

Summaries

JERZY ALENOWICZ, MAREK ONICHIMIUK, MARIAN WYGODA

Extreme Loadings in the Process of Design and Exploitation of Bucket Wheel Excavators Intended for Operation in Hard Diggable Soils of Brown Coal Opencast Mines • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

Problems connected with extreme loadings modelling in the process of design and exploitation of bucket wheel excavators intended for operation in the hard diggable soils, have been presented in the article. Existing deterministic model of bucket wheel loadings has been described. New statistical approach to digging forces modelling of hard diggable soils with bucket wheel excavators has been presented on the basis of actual research on parameters of this process. Extreme values of statistical asymptotic distributions of steel structure stress and unit digging resistances are the basis for modelling. The model of component tangent digging force operating directly on the edge bucket of bucket wheel excavators was proposed. The further procedure connected with verification of proposed statistical model was discussed. The advantages resulting from use of the above model in design and exploitation of opencast mining bucket wheel excavators were given.

Keywords: *opencast mines, hard diggable soils, excavators, loadings, modeling, design, exploitation*

JAN ANUSZCZYK, MARIUSZ JABŁOŃSKI

Electromechanical Driving Systems Tests of the Spreader “ZGOT” • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

Paper presents the results of laboratory and industrial testing of the caterpillar drives of the loading feeder of the spreader ZGOT-15400.120 working in the strip pit Szczerców of the KWB “Bełchatów” Mine. The electromagnetic and electromechanical transient states in the drive systems have been analysed. A new conception of sensorless steering algorithm modification in the CUVC board controlling of converter has been introduced. After proposed solution the decrease of motors torque oscillations and mechanical vibrations in the low frequencies range of converter work was obtained.

Keywords: *surface mining, spreader, driving systems, frequency converter, steering algorithms*

SŁAWOMIR BŁASZCZYK

The monitoring of the condition of „Kozmin I” mining ground using GPS technology • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

In order to check the range of the influence of mining works on „Kozmin I” mining ground, „Adamów” Coal Mine Plc in Turek took actions aiming at conducting scientific research using precise satellite measurements. The article includes some basic information concerning the calculation of reference and controlled point coordinates in order to describe absolute relocations. The works preceding the measurements have been discussed, that is the choice of the location of the points taking into consideration A-2 motorway in particular. The authors of the article have also described building and assembling signs in the ground which make up geodesic two-functional base on the mining ground in order to mark possible relocations. The report from conducting the initial satellite measurement has been presented here together with the conclusions. The Department of Geodesy and Navigation of Warmińsko-Mazurski University in Olsztyn is the scientific unit conducting the research.

Keywords: *mining ground, surface deformations, relocations of points, satellite GPS measurements, point coordinates*

REBECA BÖHNER, CHRISTIAN NIEMANN-DELIUS

Numeric Dispersion Calculations for Evaluation Measures and Prediction of Particulate Matter Emissions by Surface Mines • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

In January 2005 a new European Legislation on Air Quality became effective. Since this time, strict limit values for particulate matter in the outside air apply to the member states of the European Union. Surface mines have come in the public focus, because particulate matter concentrations are substantial in their vicinity. The material mining industry operating open pits contributes to particulate matter concentrations on account of the spatial extent of its operations and the related processes. According to the EU law every particulate matter polluter is obliged to reduce its emissions and start measures to reduce dust if necessary. Therefore, action plans have been drawn up and implemented for example for the Hambach and the Garzweiler mine in the Rhenish Lignite District in Germany. The measures mostly comprise technical means, but the effect is not yet complete scientifically established. The development of adequate measures to avoid particulate matter emissions is a central task for companies as well as for public authorities. An important part in this is the knowledge of the processes that entail particulate matter concentrations. The aim is to pinpoint particulate matter concentrations and detect the processes which are responsible. Next to selective measurements, numeric dispersion models constitute an important monitoring and forecast procedure. The results enable delivering a clear picture of the emissions and their dispersion, to guide planning and to achieve the standards of the current and future air European quality regulations.

Keywords: *strict limit values, emission, opencast mining*

TOMASZ CHMIELNIAK, JÓZEF POPOWICZ, WŁODZIMIERZ SARNECKI

Study of Lignite Gasification for Methanol Production • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The performance of methanol production plant based on lignite gasification using commercially available technology was simulated. For lignite gasification the entrained flow, dry feeding gasifier was selected. Pre-feasibility study of the plant processing 2 million ton of raw coal (50% water content) was presented and discussed. For considered plant configurations, results of analysis confirm economical feasibility of the technology.

