and M E Gnenik
ESTIMATION OF APPROPRIATE RANGE EXTENDER POWER FOR BATTERY ELECTRIC VEHICLE
Abstract: The article presents the results of an experimental and theoretical study of the energy consumption of a vehicle under different conditions. The purpose was to determine the power of the auxiliary range extender on board of the electric battery vehicle. Driving is considered both for real road conditions of a large city, and a specific driving cycle. The high validity of the results is ensured by the use of the new driving cycle WLTC. It is shown that in urban traffic conditions 5 kW auxiliary power plant is sufficient for adequate compensation of electricity consumption of a vehicle with a curb weight 2500 kg.

Yu V Bebikhov, I A Yakushev, A N Egorov, Ya S Kharitonov, N V Golubtsovand R R Gibadullin
THE EFFECT OF HIGHER VOLTAGE AND CURRENT HARMONICS ON THE OPERATION OF ELECTRICAL SYSTEMS
Abstract. The article deals with the assessment of the impact of higher harmonics on the operation of variable-frequency electric drive systems used in processing units at mining enterprises. Beyond that, energy efficiency and the operation experience of variable-frequency electric drive use at mining enterprises were studied. The advantages and drawbacks of the employment of variable-frequency electric drive systems were found. They include energy saving and reducing maintenance costs for processing units on the one hand, as well as losses due to their incorrect selection and electromagnetic compatibility distortion on the other hand.

A E Auhadeev, R S Litvinenko, V P Fandeev, P P Pavlov, V M Btakov and A R Litvinenko
RESEARCH OF RELIABILITY OF URBAN ELECTRIC TRANSPORT SYSTEM
Abstract. Modern methods for analyzing and assessing the reliability of complex technical systems consider only its individual elements. The specifics of structural-functional interactions and integration into subsystems of different hierarchical levels are not taken into account. Studies show that analyzing the reliability of urban electric transport, also focus on individual components: the reliability of electric traction rolling stock, the reliability of the power supply system, the reliability of the track infrastructure, etc. The authors propose an approach that allows to consider urban electric transport as a complex technical

system consisting of several levels that are hierarchically subordinate. Each level combines the components directly involved in the transmission and transformation of electric power into mechanical operation of the rolling stock under the influence of the external environment by means of traction electrical equipment. This approach will allow to develop the theoretical foundations of methods for analyzing the impact of the reliability of individual components of a complex technical system of urban electric transport on the effectiveness of the electric traction implementation.

D D Micu, I V Ivshin, E I Gracheva and O V Naumov and A N Gorlov
INFLUENCE OF VALUE OF RESISTANCE CONTACT UNITS OF SWITCHING DEVICES ON LOSSES OF THE ELECTRIC POWER IN SHOP NETWORKS OF LOW TENSION

Abstract. The calculation of resistance tightening contact joints of switching devices allowing to consider technical condition of low-voltage switching equipment and to specify the value of the energy emitted in the switching device in the mode of operation electrical networks is presented in article.

O A Filina, A N Tsvetkov, P P Pavlov, V M Butakov and Radu Dumitri
VIBRATION MODEL AS A SYSTEM OF COUPLED OSCILLATORS IN A DIRECT CURRENT ELECTRIC MOTOR

Abstract: This article describes a vibration model connected by individual nodes of a DC motor. The purpose of the article is a mathematical model allowing to predict the work of machines with a depreciation resource and search for ways to increase the information content of assessing the functioning of the rolling stock condition without dismantling them. Currently, the operational reliability of the DC motor is reduced after the development of the service life. Study and evaluation of the vibration effect on the brush-collector node. The main components of the DC motor (bearings, electrical brushes) are unrecoverable. Therefore any interference with their normal operation leads to premature wear of the entire DC motor. Existing methods for life-extending maintain the operational reliability of a DC motor equal or close to the passport data for several years. This model allows vibration diagnostics without dismantling the DC motor and stopping the rolling stock. The mathematical model describes the oscillations of each node of the DC motor in the direction of movement of the rolling stock, showing the excess of the permissible value. After mathematical processing of the results, a machine reliability model under study is obtained (usually in the form of polynomials) as a function of the needed parameters – the influencing factors. Due to this model, pre-detected defects can save on repairs and maintenance in the future. This model is the basis of software for online diagnostics. The proposed model allows providing an objective use of repair and restoration compositions depending on the current

technical condition, which will lead to an increase in the service life of the mechanism and savings in operating costs. On the one hand, extending the operating life of a DC motor should produce an economic effect, and on the other hand, technical measures to maintain operational reliability cause an increase in material costs.

G A Belov, S.V. Abramov, G V Malinin1, A V Salov

CONTROL UNIT FOR ELECTROMAGNET CURRENT

Abstract: The paper deals with the results of research and development of the electromagnet current control unit for the case when only two outputs without specifying the polarity of the source connection may be available from a circuit with a series of DC voltage sources and electromagnet winding. Theoretical results have been verified by modelling in Matlab-Simulink environment as well as by testing the starter of the contactor air switch.

A G Rusina, Dzh Kh Khudzhasaidov, and O V Naumov and A N Gorlov

DEVELOPMENT OF AN INTELLIGENT SYSTEM FOR INTEGRATED MANAGEMENT OF HYDROELECTRIC CASCADE MODES

Abstract: The paper deals with an isolated electric power system based on hydroelectric power plants. The analysis of existing methods and approaches to the study of modes of EPS with included in their composition of hydroelectric power plants. A mathematical model of a hydroelectric station cascade has been developed, which allows to take into account the hydraulic connection in the calculation of electrical modes and also has developed a software tool to optimize the operating modes of hydroelectric power plants as part of the power system by redistributing the load between hydraulic units both inside the station and between hydroelectric complexes of cascade hydroelectric stations. The task of modeling power consumption and load graphs of EPS with specific properties, based on the application of artificial intelligence methods, is considered.

A Yu Khrennikov, N M Aleksandrov

CALCULATION OF THE ELECTRODYNAMIC FORCES CAUSING DEFORMATION OF THE POWER TRANSFORMER'S WINDINGS

Abstract: This paper describes modified method to calculate electrodynamic forces causing deformation of the power transformer's windings. This method takes into account the deformed shape of the winding. The new equations allow to get better accuracy.

Calculation of the electrodynamic forces causing deformation of the power transformer's windings

N A Malev, A I Mukhametshin and O V Pogoditsky and W M Mwaku

METHOD OF ANALYSIS AND CONTROL OF PARAMETERS OF AN ELECTROMECHANICAL CONVERTERS BASED ON A LINEAR INTEGRAL CRITERION USING SENSITIVITY MODELS

Abstract: During the electromechanical converters operation in the composition of the working sets, objects parameters can change both under the influence of external factors, such as changes in the environmental characteristics, and due to parametric disturbances caused by changes of the physical characteristics of electromechanical converters elements. In this regard, the analysis and monitoring of electromechanical converters parameters is an important task. The article deals with a method that allows to ensure control over the operation of electromechanical converters during operation as part of working sets, based on variations analysis of the object parameters. The article provides a linear integral criterion computational scheme using the reference and sensitivity models to the parameters to be analyzed. The results provide a good way to estimate changes of the electromechanical converters parameters with the required accuracy.

Dan Doru Micu, E I Gracheva and O V Naumov

CALCULATION OF LOADING ABILITY OF POWER TRANSFORMERS TAKING INTO ACCOUNT ELECTROMECHANICAL CHARACTERISTICS

Abstract: Calculation of operation modes of power transformers for determination of value of optimum loading at which the performance coefficient of the transformer reaches the maximum value is presented in article and also options of increase in efficiency of operation of power transformers of the industrial enterprises are offered

A V Puzakov

DEVELOPING THE MODEL OF NORMAL OPERATION OF STARTER MOTOR TRACTION RELAYS

Abstract: Malfunction of motor starter traction relays cause the impossibility of the reliable start of internal combustion engines which, if the worst comes to the worst, can create the risk of traffic accident occurrence. Electric resistances of traction relay coils are structural and diagnostic parameters at the same time. Emergence and development of failures causes the change of magnetomotive force generated by the traction relay coils. Critical values of electric resistances correspond to failures of traction relay coils, i.e., inability to perform the built-in functions. The developed mathematical model of traction relay normal operation includes the amount of effort generated and voltage loss on contacts as controlled values for the drive mechanism and the starter electric motor, respectively. The results obtained contribute to the development of the method of motor-and-tractor starter diagnostics without removing it from the engine.

A N Korkishko, O A Korkishko, A A Kosov

FEASIBILITY STUDY ON THE USE OF TUBING PIPES IN CONSTRUCTING INTERMEDIATE SUPPORT FOR HIGH VOLTAGE POWER LINES 6-10 KV IN THE DEVELOPMENT OF OIL FIELDS

Abstract: This article is devoted to assessing the technical effectiveness and economic feasibility of the oil-well tubing in the construction of intermediate supports for overhead power lines (6–10 kV) in the development of oil, gas and condensate field in the conditions of Far North. The article considers the technical possibility and economic feasibility of using the built-up cross section of the intermediate support of overhead lines consisting of two tubes tubing welded together. With SCAD office software, the strength of the proposed section has been calculated for the design load, taking into account the impact of climatic factors. A comparative analysis of the construction cost was performed for 1 km overhead power lines made of conventional materials and oil-well tubing. The calculations showed the feasibility of using this material for the construction of 6-10 kV overhead lines.

S A Livshits, N A Yudina, T U Dunaeva, E K Nikolaeva, S R Enikeeva, B.E. Umirzakov

IDENTIFICATION OF AREAS OF EMERGENCE OF CRITICAL FLOW REGIMES OF NONLINEAR VISCOUS LIQUIDS IN A TUBULAR REACTOR

Abstract: The mathematical model describing heat-mass transfer in the course of rheologically complex media in a tubular reactor is developed in the article. Using the example of the continuous production scheme for grade B2 polymethacrylate, solutions of the characteristic equations confirming the possibility of emergence of critical flow regimes for certain sets of control parameters were obtained.

Л Н Токарев

ТРАНСФОРМАТОРНЫЕ ЭДС В ДИФФЕРЕНЦИАЛЬНЫХ УРАВНЕНИЯХ СИНХРОННЫХ ГЕНЕРАТОРОВ

Abstract: The article presents the differential equations of the synchronous generator, transformed in accordance with the theory of two reactions, that is, in the axes d-q. The influence of transformer EMF on transients is considered. It is proved that for the accurate calculation of transients in the electric power system it is necessary to use the differential equations of the synchronous generator taking into account the transformer EMF in the stator.

D Köppen, O V Vladimirov, T A Musaev and O V Fedorov

A METHOD FOR CHOOSING THE OPTIMAL QUANTITY OF SHORT-CIRCUIT INDICATING DEVICES TO ENHANCE POWER SUPPLY RELIABILITY

Abstract: This article considers a method for solving the problem of choosing the optimal quantity of short-circuit indicating devices for providing a required reliability of the 6(10) kV distribution power grid. Compatibility of the equipment powered was taken into account. An outcome of the problem solution became a mathematical model; an optimization task, limiting and boundary conditions were formulated.

W Bialy, V E Sovin, V I Zatsepina, E P Zatsepin and O Ya Shachnev

ENSURING EFFICIENT OPERATION OF ELECTROMECHANICAL SYSTEMS WITH FREQUENCY REGULATION WITH PERIODIC VOLTAGE SAGS

The article reflects influence of high-power electricity consumers on control elements of frequency control of electric drive. Solution of problem of eliminating influence of voltage dips on electromechanical systems by means of a modern method of reactive power compensation is presented. Graphs of power, current, voltage versus time are presented, graphs of voltage curve are analyzed in detail with proposal of method of its normalization.

N V Hruntovich, A A Kapanski, D Baczynski, E E Kostyleva and O V Fedorov

THE USE OF VARIABLE FREQUENCY DRIVE PUMP WORKING ON A WATER TOWER

Abstract: The development of the existing water supply system in towns and villages involves the use of frequency converters and specialized control algorithms that can maintain the pressure level established in the network within certain limits. The implementation of the standard scheme includes the elimination of the water tower, which, on the one hand, reduces the cost of its maintenance. On the other hand, in emergency situations, the water tower provides the water supply to the consumer, which increases the time of uninterrupted water supply during repair work. The article reveals a method of increasing the energy efficiency of transporting drinking water with the help of a water tower by eliminating the excessive pressure of the water rise when using frequency converters. Conducted research which involves more than 300 pumping stations, allowed to establish the average value of the excessive pressure of water rise, which reached 0.36 MPa. For the wells under study, optimization of the pump operation modes revealed the energy-saving potential up to 52% due to excessive pressure reduction and up to 2.0% due to a decrease in starting power at the time of engine acceleration.

