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Intelligent mine – Marcel 4.0

December 2018



KWK ROW Ruch Marcel is a two-pole mine. It consists of, so called, mother part, where group 700 coal seams are exploited, and Marklowice part, where takes place the exploitation of coal seams belonging to group 500. The mine produces annually over 2,800 thousand tonnes of 32, 33 and 34 type of coal.

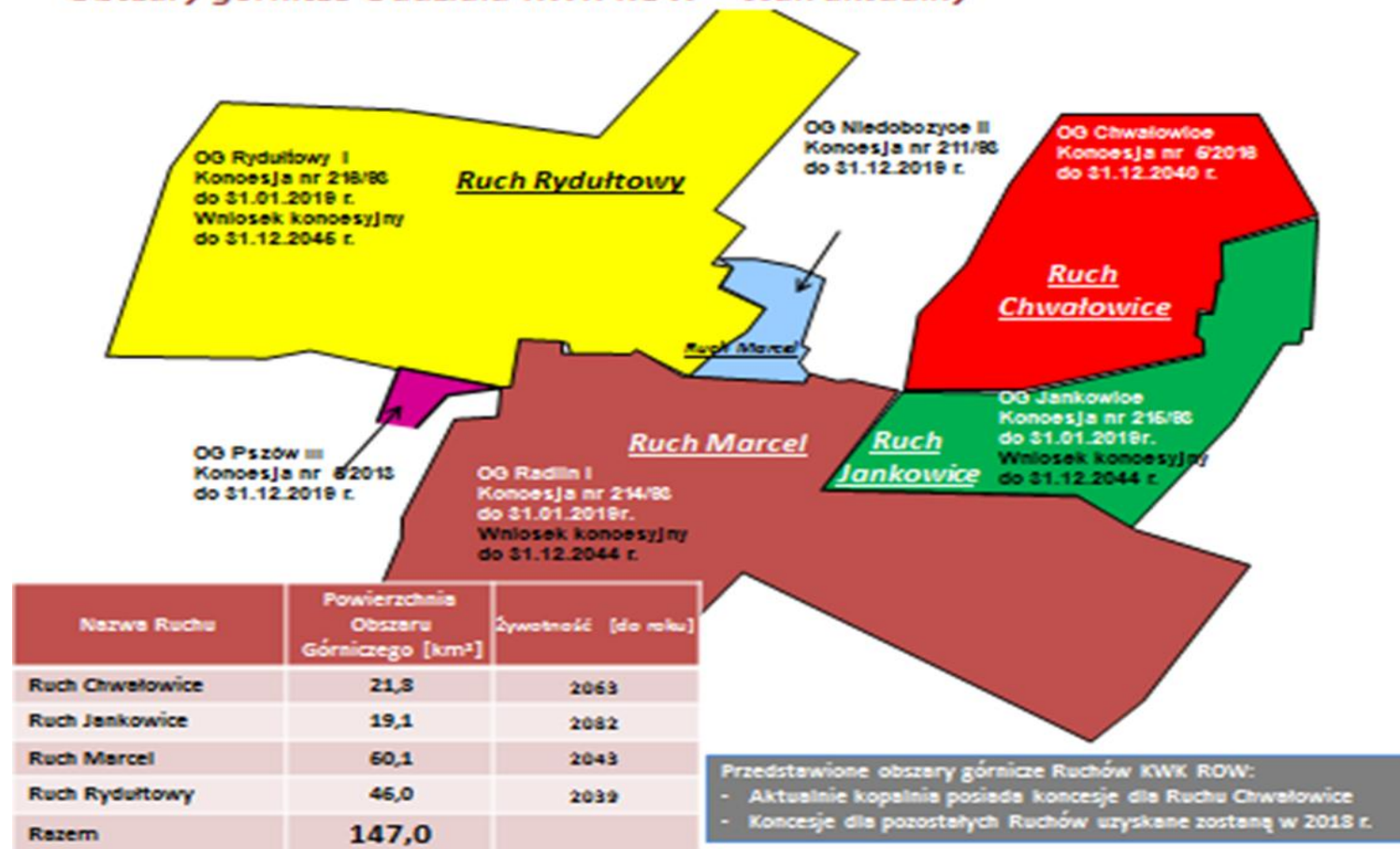
Mining area – 60.1km²

Amount of operational resources as at 31/12/2013 until the end of the concession is 30.782 million tonnes, while the total amount of resources in the entire seam equals to 76.920 million tonnes.