Keywords: *lignite, gasification, methanol*

ANDRZEJ CHROST, LEOPOLD CZARNECKI, ŁUKASZ KRYWULT, JOACHIM SCHNEIDER-GLÖTZL

The Use of the Photo-Elasticity Technology of Measurements in Slope Stability Monitoring • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The article discusses issues connected with possibilities of the use of photo-elasticity technology in large geotechnical objects. It describes the installation of the prototype geotextile with polymer optic fiber on the slope failure in Belchatów open cast mine and it presents the results of measurements.

Keywords: *The Geotextile, Optical Time Domain Reflectory, Polymer Optical Fiber, deformation terrain, monitoring of slopes failures*

BOLESŁAW CIRKOS, MARZENA GURGUL

Activities Undertaken by PGE Elektrownia Belchatów SA Within the Context of the Development of Clean Coal Technologies. A Demonstration CCS Plant • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The application of the best available techniques (BAT) in design and construction of the plant and all the power generation facilities guarantees the compliance with all the environment protection standards, both the national ones and the EU ones. In 2007 the Belchatów Power Plant started the implementation of a comprehensive modernization and refurbishment programme of units no. 3–12, which will end in the year 2013. The modernizations will reduce considerably the emission of pollutants, especially nitrogen oxides and such greenhouse gases as carbon dioxide. Since 2007 the development of the low emission carbon technologies in PGE Elektrownia Belchatów SA has resulted in the ongoing research and preparatory works on the construction of a CCS plant fully integrated into the 858 MW unit. The demonstration post combustion CO₂ capture plant of the 858 MW unit will be based on the advanced amine technology. It will capture yearly around 2.1 million tons of CO₂ from flue gases. The project execution will

enable the Company to obtain both the necessary engineering knowledge and experience in the design, construction and operation of CCS plant, and subsequently — their optimization and future commercial use. PGE Elektrownia Bełchatów SA has endeavoured to get qualified to the EU CCS Demonstration Programme.

Keywords: *best available techniques (BAT), desulphurization plants, comprehensive modernization of units, carbon dioxide capture and storage, advanced amines, CCS demonstration plant*

JÓZEF DUBIŃSKI, ANTONI TAJDUŚ

The Opportunities and Threats for the Polish Lignite Mining in the Light of Global and European Conditions • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The main assumptions of the “Polish energy policy until 2030” and the role of lignite in its implementation as a stabilizer of the energy’s security have been presented. The significant potential of mining lignite industry both in terms of resources as well as production has been emphasized. It is supported by the research and engineering institutions, producers of machinery and equipment. Global and European trends in the development of lignite production has been discussed. The paper points out on the existing environmental conditions, which may create difficulties for development of lignite mining in Poland. The proposals of the actions in order to minimize the threats and ensure the efficient functioning of lignite mining in Poland have been formulated.

Keywords: *energy policy, energy’s security, mining, lignite, resources basis*

RYSZARD FRANKOWSKI, ANDRZEJ GADEK

Update of Stratigraphic Model of Brown Coal Deposit „Belchatow” in Area of Belchatow Field Using Mincom Software • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

After four years of utilizing digital model of the deposit, in result of drilling many new research drill holes, in the beginning of this year (2009) undertaken was the task to update the possessed model in the area of “Belchatow” field. In the result of gained experiences introduced was a new way of creating contour lines based surfaces, that are used to apply trends to geological layers modeled. This new approach to the process of creating of trend contour lines as well as taking into consideration new drillings and associated new quality samples results in better quality and better match between model and the reality uncovered in result of exploitation being carried. Currently the updated model allows for more reliable and more accurate mine plans to be created. This article describes work performed by Geological department of PGE KWB “Belchatow” SA (Belchatow mine) in cooperation with Katowice (Poland) branch of Mincom International.