Nic Vas Hruntovich1, Nad Vl Hruntovich, A A Kapanski, I V Petrov and E E Kostyleva

VIBRATION DIAGNOSTIC OF ELECTRIC MOTOR ROLLER BEARINGS

Abstract: The low quality of the new rolling bearings leads to additional costs for electric motor repair, and additional expenses connected with the technological process, value of which can reach from several thousand to tens of thousand dollars. To increase detection the reliability of rolling bearing defects of asynchronous motors, complex vibration diagnostics was used at informative frequencies in the vibration frequency and amplitude in the range of 5-5000 Hz. Based on the diagnostic model of rolling bearings the software program "Tayamnitsa" is developed, which allows to calculate the diagnostic frequency corresponding to certain defects, determine the defect level and form a diagnostic table for defects. Vibration diagnostics of new and used rolling bearings have been conducted for various regional enterprises and power plants. It has been determined that 40-50% of used bearings are removed in good technical condition. When new bearings were diagnosed in the 500-5000 Hz range, only 48.4% of the bearings are considered serviceable due to the low accuracy class of metal processing and unacceptably high vibration level

W Biały, A R Safin, V I Zatsepina, E P Zatsepin, P I Skomorokhov

IMPROVING THE RELIABILITY OF OPERATION OF ELECTROMECHANICAL DEVICES BY MEANS OF IONISTOR-BATTERY BACKUP

Abstract: This article is devoted to the problem of improving the reliability of operation of electromechanical devices and devices at electric power industry facilities. Particular attention is paid to the fact that electromechanical devices and devices designed for a voltage class of 110 kV and higher in the Russian power system are still the majority compared to microprocessor and microelectronic devices. And given their long service life and the inability to promptly replace all devices at once, improving the reliability of their operation is highly relevant. Developed a schematic solution to the problem. The scientific novelty of the proposed solution lies in the fact that the redundant power supply circuit with operating current of electromechanical devices offers a consolidated use of innovative electric power storage devices - ionizers and classic rechargeable batteries combined according to a special circuit. This solution maximizes the reliability of the operation of both the electromechanical devices and devices themselves, as well as their automatic control.

M O Ward, A V Vinogradov, A V Vinogradova, V E Bolshev, N V Makhiyanova, M S Garifullin **JUSTIFICATION FOR CREATING A**

MOBILE COMPLEX TO ASSESS ELECTRIC ENERGY LOSS IN POWER TRANSFORMERS DURING THE OPERATION PROCESS

Abstract: The paper analyzes the statistical data on the transformers of the Kromsky branch of Oreloblenergo OJSC including the average lifetime of the transformers and no-load losses measured in accordance with the requirements of Russian standard GOST 3484.1. The analysis indicates that the declared passport data differ from the measured data. There is also the analysis of technical solutions to improve the power transformer design including to development of new types of electrical steel used in transformer cores, superconducting materials for winding. The article gives an understanding of the advantages and disadvantages of using these technologies as well as the possible reduction of electrical losses. In conclusion there is the justification for creating the mobile measuring complex to assess electric energy loss in power transformers during operation without disconnecting the load. The paper describes the result achieved using such a mobile measuring complex along with the economic effect of creating the project

M O Ward, V A Chernyshov, A E Semenov, V E Bolshev, R P Belikov and M S Garifullin

THE METHOD OF EXTENDING DRONE PILOTING AUTONOMY WHEN MONITORING THE TECHNICAL CONDITION OF 6-10 KV OVERHEAD POWER LINES

Abstract: The paper considers options for the implementation of the technical condition monitoring of the of power supply system elements, the assessment of overgrowing of the power line routes using an unmanned aerial vehicle. A method for emergency control of an unmanned aerial vehicle used to monitor the technical condition of 6-10 kV overhead power lines has been proposed. This method is used in case of loss of radio communication between the unmanned aerial vehicle and the ground control station. The method is based on the activation of the automatic piloting system allowing the unmanned aerial vehicle flight to continue to the pre-determined emergency landing area. The autopilot is carried out by means of a servo controller and sensitive sensors reacting to the intensity of the electromagnetic field of a 6-10 kV overhead power line.

A V Vinogradov, A V Vinogradova, M O Ward, A N Kharkhardin, A I Psaryov, M S Garifullin

CHOICE OF COMMUTATION DEVICE AND DEVELOPMENT OF THE SCHEME OF A UNIVERSAL SECTIONALIZING POINT WITH AUTOMATIC LOAD TRANSFER FUNCTION FOR THE 0.38 KV ELECTRIC NETWORK

Abstract: The overestimated length of rural power lines of 0.38 kV leads to the fact that it is often not possible to fulfill both the sensitivity conditions of the

protective device installed at the transformer substation and protecting the line from overloads and short circuits, and the requirements of the power supply reliability of consumers. This problem can be solved by installing in-line universal sectionalizing point equipped with an automatic load transfer function. The use of these devices allows dividing a line into sections provides the necessary sensitivity of protection for each section of the line and the possibility of supplying power to undamaged areas from a backup power source. In addition, only with the use of automated switching devices installed in power lines, it is possible to create intelligent electrical networks. When developing these devices, it is necessary to take into account the electromechanical characteristics of switching devices that are planned to be used for switching lines.

A V Golenishchev-Kutuzov, T V Tabachnikova and G T Merzadinova
SIMULATED MODEL OF ELECTRIC INSTALLATION OF ELECTRIC CENTRIFUGAL PUMP WITH SUBMERSIBLE OF INDIVIDUAL COMPENSATION INSTALLATION
Abstract: The scheme of substitution and the system of differential equations of electrotechnical complex of producing well is given. The mathematical and simulation models of the electric drive of the electric centrifugal pump installation with submersible individual compensating installation are developed. The scheme of inclusion and practical realization of the individual compensating installation which consists of battery of the static capacitor with non-standard nominal voltage which are connected directly to clips of the stator of the submersible electric motor in a well is offered. The simulation model of electric actuator of the electric centrifugal pump installation allows to simulate the mode of operation of the electric actuator in steady-state and transient modes, and also allows to simulate the group start of electric drives of the electrical complex of the producing well. As a result of the simulate modeling, the optimal level of voltage of outgoing line and energy parameters and the optimal parameters of individual, node and centralized compensating installations, the rational voltage level the main substation are determined.

E I Gracheva, V N Petrov, N V Russova, D V Samuilov, G P Svintsov, I V Pro-tosovitski
TO MODELING THE DYNAMICS OF A SINGLE-WINDING FORCED VALVE ELECTROMAGNET IN A CIRCUIT WITH A BALLAST RESISTOR
Abstract: We have built a mathematical model of starting up a forced U-shaped valve electromagnet of static voltage taking into account dynamic parameters and characteristics. The offered model takes into account the influence of eddy currents in the closed circuits of the magnetic system.At the first stage we have

developed a mathematical model that allows to determine optimum dimen-sions, to minimize the mass of active materials (the total mass of copper for windings and ferromag-netic steel), that are used in construction of the electromagnet.
Then, based on a known method of integration of the dynamic equations we have obtained an actua-tion model of the valve magnet taking onto account equivalent resistances of cores of both circular and rectangular cross-sections.
Modeling of dynamic parameters and characteristics was done taking into account secondary con-tours without increasing order of differential equations.
We list calculated values of dynamic parameters and characteristics of the electromagnet in a circuit with a balance resistor.

N Yu Zaitsev, Yu M Zaitsev, E V Mikhailova, D S Sazanov, G P Svintsov and B M Adrianov

TRIGGER LOW-VOLTAGE DEVICES ELECTROMECHANICAL APPARATUS

Abstract: Based on the analysis of the existing classification of low-voltage electromechanical devices, it was proposed, on the basis of the functions performed, to unite into the group of electromagnetic mechanisms the indicating relays, vacuum contactors, time relays with clockwork, and executive bodies of circuit breaker releases. The definition of launching devices is given, the main feature of which is a mechanical characteristic, the change of which, with appropriate coordination with the traction characteristic of an electromagnet, can lead to an improvement of the most important characteristics of these devices, such as power consumption and resistance to mechanical influencing factors. On the example of the calculation of the index relay, it is shown and experimentally confirmed that a change in the initial force of the mechanical characteristic and its rigidity leads to a decrease in power consumption while maintaining shock stability.

A E Auhadeev, R G Idiyatullin, P P Pavlov, V M Butakov, L N Kisneeva and D I Tukhbatullina

ELABORATION OF THE METHODOLOGICAL FOUNDATIONS OF THE THEORY AND CALCULATION METHODS OF RATIONAL OPERATING MODES OF TRACTION ELECTRICAL EQUIPMENT OF URBAN ELECTRIC TRANSPORT

Abstract: Research shows that the existing theory and methods for calculating rational operating modes of traction electrical equipment do not provide a sufficient level of adequacy under real operating conditions of urban electric transport, which is due to the high complexity of the processes and the lack of a sufficiently developed methodology for their interpretation in industry theory. The purpose of the study was researching the process of electric traction as a result of transformation electrical energy in purposeful mechanical movement of

electric rolling stock with the implementation of all technological conditions of production and technical system of urban electric transport. The scientific hypothesis that the modes of operation of electric traction equipment as part of an automated electric drive of the rolling stock of urban electric transport are formed under the influence of a complexly organized technological process of electric traction and are the topological basis of its structure is theoretically substantiated. The main result of the research is the formulated theoretical system which allows to present the process of electric traction as a system consisting of five levels that are in hierarchical relations and solve each specific problem of building the movement of electric transport. Such an approach will allow developing the theory and methods for calculating rational operating modes of traction electrical equipment of urban electric transport, the improvement of the energy efficiency of which is the actual scientific problem.

A.L. Slavutskiy, L.N. Vasilieva,V.G, Grigoriev, S.G. Chumarov, A.V. Kartuzov, A.I. Kitaev

TRANSIENTS IN THE LOAD NODE AT POWER LOSS: GROUP RUN-OUT OF INDUCTION MOTORS

Abstract: The simulation of transient processes in the complex load node with powerful induction motors at power loss is carried out. For the modeling the method of synthetic schemes (Dommel's algorithm) was used. Calculations are carried out within the dynamic model of motors in phase coordinates. The results of simulation and analysis modes of the load node with two induction motors connected to the electric buses of 10 kV and fed through step-down transformer capacity of 16 MVA are presented. The applied model of power transformer consists of inductively coupled branches. The features of single and joint run-out of motors with different torque of mechanical loads are analyzed. Estimates of the parameters and time intervals at which the run-out of the motors is close to synchronous are obtained, the features of energy recuperation and the interaction of the motors in the load node are analyzed.

Fouad Alhajj Hassan and Alexander Sidorov

STUDY OF POWER SYSTEM STABILITY: MATLAB PROGRAM STUDYING DATA FROM ZAHRANI POWER PLANT (BEIRUT, LEBANON)

Abstract: Stability has a major concern in power systems; instability can cause fluctuation in many parameters of power system. Since the purpose is to keep feeding the load when a fault or disturbance of overload occurs, the main concern will be focused on over voltage and frequency because they might make a great damage and might shutdown the system. In this study, calculation will be made on one machine connected to infinite bus, steady state and transient stability using Matlab to achieve a stable system.

K V Bykov, N M Lazareva and V M Yarov

DYNAMIC MODES OF OPERATION OF A THREE-LEVEL LLC-CONVERTER WITH PHASE-IMPULSE CONTROL

Abstract: Usually, parametric synthesis of controllers for a closed control system is carried out for nominal conditions, and then the source performance for other load resistance values is estimated. As a result, the control system may not always provide the sufficient mode stabilization with a changing load resistance value. The paper suggests an alternative version. It deals with estimation of dynamic transient responses for the required mode parameter in an open-circuit system as well as with determination of transfer functions and the controller parameters for the most complicated version of transient response curves. The paper presents the results of simulation modelling of dynamic operating conditions for LLC converter using Simulink Matlab as well as load characteristics for three versions of a closed control system.