Total employment: 2978.



Obszary górnicze Oddziału KWK ROW – stan aktualny



Industry 4.0 – the fourth stage of industrial revolution

The first industrial revolution was associated with the application of water energy, invention of the steam engine and mechanization of work. Application of electricity and introduction of mass production techniques were signs of the second revolution.

The third revolution was an effect of automation of the production processes, what has been enabled by evolving information technologies.

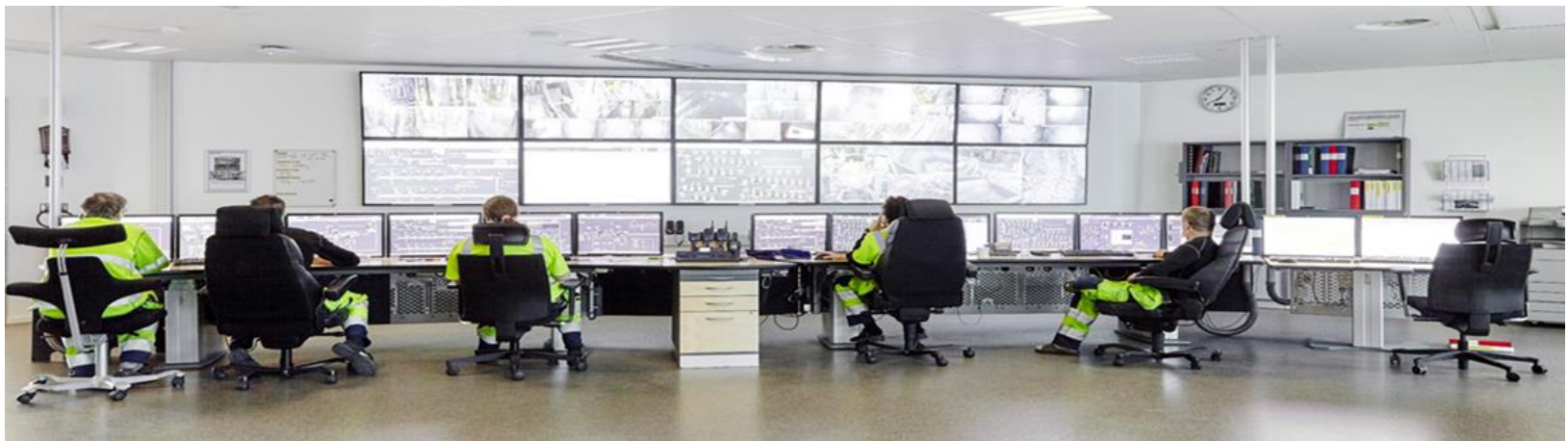
Actually, we are witnessing the fourth industrial revolution, which concerns integration of the physical objects with the information network.

Industry 4.0 is a digitalization of the production structure, supervised by the cyber-physical systems. Computers and networks are monitoring the physical processes, usually with the feedback, where the processes are affecting computations and reversely. For the concept of Industry 4.0 six rules have been defined: cooperation, virtualization, decentralization, real-time ability assessment, focus on service and modularity.



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For safer and more effective operation, the mining plants more often are implementing the new achievements in the field of production. Specification of the coal mine work requires facing many challenges and objective barriers in this manner, like, for example geology, volume of excavations, mobility of devices, tele-communication and many other limitations. Acquisition of real-time data from different systems, their common processing, interpretation and back-control of the entire system are conditions crucial in order to assure the safety of staff and optimized usage of assets, energy and other resources.