Keywords: *computer aided deposit modeling, Belchatow, Minescape*

ANNA GAWIN

Using Digital Terrestrial Photogrammetry to Update Numerical Map in Opencast Mines • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

One of the basic tasks of surveying mining services in outcast mining is performing geodesy works related to the construction, expansion and movement of a mine, including surveying the taken overburden and mined mineral. Close-range photogrammetry is a method that allows the periodical surveying of exploited mining opencasts to be performed quickly and in a safe way. It is used in PGE KWB “Belchatów” SA from the middle 70s of the last century. However, the analytical photogrammetry used so far, based on analogue solutions, is not sufficient anymore. Considering economic factors, technological development and work ergonomics in mining surveying, some activities has been performed, aiming at implementing new surveying methods to update digital opencast model in PGE KWB “Belchatów” SA. In 2005, the Department of Surveying started the new technology implementation program, using terrestrial digital pictures and digital workstations to perform photogrammetric measurements. This paper presents the technological process and the results of the research related to the possibility of using digital photogrammetry for opencast mining purposes in the scope of numerical map updating.

Keywords: *digital photogrammetry, terrestrial photogrammetry, numerical map, open pit mining*

LECH GŁADYSIEWICZ, WITOLD KAWALEC

Long Distance, Energy-Efficient Belt Conveyors • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

New generation of energy-efficient belt conveyors for lignite mining industry has been proposed. These conveyors would be suitable for long distance links between the planned lignite pits and the existing power plants. This solution would allow to extend the lifetime of the power plants which would help to decrease the costs of generated power. Results of investigations of belt conveyor resistance to motion together with the available sophisticated, specialised software enable to analyse the influence of various parameters on belt conveyors drive energy efficiency. The theoretical analysis points on the key directions of a belt transportation modernisation. Effects of possible improvements causing the decrease of a belt conveyor resistance to motion are investigated and verified by tests. The results of research and development works focused on main elements of high capacity belt conveyors: idlers and conveyor belt, encouraging conclusions of analytical reports as well as numerous implementations of energy-efficient belt conveyors worldwide suggest that extensive efforts in this field should be done.

Keywords: *belt conveyors, resistances to motion, idlers, conveyor belt*

JAN ICIEK, KRZYSZTOF ZIEMIŃSKI, ALICJA ZAWADZKA, MONIKA KOWALSKA

Alternative Methods of Energy Recovery from Brown Coal • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The significant supplies of brown coal in Poland make possible search the solutions, which make possible the exploitation of deposits about small supplies or the layers of carbon of the young which characterize with low calorificity. The costs logging of energy in traditional way will rise because of burning the carbon grew up with attention on requirement. The methods of traditional exploitation of brown coal can also encounter on technological difficulties as well as the opposition of local communities. The underground gasification of brown coal can turn out with future technology in case using deposits about small volume. Received in result of process UCG — the syngas or the biogas being the product of biogasification, the balanced alternative fuels can make up.

Keywords: *brown coal, method UCG, biogasification, methanogenic fermentation*

ZBIGNIEW JAGODZIŃSKI

Influence of Dumping Method on Residual Pit's Volume on Example of Open Pit "Drzewce" in Konin Lignite Mine • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The article broaches the subject of determining how dumping method affects the size of residual pit. This issue is bound up with the drive to minimize exploitation costs through complex design of the entire excavating process while taking into account the costs of future residual pit liquidation. The algorithm of calculating particular volumes of the opening cut, internal dump and finally — of the residual pit is presented. The calculations are presented in the example of „Drzewce” pit in Konin Lignite Mine.

Keywords: *lignite surfer mining, opening cut, dump, residual pit*

PAWEŁ KACZYŃSKI, JERZY CZMOCHOWSKI

The Analysis of Fractures Forming in the Connection Region of the Steering Frame and the Caterpillar Girder • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The most important problems during surface mining are fractures of a mining machines load-carrying structures. They occur most often in the connection region of the steering frame and caterpillar girder. The greatest forces affect this elements in a case of changing the trajectory. According to standard DIN 22261 fatigue calculations of undercarriages are not compulsory. In this article the fracture source of a loading elevator undercarriage connected with an excavator SchRs-4000 was analyzed by the use of numerical methods. The forces acting on the undercarriage were calculated. The Finite Element Analysis was carried out and the results were presented in this paper. On the basis of FEA the fracture spots of a load-carrying structure were specified and the proposals of strengthening were suggested in order to improve fracture toughness.

