Pokłady możliwości

KGHM
POLSKA MIEDŹ

The role of innovation in KGHM

Wrocław, 15 V 2019

KGHM's operations are based on a 60-year mining tradition

The discovery of copper resources allowed for a radical change in the economic situation in the region and the development of KGHM Polska Miedź S.A.

Due to foreign expansion, the Company joined the group of global copper producers

Discovery of resources by Jan Wyżykowski

Official start of smelter construction in Głogów

Acquisition of shares in the Afton Ajax project

1950 **1960** **1970** **1980** **1990** **2000** **2012**

Establishment of Lubin Mining Plant

Going public

Takeover of a mining company Quadra FNX

Future of KGHM is …

International expansion allows the company to build value based on knowledge and skills

The development and implementation of new technologies makes KGHM the global leader who sets directions for the industry development

Starting operations of foreign assets

Integrated monitoring system for mining operations

An intelligent mine based on neural networks

Sustainable development

2015 | **2025** | **2035** | **2045** | **2055** | **2065+**

KGHM 4.0

Mining IT

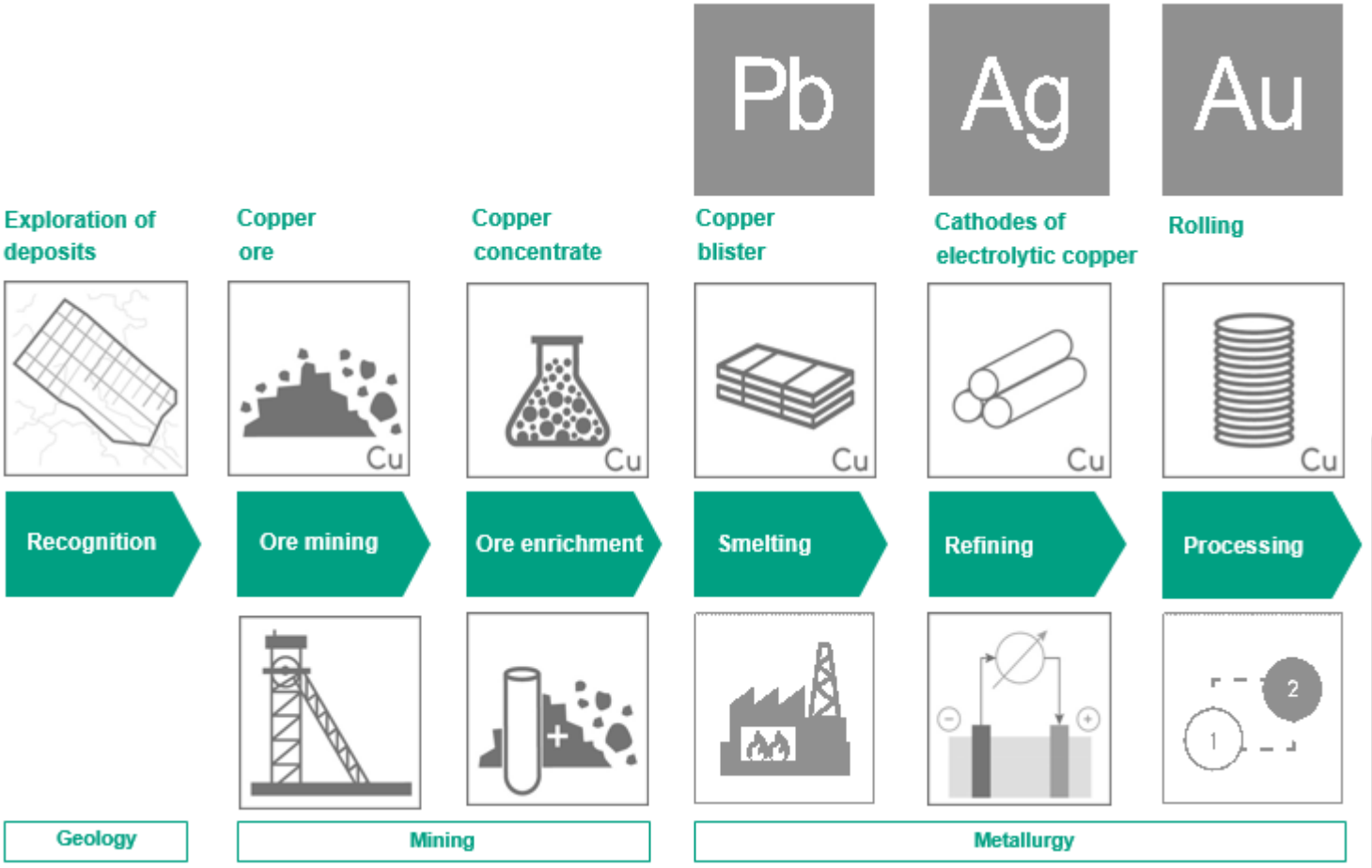
Space Mining (?)