D Y Alekin, O S Popkova, N G Yagovkin

MODEL OF EFFICIENT OPERATION OF OPERATING PERSONNEL IN AN EMERGENCY DURING THE PROCESS OF AN ELECTRIC POWER FACILITY

Abstract: In this paper, a model of personnel activities in emergencies during the operation of an electric power facility is proposed. The factors that characterize the inerrancy of the activities of operational personnel and their relationships that determine the effectiveness of actions are identified. The efficiency of various strategies of human behavior are functions of the properties of the situation, the technical condition, and characteristics of the equipment, professional attributes of the person.

A V Serebryannokov, D V Zinovev, G A Kravchenko, A G Kalinin, D V Ilin and L A Ilina

PRINCIPLES OF REDUCING THE PHASE SHIFT BETWEEN INSTANTANEOUS ANALOGUE AND DISCRETE SIGNALS AND THE CORRESPONDING VALUES IN THE SV STREAM IN A DIGITAL SUBSTATION

Abstract: There are numerous publicly available articles on digital substations, including those dedicated to current and voltage measurements, time synchronization, test systems development, principles of substation design, and other aspects of this topic. But the phase shift between instantaneous signals and the corresponding values in the SV (sampled values) stream has been little discussed. We can list the following principles to reduce the phase shift between instantaneous analogue and discrete signals and the corresponding values in the SV stream. 1) Exclusion from the device, of non-essential elements that introduce additional propagation delays of analogue and discrete signals, provided that such exclusion does not adversely affect the device performance or

characteristics. 2) Reduction of the delay time for the other device elements to the minimum values. 3) Adjustment of the delay time of some device elements or addition of special delay elements to equalize the time of signal propagation over analogue and discrete channels. 4) Consideration of the total delay time of signal propagation over analogue and discrete channels and adjustment of the time stamp in the SV frame. The article provides examples of application of these principles in signal generation and measuring devices and phase shift meters.

V N Meshcheryakov, V V Danilov, Sh R Khasanov and S Valtchev
MINIMIZATION OF THE STATOR CURRENT IN INDUCTION MOTOR WITH DEFINED LOAD ON THE SHAFT BY MAINTAINING OPTIMUM ABSOLUTE SLIP
Abstract: This paper presents the study of induction motor operation with regulated frequency and voltage while maintaining the absolute slip of the two optimal modes - with a minimum of the “stator current / torque” ratio and a minimum of the “winding loss / torque” ratio; the results of experimental studies confirm the validity of the analytical expressions.

V N Meshcheryakov, D V Lastochkin, A G Logacheva, S Valtchev
ENERGY SAVING SYSTEM OF FREQUENCY-CASCADING ASYNCHRONOUS ELECTRIC DRIVE
Abstract: This paper discusses the wound rotor induction motor and variable-frequency drive (VFD) that regulates the stator voltage frequency. The stator and rotor windings are connected to a common electrical circuit. The slip energy of the motor goes to the DC link and feeds the stator winding of the motor. The block diagram of the electric drive, the equivalent circuit and the basic characteristic of the cascade VFD are considered. It is shown that the energy-saving mode with a minimum ratio “stator current / torque” is achieved at an angle between vectors of the stator current and the excitation current at the level of 45 degrees. The experimental static mechanical characteristics of the electric drive were obtained. These characteristics provide a limitation of the starting torque.

V Kozlov, E Kirzhatskikh and R Giniatullin
DIFFERENTIAL METHOD FOR DAMAGE LOCATION DETERMINING IN 10 KV DISTRIBUTION NETWORKS WITH ISOLATED NEUTRAL
Abstract: Half of the length of all transmission lines (TL) are medium voltage networks. Single-line-to-ground short circuit (SLGSC) in distribution networks is the most common type of damage, accounting up to 70% of all types of damage. Faults in damage repair leads to an overvoltage of two healthy phases,

resulting in double shorts, two-, three-phase shorts, which contributes to consumers' disconnection. Remote damage location (DL) determination in tree-type networks is considered to be the most relevant, since these networks are spread over large areas, crossing rivers, ravines, lakes, forests, etc. This paper presents a differential method for DL determining based on steady-state voltage of damaged phase frequency. Measuring the parameters of emergency mode at the beginning and at the ends of 10kV TL allows compact stand-alone sensors using without their synchronization.

D A Sorokin S I Volskiy, Y Y Skorokhod

THREE-PHASE POWER FACTOR CORRECTOR WITH DIRECT POWER CONTROL AND POWER SUPPLY OF THE UNBALANCED INDUSTRIAL NETWORK

Abstract: Nowadays three-phase power factor correctors (PFC) became widely used. This phenomenon is due to strict requirements of the international electrical technical commission standards to harmonic composition of the current supplied by three-phase industrial network. New schematic technical version of three-phase PFC having direct power control and improved efficiency factor is presented. Mathematical description of the power component and control system taking in account its functioning in dependence on asymmetrical three-phase input voltage was fulfilled. The electrical processes in the presented PFC is analysed by the means of computer simulation. Results obtained present interest to the persons engaged in the development of the electrical energy systems and complexes to which higher requirements in respect to power loss reduction and reliable functioning in the case of three-phase asymmetrical industrial network.

A Fedotov, R Misbakhov, N Chernova, K Bakhteev, A Akhmetschin and T Dzhunuev

CALCULATION OF ELECTRICAL LOADS FOR DECENTRALIZED POWER SUPPLY SYSTEMS AND THE CHOICE OF POWER GAS PISTON INSTALLATIONS WHICH USE ELECTROCHEMICAL ENERGY STORAGE

Abstract: In autonomous electric power supply systems of remote areas of the country where there are no centralized electric power supply, diesel generator units (DGU), and gas piston installations (GPI) is used as a source of electrical power. Selection of their nominal power determined load value, for which the preliminary calculation using the standard values. Researches of electric power profiles for apartment and public buildings of the Republic of Tatarstan showed a significant difference from the current regulatory values. At present, the regions are granted the right to independently set specific loads for such objects.

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The article proposes a method for selecting the power of autonomous power plants for actual loads for urban and rural settlements.

SES-2019

AUTOMATION, INSTRUMENTS AND CONTROL METHODS

A V Golenishchev-Kutuzov, V A Golenishchev-Kutuzov, D A Ivanov, G D Mardanov, A V Semennikov and L V Ahmetvaleeva

EFFECT OF PARTIAL DISCHARGES ON THE OPERATING CONDITION OF HIGH-VOLTAGE INSULATORS

Abstract: The features of the dielectric rod defects and the rod-electrod defects of polymer insulators were investigated by using the developed complex method of contactless remote diagnostics of high-voltage insulators health, which includes the initial detection of local areas with elevated electric field gradients as well as measurement of a set of partial discharges characteristics. The radiation of extra-large partial discharges was detected and partial discharges features were investigated. According to the measurement results, a diagram was constructed for the electro-physical processes that accompany the emission of extra-large partial discharges; and the reasons for their occurrence were established.

I V Ivshin, A R Safin, A N Tsvetkov, T I Petrov and V Yu Kornilov and LV Dolomanyuk

ADAPTIVE CONTROL SYSTEM OF THE PUMPING UNIT

Abstract: Rapid diagnosis of the pumping unit should ensure the identification of the main classes of malfunctions and, if possible, a quantitative assessment of the degree of malfunction in order to implement a short-term prediction of the technical condition.

A M-N Alzakkar, I M Valeev, N P Mestnikov and E G Nurullin

THE ARTIFICIAL POWER SYSTEM NETWORKS STABILITY CONTROL BY USING THETECHNOLOGY OF NEURAL NETWORK

Abstract: In the present work, the electric voltage stability in Muharda station in Syria has studied during the normal and up normal loading state. The results in this study were getting from artificial neural network, which is consisting from three layers (input-hidden-output),where this network characterized by the speed and accuracy in processing before the failure and turn off the supplying which may lead to economical problems. This study has been done through two different patterns of generating in this station (single - double) generators. The achievement of this network consists of two stages: training Stage (off-line) and testing Stage (on-line)to make a comparison between the training stage and testing stage which leading to optimization the load in testing cases depending on training data.

V A Petrosyan , A V Belousov, A G GrebenikandYu A Koshlich

THE PROBLEM OF CREATING AN AUTOMATEDSYSTEM TO CONTROL GROWTH OF SAPPHIRE SINGLE CRYSTALS FROM MELT AS APROBLEM OF CONTROL AND MONITORING OF A COMPLEX NONLINEAR AND DYNAMIC SYSTEM

Abstract: The paper is mentioned some problems of automated control system development for growth of large (150 kg and above) sapphire single crystals. It is obtained analytical equation for the temperature distribution and thermal stresses along the crystal axis during the growth.An analysis was carried out and numerical estimates were obtained for the axial distribution of components of thermoelastic stresses depending on the physical, optical, and geometric parameters of the crystal.It is shown that the cause of thermal stresses and blocks during crystal growth is nonlinear temperature dependence of thermal conductivity and thermal expansion coefficient.

И М Сафаров, М И Сазгетдинов

ЦИФРОВАЯ ЭНЕРГЕТИКА И СИСТЕМА АВТОМАТИЧЕСКОГО УПРАВЛЕНИЯ ЦИФРОВОЙ ЭНЕРГИЕЙ В РЕСПУБЛИКЕ ТАТАРСТАН

Abstract: В настоящее время наиболее важной и ведущей особенностью системы автоматического управления цифровой энергетикой в Республике Татарстан является то, что энергетические системы постоянно и регулярно отправляют огромные средства в реконструкцию производственных мощностей. Но вложенные средства, а именно замена, ремонт или реконструкция основного технологического оборудования, невозможны без усовершенствования систем управления этим оборудованием

B V Kavalerov, I Ziyatdinov, Sh D Basargin

GAS TURBINE UNIT SIMPLIFIED MODEL ADAPTIVE CONTROL

Abstract: The article explores the possibilities of building automatic control systems for gas turbine power plants. The use of the principles of adaptive control with a reference model and a signal effect is being studied. As an adaptation method, a method based on the Lyapunov function is used, in order to reduce the time for searching for an extremum. There is a need to ensure the specified indicators of electricity the quality in a constantly changing electrical load and changes in operating modes of the power plant in gas turbine units. The article presents a model of a gas turbine installation for the study of adaptive control. It is shown that the improvement of one coordinate is possible to obtain due to some deterioration of the other coordinate. For further study of this problem, a simplified second-order dynamic model has been constructed. With the help of such a model, complex studies of various stages of adaptive control were carried out. Results were obtained by varying the parameters of adaptive

control and simulation parameters. The research results are designed to find the optimal ratios of adaptive automatic control systems parameters for power industry gas turbine plants.

M ASafin, E I Gerasimov
AUTOMATED MANAGEMENT SYSTEM OF TECHNOLOGICAL PROCESS OF INSTALLATIONS OF CLOSED WATER SUPPLY FOR FISH CULTIVATION
Abstract: The report described an automated process control system for closed-loop water supply systems for year-round fish farming in closed aquaculture farms, described the principle of operation and the technological process for maintaining stable fish growth conditions

A N Bogdanov, I A Ryabykh, A I Galiev
IMPROVING EDUCATION QUALITY USING BY AUTOMATED VIRTUAL REALITY SYSTEM Abstract: . The paper discusses options for the implementation of virtual reality training classes with the possibility of using the developed training software and hardware complex “Substation 110/35/10 kV”.

A.R. Zagretdinov, R.B. Kazakov, A.A. Mukatdarov
CONTROL THE TIGHTNESS OF THE PIPELINE VALVE SHUTTER ACCORDING TO THE CHANGE IN THE HURST EXPONENT OF VIBROACOUSTIC SIGNALS
Abstract: The article is devoted to the study of the possibility of applying the method of standardized scope (R/S analysis) to control the tightness of the pipeline valve shutter. Experimental studies have confirmed the possibility of using R/S analysis to control the tightness of the pipeline valve shutter. Hurst's exponent allows you to qualitatively determine the flowof the pipeline valve shutter.