Keywords: *bucket wheel excavators, finite element method, turn mechanism of caterpillar*

RENÉ KAHNT, VOLKER SONTAG, THOMAS BAUCH

Simulation Model for Lignite Handling at the Boxberg Stockyard • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The new-built unit R of the Boxberg power plant and the re-commissioning of the Reichwalde opencast mine in 2010 require the extension of the coal stockyard at Boxberg (KLP Bx), to meet the considerably higher coal handling requirements. Therefore, the plant-technical concept of the KLP Bx was extended. Aim was to proof the viability of the selected plant concept for a safe operational management, i.e. coverage of the coal handling via the coal stockyard within one reference week under consideration of the various technical and technological conditions under the given marginal conditions. A conventional verification was not possible due to the high variability of the whole system. In cooperation with GMB Senftenberg and G.E.O.S. Freiberg, a coal handling model was developed taking into consideration prioritized criteria for meeting the objective and marginal conditions. Based on the simulation tool GoldSim™ further considerations of variants are enabled. An outlook for further fields of application was presented and the limitations were explained.

Keywords: *simulation tool, simulation model, opencast mine, coal handling model, coal stockyard, lignite handling*

ZBIGNIEW KASZTELEWICZ, JACEK KACZOROWSKI

Lignite Mines Revitalisation Based on the Example of Belchatów Lignite Mine • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The examples of lignite mine revitalization which were conducted in Poland and abroad were presented in the article. The attention was paid to the difficulties of lignite mine reclamation and possibility of their attractive regeneration. Mine closure and its reclamation are presently the Belchatów Lignite Mine challenges. Nevertheless, this process will take a few dozen years, the vision of final revitalization should already be created. It ensures proper process of closing down and reclamation of the post-mining region course. Concept for Belchatów Lignite Mine closure and revitalization, which was worked out by AGH University of Science and Technology staff, was presented in the article.

Keywords: *lignite mines, closure down, revitalization, reclamation*

ZBIGNIEW KASZTELEWICZ, JACEK KACZOROWSKI,
SŁAWOMIR MAZUREK, DARIUSZ ORLIKOWSKI, STANISŁAW ŻUK

Present Status and Development Strategy of Brown Coal Industry in the First Half of XXI Century • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The article introduces the present state of brown coal mines, including fundamental production parameters from the beginnings of operation till year 2008. The main part of the article are assumptions concerning individual mines about sustaining and developing production capacity both in existing and perspective basins. There are also possible quantities of coal output, quantities of power and production of electric energy in active and new power plants as well as chemical processing of brown coal to liquid and gas fuels shown in the paper.

Keywords: *opencast mining, brown coal, power industry, energetic safety*

ZBIGNIEW KASZTELEWICZ, KRZYSZTOF POLAK, MACIEJ ZAJĄCZKOWSKI

The Possibilities of Implementing Clean Coal Technologies in the Brown Coal Industry in Poland • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The climatic policy of EU is being gradually modified because of different understanding of the climate protection in member countries and because of the costs related to its implementation in particular states. However its goals are constant: reduction of greenhouse gases to the atmosphere, reducing the power consumption and increasing the participation of renewable energy sources. Independently of the final form of EU's energy-climate package the brown coal industry in Poland has to prepare for its consequences. Therefore it is necessary to implement so called "clean coal technologies" and expand the directions of brown coal usage. The article describes available and perspective coal technologies that — if implemented — would allow to decrease CO₂ emissions in Poland. The particular emphasis is put on: increasing the efficiency of power units running on brown coal, capture and storage

of carbon dioxide as well as both underground and surface gasification of brown coal deposits. Future research directions over developing the most favorable in Polish conditions are shown, taking environmental, economical and technical considerations into account.

Keywords: *EU energy-climate package, CO₂ emission, clean coal technologies, efficiency of power units running on brown coal, CCS, brown coal gasification*

ZBIGNIEW KASZTELEWICZ, MIRANDA PTAK

Ten Most Important Postulates of Brown Coal Industry in Poland Considering Current Conditionings • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The article introduces 10 most important postulates that can emerge during analysis of brown coal industry's position in Poland. The postulates concern different thematic layers. Particularly they refer to law regulations that should be — according to the authors — simplified. Furthermore, among the brought up postulates are the matters of deposit ownership and the status of brown coal as strategic mineral. The article is not lacking in difficult, disputable questions for which answers should be searched for in the currently developed energetic policy of the state and the conception of land use planning in Poland. Arrangements contained in these documents will determine the position and condition of brown coal industry in the following decades. So, according to the authors, it is even more crucial to take care of implementation of the “10 commandments” that serve the energetic safety based on Polish brown coal.

