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**The International
Copper Ore Mining Congress**
(Lubin September 16-18, 2015)

The 3rd Polish Mining Congress
(Wrocław September 14-16, 2015)



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Opportunities and challenges

Interview with Herbert Wirth, PhD., Eng., honorary patron of the International Copper Ore Mining Congress, Chairman of the Management Board at KGHM Polska Miedź S.A.

The International Copper Ore Mining Congress (Lubin 16-18, 2015) is held for the third time now. Does this mean, it is an increasingly important event in the sector?

The very fact that we are already having the third edition of the congress means that it turns the expectation of the mining industry into not only concept solutions but, above all, into their practical application in technology. We are meeting once in every three years to discuss problems and challenges facing not only the copper industry in the coming future. The fact that participants will come to the congress from all over the world, among them many panellists and businessmen presenting their achievements in mining know-how testify to the high rank of this event. The International Copper Ore Mining Congress is also important from KGHM's point of view. Conclusions following out of the debates and relations established between business partners will bring measurable business benefits to all the interested parties.

Many of the discussion points included in this year's agenda refer to prospects for development, extraction forecasts, and demand. Do you think the coming years will be good for copper mining in Poland and in the world?

I want the coming years to be better and better for the copper industry. Although the recent developments on external markets, such as the Chinese market, reflect a pretty worrying turmoil but long-term forecasts speak of a permanently growing demand for this red gold. We should not forget that copper deposits, like all other deposits, are steadily depleted. Those which are easier to reach are being depleted too. When one day it becomes impossible to expand the area of open-cast mines any more, the mines will have to switch to underground operation. They will have to drill shafts and start underground excavation. The Chilean market is a perfect case of the declining trend in open-cast mining. Seventy per-cent of Chilean mines are now open-cast type. But this rate will change considerably within the coming decade and the proportion of open-cast copper mines in that country will drop below 50 per-cent.

What about industry branches other than copper mining, and what about its related industries? Can the congress be of any interest to those as well?

I hate using the phrase „specificity of copper (or coal) mining”. There are, of course, differences between these two sectors, but they also have a common denominator. Achievements in, say,



automation, computerisation, drilling and building shafts, can be transplanted into coal mining. We dedicate this congress to copper mining but I do believe it will offer lots of interesting things to all types of the mining industry.

You are the honorary patron of the congress and CEO for the Management Board of KGHM Polska Miedź S.A. This could, perhaps, keep us talking a long time but could you, please, say in just a few sentences what kind of challenges or opportunities are facing your company now?

KGHM implements the vision of a smart mine, that is, a safer place of work where we reduce human effort by making a maximum use of human mind. In this way, we can further eliminate situations which are hazardous to the health and life of our employees. We want to apply a technology that will make the work of our people even safer. Well, of course, from the economic point of view, we also want those safer jobs to generate less cost. Hence the idea of reaching for a totally different technology. It is a longwall mining technology, somewhat similar to that used in coal mines, because it allows high automation or even robotisation of the whole process. We are now half-way through underground testing of a machine similar to a longwall shearer. It is controlled by an operator sitting far away in a safe place. There is actually no reason why the operator could not sit in an overground office but now, in the testing phase, we want to keep closer to the process. We want that machine soon to be able to identify the quality of a deposit and, thanks to its learning process, make unassisted decisions on what to do next. The machine will judge which part of the deposit to dig, what force to use, whether to increase or reduce the rotation of the shearing head, and so on. The collection, analysis, and saving millions of data will allow the machine equipped with neural networks to learn, eliminate unwanted behaviours, and make the optimum choice. In the steel industry, neural networks will revolutionise the blast furnace control process because it will know by itself how to analyse the feed stock, which temperature to select, how much oxygen to deliver in, and it will also control the time and other parameters of the process.

KGHM holds a concession for the recognition of potassium and magnesium sulphate deposits in the area of the Baltic town of Puck...

KGHM can see some new development opportunities coming up, among them, moving into the upstream sector. This would involve, for instance, supplying semi-products, such as potassium

or phosphorus for the production of fertilisers. Mind you, the human population keeps growing. There will be 2.5 billion more people living on the globe in 2023 than today. Those people must eat which brings us to a conclusion that going for the widely-defined food sector must pay off. On the other hand, progressing urbanisation will increase the demand for raw-materials. American estimations say that statistically, each of us uses the average of 150,000 tonnes of various raw-materials in our lifetime. Those materials, whether obtained from recycling or primary deposits, will always be in demand.

Being a global and advanced company, we want to respond to the needs of the revolutionary industry based on minerals. Closing: KGHM must be an innovative and global company. Innovativeness must be present not only in the area where products or processes are

introduced but also in management. This should be our distinctive feature. What counts is not just understanding which products will be in demand and how to get them, but also the skill of managing that knowledge. This is why it has been included in our new strategy. Innovation, remote control, automation, and robotisation are the response of present day to the ignorance of the past.