M V Talanov,V M Talanov
SOFTWARE AND HARDWARE SOLUTION FOR DIGITAL SIGNAL PROCESSING ALGORITHMS TESTING
Abstract: The article describes the microprocessor system for various digital signal processing algorithms testing. The development of electric drive control systems is carried out with the usage of modeling systems such as, MATLAB/Simulink. Modern digital control systems are based on specialized digital signal microcontrollers. The present market offers evaluation boards, for example STM32F4DISCOVERY, which enablesto connect a microcontroller to a personal computer. It makes possible to use the microcontroller as a part of the mathematical model of the control system. However, the designing of the

control system simulation model and the program for the microprocessor is carried out in different programming environments. Thus, the software and hardware solution for testing programs for the microprocessor, which is a part of the control system, is relevant. This article deals with the designing of the modeling method in which the prototype program for the microprocessor is debugged as apart of the electric drive control system simulation model.

T A Akhmetshina, G I Il'in,A G Il'in and R R Fayzullin

ON THE PECULIARITIES OF THE BEHAVIOUR OF THE INSTANTANEOUS FREQUENCY OF THE APSK-N-SIGNAL AT THE LINEAR SELECTIVE SYSTEM OUTPUT IN THE PRESENCE OF STRONG ISI

Abstract: The work is devoted to solving problem of long-term synchronization of optical coherent emission of a helium-neon laser in the automatic mode, which can be used in particular in portable gravitational field detectors. A block diagram of the system that solves this problem is presented, the principle of operation is described. Much attention is also paid to existing solutions, their shortcomings are described

М. Ю. Васильева И. И. Исмагилов и В.В. Плотников

ПОСТРОЕНИЕ БЫСТРЫХ АЛГОРИТМОВ ПРЕОБРАЗОВАНИЙ УОЛША И ИХ ПРИМЕНЕНИЕ В АВТОМАТИЗИРОВАННЫХ СИСТЕМАХ УПРАВЛЕНИЯ

DEVELOPMENT OF FAST WALSH TRANSFORM ALGORITHMS AND THEIR APPLICATION IN AUTOMATED CONTROL SYSTEMS

Abstract: В статье рассматривается комплекс вопросов, связанных с применением преобразований Уолша в автоматизированных системах управления. Приводится построение новых упорядочений функций Уолша, рассмотрена оригинальная методика построения быстрых алгоритмов в разностно-упорядоченных системах дискретных функций Уолша-Адамара. Теоретические результаты проиллюстрированы конкретными примерами.

Gataullin D I

THE USE OF AUTOMATED SYSTEMS TO IMPROVE QUALITY CONTROL OF ENERGY CONSUMPTION

Abstract: To effectively plan the analysis of energy saving and energy efficiency measures, it is necessary to take account of energy consumption. However, this leads to an increase in the number of metering stations, which in turn leads to additional human and material costs for their maintenance, as well as the collection and processing of information from the devices installed on them. The ability to automate these works is the most profitable solution. In this

paper, the ACEAS installed in the KSPEU was considered. It was analyzed its work from April to May 2019.

A R Mirgaleeva, K H Gilfanov
AUTOMATED PROCESS CONTROL SYSTEM OF REGIONAL SUBSTATIONS RETROFIT
Abstract: The article presents data on the state of the Digital Substation technology in Russia. Also voiced the advantages and disadvantages of this technology. Since the main disadvantage is the economic inexpediency of introducing digital substations, the article proposed a method to improve the reliability of electricity supply to regional areas.

M A Safin, A R Shaykhutdinova
PROTECTION OF GREENHOUSES BY IMPROVING THE AUTOMATIC CONTROL SYSTEM
Abstract: The article tells about the automatic control system (ACS) of greenhouses, about the types of greenhouses and about the protection of greenhouses from hail. Examples of accidents related to greenhouses are also given, and asolutionis proposed for protecting greenhouses by improving the APCS

K **V Epifancev and S A Solovev**
SOFTWARE PLATFORM FOR ANALYSIS OF DATA IN THE FIELD OF WASTE MANAGEMENT
Abstract: This article is dedicated modern problem of soft poor in recycling in Russia. In our time we have a big problem with ecology and need automatization process of exchange waste. In first time it will be an account in which every people may be write information about own waste, which he wanted utilizationing. In net, another client matter may see this information and may be -it want buy these waste, for business, for example. So, we need analyzed all program, which take part in performance , Russian plants, because every day produced hundred tons of waste. About this soft, and another analogical program discussing in this article.

N K Andreev
INFLUENCE OF SENSITIVITY AND SPECIFITY OF MEASURING METHODS ON THEIR INFORMATIVITY AND HARDWARE REQUIREMENTS
Abstract:. This paper is devoted to discussion how the sensitivity and specificity of a physical quantity under measurement to other physical, chemical and biologic features influence on the information volume circulating in a smart system that is to the degree of smartness. Measurement systems in the fields of

magnetic resonance imaging, acoustic inspection and optical control of high voltage insulators in relation to the work for elaboration of devices are discussed. It will be considered how the addition of new measuring channels in optics, acoustics and MRI is reflected in the quality of images and how it affects data processing and hardware requirements.

R N Khizbullin, R N Khizbullin
WAYS TO IMPROVE SAFETY IN THE POWER INDUSTRY: AUTOMATED HARDWARE SYSTEM FOR PRE-SHIFT INSPECTION OF PERSONNEL OF POWER ENTERPRISES
Abstract: This article considers the possibility for application of the automated medical system at power engineering enterprises, ensuring monitoring the physiological state of personnel of enterprises. The considered complex includes separate functional units with new technical characteristics, providing high accuracy of the recorded physiological parameters of the surveyed workers before working shift and, consequently, reliability of health monitoring.

G M Safiullina, N V Bogdanova and D R Gilyazov
RELEVANT ISSUES OF FUEL SUPPLY PATHS MODERNIZATION AT EKIBASTUZ B.NURZHANOVA STATE DISTRICT POWER STATION (SDPS) -1 BY AUTOMATED PROCESS CONTROL SYSTEMS
Abstract: Modern requirements for the quality of technological processes and the level of automation of complex facilities have made an extremely relevant issue of the process control system modernization of at Ekibastuz B. Nurzhanova SDPS-1. In order to ensure the required level of technological parameters, the modernization of fuel supply paths was carried out by KER-Engineering LLC. As a result, the performance of Ekibastuz SDPS -1 was significantly improved.

I P Miroshnichenko, I A Parinov, V P Sizov
ON INCREASING THE NOISE IMMUNITY OF MICROACOUSTIC-MECHANICAL GYROSCOPE
Abstract: The paper proposes and describes a new modified microacoustic-mechanical gyroscope, which, while maintaining the positive qualities of known analogs, differs in comparison with them its enhanced functionality by converting the angular speeds of rotation of the supporting base into electrical signals simultaneously with respect to two axes of rotation and increasing the level of the useful signal compared to with noise level. The proposed technical solution is protected by a patent of the Russian Federation for invention. The proposed gyroscope can be used in navigation systems, orientation and control of various moving objects in aviation technology, auto transport, robotics, etc.

I P Miroshnichenko, I A Parinov, T P Savostina,VP Sizov

OPTICAL DEVICE FOR MEASURING SMALL DISPLACEMENTS OF CONTROL OBJECTS SURFACES WITH PROTECTION FROM EXTERNAL MECHANICAL LOADING

Abstract: The paper describes high-precision contactless optical devices for measuring small linear and angular displacements of the surfaces of control objects based on modern laser technologies and new methods of optical interferometry. A new scientific-based technical solution has been proposed, which allows one to provide continuous protection against the influence of external mechanical loading in the measurement process. The proposed technical solutions are successfully used to solve actual scientific and industrial problems and can also be successfully used to control the quality of structural materials and diagnostics of the state of goods under operating conditions in mechanical engineering, shipbuilding, aircraft construction, etc.

A V Chupaev, R S Zaripova, R RGalyamov, A Y Sharifullina

THE USE OF INDUSTRIAL WIRELESS NETWORKS BASED ON STANDARD ISA-100.11A AND PROTOCOL WIRELESSHART IN PROCESS CONTROL

Abstract:. This article considers wireless technologies in the field of automation of technological processes and production in the energy, chemical, petrochemical and oil refining, gas, railway, mining, metallurgical and other industries where the use of wireless industrial devices is necessary due to specific features.Wireless technologies provide the ability to connect measuring devices directly to the wireless network with further transfer of information through a wireless gateway to an automated control system.This article will discuss the types of wireless networks that are classified according to the possible range of action (Wireless Wide area network, Wireless Local Area Network, Wireless Personal Area Network).The most common standards of organization of wireless industrial networks, including IEEE 802.11 b/g/n, IEEE 802.15.1, IEEE 802.15.4, IEEE 802.16 e, will also be considered, including in the field of management of chemical-technological processes and productions.Data transmission protocols ISA-100.11.a and WirelessHART and a number of their features will be analyzed.The basic standard network structures based on the ISA-100.11.a and WirelessHART protocols, their typical components, will be considered.The article provides an analytical comparison of the ISA100.11a and WirelessHART over the OSI network model layers, including the physical layer, the link layer, the network layer, the transport layer, the session layer, the presentation layer and the application layer (process control, management, security, application sublayer).The main stages of calculation of wireless industrial network are given, in particular: calculation of the network information load, calculation of the network's energy parameters,

frequency-territorial planning, development of the communication scheme and interface with external networks.The formulas for calculating the network information load using Nazarov's methodology, calculating the network's energy parameters, taking into account the overall losses in the propagation of radio waves, including losses in free space, losses in partitions and walls inside the building, losses due to interference and signal fading are given.

M A Safin, O V Borisova and A S Marchenko

AUTOMATING THE PROCESS OF CREATING THE CLIMATE FOR GROWING STRAWBERRIES IN THE WINTER TIME

Abstract: This article describes the process of automation of the greenhouse for growing strawberries and maintaining the microclimate in it for maximum yield at all times of the year.

I A Sultanguzin, D A Kruglikov, T V Yatsyuk, I D Kalyakin, Yu V Yavorovsky, and A V Govorin

THE USE OF BIM, BEM AND CFD TECHNOLOGIES FOR DESIGN, CONSTRUCTION AND OPERATION OF ENERGY-EFFICIENT HOUSES

The article presents the concept and the process of integrated design, construction and operation of an energy-efficient house during the life cycle based on the use of BIM, BEM and CFD technologies. The task of complex design is to create a house with harmonious architecture and minimal energy costs to maintain a comfortable microclimate, including using renewable energy sources. The article shows the effectiveness of the use of an integrated approach in the design of a house close to the Passive House standards. Plan and area designing of the house was made in program ArchiCAD, the calculation of the energy balance and the selection of engineering equipment are made in the Passive House Design Package (PHPP). The simulation of the microclimate model was made in the CFD-package. The calculated heatingloads are compared with the actual, obtained during the house maintenance, through the system of smart house HEAT MONITOR Hydro Logo and automated measurement of energy resources by PolyTER.

Yu V Bebikhov, A S Semenov,M N Semenova, S N Pavlova, M A Glazun and N K Miftahova

THE EVALUATION OF THE OPERATION OF CONTINUOUS MONITORING SYSTEM CONTROL OF POWER QUALITY AT MINING ENTERPRISES

Abstract: In the paper, theoretical and experimental studies including measuring of the electricity quality indices at mining enterprises were made. The evaluation of the efficiency of the applied means of high-harmonic compensation was

fulfilled. The proposals to create the system for continuous monitoring of power quality indices were developed. Electrical devices of surface and underground complexes of mines connected to distribution networks 6 kV and used in mining and processing of diamondiferous ores were considered as the research objects. The results of installation of the monitoring system of electric power quality indices at electric drives and frequency converters of some process units were studied. Technical and economic analysis was carried out, and the guidelines concerning the improvement of energy efficiency of frequency-controlled electric drives were formulated.