Keywords: *opencast mining, brown coal, power industry, energetic safety*

PAWEŁ KIELBIK, MARCIN PAPIERKOWSKI, MARIAN ROTKO, JAN SKORODECKI, WIESŁAW ZIELIŃSKI

On-Line Measurement of Ash Content in Lignite on Steel Cord Conveyor Belts • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

Paper presents a new method of measurement of the ash content in lignite, providing a simple and relatively cheap solution to a problem of continuous monitoring of this parameter directly on the steel cord conveyor belts. This method, possible to be utilized in points where till now practically none measurement was possible, has been introduced on the background of radiometric methods used so far in continuous measurements of ash content in lignite. The paper provides a general description of methods used in continuous measurements of the ash content on usual belts (textile), a new backscattering — absorption method, as well as findings from tests of the ash monitor prototype executed in conditions of industrial exploitation at one of the main conveyer flight in PGE KWB “Belchatów” SA.

Keywords: *lignite, on-line measurement of ash content, radiometric methods, steel cord conveyer belts*

WIESŁAW KOZIOL, ŁUKASZ MACHNIAK

Selected Technology of Hard Workable Rocks Excavation in Lignite Open Pit Mines • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The paper describes geological and qualitative characteristic of hard workable rocks on a example of lignite deposit „Belchatów”. The analyses methods of rocks workability classification with BWE were executed. The attention was paid to development the technology using compact bucket wheel excavators with high digging forces. Auxiliary technologies like too: hydraulic excavators, surface miner, rippers and hydraulic rammers were also introduced. These technologies can pick up efficiency of excavation hard workable rocks.

Keywords: *excavation of hard workable rocks, classification of rocks workability, compact BWE*

KRZYSZTOF KRAUZE, KRZYSZTOF KOTWICA

Application of Cutting Head for Cohesive Floor Mining in Hard and Brown Coal Mines • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

Formations of cohesive rocks, which are hardly mined with use of actually used bucket-wheel excavators are often found during blanket mining in brown coal mines. A new solution of the cutting system moved on caterpillar

chassis allowing mining of such rocks has been described in this study. Construction and principle of operation of such cutting unit, as well as preliminary results of the machine operation have been described for conditions met during floor mining in underground mines.

Keywords: *cohesive rock, floor mining, cutting tool, caterpillar chassis*

KRZYSZTOF KRAUZE, KRZYSZTOF KOTWICA, PETER SCHEFFZYK

Adaptation of ESZ 6/45-Type Excavators Equipped with Modern Electric Drives • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

Results of preliminary works aimed at modernization of ESZ 6/45-type dragline excavators with walking chassis have been presented in this study. The modernization comprised replacement of actually used low-efficient driving systems based on d.c. motors with modern driving systems based on a.c. motors. The replacement in question was accompanied by the machine control system modification, including modification of pneumatic and central lubrication systems. Moreover, a new solution of the operator cab construction has been designed for the modified machine. The targeted works were accompanied by inventory control of the excavator subassemblies, including their visualization. The machine stability was also tested.

Keywords: *dragline excavator, electric motors, visualization, stability*

RENATA MARTYNIAK, WOJCIECH SOŁTYK

Chemism Changes of Underground Waters Occurring as a Result of the “Bełchatów” Brown Coal Deposit Dehydration, Taking Their Influence on the Natural Environment Into Account • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The largest strip mine in Poland, KWB “Bełchatów”, began operating a drainage system on the Bełchatów Field in 1975. The drainage system is one of the fundamental and most important elements required for correct and safe functioning of the entire system of mine works. In order to exploit a brown coal deposit, it is necessary to lower the level of underground waters below the exploitation levels with target depression totalling 300 m below terrain level. The quality of underground waters pumped by the sunk drainage system is transformed by geological and hydrochemical factors as well as changes under the influence of anthropogenic interactions.

Keywords: *underground waters, average concentration, chlorides, sulphates, chemical composition of waters*

EUGENIUSZ MATRAS, RYSZARD REIZER, WOJCIECH UMIŃSKI

Modernization of Caterpillar and Steering Screw Drives of SchRs 4600 Excavators for Brown Coal Mine Belchatow Concept and Technical Project • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

Brown Coal Mine Belchatow decided to modernize caterpillar and steering drives of SchRs 4600 excavators that have been build by Krupp of Germany in the seventies of 20th century. In the paper a concept and technical solutions that fulfil the aim of modernization are presented. DC motors driving excavator caterpillars are replaced by AC motors. Each AC motor is supplied and controlled by an advanced adjustable frequency converter. Frequency converters DC terminals are connected to the common DC bus. Such a solution makes it possible to control velocity each of the excavator caterpillar and return energy from motors working as generators to motors driving caterpillars while the excavator is turning. Additionally power feedback units are used to return electrical energy to the mains when AC motors work as generators while the excavator goes down the slope. A program logic controller (PLC) is used for control and monitoring of the multi-motor excavator drive system.