Interview granted to D.W.

The International Copper Ore Mining Congress 2015 is organised by: the Association of Mining Engineers and Technicians (SITG), Branch in Lubin and the Polska Miedź Union of Employers (ZPPM).

More on www.sitglubin-kongres.pl

Mining yesterday – today – tomorrow

Statement by Professor Wojciech Ciężkowski, PhD., Eng., Dean of the Geo-engineering, Mining, and Geology Department at the Wrocław Technical University.

The 3rd Polish Mining Congress, this time to be held in Wrocław (September 14-16, 2015) is a forum on which the Polish mining industry sums up its performance and presents the attainments of mining and geological sciences, as well as its technical and technological advancement. The congress will skip much of the material related to copper mining because this will be discussed at the 3rd International Copper Ore Mining Congress which starts shortly after our congress but both conferences will share all the visits of experts to selected sites.



The congress is held at a special time. For one thing, most branches of Polish mining are rather successful and copper mining has even reached a global level but, for the other, the hard coal mining is in a crisis. All this happens in a situation where world-wide demand for minerals has rapidly grown in the recent years and the EU countries are facing problems with getting their strategic raw-materials in the first place. On top of that Poland, a country rich in various minerals, has no clear policy on raw-materials and Polish mining industry becomes less and less competitive. This, combined with the recent economic slow-down in China and the „black Monday” of August 24, 2015, on world markets shows how far globalisation has advanced in the economy of minerals.

In this context, an economically efficient minerals extraction done with the use of advanced digging and information technologies (smart mine) and in a most environment-friendly way (green mine) becomes extremely important. This way of mining will be supported by the increasingly numerous EU innovation programmes addressed to raw-materials (Horyzont 2020, Era-min, KIC Raw Materials, RawMatTERS). Proper processing and recycling of minerals is also

important, as well as contemplating the future mining areas in the sea bottom and in outer space. All this will be discussed at 12 conferences during the congress. The Wrocław debate will hear nearly 150 lectures and presentations organised in 35 sessions. Surely, experts will continue discussions when they go to visit some of the sites.

The motto of the congress is „Mining yesterday – today – tomorrow”. Having a good understanding of the evolution of mineral extraction methods and a good command of current technologies, we can easily talk about the mining of tomorrow. While continuing the traditional methods, mining will increasingly often reach for sophisticated

technologies, reach deeper underground where geological conditions are tougher, and it will definitely explore sea and ocean bottom, to eventually start digging on other planets of the Solar System. All this leads to the development of smart mines, which are safe for the workers and where advanced technology is employed. All these are signs telling us what should the mining education be like. Mining students of various schools should, therefore, acquire a wide range of competence allowing them to integrate knowledge from various disciplines of science and technology. Students are being trained in this way already today.

My Department of Geoengineering, Mining, and Geology at the Wrocław Technical University now offers training in two directions: **mining and geology** and **surveying and cartography**. The **mining and geology** is read by first and second cycle students specialising in: underground and open-cast exploration of deposits, reconnaissance and mining geology, geo-information, geo-engineering and also geo-technical and, in the English language, also the environmental engineering and minerals engineering. The department also offers

post-graduate studies and a number of other training courses and workshops.

The special feature of studies in our department is that they are interdisciplinary. The training is intended for candidates who are interested in gaining knowledge, skills, and competence allowing them to get jobs in the mining industry and its related sectors, as well as in business companies, administration, or other institutions where their knowledge of technical and natural sciences can be of great use. This is why our department invariably draws high interest among candidate students despite the clearly difficult time some sectors of the mining industry are going through these days. The department now has about 1,400 students in Wrocław and in its Branch in Legnica. Current recruitment of new candidates goes on just as good as in previous years.

Training a good graduate takes various forms of teaching. Apart from traditional class work at the Wrocław campus, students could in the past and can now take international studies in mining universities of Finland (Helsinki), the Netherlands (Delft), Germany (Freiberg, Aachen), Slovakia (Kosice), Hungary (Miskolc), and Great Britain (Exeter). My department is the only one that pays for student apprenticeship in a variety of mining companies across Poland. Delivering the latest mining knowledge is an important part of studies which is why many our lecturers are also experts working for the industry, mainly KGHM, and for a number of foreign companies. Study tours to KGHM International's mines in Canada,

the United States, and Chile have recently made our studies even more attractive by giving students a better understanding of what is a global-scale mining industry. This teaching programme produces impressive effects, for instance, in two years in a line, our students have taken the top places in a Mining Knowledge Competition held by the annual Mining Exploration School in Kraków. When mining technologies become recognized as one of the National Intelligent Specialties, and when obtaining and advanced processing and application of minerals is recognised as one of the Lower Silesian Intelligent Specialties, this industry may become even more popular. We also expect getting various forms of support from the Operating Programme Knowledge-Education-Development and other programmes.