E G Egorov, N Ju Luija, E V Mikhailova, V N Pichugin, R V Fedorov and V M Zbrodiga

FEATURES OF SWITCHING TESTS CIRCUIT BREAKERS

Abstract:.Wedemonstratethatthemostefficientwaytoextinguishtheshort-circuitarcisextinguishinginsidethecamerawithanarcextinguishinggrid, whichsplitsitintoseveralsmallerarcs. The active resistivity of these partial arcs decreases the amplitude of the current of the short-circuit arc, decreases the angle φbetween current and voltage, which decreases the amplitude of the return current and enhances the condition for the arc extinguishing.We analyze the process of arc extinguishing in the three-phase circuit. We would like to note that during the extinguishing of the arc in the first extinguishing pole resistance of electric arcs in two other poles deforms the voltage triangle decreasing the coefficients of the scheme from 1.5 to 1.3 according to the experimental data.This allows to decrease the difficulty of the tests for maximum commutation capability. Simultaneously, we consider the necessity of the selection and regulation of the wave parameters (amplitude coefficient and normal mode) of the test circuit according to the standard for test preparation.Taking into account the decrease of the coefficient of the scheme and the real wave parameters will allow to objectively estimate commutation capability and to optimize the parameters pf the contact arc extinguishing system of an automated switch.

D M Valiullina, Yu K Ilyasova and V K Kozlov

DIAGNOSTICS OF THE TECHNICAL CONDITION OF TRANSFORMERS ACCORDING TO THE COLOR CHARACTERISTICS OF TRANSFORMER OIL

Abstract: This paper presents the results of a research of transformer oil in a visual way. The high information content of the optical radiation scattered and transmitted through the oil is shown. By the color of the radiation, it is possible to determine such characteristics of the oil as acid number, dielectric loss tangent, the presence of colloidal particles, their concentration and size, as well as the presence of aromatic compounds in the oil, changes in their molecular

composition and concentration. By the presence of aromatic compounds and colloidal particles, it is possible to visually state the development of thermal and discharge defects in a transformer. This diagnostic system allows to assess the condition of power transformers without shutting them down, make decisions on their further operation without the use of expensive equipment and at the initial stage to identify the changes that are significant and necessary. This is due to the high cost of the transformer, its importance in terms of the reliability of power supply to consumers, the complexity of determining damages and defects at an early stage of development.

A D Zaripova, D K Zaripov, A E Usachev

AUTOMATIC CONDITION MONITORING METHOD TO FIND DEFECTS IN HIGH-VOLTAGE INSULATORS USING INFRARED IMAGES

Abstract: .In recent years, infrared imaging has become an important tool, particularly for predicting and preventing electrical equipment failure. Systems for online monitoring of the equipment conditionsused in electrical substations are based on computer vision algorithms to perform visual analysis, automatically detect and assess equipment condition. This article describes a developed method that automatically finds defects in high-voltage insulators using infrared images. This method is based on the Otsu method, which is one of the most popular andeffectivesegmentation methodsthat can be applied to finding defects in infrared images. The result is a comparative analysis of computer vision methods in infrared images used in our research. Automatic condition monitoring to find defects in high-voltage insulators in infrared images can be considered as the base method for an automated thermal imaging system for monitoring electrical substation equipment.

T K Huseynov, T T Gadirova, B K Amiraslanov, N A Abdulova, A I Quliyevaand K R Haciyeva

VIBRATION-AMPLITUDE LIQUIDS DENSIMETER

Abstract:. This paper is devoted to the current model of vibration-amplitude liquid densimeter developed by the authors. Firstly, the necessity to develop vibration-amplitude liquids densimeters with straigt-flow sensing elements (resonators) belonging to the “low cost - low accuracy” category is justified. The resonator structure, developed as the result of the search using the heuristic method, is described. The proposed resonator is a tube rigidly fixed at the ends with additional weights attached symmetrically at the vertical axis at the points of the antinodes of the second fundamental oscillation mode in order to improve the resonator quality- factor by suppressing parasitic harmonics. The structure provides the possibility to restore the resonator natural oscillation frequency (decreased with time) to the primary one. It may be achieved by sequence

screwing rods with different lengths into additional masses. The choice of the operating frequency of oscillations equal to 100 Hz is proved. It ensures invariance to the presence of solid inclusions in measured liquid and simplifies the electromagnetic excitation system. There are alsotheoretical relations obtained as a result of solving a differential equation of natural oscillations of a rigidly fixed tube with additional point masses, which are symmetricallylocated relatively vertical axis. They allow determining the own resonator oscillations frequencies for given parameters. The description of the operating model of the vibration-amplitude liquids densimeter, obtained experimentally and its calibration characteristic, is given.

M F Sadykov, D A Yaroslavsky, D A Ivanov and M P Goryachev

INCLINOMETRIC METHOD FOR DETERMINING THE MECHANICAL STATE OF AN OVERHEAD POWER TRANSMISSION LINE

Abstract: Mechanical deformations when a wire is stretched causes its rotation around its axis, which allows to obtain additional information about the wire behavior on an overhead transmission line and to consider it no longer as a group of sections from one span but as a whole interconnected section with redistribution of mechanical loads between spans. To determine the tensile strength of the wire by its torsion, a method for determining the mechanical parameters of an overhead transmission line was developed. Its based on the inclinometric method and the theory of force calculation of steel ropes. This technique takes into account the torsion, the angle of inclination and the temperature of the wire. The technique is implemented in the system for monitoring the status of overhead power lines, takes into account the torsion angle of the wire, helps to prevent emergencies on the overhead power line by determining the tensile strength of the wire, checking for defects in the wires of the overhead power line and defects in the suspension armature. The monitoring system includes control devices, a data collection and data processing center, a dispatcher software package. Control devices are installed directly on the wire / ground wire of an overhead power line, measure the angle of rotation, the angle of inclination and the temperature of the wire. The data collection and data processing station processes them according to the developed methodology in specialized software. The system for monitoring the status of overhead power lines based on the inclinometric method helps to prevent emergencies and reduce the economic costs of maintaining and restoring overhead power lines.

A M Sagdatullin

IMPROVING THE ENERGY EFFICIENCY OF OIL PRODUCTIONUSING IDENTIFICATION AND PREDICTION OF OPERATING MODES OF PRODUCTION WELLS BASED ON DATA

ANALYSIS METHODS, MACHINE LEARNING AND NEURAL NETWORKS

Abstract:. Currently, there is a need to improve the systems and control of pumping equipment in the field of oil and gas production and oil and gas transport. Therefore, an adaptive neural network control system for a production well electric drive was developed. The task of expanding the functional capabilities of asynchronous electric motors control of the oil and gas production system using the methods of neural networks is solved. The software modules of the well drive control system based on the neural network are developed, the identification system was designed, and a scheme is developed to adapt the control processes to changing load parameters, that is, to dynamic load, to implement the entire system for real-time control of the high-speed process.In this paper, based on a model of an identification block that includes a multilayered neural network of direct propagation, the control of the well system was implemented. The neural network of the proposed system was trained on the basis of the error back-propagation algorithm, and the identification unit workas forecaster of system operation modes based on the error prediction.In the initial stage of the model adaptation, some fluctuations of the torque are observed at the output work of the neural net, which is associated with new operating conditions and underestimated level of learning. However, the identification object and control system is able to maintain an error at minimum values and adapt the control system to a new conditions, which confirms the reliability of the proposed scheme.

K Kh Gilfanov, R A Shakirov

INTELLECTUAL MODELING OF SURFACE HEAT-EXCHANGE ENHANCER BASED ON ARTIFICIAL NEURAL NETWORKS

Abstract: The results of neural network modeling of average heattransfer in the channels of exchangers with surface enhancer of different shapes are presented. Artificial neural networks are trained using experimental data, which covers more than ten sources. The possibility and prospects of building artificial neural networks for modeling the characteristics of heat exchange surfaces are shown.

O S Zueva

MODIFIED METHOD OF CONDUCTOMETRY DATA USING FOR CALCULATION OF IONIC SURFACTANT SOLUTIONS PARAMETERS: PART 1

Abstract:. Methods for calculation of specific conductance of ions and micelles and the degree of micelle ionization using conductometric data in various approximations of the Debye – Hückel – Onsager theory were considered. The analysis of the existing calculation methods was carried out to identify their drawbacks and to suggest ways of their elimination.The calculation method of

the micellar parameters on the basis of conductometric data using micellar size was modified, and a new formula for determining the degree of micelle ionization was obtained. All calculations using the modified method were performed in the first and the second approximations, and the newly obtained values of the micellar parameters are in greater agreement with the results of other studies. Based on the calculations performed, it was shown that the contribution of micelles to the total conductivity of micellar solution cannot be neglected, since at high concentrations the contribution of micelles exceeds the contribution of counterions and can exceed 50%.

O S Zueva

MODIFIED METHOD OF CONDUCTOMETRY DATA USING FOR CALCULATION OF IONIC SURFACTANT SOLUTIONS PARAMETERS: PART 2

Abstract: Methodology for simple analytical refinement of the equivalent electrical conductivities of surfactant ions and counterions was proposed in the framework of the Debye – Hückel – Onsager theory as applied to surfactant dispersions at various concentrations. The developed methodology is based on the use of the mathematical form for the concentration dependencies of the specific conductivity in the premicellar region and makes it possible to calculate the equivalent conductivities of surfactant ions both under infinite dilution conditions and near the CMC. One of the advantages of the described method is the possibility of calculating the ion conductivities in the presence of a minimum number of experimental points (formally, a straight line can be constructed and its tangent of the angle of inclination can be determined even by two points corresponding to region 0.2 CMC — 0.8 CMC). Using the values of the equivalent conductivities of surfactant ions and counterions calculated for the required concentrations, allows to determine the parameters of the solutionmore accurately, including the contribution of micelles to the total conductivity of the solution.

I R Ismagilov, R I Kalimullin, A N Borisov

INCREASING THE LASER-ACOUSTIC METHOD EFFICIENCY FOR TESTING METAL PRODUCTS BY USING 3D VISUALIZATION

Abstract: The article proposes a solution to the problem of increasing the efficiency of the laser-acoustic method of non-destructive testing. An approach to increasing the probability of detecting surface defects of microscopic dimensions in metals is considered. Due to the increased accuracy of determining defect parameters, the detail of 3D visualization of testing results was improved.

J.V. Torkunova , M.N. Habrieva and L.V. Plotnikova

CURRENT APPLICATION ISSUES OF IT-TECHNOLOGIES IN ELECTRIC POWER INDUSTRY

Abstract: The article considers the problems of IT-technology development in the power industry. During the studies the analysis of the competitive advantages of information technologies was carried out and the functional features of information systems were revealed Material Requirements Planning (MRP), Manufacturing resource planning (MRP II), Enterprise Resource Planning (ERP), Enterprise Resource & Relationship Processing (ERP II), Customer Relationship Management (CRM), Supply Chain Management (SCM)). The authors also justify the incentives for the development of intelligent technologies in the electric power industry. The main purpose of the study was to substantiate that management capabilities based on IT technology create the conditions for innovative development of the industry. The digitalization of the energy sector, intelligent metering and distribution systems for the electric power present new requirements for the training of IT specialists. Analysis of the main current IT-trends in the power sector helps to justify the need for the use of the Internet services laboratory in the educational process

S V Sidorov, V V Sushkov, I S Sukhachev

DEVELOPMENT OF A METHOD FOR DETERMINING THE LOCATION OF A SINGLE LINE-TO-GROUND FAULT OF AN OVERHEAD POWER LINE WITH VOLTAGE OF 6(10) KV CONSIDERING CLIMATIC FACTORS

Abstract: One of the main causes of the high accidents and outages rate in 6(10)-kV distributed power supply systems of oil well clusters is damage to overhead power lines due to single line-to-ground faults. Widely conducted studies to locate a single line-to-ground fault have established a correlation between the accuracy of determination and a large number of changing factors, such as operating mode parameters, overhead power line parameters, type of damage, transition resistance, soil resistance, and others. Rationing of technical means for determining the location of a single line-to-ground fault by instrumental errors without taking into account the methodological component translates into the error in locating the damage up to 30%. Thus, relevant research is aimed at determining the primary parameters of power lines and minimizing the methodological error in determining the location of damaged power lines, considering climatic factors. The study takes into account the basic physical processes of propagation of an electromagnetic wave in the power line. The main principles of the theory of electrical circuits and the electromagnetic field and MATLAB Simulink package algorithms are used. As part of the study, a technique has been developed that allows determining the distance from

6(10)/0.4-kV substations to a single line-to-ground fault location in distribution networks of oil well clusters taking into account climatic factors. A simulation model of a 10-kV distribution network supplying oil well clusters was developed in MATLAB Simulink, taking into account the dependence of the primary power line parameters on climatic factors and soil resistivity.