Keywords: *excavator, caterpillar drive, steering drive, frequency converter, controller PLC*

ADAM MIREK, LESZEK BIAŁY

The State of Natural Threats in Lignite Mines with Special Taking into Consideration Threats Occurring in Lignite Mine „Bełchatów” • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

In the paper reasons of main kinds of natural threats in Polish lignite mines and applied methods counteracting them, with special taking into consideration natural threats occurring in Lignite Mine „Bełchatów”, have been talked

over. The greatest attention has been paid to geotechnic threat, which is potentially the most dangerous threat for continuity of activity of mine pits and the state of work safety. Some examples of events connected with individual kinds of threats have been showed. In summary, activities to continue and increase the state of safety towards natural threats occurring in lignite mines have been proposed.

Keywords: *natural threats, lignite, Belchatów*

VRATISLAV ONDRÁČEK, MICHAL REHOR

Restoration of North Bohemian Dump Localities • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

More than 70% of mined brown coal comes from the North Bohemian Basin these days. Open cast brown coal mining has lead to large damage on the landscape. That is why the reclamation work has become important on principle recently. Reclamation of phytotoxic areas is one of the serious problems in the North Bohemian Basin. It mainly concerns the areas with the occurrence of overburden rocks from the coal bed enriched with coal. The presented paper includes the characteristics of the suitable fertilizable rocks. The results are documented with the long term monitoring of physical, mineralogical, chemical and pedological parameters of rocks in the testing areas.

Keywords: *post-mining landscape, reclamation of dumps, restoration methodology including application of non-traditional methods, characteristics of geology and pedology, phytotoxic zones*

DARIUSZ ORLIKOWSKI, LILLA SZWED

Water direction of reclamation in KWB „Adamów” SA — investment for future of the region • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The report presents the problem of reclamation of terrains after lignite exploitation and is based on an example of KWB „Adamów” SA. It has been shown that water is more and more popular direction of reclamation. It describes three water basins built by the opencast mine. The report also includes further plans by KWB „Adamów” SA to build three other basins. The significance of the economic factor is highlighted as the major issue in the selection process of the reclamation method. The report concludes that there is a need to change the way of thinking when it comes to the reclamation process.

Keywords: *lignite, water direction of reclamation, water basins*

MACIEJ PAWLIK, ANDRZEJ OZIEMSKI

Estimation of Reliability Measures for Lignite Fired 370 MW Power Units • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The paper presents results of reliability analysis made for the 370 MW power units installed in the Belchatów Power Station. The concept of standardized power unit and the method of a histogram with a set number of observations in each class was applied in a study. The study includes analysis of probability distributions of operation times and repair times for the main power unit components. Empirical probability distribution functions are identified and their parameters are estimated in the study. The final forecast includes an estimation of such reliability measures like expected operation time, expected failure rate, average repair time and expected annual failure duration.

Keywords: *power unit, reliability, probability density function*

MARCIN PIETRZYKOWSKI, JAROSŁAW SOCHA, WOJCIECH KRZAKLEWSKI

The Potential to Produce Energy from Tree Stand Biomass on a Reclaimed Plateau of External Mine Slope KWB „Belchatów” • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The aim of the work was to quantify the biomass, and potential for renewable energy production, of a stand of Scots Pine (*Pinus sylvestris* L.), in the first age group (up to 20 years), that grow on the external slope of the “Belchatów” lignite mine. The results were compared to managed forests in the vicinity of the slope. The research was conducted

on 8 experimental plots (10 × 10 meters) in two trophy variants (quaternary loamy sands and tertiary pyritic strata after neutralization) using 12–19 year old tree stands, with 4 replications for each variant. One control plot was arranged in managed tree stands adjacent to the mine. It was found that post-mining sites, compared natural site, have an average 30% potential for biomass production and carbon sequestration. The range of tree stands' biomass, on the lignite mine slope, was 8 to 40 Mg ha⁻¹, and average 25 Mg ha⁻¹ dry biomass. Potential *production* of renewable energy was estimated to be 80 to 400 kJ ha⁻¹ × 10⁶, and average 240 kJ × 10⁶ ha⁻¹. Total energy potential on the external slope plateau (approximately 300 ha) was 24 000 to 12 000 and average 130 000 kJ × 10⁶ ha⁻¹. The results show the potential to manage post-mining sites, as tree plantations for renewable energy production.