All these measures, strengthened by training on the most advanced equipment and software, are undertaken to produce the best-qualified graduates. How successful is this method of training you can see on the number of our graduates who get jobs in many mining companies in Poland and abroad. Many of them hold managerial posts in copper mining, lignite industry, rock quarrying, etc. Part of the Polish mining sector is in a kind of impasse now but the whole sector has a great future ahead – after all, most of the daily-use objects and most of the highly advanced and innovative ones are made of natural raw-materials which must first be identified, hoisted, and processed. ■

More on pkg2015.pwr.wroc.pl

KGHM's exploration programme

KGHM Polska Miedź S.A. is the biggest producer of silver and eighth biggest producer of copper in the world. To preserve all its assets and ensure their growth, the company must gain and enlarge its current resource base which is the foundation of development. The 2015-2020 Strategy adopted by KGHM provides for replacing one tonne of extracted copper ore with three tonnes documented in the resource.

The company portfolio comprises a number of exploration projects scattered in various places across Poland. These are projects of two types: those concerned with initially documented deposits and others concerned with areas where there is only some possibility of finding and documenting deposits. These works are going on in the Sudeten monocline, next to the now-exploited deposits (Głogów, Retków-Ścinawa) ¹ (see map), in the North-Sudeten syncline (Grodziec, Konrad, and Stojanów Synclines), and rather recently, also close to the Zatoka Pucka bay on the Baltic in the north of the country.