Production process - integrated mining and metallurgical activity

KGHM – 6. place in copper production in the world
1-2. place in silver production in the world





Mines
ZG „Lubin”
ZG „Polkowice-Sieroszowice”
ZG „Rudna”

•**Ore enrichment plants**
including three enrichment installations in each mine

Smelters
HM „Legnica”
HM „Głogów I”
HM „Głogów II”

Copper rolling mill
„Cedynia” in Orsk

KGHM

KGHM Strategy

High market volatility forces the need for new strategic directions

Areas of interest

Safety

- Removal of employees from hazardous and environmentally hazardous places
- Current information on the location of people and machines in underground excavations

Production

- Extended effective working time - increased production
- Improving the quality of production thanks to the control of its individual stages

Management

- Dedicated computer applications - supporting the production management process
- Decisions based on reliable data - optimal use of resources

Information

- Reliable information at the right time and place
- Real-time information as the basis for effective management

Maintenance of machines

- Monitoring of machines, devices and processes enables proactive maintenance of traffic
- High technical culture of work - professional service of machines and devices

Production

KGHM's mines operate in an area which characterizes of unfavorable geothermal gradient. The initial temperature of rocks in the Rudna mine at a depth of 850 meters is 35°C, at a depth of 1,200 meters the temperature is 46°C.

The geothermal gradient for KGHM mines is on average 1°C for 32 meters.

KGHM's mining activity inevitably goes to deeper depths below 1,200 meters. At a depth of 1,700 meters, the temperature would be over 60°C

KGHM 4.0

KGHM 4.0 is the application of the latest technologies such as IoT (Internet of Things), vertical / horizontal software integration of many functioning IT systems, Big Data analyzes, systems based on augmented reality.

The KGHM 4.0 program will cover the entire activity of KGHM Polska Miedź S.A. both in the R & D and investment areas.

KGHM 4.0 will be based on several pillars, such as:

KGHM 4.0 will cover a much wider sector than the mining and metallurgical production. The program will cover, among others areas such as
:

- Automation and robotization of the production system

- Trade and logistic

- Data processing, Big Data

- Cybersecurity

KGHM 4.0

Data transmition	Broadband data transmission in underground excavations
MONITORING	Media monitoring: power supply, ventilation, drainage
LOCATION	System of location and identification of machines and people under ground
ROBOTICS	Robotization of production and auxiliary processes
ANALYTICS	Multidimensional analysis of data from production processes

- **IoT**
  - **Internet of Things**
- **AR**
  - **Augmented Reality**
- **BD**
  - **Business Intelligence**
  - **Big Data**

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Robotics - Remote controlled and automatic devices for breaking the block

- Withdrawing employees from dangerous p independence from gas, climatic and rock
- Improvement of service efficiency
- Automation of the process thanks to advanced solutions (3D scanning, VR)

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Robotization - Inspection works in mining departments

Identified possibilities of using robots in KGHM mines:

- Analysis of Cu content in the mine face (X-ray analyzer)
- Inspection of infrastructure (belt conveyors, cable lines and pipelines)
- Measurements of environmental parameters
- Supporting rescue operations
- 3D scanning of mining excavations

Monitoring tester for belt conveyors (another source of innovation)

The diagnostic tester needs to be connected to the trunk cable of the belt conveyor. It allows you quickly to read the basic parameters of the route such as: voltage, condition of the transmission line, or the condition of the circuit breakers

A quick diagnosis of the condition of the conveyor belts allow for improved safety, reduced downtime and breakdowns, thus exposing the worker to difficult conditions

Circular Economy

Implementation of solutions in the field of circular economy in the mining and processing of non-ferrous metal ores, and thus increase competitiveness while minimizing the negative impact on the environment resulting from the activity.
Activities in the field of CE will be consistent with the assumptions of Poland's raw materials and industrial policy