I D Gizzatova, V K Kozlov and D.M. Valiullina

DETERMINATION OF THE TRUE WATER CONTENT, THE NATURE OF THE IMPURITIES AND THEIR CONCENTRATION IN TRANSFORMER OIL

Abstract: During the operation of transformers, the insulating oil is aging, therefore, there is the deterioration of its insulating properties, which is determined by multiple physico-chemical processes. The most dangerous factor, from the point of view of preserving the operational reliability and resource of a power transformer, is the moisture content of the insulation. Most methods for determining moisture content have measurement errors. These errors are largely dependent on impurities that are contained in the oil. The modified Fisher method proposed in the article allows determining the amount of impurities in the oil and the absolute moisture content. Conducted research allows also to determine the composition of impurities, to reveal the relationship between impurities and some parameters of transformer oil.

A P Garnov, O N Bykova and V M Repnikova

METHODS OF CONDITIONING SUSTAINABLE GROWTH PROGRAMS OF POWER GENERATING COMPANIES

Abstract: Purpose: reviewing the existing programs of enhancing the performance and reliability of the power facilities in Russia, identifying the related issues and shortcomings, suggesting the ways of growth. Findings: the study resulted in a method of forming a sustainable growth program for power generating companies, which has the advantage of involving a wide range of stakeholders in its development and introduction. Results: the issues related to the effective performance of the power industry can be addressed by creating mechanisms for state backing of the power sector. Value: the authors conclude that the power generating companies should put their own sustainable growth programs in place. Using the methods of developing sustainable growth programs, the authors describe the most preferred mechanisms of state backing.

ECONOMICS AND ENERGY MANAGEMENT

N S Volotkovskaya, N N Kugusheva, A S Semenov, I A Yakushev S N Pavlova and O V Kolosova

STRUCTURE, CONDITION, AND PROSPECTS OF ELECTRICAL GRIDS IN THE REPUBLIC OF SAKHA (YAKUTIA)

Abstract: The paper analyzes the condition of electrical grids in the west of the Republic of Sakha (Yakutia); data sampled for the last 10 years. It demonstrates the geographic location of grids, which defines the scale of the study. Technical indicators are presented for 10 years; they reflect an increase in the fixed assets. The paper derives mathematical models of the wear of transmission equipment used in the western grids. It proves that the condition of equipment will deteriorate further unless its maintenance is properly funded. The paper analyzes the prospects of electrical grids in the Republic of Sakha (Yakutia). It presents a program for local energy optimization. The costs associated with five alternative development scenarios are calculated and presented in a tabular format.

Z Gelʹmanova, O Pak, G Sivyakova, G Zhabalova, O Lelikova, O Onischenko

THE SCENARIO OF DEVELOPMENT OF ELECTRIC POWER INDUSTRY IN THE REPUBLIC OF KAZAKHSTAN

Abstract: The article explored the energy sector of the Republic of Kazakhstan. The data on the demand for new installed capacity are presented. The scenarios for the development of the energy sector and factors determining the characteristics of scenarios are considered. The main results of the simulation are analyzed. SWOT analysis was made in the field of saving energy and efficiency energy. Based on the results of the data, conclusions were drawn and measures were proposed.

E S Melekhin, A A Pelmeneva and E S Kuzina

ECONOMIC PREREQUISITES FOR THE DEVELOPMENT OF LOW-ENERGY BASED ON THE DEVELOPMENT OF UNCLAIMED HYDROCARBON DEPOSITS

Abstract: The article assesses the state of the mineral resource base of hydrocarbon raw materials, provides estimates of the commercial efficiency of hydrocarbon field development, examines and substantiates the main economic prerequisites for the development of distributed generation based on the development of unclaimed small hydrocarbon fields.

E A Husainova, L R Urazbahtina, N A Serkina, E A Dolonina, O V Filina and Lenka Švecová

MONITORING TOOLS OF REGIONAL ECONOMIC SECURITY

Abstract: Ensuring the economic security of the region is one of the key tasks of managing the subject of the federation. By ensuring economic security, priorities of regional management are determined, and therefore the economic security system should be integrated into the development management system of the socio-economic system of the region and carry out an information and analytical function in it, which requires the development and implementation of

economic security monitoring tools in the regional management system. The article formulated an algorithm integration tools for monitoring threats to economic security in the regional economic development of the control system the methodical approach to assessing threats to regional economic security.

A I Shinkevich, S S Kudryavtseva, A N Dyrdonova, D Kh Gallyamova, A A Farrakhova, E L Vodolazhskaya

ASSESSMENT OF THE EFFICIENCY OF ENERGY- AND RESOURCE-SAVING TECHNOLOGIES IN THE MODEL OF OPEN INNOVATION

Abstract: The relevance of this work is determined by the fact that the issues of resource-saving technologies implementation in the model of open innovation have not been fully addressed yet and require further study and systematization of the determining factors, which is especially important on the back of the transition to a new technological pattern and the use of the emerging technological opportunity windows. The solution of the problems mentioned will reveal new opportunities for qualitative and quantitative growth of production systems by improving the innovation targeting in the field of resource saving and energy efficiency. The purpose of the article is to identify the functional dependence between the Networked Readiness Index and the emerging technological opportunity windows in order to improve the efficiency of resource-saving technologies in open innovation and production systems. The main research methods underlying the article include the method of description used to identify trends in the Networked Readiness Index across the globe, the correlation analysis method used to identify a close relationship between the Networked Readiness Index and indicators of state support granted to the innovations in production, and the regression analysis method used to build a regression model of the dependence between the resource-saving system and production indicators. The article touches upon the aspects of improving the resource-saving system efficiency in the framework of the open innovation model in the field of production. The correlation between the Networked Readiness Index and the indicators of the state institutions quality characterizing the level of innovation support provided to the industry across the world countries has been revealed, and the functional connection between the use of waste at petrochemical plants and the petrochemical products shipped has been proved using the emerging economies as an example. The materials of the article can be used in the development of strategies and programs aimed to improve the resource-saving system efficiency in petrochemical companies of developing countries, taking into account the emerging technological opportunity windows and technology readiness of the production for innovative transformations.

A I Shinkevich, T V Malysheva, I A Zaraichenko, A A Lubnina, G R Garipova, M M Sharafutdinova

INVESTIGATION OF ENERGY CONSUMPTION TRENDS IN PETROCHEMICAL PLANTS FOR THE MANAGEMENT OF RESOURCE SAVING

Abstract: The relevance of the research topic is due to the study of the important problem of improving the energy efficiency of the economy and the meso and micro levels. In the conditions of the development of an innovative economy, energy saving becomes one of the main factors for increasing the economic efficiency and economic security of industrial enterprises and complexes. The article discusses the main aspects of the organization of energy-saving environmental production systems. The factors affecting the energy efficiency of the production process from the standpoint of logistics, including the processes of storage, storage and transportation of products within an industrial enterprise, are summarized. As a criterion of energy saving in logistics chains, the coefficient of consumption of energy resources spent per unit of production is given. The analysis of the dynamics of fuel and energy costs per unit of output by the types of activities of petrochemical plants of the Republic of Tatarstan was carried out. The specificity of the level of fuel and energy costs by type of activity is shown, depending on the specifics of production and products. The variation of energy consumption data by types of petrochemical production activities for 10 years has been calculated. The prospects for reducing the energy intensity of petrochemical enterprises in the context of the liberalization of the market of electric energy and power are considered. The materials of the study can be used in managing the development of the real sector of the economy, the service sector, both at the enterprise services level and in government structures. In addition, the proposed methodology is appropriate for assessing the level of resource-saving production, building innovative energy-saving development strategies, and developing a mechanism for targeted actions for the rational use of resources.

A I Shinkevich, N V Barsegyan, M V Shinkevich, S Sh Ostanina, F F Galimulina, M E Nadezhdina

RESERVES FOR IMPROVING THE EFFICIENCY OF PETROCHEMICAL PRODUCTION ON THE BASIS OF ‘‘INDUSTRY 4.0’’

Abstract: One of the current problems in the industrial complex is the issue of resource saving and energy efficiency, which is confirmed by the relevant government programs, strategies, regulatory documents. The solution of the problem of increasing the efficiency of the organization of production systems requires the definition and development of the necessary mechanisms, in particular, by automating production processes. The article analyzes the key

trends in the development of the concept of "industry 4.0" in the petrochemical industry. The factors influencing efficiency of the organization of production systems are revealed. The main directions promoting development and improvement of the organization of production are defined. It considers the basic tools of process improvements, process automation, petrochemical plants: work on the system of just-in-time, 5S system of rationalization of the workplace, different information systems, particularly ERP systems, CALS-technologies. Advantages of automation of production processes at the enterprises of petrochemical complex are defined.

D O Romanov, Y V Yavorovsky
FEASIBILITY STUDY OF CONVENTIONAL, DVSP, AND THD-BASED HEAT SUPPLY SYSTEMS
Abstract: Thermohydraulic dispatcher (THD) can be widely used in district heating systems.Heat source is one of the possible places of its application. In this case, it is possible to achieve hydrodynamic separation of heat source and heat supply network. This paper deals with comparison of three types of heat substation connection to heat source: conventional system, DVSP system, THD-based system. The latter two have variable speed pumps instead of throttling valves.Based on electricity consumption and investment costs calculations, total discounted costs of three systems were estimated. In result, DVSP system is more beneficial, while conventional system and THD-based system have high operational and investment costs accordingly.

V V Avilova, A V Safina and E V Demidova
DIVERSIFICATION OF RUSSIAN ENERGY EXPORTS TO ASIA-PACIFIC COUNTRIES: OPPORTUNITIES AND RISKS
Abstract: We have analyzed the dynamics of Russian energy exports with an outlook up to 2040. This paper justifies the need to diversify Russian energy supplies to the Asia-Pacific countries and defines the areas of mutually beneficial relations. It also considers the positive effects of mutual cooperation projects, possible risks, and the conditions for their mitigation.

A V Novichkova, O V Malygina, T V Trofimova, A V Lomovtseva, V V Avdonkina, O S Rybkina
MANAGEMENT INNOVATION THROUGH THE FORMATION OF A MODEL OF CORPORATE MEMORY
Abstract: The Russian Corporation need to work at the new principles of functioning in modern social and economic conditions, surely implementation of innovative activity is the main and necessary conditions have to be created for it. However, innovative activity of the organization depends on maintaining and developing competencies on a straight line, for which the corporate memory as a

certain framework is needed in turn. In this article, the role and tasks of corporate memory in the innovation process is considered, given its sources, and the stages of functioning model of corporate memory reflected.

E A Husainova, L R Urazbahtina, N A Serkina, E A Dolonina, A A Derbeneva, O V Filina and Galina Ostapenko

FEATURES OF MANAGEMENT AND FACTORS OF ECONOMIC STABILITY OF AN INDUSTRIAL ENTERPRISE IN THE REGION

Abstract: The article studies the features of the economic stability of enterprises, gives a brief description of this concept. The economic stability of an individual enterprise is being actualized with a view to the economic sustainability and competitiveness of the mesoeconomic system. The need for differentiation of the concepts of stability and equilibrium is noted. Factors of influence on the economic stability of the enterprise are considered. The need to manage economic sustainability is argued.

N D Chichirova, I G Akhmetova, K V Lapin, A R Gilmanova and ION Ion

IMPROVING OF THE HEAT SUPPLY ENERGY EFFICIENCY IN RUSSIAN CITIES THROUGH THE INDIVIDUAL HEAT POINTS INTRODUCTION

Abstract: This article statesthe problems with the use of central heating stations, as well as the need to introduce individual heat points. As a result, the authors considered the issue of improving the energy efficiency of heat supply systems in Russian cities while replacing central heating stations with individual heat points. The beneficial effects of the activities are especially noted.

I G Akhmetova A A Derbenyova, R R Dyganova, E A Husainova and Jaromír Veber

MANAGEMENT ORGANIZATION ACCOUNTING FOR THE RESPONSIBILITY CENTERS

Abstract: The paper is devoted to the problem of applying management accounting for responsibility centers in practice, also revealed technology for practical implementation in production. In order to obtain reliable data on the effectiveness of this separation technique, a deep research is needed, taking into account the industries characteristics in which it can be used.