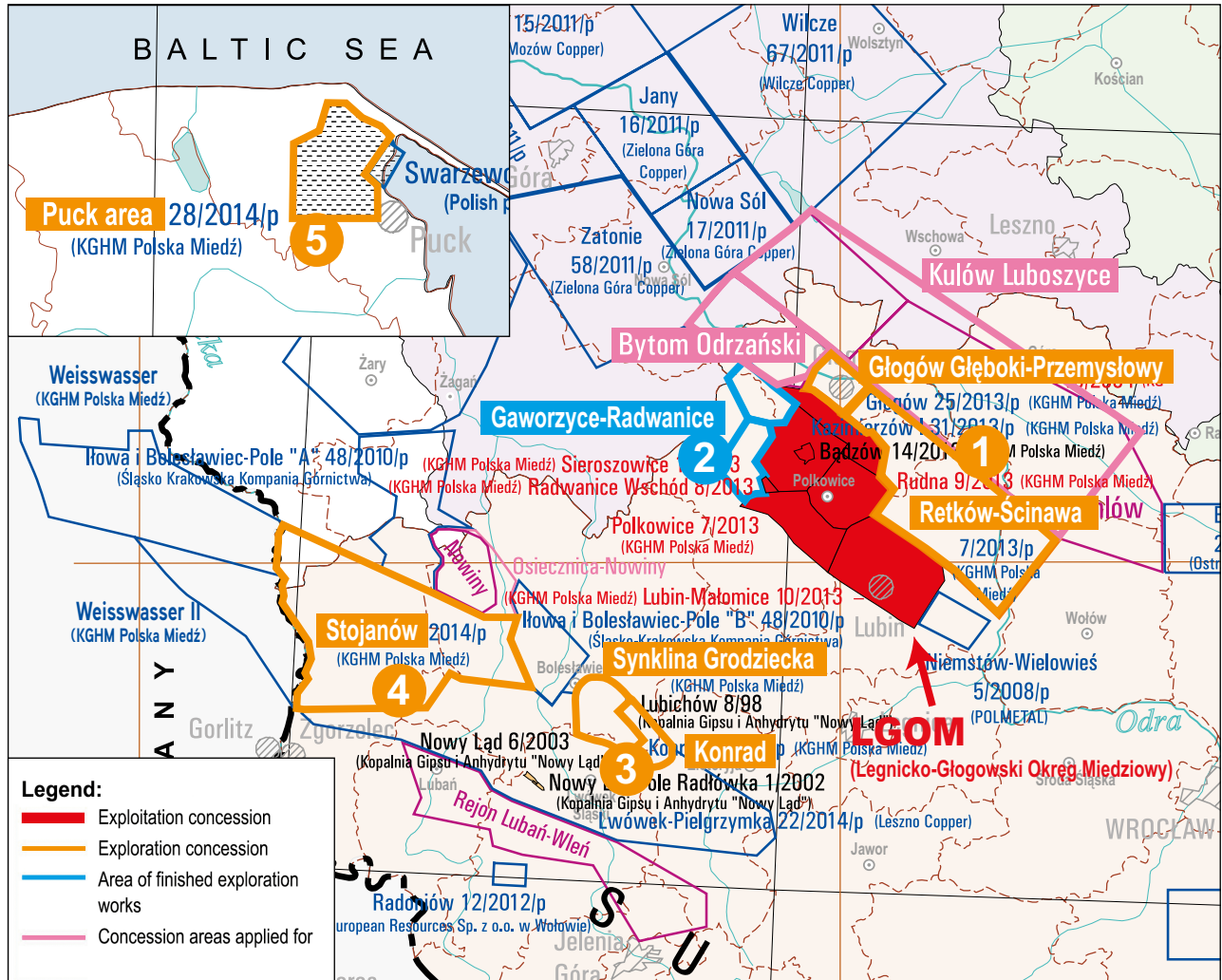
Sudeten monocline

In the years 2008-2014, KGHM was exploring the area of Gaworzyce-Radwanice ² (see map), which is directly adjacent to the mining areas of Sieroszowice, Polkowice, and Głogów Głęboki Przemysłowy. A number of prospecting and recognizing projects

were completed at that time. Geophysical surveys were done on the surface. Five boreholes were made alongside many laboratory tests of the obtained sample cores. This allowed an estimation of the copper ore resource and making a geological documentation of the deposit which was approved by the geological administration authorities in that year. It was another step in getting closer to a continuous technical and design work on obtaining concessions for taking copper ore from this area. The result was a preliminary documentation of a resource containing about 4.1 million tonnes of copper.

Deposits named Bytom Odrzański, Głogów, and Retków documented in the 1970s and 1980s are situated north and north-east of the Głogów Głęboki Przemysłowy deposit. Owing to the 2013 concessions for prospecting and recognition of copper ores in the area of Retków-Ścinawa and Głogów, which also includes the Głogów and Retków deposits, KGHM can carry on precise recognition of those areas where reconnaissance drilling programme was also done several decades ago.

The Retków-Ścinawa concession covers an area of about 401 km² and it will be valid for more than 10 years, while the Głogów concession covers an area of some 46 km². In 2014, boreholing also started at the areas of Retków-Ścinawa and Głogów. The first phases of this programme include making 15 boreholes reaching



KGHM prospecting programme on the backdrop of a section of a map of licences for prospecting, identification, and extraction of the deposits of chemical, rock, and metal deposits, as on 31.12.2014.

1,500 metres deep. They are expected to be finished in the middle of the next year. Then, the obtained test results will be studied to provide grounds for a decision on the scope of the further phases.

KGHM is also interested to do prospecting and recognition works in the areas of Bytom Odrzański, Kulów-Luboszyce and has, therefore, applied for the respective concessions. Since there is one more company interested to

to determine the geological and mining conditions for a safe mining production in future.

North Sudeten syncline

Apart from the Sudeten monocline, KGHM is also exploring in the North Sudeten syncline. At first, the work was done in one concessioned area of the Grodziec Syncline, in what is known as the Old Copper Basin near Bolesławiec 3 (see map) where a

The 2015-2020 Strategy adopted by KGHM provides for replacing one tonne of copper ore with three tonnes documented in the resource.

start prospecting and recognising work in that area, the final and legally valid concession will come delayed in relation to KGHM schedules made when it was planning its campaign in the region of the Legnica-Głogów Copper District (LGOM). The exploration work includes a number of hydrogeological, gas, and geotechnical studies. The number of extra tests will be updated according to the progressing work because KGHM is recognising deposits not only to find copper but also

programme of 18 boreholes was completed in the years 2010-2014. During that project, the company applied for a new concession for the prospectation and recognition of copper deposits in the Konrad area situated in direct vicinity of the Grodziec Syncline concessions and encompasses the area once worked by the old Konrad mine.

Exploration work is still continued there and the planned geophysical studies and drilling will be used in making the Deposit Management Plan.

KGHM has one more exploration concession in the North Sudeten syncline – Stojanów 4 (see map) granted to the company in 2014. In geological terms, this area is an extension of the Weisswasser area where a subsidiary KGHM Kupfer AG is also doing exploration work. The trans-border prospecting concept adopted by KGHM has, for the first time ever, permitted synchronised geological prospecting on both sides of the state border.

These works are intended to find copper and silver ores and their scope encompasses re-interpretation of archival study results, re-processing of archival geophysical measurements on which they will determine the scope of new surface geophysical measurement and boreholes.