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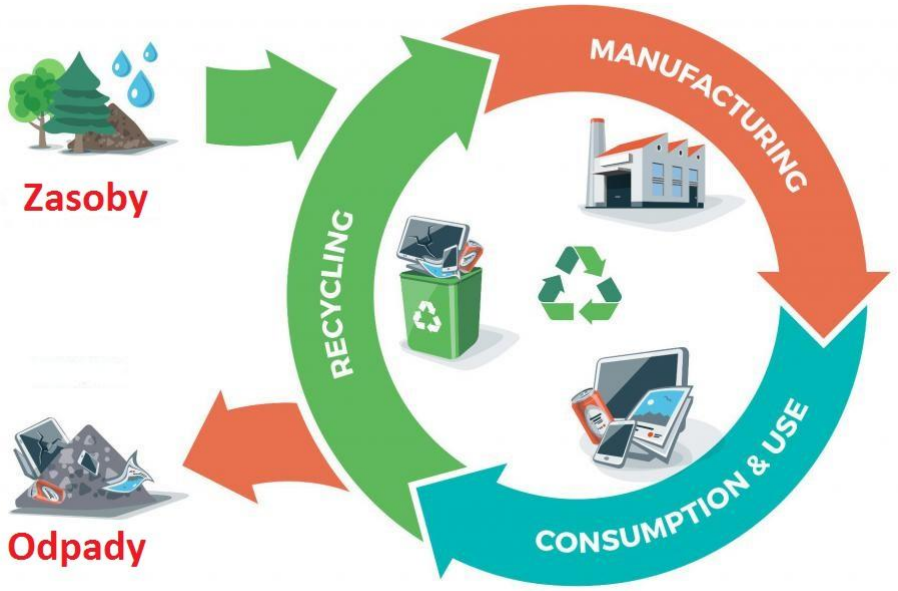
Current waste inventory

Determination of waste streams to be managed

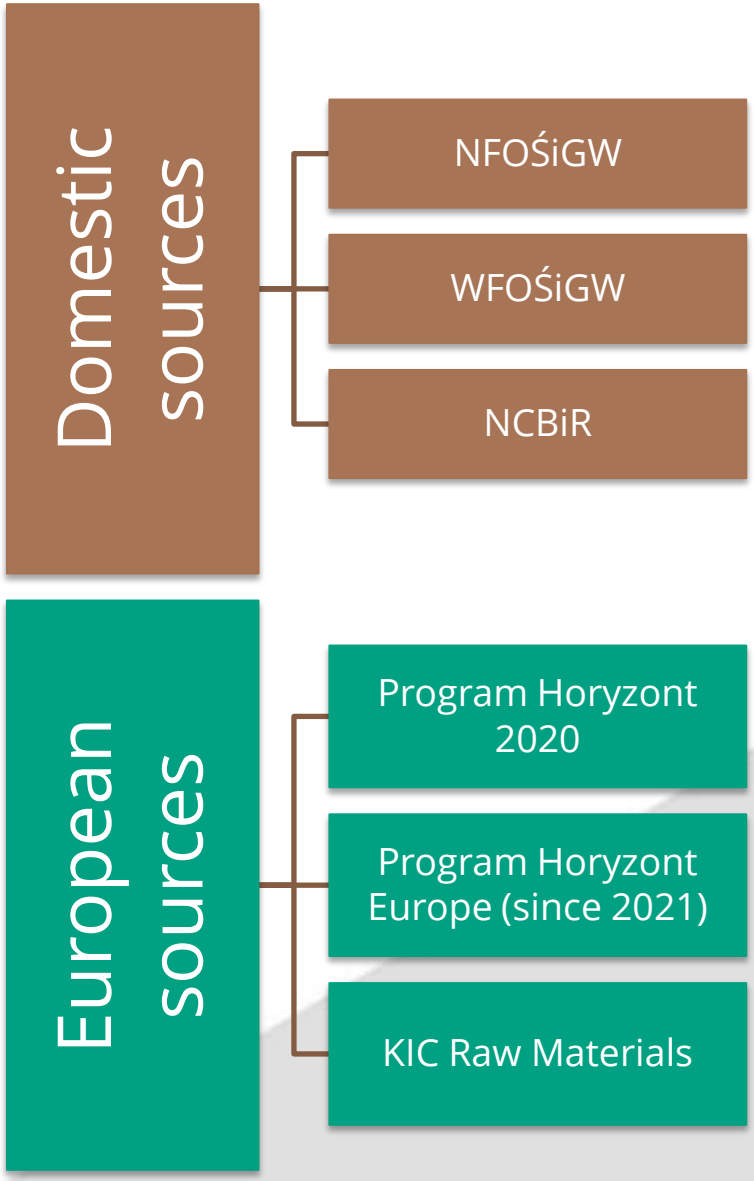


Searching for the possibility of waste management outside KGHM

Cooperation with regulators on the national and international arena, including the EU