The power-machinery systems for controlling the production process applied in KWK ROW Ruch Marcel:

- SmoK-2, DEMKop developed by Somar Sp. z o.o.,
- SAURON, developed by RNT Sp. z o.o.,
- Betacontrol, produced by Becker-Warkop Sp. z o.o.,
- e-mine, produced by FAMUR,
- BSAR-nET, produced by ELPRO-7 sp. z o.o.,
- System for monitoring the pressure in stands of the mechanized cover section DOH Dropsy, produced by DOH,
- System for supervision over 110kV switchgear, produced by Micronica S.C.,
- InduSoft Web Studio – system for visualization of the de-methanization station implemented by Carboautomatyka S.A.,
- Wonderware In Touch – visualization of the work of the processing plant, implemented by Carboautomatyka S.A.
- ZEFIR – laboratory of computer programming "PRUNELLA"

Gasometric systems applied in KWK ROW Ruch Marcel:

In scope of gasometric sensors:

- SMP-NT/A, produced by ITI EMAG Katowice,
- CST, produced by HASO Sp. z o.o. Tychy,
- KSP-bis, produced by Carboautomatyka Tychy.

Alarming in the scope of state of tele-signallers:

- Hetman, produced by DGT Sp. z o.o. Straszyn.

Bi-state informing about the work of devices:

- FOD-900, produced by Tranz-Tel Sp. z o.o. Kobiór,
- gasometric SMP-NT/A, CST, KSP-bis, with application of bi-state centrals,
- Safety systems SBKW, produced by HASO Sp. z o.o. Tychy.

DIGITAL SOLUTIONS TO IMPLEMENT IN KWK ROW RUCH MARCEL

ABB Ability™ 800xA – EXPANDED AUTOMATION

System 800xA by ABB will ensure common environment necessary to create and apply reliable business decisions. Based on the Object-Aspect technology, the integration architecture is referring to all the data from the plant (aspects), and to particular plant resources (objects) The client-server architecture of the platform improves the communication between controllers, allows to centralize the configuration tasks of the backups and ensures systematic management of the data for purposes related with trends, history and audit log .

800xA system is an automation platform, which unifies the ability to design, initiate and apply the automation process strategy for electrical and safety energy management.

800xA system and included Object-Aspect technology ensure unified environment for operations and control, which improve the effectiveness of work and production efficiency. It is achieved by integrating the information, independent on the source, and its filtering by functions, such as personalized workplaces, advanced alarms management and integration of numerous systems.

ABB Ability™ KNOWLEDGE MANAGER

ABB Ability™ Knowledge Manager will ensure elastic approach to gathering, organizing and distribution of information about production and quality in the entire plant.

ABB Ability™ Knowledge Manager conducts the data management based on data collected in the process from different sources. Thanks to the functions and components necessary for the specific industrial process and for quality, the data is also stored and reported. KM constitutes a significant information base for the processes, production or demurrages, bookkeeping, statistical control, planning and quality management.

Main functions of the ABB Ability™ Knowledge Manager

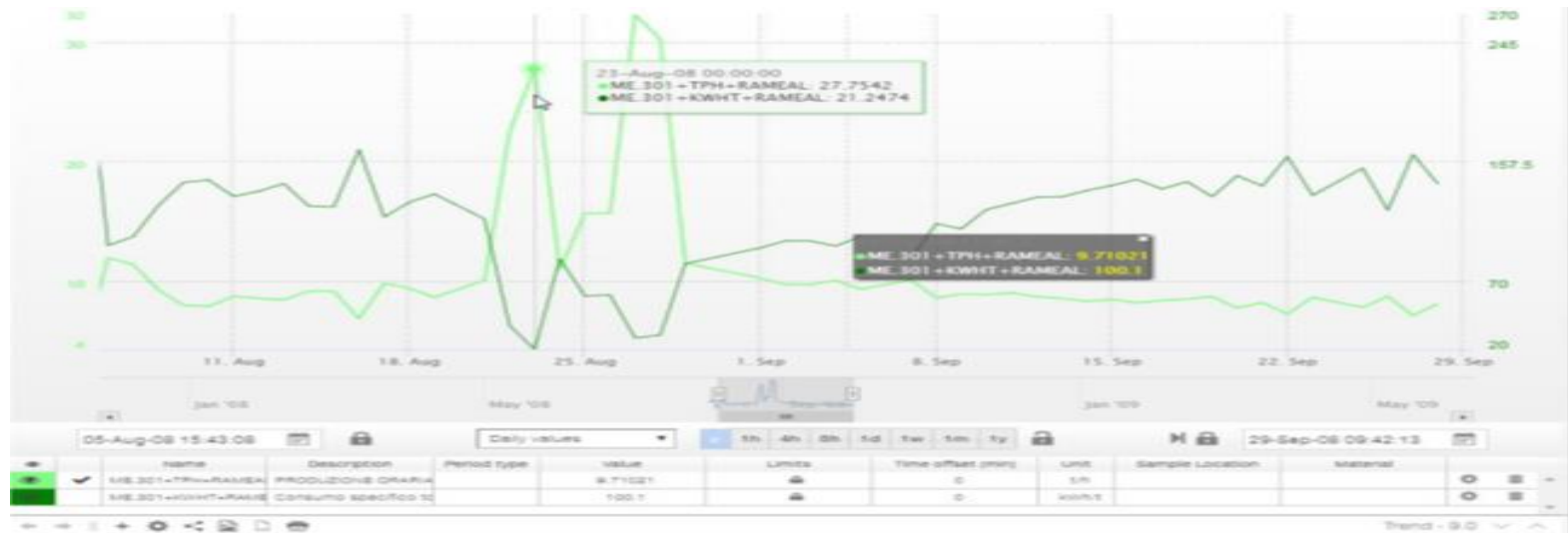
User interface is web-based and allows the access to all the applications, works in a standard software of the web browser; there is no need for installing any other programs on the Client's computer.