The Zatoka Pucka bay

Following the latest trends in the raw-materials industry which are based on long-term forecasting and growing demand for other raw-materials, KGHM has turned its eyes on sylvinites

and magnesium salts. In Poland, there are 4 documented deposits of those minerals 5 (see map) in the area of the Pucka Bay. KGHM holds the licence to prospect and recognize three of those: Zdrada, Chtapowo, and Mioszyno, whose combined resource reaches 453 million tonnes. Under the Environment Minister's concession for prospecting and recognising the deposit of sylvinites and magnesium salts near the town of Puck and of accompanying minerals: copper ore, silver ore, rock salt which covers an area of 103.75 km², KGHM has included in its programme two phases of geological works. Phase one started in 2015 and it includes an analysis and re-interpretation of archival data, surface geophysical studies, and 5 reconnaissance boreholes. The scope of the second phase provides for 3 to 17 more boreholes but it will carry much more details available after processing the results of the first phase which has been scheduled for completion at the end of quarter 1 and early in quarter 2, 2017.

D.W.

KGHM builds 31st shaft

The construction of a mine shaft is a huge project taking many years. Its success depends on the perfectly designed investment plan, completion of detailed geological, hydrological, and geophysical studies, precise co-ordination of the work of expert groups, application of innovative technologies and high-tech machinery, and on the knowledge and experience of the workers. Only KGHM is currently building new mine shafts in Europe.

Drilling the first 400 metres of the shaft is the greatest challenge for engineers working at the Copper Basin. They must drill through the layers of wet sands, aggregates, and silts. This is why the Mine Construction Company Pe-Be-Ka, which has built all the shafts for KGHM, has harnessed a world-unique rock-freezing technology.

Depth record

Inside just a few years, Pe-Be-Ka built KGHM's 31st shaft SW-4 for the Polkowice-Sieroszowice mine, named after the legendary pioneer of Polish copper Tadeusz Zastawnik. This SW-4 ventilation shaft is necessary to improve the ventilation and air-conditioning performance in the tunnels of the Polkowice-Sieroszowice mine.

The preparatory works for the construction of the Tadeusz Zastawnik shaft started in 2005. At that time, they had to freeze rock at the deepest level in the Copper Basin which required using a unique technology of selective freezing with comprehensive control of the whole process and monitoring of the operation of freezers and circulation of the coolant.

First bucket hoisted at SW-4

The next stage of the project – drilling the shaft – began in the middle of 2008. The first bucket was hoisted on June 30. The first section of the shaft was drilled with the mechanical rock dredging method and

a shaft-drilling machine. That technology has been long improved by Pe-Be-Ka and it uses a dredging head of a machine converted from one used in coal mining. When they reached the depth of about 400 metres past the silts and sands, where a harder material of sandstone began, they replaced mechanical dredging with the blasting technology. But they had to continue freezing the rock to keep water influx away. This technology invented by Pe-Be-Ka was effective down to the level of 650 metres where freezing was not necessary any more.

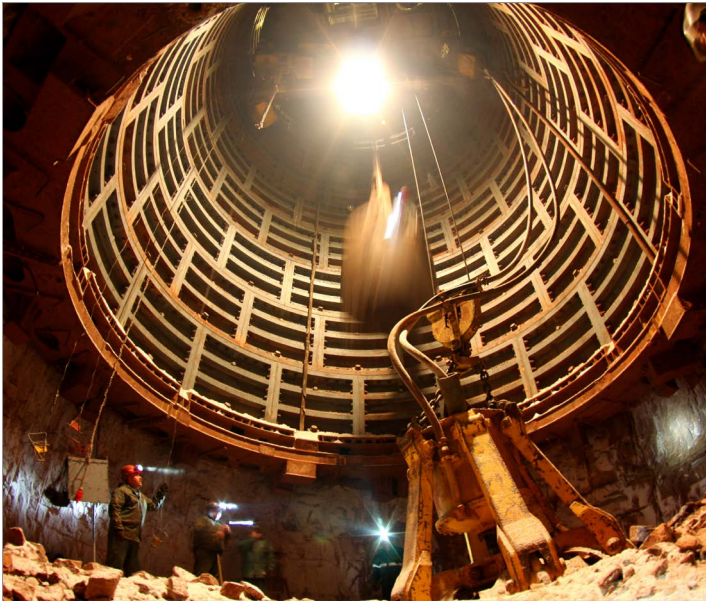
Battling nature

Shaft building is a difficult task full of unpredictable phenomena requiring much flexibility and being prepared for non-routine solutions. Another change of technology was forced by an unusually massive deposit of salt at the depth between 1,026 and 1,192 metres. Pe-Be-Ka engineers faced this kind of a task for the first time in the history of the Copper Basin. They had to solve the problem of salt rheology. This phenomenon steadily reduces the shaft's diameter and they had to develop a method for securing the walls of the shaft to stop their movement. Engineers chose innovative walled supports reinforced with steel rings. The Tadeusz Zastawnik shaft is the first facility at the Copper Basin where this solution was applied.

The shaft was technically connected with tunnels of the ZG Polkowice-Sieroszowice tunnels on July 17, 2013. The shaft began to deliver air at a rate of some 10,000 m³/minute but the target rate is to reach a rate of 70,000 m³/minute.