Search for development technologies other than storage

Co-financing of R & D activities and investments from public funds



Participation of KGHM in European research projects

	Horyzont 2020	KIC Raw Materials
Number of imlemented projects	4	3
Value of projects	Over 30 mln EUR	Over 2 mln EUR
Number of submitted applications for co-financing (2019)	5	6

Implementation of the strategy through active participation in international organizations

EIP

The purpose of EIP is to accelerate the pace of finding innovative counter-measuresnegative effects of the so-called global social challenges (such as: climate and demographic changes, raw materials shortage) by limiting the fragmentation of activities and mobilizing entities throughout the innovation cycle. EIP activities are included in the Strategic Implementation Plan and specify the actions: research, knowledge about raw materials, exchange of best practices, review of selected legal acts, licenses, standardization and political dialogue. It is aimed at innovations in both technology and non-technological areas of politics as well as international cooperation. The implementation of the Strategic SIP Plan takes place through:

Call for Commitments Commission regularly invites organizations from around the world to submit project proposals that implement the EIP policy to the greatest extent

Horyzont 2020 Many activities implementing the EIP's objectives through SIP have been undertaken in the Horizon 2020 program, where projects are implemented in the field of raw materials

KIC Raw Materials The area of SIP II (Improvement of framework conditions for raw materials in Europe) is implemented by the KIC Raw Materials initiative (Knowledge and Innovation Community on Raw Materials). It is expected that KIC will also contribute to the implementation of activities in the area of I.A (Coordination of research and innovation), I.B (Technologies for primary and secondary raw materials), I.C (Substitution of raw materials)

Many activities ceoncerning II.B area Waste management is included in the document "Action Plan for Closed Circulation Economy" and waste directives: Framework Directive and Landfill Directive

Supporting activities related to the acquisition of critical raw materials

European Technology Platform on Sustainable Mineral Resources (ETPSMR)

The main tasks ahead of the platform include: creating and adopting a program supporting the development of the raw materials industry in EU countries based on European raw materials resources, securing access to existing deposits in EU countries, supporting European research and development potential , the development of innovative production technologies, the re-use of waste materials of this industry and environmental protection. Participants of the platform are representatives of the European Commission, European enterprises from the mining and processing industries, associations, research centers related to the mining industry, higher education institutions. The platform has the following structure: shareholders, working groups, management group (High Level Group).

A representative of KGHM was appointed as the President of the European Technology Platform on Sustainable Mineral Resources (ETP on SMR) in Brussels. The implementation of the Platform's objectives will contribute to the medium and long-term securing of a stable supply of raw materials that are necessary to meet the basic needs of a modern society that effectively uses resources. The platform is a consultative role in the field of EIP policy making.

Euromines

The mission of Euromines is to represent and promote the interests of the mining industry in the EU institutions in the field of legislative issues related to environmental protection, occupational health and safety and research and development policy in order to ensure sustainable and sustainable development of the mining industry. Euromines enables cooperation and information exchange within the entire mining industry in Europe. The Association works closely and strengthens contacts with mining companies around the world. Euromines includes large and medium mining companies from 16 European countries, employing a total of 350,000 employees .

Eurometaux

Eurometaux (European Association of Metals) - European Federation of Producers and Converters of Non-Ferrous Metals based in Brussels, founded in 1957. Its overriding goal is to promote and represent the interests of the non-ferrous metals industry towards the organs of the European Union. Currently, the Eurometaux organization has 54 members, who belong to the group of private sector entities as well as operate in the form of branch chambers of commerce. Main areas of activity: 1. EU energy and climate policy 2. Security of raw materials supply in the EU 3. Implementation of REACH 4.Â Recycling 5.Â EU trade policy

Cooperation with institutions and enterprises

- Cooperation with the Ministry of Development in the field of creating National Intelligent Specializations (including KIS 7 - Natural resources and waste management)