The user interface is adjusted to the small screens of mobile devices, such as smartphones or tablets.

The server works on the Microsoft Windows OS and connects with the client devices through the standards office network. Every computer of an office kind for a general purpose can be applied as the client station.

Reports

The system allows to create interactive reports with linear charts, giving an overview on data changes over defined time-interval. It is also possible to visualize several charts in a single window, with a single time-navigation bar. More advanced functions allow to statistical grouping of data, time-shifting and filtering.



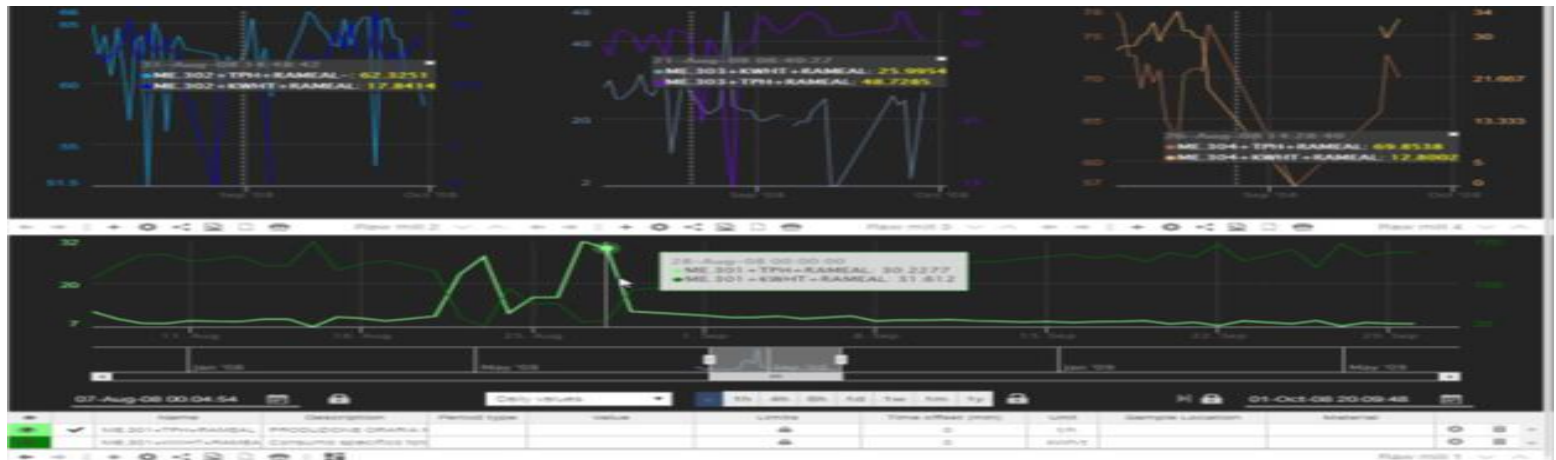


Process review report

Process review reports show the actual state of the plant. The users are enabled to shift in time to examine the values by use of the attached control bar, what is possible also for binary elements to create a line charts or interactive trend for further data inspection.