New shaft, new solutions

The work on shaft GG-1 was commenced in 2010. It is the 31st and deepest shaft at the Copper Basin so far. The shaft was built at the Polkowice county, village of Grębocice, about 0.5 km away from



SW-4 shaft at the drilling phase

SW-4 shaft in numbers: • 1,216 metres – depth • 7.5 metre – average diameter inside the supports • 155 metres – approximate thickness of salt drilled through by Pe-Be-Ka equipment • 470 – the number of tubing rings fitted in the shaft • 70,000 metres³ of air/minute – the target air pumping rate through the shaft

GG-1 shaft in numbers: • 7.5 metre – average diameter inside the supports • 40 – the number of freezing holes • minus 28 degrees Centigrade – the temperature of brine pumped into the freezing holes • 45.5 metres – the distance from the ground to the top of the shaft • ca 1,300 metres – the target depth of the GG-1 shaft.

the village of Kwielice. GG-1 will offer a broader access to the Głogów Głęboki Przemysłowy deposit sitting beneath the level of 1,200 metres.

The first chilled brine flowed into 40 freezing holes in February 2013. Several months later, they installed the shaft drilling equipment including the hoisting mechanism with thirteen steel ropes each longer than 1,500 metres and some heavier than 20 tonnes. The drilling started at the end of 2013 and the first bucket of rock was hoisted on December 11.

Having drilled through the more loose layers of sands, silts, and loams containing some layers of lignite (unstable and rather wet – hence they had to be frozen to stabilise the rock mass and stop the influx of water), the Pe-Be-Ka engineers went on to reach solid rock base at 393 metres in autumn 2014. They changed the mechanical dredging method into blasting and a KDS-2 dredger.

Many new solutions were applied to build the GG-1 shaft. One 45-tonne windlass was installed to replace two 18-tonne ones. This provides more free space which makes work easier at the shaft. The shaft tower is the tallest built so far – 40 metres high and weighing 1,100 tonnes.

The construction is scheduled for completion in 2019 after they reach the depth close to 1.5 kilometre. When finished, the GG-1 shaft will be used for transporting materials and people. It will also have a ventilating function.

D.W.

Let us use the debate over the report „Poland’s policy on minerals” to think of what we should do to meet the expectations of a new Polish generation.

Map of mineral deposits and CSR*

Measures involved in the Corporate Social Responsibility (CSR) are highly interdisciplinary: important are economic, historical, cultural variables, as well as variables related to management, psychology, philosophy, sociology of organisation, and political science. If we want to better understand the processes and phenomena accompanying the CSR it is good to study those measures in the context of the systemic operation of an enterprise which takes into consideration this mesh of inter-relations and links between the organisation and its environment (closer and further stakeholder groups).



Listed companies will have to publish information on their CSR measures from January 1, 2017, on. This obligation is introduced by a European Union Directive. Poland will probably adopt its respective regulations in the next year. Companies are now making reports on their CSR efforts but they do it for prestige and for shareholders and customers. It is part of their strategy integrated with functioning in a particular community (particular time and place). The next stage should consist in producing reports on how they implement **objectives adopted to benefit the community, e.g. support to local enterprise, support**

to the efficiency of local land use plans, unemployment control, collaboration with public organisations, and participation in designing municipal investment projects.

The directive on publishing **non-financial information and information on diversity**, adopted in April last year, will make companies employing more than 500 people to publish such information as: their environmental protection programmes, welfare policy, corruption prevention, and respect for human rights. This, in turn, will allow the companies to design their strategies and adopt policies they need which also provide added value to the surrounding world and to the companies themselves (including the shareholders).

CSR and policy on minerals

CSR should strengthen the competitive power of the region by developing investment projects relying on regional/local human, scientific, and **mineral** resources.

It should promote innovation along the whole chain of collaboration with the central administration, local authorities, academy, and it should promote **minerals** as an added value because it becomes necessary to solve problems stemming from the opinion of local public or pro-ecological organisations.

This has become a standard in the mineral industry all over the world. Situations of this type are seen increasingly often in Poland too. Polish scientific literature on managing mineral raw-materials is virtually silent about it but in the meantime

While the negative image of Polish mining crystallised over years, the process of its change must be handled in a very intentional and systematic way. It would be advisable to develop a general strategy and a more detailed plan of various measures, perhaps, putting a special focus on media campaigns in order to, say, **use the nation-wide debate over the recently published report Poland's policy on raw-materials: a paper on what does not exist but is badly needed which deals with issues closely connected with the subject of the White Paper.**

Social and economic development

The mining industry should put all possible emphasis not only on environmental protection but also on its **input in the social and**

Ensuring the possibility to extract minerals as a source of raw-materials is a necessary condition of sustainable development and inter-generational justice. These deposits are a non-renewable natural resource and this fact makes us responsible for using them in a careful and rational way. Individual municipalities should include in their local land-use plans also plans for the management of mineral resources suitable for the production of building materials (sands, aggregates, crushed aggregates, building ceramics) and programmes for the post-mining landscape recultivation.