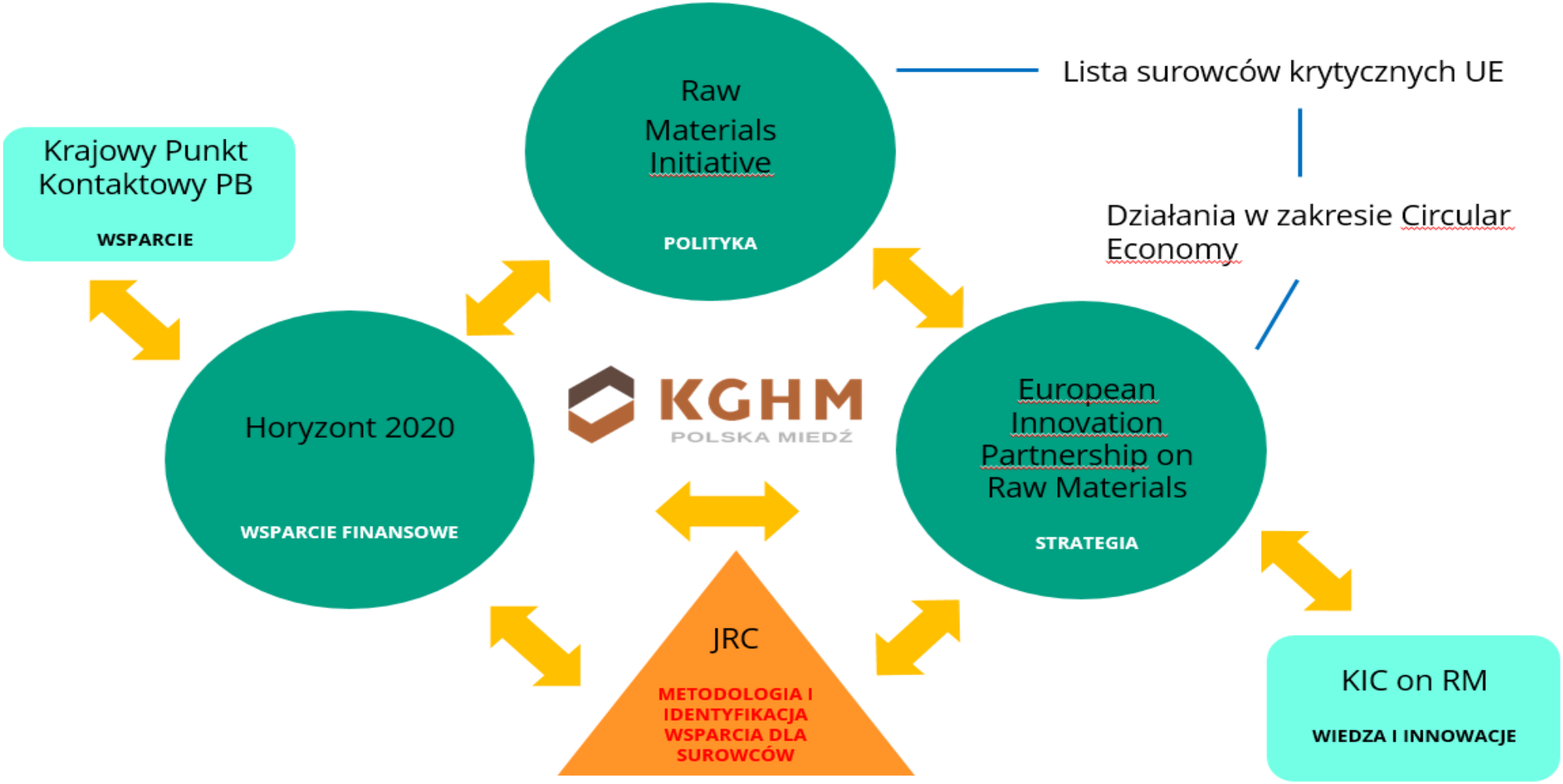
- Participation as Industry representative in the project "Increasing the participation of the Łukasiewicz Research Network Institutes (SBŁ) in EU-funded R & D programs" (DIALOG program) coordinated by Technology Partners

- Current cooperation with the National Contact Point of the EU Research Programs and Innovation Hub CLC East in the scope of participation in framework programs in the area of mineral resources
  - Participation in brokerage meetings and information days
  - Advising on formal and legal aspects

KGHM

European Union Raw Materials Policy

KGHM Polska Miedź S.A. as an innovative company, it implements a number of projects and initiatives in the area of research and development that are part of the current Strategy of KGHM Polska Miedź S.A. for 2017-2021, with a perspective until 2040 and supporting strategies.
The implementation of these projects is financed both from own resources and available external, domestic and European funds, including Horizon 2020, European Innovation Partnership.