Y N Zatsarinnaya, A G Logacheva, R N Gaynullin,S F Alekseeva, D I Amirov and COMAN Gelu

SOLUTION FOR RENEWABLE FUTURE

Abstract: Nowadays renewable energy sources are actively promoted as the most sustainable types of power to drive electricity generation of the future. Distributed generation with the use of wind turbines, solar panel, and biological

fuel may become an answer to the numerous challenges which large power grids are facing. But integration of renewable energy based generation facilities requires not only availability of special technical means but also establishing of new types of trading patterns and platforms are necessary. This article provides the concept of smart billing system which allows to involve single households to the progressive type of energy consumption and generation and creates the new type of energy system and market participant – prosumer. Two types of billing approaches are suggested for households equipped with renewable energy sources based generation facilities. The first one implies that generated energy is consumed by the household itself and the second one implies that surplus of generated energy is sold to the grid. As calculation has shown the first pattern is beneficial for small facilities which in overall don't have a large surplus in generation over consumption. And the second one is beneficial for those who generate more than they consume.

V Y Bauer and D G Shuvalova

DEVELOPMENT OF A METHOD FOR MONITORING AND CONTROL OF THE PROCESS OF PRODUCTION LOCALIZATION REGARDING POWER ENGINEERING

Abstract: This article describes the problem ofmonitoring and control of the process of production localization regarding power engineering industry.In this research, the authors identifiedan additional factor for assessing the level of localization of the power engineering industry, which takes into account the specifics of the industry. The authors also developed a method for monitoring and controlling the process of localizing production at various stages of the application of this strategy.

O V Shemelova, E V Yakovleva, T G Makuseva, I I Eremina and O N Makusev

SOLVING OPTIMIZATION PROBLEMS WHEN DESIGNING POWER SUPPLY CIRCUITS

Abstract: One of the quickly developing trends in the optimization of electric power grids is system development of operation and optimization of branch circuits which are based on linear programming problems. One of its categories is traffic problem. The paper discusses the formulation of various types of transport optimization problems used in the design of the most efficient power supply systems in the real sector of economy. The construction of arithmetic models of problems is carried out. Their optimality criterion is cost minimization for the design of electrical network diagrams consisting of power lines connecting sources and consumers. Examples of designing optimization power layout in mathematical problems considering the transmission capacity of power lines is given. The paper also touches upon a mathematical problem considering

possible transit of capacities. The task is to build a mathematical model and solve problems that ensure minimization of process losses and losses of power when designing electrical networks. The results of solving problems are presented in the form of power supply circuits corresponding to the most optimal linking of source and consumer nodes. The work is of a scientific and practical significance as it considers the problem of optimizing economic costs when designing electric power network schemes. Moreover it is based on a qualitatively different level of use of the traffic problem algorithm. The algorithm for solving the minimization problem obtained in this paper allows developing the necessary computing operations as well as quickly obtaining the results of solving the cost optimization problem in the designed electric power network.

A N Dyrdonova and T S Lin'kova

PRINCIPLES OF PETROCHEMICAL CLUSTER' SUSTAINABILITY ASSESSMENT BASED ON ITS MEMBERS' ENERGY EFFICIENCY PERFORMANCE

Abstract: For the Russian economy, the most crucial prerequisite for its moving towards sustainable development would be strong improvement of performance of the domestic enterprises and production complexes. It is obvious that this issue should be addressed with due consideration of the special aspects relevant to social and economic growth of various Russian areas, along with creating a respective cluster-based infrastructure. Therefore, all arrangements aimed at performance efficiency improvement should be reconciled with the social and economic development strategies designed for a particular area, and should be well considered when working out strategic development plans for the regional industrial and territorial clusters, as well as particular enterprises and production plants. This paper includes an analysis of the dynamics pattern of the main indicators characterizing the energy use efficiency in regard to the largest enterprise forming the core of the petrochemical cluster in one of the Russian regions. The study furthermore shows the determined factors bringing the greatest impact on the production energy efficiency improvement. The authors also describe the prospects for production energy intensity reduction against the backdrop of the electric energy and power market liberalization, and explain how accommodation of the industrial clusters' activities to the changes taking place in the macroeconomic environment for business entities may determine the need for addressing a whole range of fundamentally new issues of methodological, methodical and organizational nature, which are relevant to development of a cluster behaviourstrategy in response to the competitive electric energy market.

N V Varlamov

THE ANALYSIS OF INTERNATIONAL EXPERIENCE IN THE ENERGY MARKET FORMATION AND ECONOMIC MECHANISMS FOR MANAGEMENT OF THE GAS SUPPLY SYSTEMS DEVELOPMENT

Abstract: The article assesses the foreign countries experience in formation of the energy market and the basics of managing the development of gas supply systems. The creation of a system in order to provide access to gas transport services for gas consumers, gas producers and its suppliers, as well as the creation of favorable conditions for investment is a significant stage in the implementation of effective market transformations. One of the fundamental points for carrying out the reforms in gas industry in the market conditions should be the arrangement of trade system for reserved capacities. The positive results of the reform include: reduction or stabilization of prices for end-users, diversification of gas supply sources, improvement of the gas supply reliability.

N V Varlamov, I A Kirshina

NATURAL GAS SUPPLY FOR INDUSTRIAL ENTERPRISES IN THE CONDITIONS OF THE RUSSIAN MARKET: CURRENT STATE AND DEVELOPMENT TRENDS

Abstract: The article considers the existing problems in the natural gas supply for industrial enterprises in the Russian market. The analysis is performed with regards to the use of natural gas in various sectors of the economy. Gas consumption in the electric power industry and metallurgy is growing at the highest rate. Gasification of Russian regions leads to thedynamic development of gas distribution system. The use of natural gas in industry makes a significant contribution to the state budget and to the socio-economic situation in the regions.

E K Nikolaeva,N A Yudina, T U Dunaeva, S A Livshits, S R Enikeeva and Mantserova T.F.

IMPROVING ECONOMIC PERFORMANCE THROUGH THE IMPLEMENTATION OF ENERGY EFFICIENT TECHNOLOGIES

Abstract: The issue is about the energy efficiency improving for the Russian Energy Economics. The energy efficiency applicability, the technical and the economic energy efficiency potential, the government energy efficiency tools are substantiated are substantiated in this work. The energy efficiency program implementation results are presented here.

N Ketoeva, N Soldatova and S Ilyashenko

LEAN MANUFACTURING AS A TOOL FOR INCREASING LABOR PRODUCTIVITY AT THE ENTERPRISE

Abstract: Since the beginning of utilization of the lean production concept it has passed several stages of implementation. The first stage failed because manufacturers that introduced lean production methods were isolated from each other; whereas in the second stage, these companies learned from their experiences. Since then, the lean production concept has been used to organize production and reduce costs, despite the fact that markets are becoming more demanding due to individualization of demand and variability of conditions. Digitalization suggests methods for adapting the concept of lean production to such a market indicator as company performance. Thus, the utilization of the concept "Industry 4.0" can initiate the third stage of development of the practice of lean manufacturing in terms of analyzing the productivity from a multidimensional point of view.

T D Syanevets and T V Sudakova

ORGANIZATIONAL LOYALTY AS A CHARACTERISTIC OF MANAGEMENT QUALITY FOR ENERGY COMPANY

Abstract: Globalization leads to the diminishing of national economic systems boundaries, standartization of production processes and companies management, thus it is becoming more difficult to form competitive advantages. Research has shown that company's competitiveness, its reputation, are dependent on management quality which is influenced by many factors including level of personnel loyalty.

Problem with personnel loyalty is common for most Russian energy companies, which management believe that workers should work effectively as they get paid for it. Research shows that there are several problems in this field: lack of effective communications between management and workers, lack of workers interest in the results, low motivation in goals achievement, low innovative behavior and so on. Management consider these problems when it is too late and company faces bankruptcy and there is no time to alter the situation. Competencies in managing personnel loyalty defines important component of management quality – goodwill. Goodwill is a number of business elements and personal characteristics of workers, which stimulate clients to continue use of products and services of particular company and bring additional profit.

Y Zhilkina, A Akhmetshin

RISKS IN THE ENERGY SECTOR: THE ANALYSIS OF MANAGEMENT PRACTICES IN THE ELECTRICITY MARKET

Abstract: Energy security is today one of the most discussed in international economic relations, the Russian political and business community, the regions and all consumers. It is being actively discussed by all governments and leading international organizations. But it should be noted that currently no universal definition of energy security is simply not there. In addition to the lack of such a

universal definition, analysis of decisions in this area, one notices the lack of attention to such phenomena as risks in the energy sector, especially in the management of investment projects in the industry.
To serious threats to Russia's security should be attributed to her unstable and vulnerable economic situation caused by the destruction of the old unions, the persistence of discriminatory restrictions in relations with Western countries, leaving the traditional markets, greater reliance on economic ties with other countries, increasing opening of the domestic market, often to the detriment of its own national interests.

E V Alekina, O S Popkova, G N Yagovkin,
WORKING CONDITIONS AS A SOCIO-ECONOMICSIGNIFICANT CATEGORY
Abstract: The paper identifies the main components of the socio-economic category “working conditions”, including all socio-economic and organizational-technical factors influencing the person’s preparation for active participation in work activities without accidents and other incidents, which is an objective necessity in modern society.

D R Peskova, J P Vasileva and U A Nazarova and Z F Sharifyanova
WORLD AND RUSSIAN FUEL AND ENERGY MARKET DEVELOPMENT PERSPECTIVES AND DRIVERS
Abstract:. The fuel and energy sector of the world economy and of Russia in particular is surviving heavy and high-speed transformations which inevitably will touch everyone. This article aims to analyze the modern tendencies of Russian worldwide natural resources perspectives of development and to understand the potential of economic drivers. Therefore the current picture of oil and gas market for Russia and others countries was evaluated. Possible risks for Russian Federation including entrepreneurial difficulties were studied. Using econometric methods the features influencing the amount of oil extracting were defined. The research allowed us to conclude that the major significant variable influencing oil extraction is “Well yield per day”. According to this result we may state the initiating of new oil fields is of great need in Russia.

O V Novikova, A E Erastov, S A Livshits
EFFICIENCY OF THE ELECTRIC POWER ENTERPRISE
Abstract: The electric power industry is at the dynamic development stage, which follows with the reconstruction and modernization of fixed assets. It is necessary to understand that this process is conducting to the risks that the company will bear in the innovative projects implementation. In this regard, the issues of the electric power enterprise efficiency management are relevant. In addition, in a market economy, the factors of both external and internal

environment can affect the efficiency of an enterprise. The set of these factors, as well as the strength of their influence can vary depending on the industry and enterprise's activities. In this regard, the purpose of this study is to formulate a system of recommendations for managing the efficiency of an electric power enterprise. The object of research is the electric power enterprise of IDGC of the North-West, PJSC. The result of the study is an econometric model, which describing the influence of external and internal factors on the electric power enterprise efficiency. The recommendations developed on the basis of this econometric model are relevant for the construction of strategies and management systems for the effective operation of electric power enterprises

E A Konnikov, K V Osipova, N A Yudina

THE PREVALENCE OF RENEWABLE ENERGY IN THE RUSSIAN ENERGY MARKET

Abstract: The energy crisis of 1973-1974 showed that it is difficult to constantly increase the power supply of production, based only on traditional energy sources. The power supply of society is the basis of its scientific and technological progress. It means that it is necessary to introduce unconventional, alternative energy sources more widely. Unlike fossil fuels, unconventional forms of energy are not limited to geologically reserves. Their use and consumption does not lead to the inevitable exhaustion of stocks. However, currently, the reform of world energy markets and increasing the share of renewable energy sources in their structure is a long and innovative process. Lots of countries (Russia in particular) bear significant risks because of reforming their own energy market, which causes a slight increase in the share of renewable energy sources. In this regard, the purpose of this study is to analyse the influence of environmental factors on the development of renewable energy sources in Russia. The result of this study is a system of econometric equations, which allows to evaluate the impact of changes in key drivers of the development of the renewable energy market.