Professor Marek Nieć, Ph.D. Eng. – Mineral and Energy Economy Research Institute of the Polish Academy of Sciences PAN, Committee on Management of Mineral Resources

the world has noticed the problem and is carefully studying it now. Poland has no institution responsible for monitoring the international political and technological trends in managing mineral resources.

CSR should focus, above all, on conveying information about mining projects to the local communities involved. It should cast some light on the complex and sensitive relations between mining industry and the community **at the time when the growth of public and ecological awareness in this country seems to outpace the economic development.** Investors implementing the particular projects, especially at their concession-getting phase, should move very carefully and detect any potential source of conflict which, after all, they have to do anyway under the current law on environmental protection.

economic development of the country (under communism, the state authorities used to do that but they badly neglected the environmental protection). Today, individual companies are able to do it but it would be good to have their efforts co-ordinated by a nation-wide institution. Let us take an example from the information and education campaign held in the recent time by the Ministry of Regional Development in connection with the planned EU-funded infrastructural projects (New ways of development...). The next important stage is a wisely-designed information campaign diversified for various target groups which should feel satisfied with the information received. Adequate procedures should also be designed for an event of potential conflicting situations (comp. Conflict Resolution... 1993).

Eugeniusz M. Makowski,
CEO GEOLAND Consulting International

* Corporate Social Responsibility CSR – a concept in which business companies on voluntary basis address public interests and environmental protection, as well as the relations with various groups of stakeholders, at the phase of building their strategies. According to the European Commission's definition, it is „responsibility of enterprises for their impact on the society.” This means that being responsible does not only mean meeting all the formal and legal requirements by business organisations (enterprises) but also spending extra money on human resource, environmental protection, and relations with the stakeholders who may have a real influence on the business performance of those organisations and their innovativeness. Therefore, this type of outlays should be considered as investment and source of investment, not as a cost, similarly as it is in quality management.

Authors used materials from a paper titled: „Guidelines and objectives of mineral policy in national strategic documents” [Założenia i cele polityki surowcowej zawarte w krajowych dokumentach strategicznych], written by: Assoc. Professor J. Kolczycka, Professor at the AGH University of Science and Technology, Mineral and Energy Economy Research Institute of the Polish Academy of Sciences PAN; Jan Kudelko, Ph.D., Eng., Professor at the Wrocław University of Technology, KGHM Cuprum Sp. z o.o.; Professor Herbert Wirth, Ph.D., Eng., CEO KGHM Polska Miedz S.A.