MINHAS - „Mobile monitoring system for gas hazard evaluation in deep mine" (european project co - financed EIT Raw Materials)

Goal

Main goal of the project is to develop monitoring system, alarm visualisation and data transmision system due to analysis of gas concentration in mine.

Participants

Project consortium:

1. Wrocław University of Technology
2. **KGHM Polska Miedź S.A.**
3. Techniche Universitat Bergakademie Freiberg
4. LTU Business AB
5. Sevitel

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – 1 000 000,00 EUR

AMICOS - „Autonomous Monitoring and Control System for Industrial Plants and Raw Materials" (european project co - financed EIT Raw Materials)

Goal

Main goal of the project is to develop monitoring and maintenamce system of industrial plants.

Participants

Project consortium:

1. Fondazione Bruno Kessler
2. **Wrocław University of Technology**
3. KGHM Polska Miedź S.A.
4. Hovering Solutions
5. Spacearth
6. Arcelor Mittal

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – 1 000 000,00 EUR

illuMINEation - „Digitalization of key factors that influence the sustainability and profitability of a the mining operations ” (european project co - financed– Horizon2020)

Goal

The **overall objective** of the *illuMINEation* project is to develop an Industrial Internet of Things (IIoT) platform that connects the physical mining world with a robust multi-level distributed IIoT platform, including cloud computing and distributed cloud data-management.

Participants

Project consortium:

1. MONTANUNIVERSITAET LEOBEN
2. **KGHM Polska Miedź S.A.**
3. EPIROCK
4. AMS
5. WorldSensing
6. DMT
7. DSI
8. GEOTEKO
9. RETENUA
10. IMA Engeneering

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – To be estimated at second stage

Budget of KGHM Polska Miedź S.A.: To be estimated

CRAMIM - „ new platform – based for enhancing efficiency and safety of mining operations ” (european project co - financed– Horizon2020)

Goal

Development and validation a new platform – based for enhancing efficiency and safety of mining operations of key raw materials. It will be attained by designing a series of advanced mechatronics devices - platforms – that combine physical and digital solutions for Big Data collection and analysis.

Participants

Project consortium:

1. Fundacja Partnerstwa Technologicznego Technology Partners
2. **KGHM Polska Miedź S.A.**
3. Teknologian Tutkimuskeskus VTT Oy
4. Przemysłowy Instytut Automatyki i Pomiarów PIAP
5. Intermodalics BVBA
6. Katholieke Universitet Lueven
7. Technicka Univerzita v Kosicach

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – 4 000 000,00 EUR

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BATERFLAI - „Sustainable supply of minerals necessary for the production of lithium batteries using biodegradable, nano-grain flotation reagents with a low carbon footprint" (european project co - financed– EIT Raw Materials)

Goal

Development of an environmentally friendly flotation reagent for non-ferrous ores.

Participants

Project consortium:

1. National Technical University of Athens
2. **KGHM Polska Miedź S.A.**
3. LTU Business AB
4. Lulea University of Technology (LTU)
5. Technical Research Centre of Finland (VTT)
6. KGHM Cuprum sp. z o.o. CBR

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – 2 700 000,00 EUR

Budget of KGHM Polska Miedź S.A.: To be estimated

Revitec - „ raw materials ercovery ” (european project co - financed– EIT Raw Materials)

Goal

Project aims to enhance the raw materials ercovery mostly by improvingthe targetmaterial liberation and incrreasing the selectivity of the separation processes.

Participants

Project consortium:

1. Silesian Technical University
2. NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU
2. Technische Universitaet BERGAKADEMIE FREIBERG
3. Akademia Górniczo-Hutnicza
4. University of Exetet
5. **KGHM Polska Miedź S.A.**
6. FLSmidth A/S
7. SELFRAG AG
8. AMEplus

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – 11 500 000,00 EUR

Budget of KGHM Polska Miedź S.A.: to be estimated

RevRis - „ Revitalization of post-mining regions” (european project co - financed– H2020)

Goal

Development of models and methods in the field of assigning new functions to post-industrial areas of mines.

Participants

Project consortium:

1. Tallin University of Technology
2. **KGHM Polska Miedź S.A.**
3. AGH University of Science and Technology
4. AMPHOS21
5. Montanuniversitat Loeben
6. National Technical University of Athens
7. Universidade Nova de Lisboa

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – to be estimated

Kobalt - „ New cobalt resources for Europe ” (european project co - financed– H2020)

Goal

The aim of the project is to develop technologies whose implementation may lead to increased supply of cobalt for the needs of the European economy.