Y Zhilkina, D Vodennikov, I Maslov

MECHANISM OF BUSINESS ENTITIES INNOVATIVE DEVELOPMENT MANAGEMENT (ORGANIZATIONAL AND ECONOMIC APPROACHES)

Abstract: The development of the national economy and the increase of domestic enterprises competitiveness are associated with the transition to an innovative model of economic development. We proposed the structure of organizational and economic mechanism, which distinctive characteristic is the composition of the interaction process of subjects and objects of management. As subjects of management in mechanism we singled out three subsystems: functional, process and administrative which are the bases of innovative

development. As a result of the research it is found that the process of innovative development management should be considered as a set of subprocesses series, reflecting the combination of the main stages of the innovation life cycle. We proposed scientific and methodical approach to evaluate the effectiveness of entities innovative development management, which allows us to assess their level of innovation and generate proposals for adjusting innovation strategy.

N Ponomareva, A Zvereva, E Golubtsova, S Ilyashenko and G Ivanov

CERTAIN ECONOMIC INSTRUMENTS AS A FACTOR OF REALIZING THE POTENTIAL OF USING ALTERNATIVE ENERGY SOURCES IN RUSSIA

Abstract: With each passing year, the problem of using alternative energy sources is gaining increasing attention, since the energy of the sun, water and wind,unlike hydrocarbons, belongs to practically inexhaustible resources. Besides this, alternative energy sources are relatively environmentally friendly, so any country is interested in using them. One of the factors affecting the increase of energy generationfrom alternative sources is the legal regulation of this area by the government. In many foreign countries a number of conceptual, doctrinal and program documents are adopted and implemented, whichare dealing with the use of renewable energy sources. In order to stimulate the use of alternative energy sources, the governments of some countries create favorable conditions for attracting investment in the development of this sector, which, further, not only creates new jobs, but also has a generally positive effect on the economy.

I P Saleeva, A V Sklyar, T E Marinchenko, M V Postnova, A V Ivanov and A I Tikhomirov

EFFICIENCY OF ALTERNATIVE ELECTRIC POWER INDUSTRY OF POULTRY FARMING

Abstract: The growing poultry industry needs additional energy resources. To improve the efficiency of the energy systems in poultry farms (hereinafter referred to as PF), energy saving options were evaluated by modeling: using different tariffs, changing suppliers, changing the supply voltage, entering the poultry farms to the wholesale electricity and capacity market. Studies have shown that the poultry farms can radically reduce the cost per kilowatt-hour through receiving electricity from an alternative source that works on the saved gas.

I P Saleeva, A V Sklyar, T E Marinchenko, M V Postnova, A V Ivanov and A I Tikhomirov

FEASIBILITY STUDY ON INNOVATIVE ENERGY-SAVING TECHNOLOGIES IN POULTRY FARMING

Abstract: The feasibility study on the effectiveness of locally and generally room livestock population heating at typical poultry houses through a joint radial convection heating system using dark infrared irradiators has been performed. The results of the thermal imaging survey of the heat insulation of poultry houses are presented. The efficiency of the combined heating system and thermal audit of poultry houses for their repair is confirmed by the practice of introducing them in a number of poultry farms.

O V Luskatova, M V Roberts and E N Dolzhenko

COMPARATIVE ANALYSIS OF OPTIONS FOR PROJECT FINANCING OF ENERGY PROJECTS BASED ON RENEWABLE SOURCES

Abstract: The implementation of generating capacity projects based on renewable energy sources is facing problems of sustainable and affordable financing. In the Russian Federation the generated power of alternative energy facilities in 2018 was less than 1%, but the State Program "Energy Development" assumes bringing the value of this indicator to 4.5% in 2024. The necessary condition for solving this task is to develop an optimal scheme for attracting investments from government and private sources. In Russia various forms of project financing for the capital-intensive innovative technologies are used such as: with the involvement of bank capital, under the program “Project Finance Factory”, the creation of special project companies, on conditions of public-private partnership. In the article the substantiation of the best option for financing the project of the creation of generating capacities of solar power factories in the Saratov region is carried out. The optimal results of the project can be achieved by combining borrowing from authorized banks with government support measures within the framework of project financing.

O V Luskatova, R A Eyvazov and M M Haytanova

PRIORITY LINES OF THE ENERGY SECTOR DEVELOPMENT IN THE REPUBLIC OF TURKEY

Abstract: The impact of renewable energy sources on the national economy of the countries across the world will only increase in the near future. It is linked both with the policy of reducing the dependence on imported sources and the opportunities offered by alternative power. Having great prospects for using renewable energy sources in power generation, Turkey has been implementing coherent policy in this field. The article deals with the energy policy Republic of Turkey, analyzes its legislation, studies the trends in the alternative energy sector development as well as the current situation in the domestic power generation.

V Elistratov, I Kudryasheva

REGIMES, MANAGEMENT AND ECONOMICS OF ENERGY COMPLEXES ON THE BASIS OF RENEWABLE ENERGY SOURCES FOR AUTONOMOUS POWER SUPPLY

Abstract: The article describes the principles of creation, management and economics of power complexes based on renewable energy sources for decentralized power supply. The introduction of energy complexes based on renewable energy sources can compete with the centralized power supply of the regions by increasing energy security and reducing the risks of major accidents and disasters. Long-term contracts for the electricity supply can be a reliable and economical insurance in case of rising fuel prices in the long term.

L Rodina

RISK MANAGEMENT OF THE ALTERNATIVE POWER ENGINEERING

Abstract: The article summarizes the experience of risk neutralization arising due to the power generation from the alternative sources - solar, wind, hydraulic power engineering on the basis of ebbs and flows, the use of biomass power plants, etc. At the same time, the tool for blitz diagnostics of risks of the alternative power engineering is proposed in order to substantiate the economic feasibility of investments. The results of the risk assessment application of alternative power engineering reduce the level of information uncertainty relating to the transition to new energy sources or diversification of energy supply.

O K Lukhovskaya, T S Kochetkovaand, Y E Zhukova

THE REGIONAL CONSUMER MARKET AS A FACTOR OF STRUCTURAL SHIFTS IN ENERGY RESOURCES CONSUMER ECONOMY OF THE REGION

Abstract: The role of the consumer market in effective marketing policy formation of regions power is not debatable. It is necessary to recognize the regional consumer market according to projections as strategically important factor of the energy market structural changes in regions of Russia. Its balanced development provides acceleration of progressive structural changes in their economy. The scientific results given in the article and received by authors are directed to the consumer market justification as one of the leading strategic factors of power development in regional economy structure, in particular to the Ivanovo region, and analysis of its growth on of energy resources consumption efficiency. It is shown that the main consequence of structural transformations in economy was the sharp industrial production slowdown (in particular in textile production of the Ivanovo region) which was followed by decrease in energy consumption and its growth in services sector acted. The consumer market acts

as the dominating factor in electricity consumption and formation of a regional electorobalance now. Our researches are directed to justification of this conclusion at the moment.

L Švecová, G Ostapenko, J Veber and Y Valeeva
THE IMPLEMENTATION CHALLENGERS OF ZERO CARBON AND ZERO WASTE APPROACHE?
Abstract: The paper discusses the implementation challengers of approaches with zero - carbon emissions and zero - waste. Based on the analysis of world statistics of energy sources, environmental policies and plans in the field of decarbonization, application of renearable energy, the authors highlight challengers and barriers to implementation such plans in the indicated time horizon. Among the main barriers named the different readiness of many countries and global energy players to reduce fossil fuels in energy mix. The paper shows other ways of energy saving, focusing in circular economy implementation. Based on the results of Czech Republic's experience in the field of it is identified, that Czech Republic is slowly embracing the zero waste approach; both awareness of people and practical applications of zero waste circular economy new concept are low in business and among the young generation. The practical implication of findings and some recommendations to environmental education and governments are introduced.

P.I. Okley, V.K. Lozenko, R.I. Inamov
METHODICAL APPROACH TO ASSESSING THE EFFECTIVENESS OF THE MANAGEMENT SYSTEM OF THERMAL POWER PLANTS IN RUSSIA
Abstract: Physical deterioration of thermal power plants based on hydrocarbon fuels leads to technological violations (TV) in their work. Low rates of renewal of thermal generation predetermines the further exploitation of old capacities. In this regard, the activity of the management of energy holdings (EH) is more focused on maintaining the equipment in working condition. The methods, approaches and tools underlying decision-making by the management of energy holding companies are different, respectively, the results of the functioning of the organized management systems (MS) of each company are also different. To assess the effectiveness of the management system it is proposed to use such a generalized indicator as the number of technological violations per year per 1 GW of installed capacity.

J V Torkunova, M N Habrieva and B. K. Shapkenov
QUALIMETRIC APPROACH TO SOLVING THE PROBLEMS OF INNOVATIVE DEVELOPMENT OF RUSSIAN POWER INDUSTRY

Abstract: The article discusses selected issues of the development of the power industry in Russia. The relevance of the development is related to the development of the electric power industry, meets the Federal Law of the Russian Federation No. 399 “On Amendments to the Federal Law“ On Energy Saving and Improving Energy Efficiency ... ”dated 12/28/2013. The article used statistical methods, the method of averages, the index method ; analyzed trends in the production and consumption of electricity in the Russian Federation; Cause-and-effect relationships between production, consumption, and rising electricity prices have been identified; developed criteria for evaluating the effectiveness of measures to implement the program for the development of the power industry proposed the author's approach to calculating the degree of effectiveness of the measures taken to ensure the implementation of the program; justified the conclusion about the need to create an institutional system as a mechanism for the innovative development of the electric power industry.

T G Bondarenko, A I Bolvachev

METHODOLOGY FOR ASSESSING THE ECONOMIC EFFICIENCY OF INVESTMENT PROJECTS IN PETROCHEMICAL COMPANIES

Abstract: The article focuses on the issues of investment potential of petrochemical companies and the need to develop a unified approach transparent for all the participants, to assess the efficiency of investment projects in petrochemical companies. The proposed methodology is to be applied to scheduling project costs and in fact, to ground the establishment of annual financing limits for a project. Additionally, the methodology is expected toreflect the possibility of updating the main indicators, both for financing the purchase of domestic and imported equipment. The methodology also takes into account the mechanism of contract pricing, recalculation of the cost of works and services is performedaccording to the rules and regulations approved for the estimates in any petrochemical company, inclusive of the indices of changes in current estimated cost to base period prices.

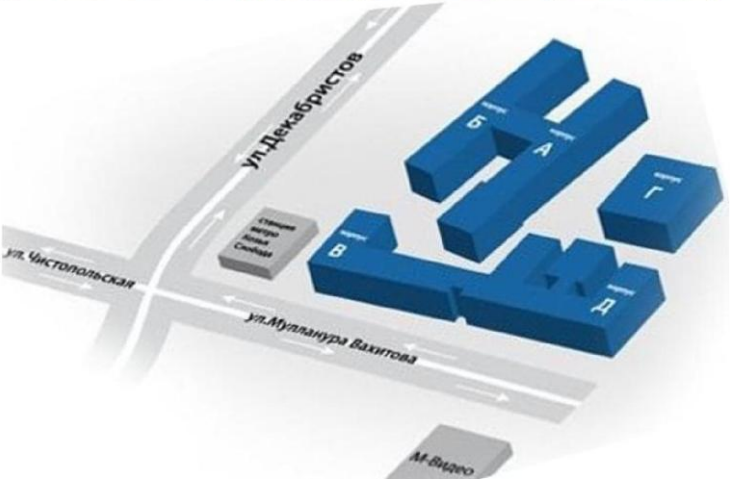
The proposed methodology for assessing the performance indicators of investment projects is one of the most multi-faceted and optimal tools for petrochemical companies for attracting additional funding from boththeir own and other sources. In the conditions of growing business volumes, and in case of complying with the recommendations of the state strategy for the industry growth until 2030, the proposed methodology is transparent and relevant to all the investment participants in terms of cash flow generation for the project.

N V Puzina, A AVereteno, E A Luneva and N V Katunina

MANAGEMENT OF LOYALTY IN DEVELOPING A COMPANY'S BRAND ON THE RUSSIAN OIL AND GAS B2B MARKET

Abstract: In this article the importance of lifestyle and preferences of the decision-makers as parts of management of loyalty is considered in developing a company's brand on the Russian oil and gas B2B market. Definitions of the concepts "brand" and "loyalty", types of loyalty, loyalty program development stages are given. The marketing research for development of the loyalty program of the oil trading company is conducted. In the article the results (characteristics, opinions and preferences of the decision-makers on the Russian market of light oil and liquefied hydrocarbon gas products) are given.





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