Operational report

Operational report is a report of tabular kind, which includes detailed information about what was happening during a given interval of time.



DESCRIPTION OF APPLIED SOLUTIONS

ABB Ability™ 800xA

800xA system is a main element of the implemented solution. All other ongoing parts of the solution are resulting from expansion of the functionality of 800xA system, such as:

- Visualization of the current state of installation
- Visualization of current diagnostic data
- Access to the history
- Trends
- Reports
- Steering

REDUNDANCY

800xA gives the ability to use the works servers in the redundancy arrangement, for increasing the accessibility and reliability. The redundancy function will be used by adding another host server of virtual machines.

Such configuration of the devices allows to secure from the loss of control in instance of failure of one of the machines, particular servers or even entire server cabinet.



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OPERATOR STATIONS

The project considers application of four operators stations.

In the first stage of implementation of the solution, two three-monitor operation stations will be delivered.

In the next stages of the solution implementation, it is planned to deliver two another expanded operation stations EOW-2.





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ENGINEERING STATION

There will be installed one two-monitor engineering station allowing for full system service from the engineering level (full configuration of 800xA system and remote access to all servers of the solution).



Thanks to the planned implementation of the optimization package, it will be possible to transform the digital possibility into reality. It will enable to optimize the capital investments and operational expenditures with simultaneous improvement of productivity of process and energy effectiveness.

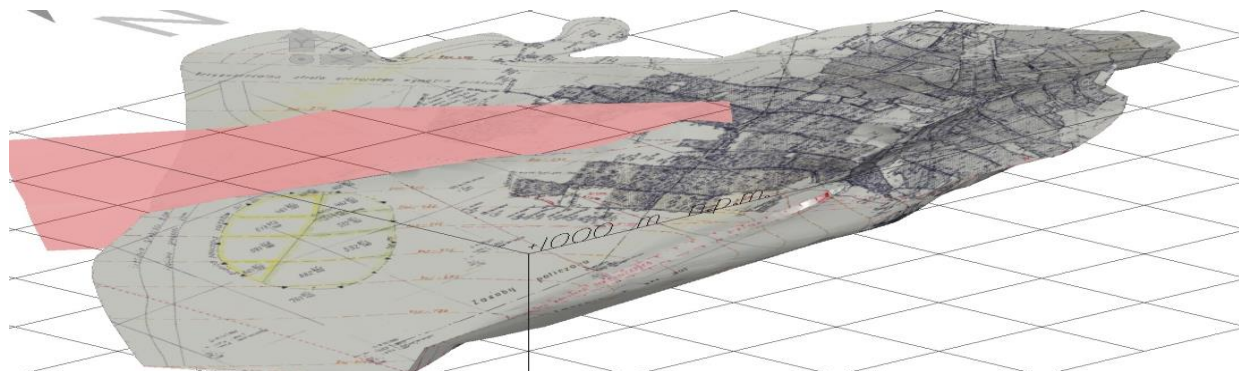
The constructed system is a fully digital portfolio of the engineering possibilities, electrification systems, drives and automation, power and process supply steering libraries, as well as applications and mining software. It delivers technologies connecting people with devices and services, ensuring high level of visibility, efficiency and optimization of operations in terms of the entire value chain.



Moreover, in KWK ROW Ruch Marcel there is going to be installed a 3D model of the seam. It is a package of integrated solutions for the coal seams and allows to textual, statistical and graphical analysis of sorted data. Correlation of the layers and seams can be carried out directly on the sections or space.

Characteristics of the solution:

Integrated information flow between all the excavation actions, optimal performance in operations of the planning process in the mine, effective engineering processes, lower excavation costs due to more intelligent systems of the technology and information management, increased potential of income, better cooperation, improvement of seam cutting process and exploitation planning.





Improvement of energy efficiency and management in KWK ROW Ruch Marcel:

Implemented system for energy management will allow to:

- Avoid the breaks in power supply,
- Power regulation, including the voltage, power distribution between generators and busbar systems,
- Reducing the energy costs,
- Control over the level of reactive and active power and transformers load level,
- Minimization of operational costs,
- Reduction of number of operators,
- Issues management,
- Single-window concept,
- Reduction of investment costs,
- Minimization of wiring and engineering costs in future investments.



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Thank you for
attention