Participants

Project consortium:

1. **KGHM Polska Miedź S.A.**
2. Instytut Metali Nieżelaznych
3. University of Kosice
4. RWTH Aachen University
5. Aquasim
6. Technical Research Centre of Finland
7. Umicore
8. GTK

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – 6 500 000,00 EUR

Konkrecje - „ iSeaMetalsPlus” (european project co - financed– H2020)

Goal

Aim of the project is to develop a cost – effectove and sustainable processing solution for deep sea polymetallic modules collected from sea bottom to commercially use contents of metals namely manganese, cobalt, copper, nickel, molybdenum, zinc.

Participants

Project consortium:

1. **KGHM Polska Miedź S.A.**
2. Instytut Metali Nieżelaznych
3. Teknologian Tutkimuskeskus VTT Oy
4. Fundation Corporatcion Tecnologica de Andalucia
5. Wspolna Organizacja Interoceanmetal
6. Vysoka Skola Chemicko – Technologicka v Praze
7. Rheinisch Westfaelische Technische Hochschule Aachen
8. Chemical Vapour Metal refining Ltd
9. Technicka Univerzita v Kosicach
10. IHC Mining BV

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – 700 000,00 EUR

Minorbix - „ earth observation ” (european project co - financed– H2020)

Goal

Earth observation based added value services and products for supporting the sustainability of extractive industries in the different phases of the mining life cycle.

Participants

Project consortium:

1. GMV
2. **KGHM Polska Miedź S.A.**
3. KGHM Cuprum
4. To be defined (…)

Advance

Stage	Date	Status
Project start	01.01.2020	-
Project end	31.12.2023	-

Key information

Project submitted for the competition

Budget

Total budget – 13 000 000,00 EUR

Budget of KGHM Polska Miedź S.A.: to be estimated

FineFuture - „Development of the assumptions of technology to improve the yield of useful metals compact in fine particles in the process of mineral processing" (european project co - financed– H2020)

Goal

The aim of the project is to develop the assumptions of technology (4-5 degree of technological readiness) to improve the yield of useful metals compact in fine particles in the process of processing minerals. The results of the preliminary tests will be used to design technological solutions that enable the flotation process to be carried out with increased nutrients contained in fine (less than 20mm) grains in relation to the current state.

Participants

Project consortium :

1. **Helmholtz – Zentrum Dresden – Rossendorf EV,**
2. BASF,
3. **KGHM Polska Miedź S.A.**
4. Maelgwyn Mineral Services Limited,
5. Grecian Magnesite Mining Industrial Shipping and Commercial Company,
6. Eramet Research,
7. Magnesitas Navarras ,
8. Turboserviceflot,
9. Industrial Minerals Association Europe ,
10. Universite de Lorraine,
11. Sofiiski Universitet Sveti Kliment Ohridski,
12. Aristotelio Panepistimio Thessalonikis,
13. Instytut metali Nieżelaznych,
14. Imperial College of Science Technology and Medicine,
15. Politechnico di Milano,
16. Istanbul Teknik Universitesi,

Advance

Etap	Date	Status
Project start	01.03.2019	
Project end	31.12.2022	

Key information

Grant was awarded for the project implementation.

Budget

Total budget – 6 195 022,50 EUR

OPMO - „Operation monitoring of mineral crushing machinery" (european project co – financed – KIC Raw Materials)

Goal

Developing a concept of a combined monitoring and diagnostics system to improve the maintenance of mineral crushing machines. On the assumption, the end product will allow savings resulting from the reduction of maintenance costs of equipment in the processing line by extending maintenance intervals and increasing operational availability.

Participants

Project consortium :

1. Tampere University of Technologie
2. **KGHM Polska Miedź S.A.**
3. AME plus
4. KGHM Cuprum
5. Metso Minerals
6. Wrocław University of Technology

Advance

Stage	Date	Status
Project start	01.03.2019	
Project end	31.12.2022	

Key information

Grant was awarded for the project implementation.

Budget

Budget of the project: 1 106 159 Euro

BioMOre - „New Mining Concept for Extracting Metals from Deep Ore Deposits using Biotechnology” (european project co - financed– H2020)

Goal

Verification in real conditions, possibilities to use a combination of fracturing technology and bioleaching to recover metals from deep and poor deposits located in Europe.