Keywords: *external slope, forest reclamation, Scots pine, biomass, renewable energy*

TADEUSZ RATAJCZAK, ELŻBIETA HYCENAR, WALDEMAR JOŃCZYK

The Anthropogenic Deposits and Value of Collect Rav-Materials on Example KWB “Belchatów” SA • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The uncoaly bed-rocks and roof-rocks play particular role in widely understood problems of functioning mining industry. They bear name associated raw materials in some situations. The occurrence of associated raw materials is related with not only operational, qualitative and ecological problems. They are piled in the form of artificially created anthropogenic deposit for protection before their irrevocable loss. The manner of storage and disparity of lithological associated raw materials as well as the interactions among components can cause change of usefulness relatively to natural sediments in lignite deposit. The situations enforce for realization of additional research of qualitative and formation.

Keywords: *associated raw materials, resource managements, anthropogenic deposit, resource properties*

ALINA REJMAN-BURZYŃSKA, EUGENIUSZ JĘDRYSIK, JERZY ŚWIĄDROWSKI

Economic and Ecological Aspects of the Conversion of Coal to Liquid Fuels • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The main objective of coal conversion into liquid is to increase hydrogen to carbon atoms ratio from the level of 0.8 in the coal matter of feed to the level about 2.0 in the product. There are four different theoretical reactions of the additions or the distribution of hydrogen in the coal matrix which give the base for different processes constituting the technology of the coal liquefaction. Generally those processes can be classified in three main categories: the direct hydrogenation, the indirect hydrogenation and the carbonization. The choice of technologies and processes forming particular conversion pathway depends on economic and ecological factors. Currently apart from economic factors such as price of fuels and raw materials, the main constrain of application of processes for production of liquid fuels from coal is the need of limitation of the emission of greenhouse gases (the carbon dioxide). The paper describes the idea of modeling system of coal liquefaction plants allowing to optimise the coal liquids production schema with the respect to economic and environmental constrains.

Keywords: *coal liquefaction, chemical technology, economic and ecological aspects of coal processing*

WOLFGANG ROLLAND, WOLFGANG KETZMER

Lusatian Lignite — Sustainable Mining to Meet Future Climate Change Policy • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

For Vattenfall, it is an important aspect of their entrepreneurial activity to make lignite sustainable in a climate-political perspective, in particular with regard to the economic development of the region. Under the headline “Innovative Energy Region Lausitz-Spreewald” representatives of the company, educational and other institutions and last but not least of policy are dedicated to a future-oriented development of Lusatia. An essential element of the long-term mining and power plant concept is the development of the CCS (Carbon Capture and Storage)-technology. Around 2020 this technology should be available for low CO₂ emission power generation based on lignite in commercial scale. Apart from climate-neutral lignite-based power generation, the expansion of the

energy-economic know-how and the use of other energy sources are among others important topics. This also includes the use of wind energy on reclamation areas, generation of biogas from biomass for power generation and the capture of CO₂ by microalgae. Of great importance is also the „low-energy housing“ topic, in particular for future resettlement locations. Lignite has its place in the energy mix, because first of all lignite is a chance for the future, especially in Lusatia.

Keywords: *reliability-openness-efficiency, future-oriented investments, future mine and power plant development concept, CCS technology, energy region Lusatia / Spreewald*

PAVOL RYBÁR

Mining Status in Slovak Republic during the Year 2008 • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

International Brown Coal Mining Congress in Bełchatów is an important discussion forum on the role of not only brown coal as a crucial energy material but also brown coal mining in Europe in general. The Slovak mining industry is one of the oldest in Europe. Slovakia possesses a significant number of documented raw materials deposits exploited by means of underground mines (4.3 million tons) and open pits (16.6 million tons). The scale of mining is adequate to the national economy needs. Open pits are mostly used to mine materials for the construction industry, whereas underground mines serve to produce coal, magnesite and small amounts of crude oil and natural gas. Slovakia mines about 2.3 million tons of hard coal and brown coal, which is a significant amount in comparison with other materials. The article presents the most important problems and issues connected with balanced development of Slovak mining in the light of current political, economic and ecological conditions.