Participants

Project consortium :

1. **KGHM Polska Miedź S.A.**
2. MIRO Mineral Industry Research Organisation
3. Akademia Górniczo-Hutnicza im. S. Staszica w Krakowie
4. Bangor University,
5. BGR Bundesanstalt Fuer Geowissenschaften Und Rohstoffe,
6. BRGM Bureau De Recherches Geologiques Et Minieres,
7. Cobre Las Cruces, S.A.,
8. Centre National De La Recherche Scientifique,
9. DMT GmbH & Co. KG,
10. G.E.O.S. Ingenieurgesellschaft MbH,
11. GTK Geologian Tutkimuskeskus,
12. Hatch Associates Limited,
13. HZDR Helmholtz-Zentrum Dresden-Rossendorf Ev,
14. Instytut Metali Nieżelaznych,
15. Kemakta Konsult AB,
16. KGHM Cuprum Sp. Z o.o. Centrum Badawczo-Rozwojowe,
17. Mintek,
18. Tampere University of Technology (TUT),
19. TU Technische Universitaet Bergakademie Freiberg,
20. VTT Technical Research Centre of Finland Ltd,
21. Umwelt- Und Ingenieurtechnik GmbH Dresden,

Advance

Etap	Date	Status
Project start	01.02.2015	
Project end	31.07.2018	

Key information

Administrative works related to the closure of the project are in progress

Budget

Total budget – 8 564 962,00 EUR

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INTMET - “Integrated innovative metallurgical system to benefit efficiently polymetallic, complex and low grade ores and concentrates” (european project co - financed– H2020)

Goal

Verification under real conditions of solutions that allow for highly effective recovery of metals such as: Cu, Zn, Pb, Ag, as well as: Co, In, Sb from difficult deposits, mainly low-quality polymetallic ores.

Participants

Project consortium :

1. Cobre Las Cruces S.A. – Koordynator Projektu
2. **KGHM Polska Miedź S.A.**
3. Sociedad Mineira de Neves Corvo – SOMINCOR
4. Outotec
5. Tecnicas Reunidas SA
6. AGQ – Mining & BioEnergy
7. Mining and Metallurgy Institute Bor RTB
8. Instytut Metali Nieżelaznych
9. MINTEK
10. Bureau de Reserches Geologiques et Minieres BRGM
11. National Research-Development Institute for Non-Ferrous and Rare Metals IMNR
12. MinPol

Advance

Stage	Date	Status
Project start	01.02.2016	
Project end	31.01.2019	

Key information

Administrative works related to the closure of the project are in progress

Budget

Total budget - 7 999 328,00 EUR

AMCO – Automated Microscopic Characterization of Ores (european project co – financed – KIC Raw Materials)

Goal

The main objective of the project is to produce and market an automatic microscopic system for mineralogical analysis of ores. This system is aimed at improving the geometallurgical efficiency of processing and metallurgical plants as well as reducing the negative impact on the environment associated with the enrichment of mineral resources.

Participants

Project consortium :

1. UPM (Universidad Politecnica de Madrit)
2. AITEMIN (Asociación para la Investigación y el Desarrollo Industrial de los Recursos Naturales)
3. ULg (Université de Liège)
4. TSL (Thin Section Lab)
5. CLC (Cobre Las Cruces)
6. **KGHM Polska Miedź S.A**

Advance

Stage	Date	Status
Rozpoczęcie projektu	01.04.2016	
Zakończenie projektu	30.03.2019	

Key information

Administrative works related to the closure of the project are in progress.

Budget

Total budget 699 448,59 euro

MaMMa – Maintained Mine and Machine
(european project co – financed – KIC Raw Materials)

Goal

The main goal of the project is to build a cyber-physical system to support management processes in the mine and maintain machines. It will collect and process data measured on mining machines and parts of the mine's infrastructure. The system is also to present the results of analyzes in a clear form for the user.

Participants

Project consortium

1. DMT GmbH & Co.
2. Clausthal University of Technology
3. KGHM Cuprum sp. z o.o. Centrum Badawczo-Rozwojowe
4. Montanuniversität Leoben
5. Politechnika Wrocławska
6. Rheinisch-Westfaelische Technische Hochschule Aachen
7. LTU Business AB
8. RISE Research Institutes of Sweden AB
9. Caterpillar Global Mining Europe GmbH
10. **KGHM Polska Miedź S.A.**

Advance

Stage	Date	Status
Project start	01.01.2018	
Project end	12.30.2020	

Key information

Current work.

Budget

Total budget 403 425 euro

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Thank you for your attention

Wiktor Kowalczyk

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