Keywords: *opencast mining, Slovak Republic*

EDWARD SOŚNIAK, ROBERT CHALUPKA

Technological Conditions of Coal Exploitation in the II-Order Graben in KWB “Bełchatów” • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The paper presents the geological structure of the “Bełchatów” Lignite Deposit in the region of the II-order graben, including the geological and engineering conditions of mining this fragment of the deposit. The history of the project works aiming at rational using of the resources has been presented in chronological order. The author has described the approved realization concept indicating the geological and technological conditions of performing the works of exploitation and tipping in the Eastern part of the II-order graben. The approved project of lignite exploitation up to the ordinate of — 110 m above sea level might be modified during the exploitation according to the current geological and engineering conditions. The stage of performance of the projected works might be assessed after the year 2016, by which the mining works in this part of the deposit will have been finished.

Keywords: *lignite, II-order graben, mining optimization, exploitation technology*

JERZY SZYMAŃSKI

Lignite Conveyors with Regulated Speed of Belt. Technical and Ekonomical Aspects • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

Nowadays surface lignite mobile conveyor belts used about 10% of total mine electrical energy. About 50% of these energy consumption is possible to save by usage a new techniques in solution of conveyor belts electrical drive. The most important feature is belt speed regulation of coal conveyors. A Mass transportation is always a very costly and these processes must particularly be inspected to reduction energy consumption. As annual lignite production in Poland is about 62mln ton it is important climatic feature too. World wide companies offers of low voltage frequency converters with power up 1MW, which have a good price and reliability. These frequency converters need to be commonly used to build drives of coal conveyors with speed belt regulation.

Keywords: *brown coal, lignite, open pit, conveyor belts, coal conveyor chain, regulated conveyor's belt, voltage frequency converter*

ROMAN SZYSZKA, SŁAWOMIR PŁOMIŃSKI

The Optimisation of Wheel Excavators Buckets Mining Hard Mineable Formations • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The technological process of overburden removal in PGE KWB "Bełchatów" SA is being put into practice by use of SchRs 4000 and SchRs 4600 bucket ladder wheel excavators. Direct mining process is being made by buckets which are exposed to intensive wear process as a result of great amount of different, changeable workability class overburden masses removal. Significant deterioration of rocks mining conditions in Szczerców Field in relation to Bełchatów Field (workability class increase) caused the decline of buckets survivability in Szczerców Field even twice and three times what led to the increase of overburden excavators standstills and the increase of expenses for regeneration. The paper presents the optimisation process of bucket corners and cutters by use of welding methods as well as constructional (geometrical) changes together with the results evaluation which were obtained during the years of observation.

Keywords: *bucket ladder excavator, bucket, corner, bucket cutter*

NORBERT WOČKA

Bucket Wheel Excavator KWK-910 — the First Polish Excavator Dedicated to a Hard Material Digging • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The first polish BWE, dedicated to digging of a hard material in Open Pit „Turów” was presented in this paper. The main technical and technological data were listed and some particular design solutions, concerning work in hard material, were presented in detail. Manufacturers of main units of the excavator were also listed

Keywords: *BWE, bucket wheel excavator*

STANISŁAW ŹUK

Analysis of Production and Economic Effects in the Brown Coal Branch in the Year of 2008 • Kwartalnik Górnictwo i Geoinżynieria • z. 2, 2009

The topic of this paper is presentation of the up-to-date status of the brown coal mining in Poland based on the production data of four brown coal mines having been running the business in Poland in the last ten years and on the basis of the production effects and the latest achievements in the branch. The operation effects as up to now, and the economic results referring to the use of the brown coal in the power engineering prove that it is a strategic fuel, playing a valid role in covering the power demands of Poland. The Polish power engineering based on the brown coal against the background of the whole Polish power engineering has also been presented and the status of the state brown coal mining in respect of the future role of the coal in Europe has been compared. In Poland, similarly as in other European countries, the brown coal branch and connected with it power engineering is modern and its functioning is based on the latest scientific, project and operation researches. The taken and planned to be taken actions secure the meeting the environmental conditions, including the appropriate directives of the European Union. In this paper, an attempt has been taken to discuss the problems connected with the possibilities and perspectives of the Polish power engineering development based on the brown coal in the 21st century.

Keywords: *analysis, production, mining, economic result, utilization brown coal*