Accession of Lubuskie and Dolnośląskie Provinces to Juncker Plan

How to win the last chance

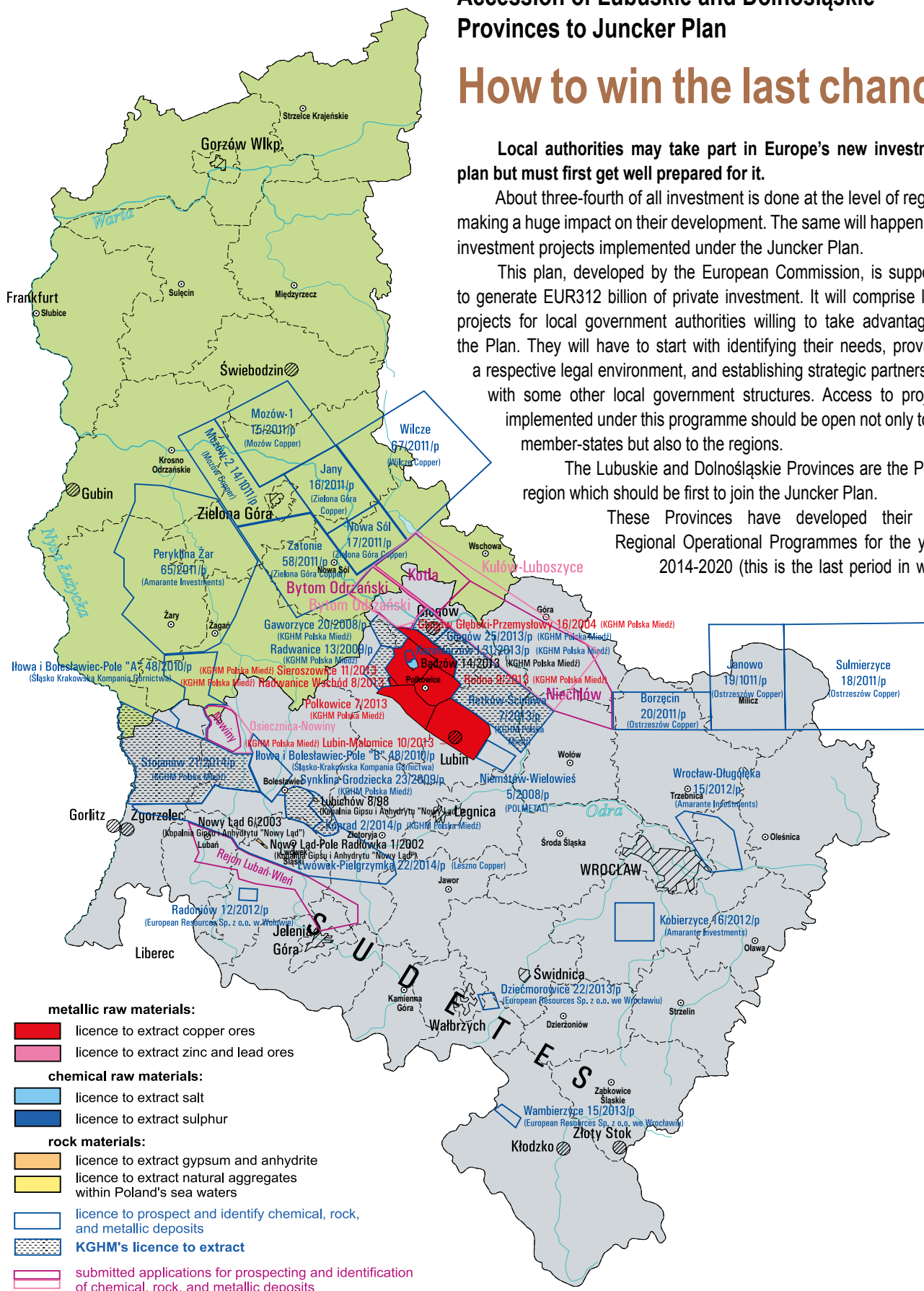
Local authorities may take part in Europe's new investment plan but must first get well prepared for it.

About three-fourth of all investment is done at the level of regions making a huge impact on their development. The same will happen with investment projects implemented under the Juncker Plan.

This plan, developed by the European Commission, is supposed to generate EUR312 billion of private investment. It will comprise large projects for local government authorities willing to take advantage of the Plan. They will have to start with identifying their needs, providing a respective legal environment, and establishing strategic partnerships with some other local government structures. Access to projects implemented under this programme should be open not only to the member-states but also to the regions.

The Lubuskie and Dolnośląskie Provinces are the Polish region which should be first to join the Juncker Plan.

These Provinces have developed their new Regional Operational Programmes for the years 2014-2020 (this is the last period in which



regions get massive support from EU funds). This is why it is so very important to spend that money wisely and achieve higher competitive advantage for the region. And we must not forget the city of Wrocław with its 126,000 students in 24 universities, among them, the respectable Technical University of Wrocław.

Lubin is the seat of KGHM Polska Miedź S.A. and its scientific and technological hinterland.

The region has grown its **creative class** (a community of talented people with high potential for innovation).

The region holds 85% of geological concessions (*see map*).

A report titled: *Poland's policy on raw materials. A paper on what does not exist but is badly needed*, by Professor Jerzy Hausner and Janusz Steinhoff Ph.D, Eng., says that as a matter of fact, Poland has no policy on raw materials at all. Before this policy can be designed, the local mineral resources must be documented. This is a pre-condition for a proper mineral resource management under the spatial management plans.

Data on mineral deposits identified in various places require making a cartographic documentation (*see text under*), that will allow a **holistic, strategic, and sustainable management of those natural resources and, by this, speeding up economic and employment growth in Poland and in the European Union.**

I suggest that the documentation of minerals, municipal development plans, and regional development plans should be done, like elsewhere in Europe, by regional design offices. Those offices should be financed by state budget money. **I suggest that the design offices should make technical documentation and deliver it to the municipalities providing village chiefs with regular technical consultancy on geology, surveying, spatial planning, etc.** The experimental village of Warta Bolesławiecka (*see text – page 12*) was chosen for the demonstration of a technology used in producing such documentation.

The documentation of the scope of mineral deposits inventory is at works now. Later on, the identified mineral resource will be presented in a way that will attract potential mining investors and companies using mineral raw-materials in their business processes (construction, road-building, stone masonry, ceramics, etc.).

Having such material in hand, the municipal authorities are competent to adjust its spatial management plan to the mining needs. Documented deposits and areas where they may potentially be discovered and documented will become the disclosed „municipality assets” and, in the case of deposits under open-cast extraction process, they will be the property of the land owners involved. When municipalities accept their development strategies addressing all-round management of their mineral deposits, the latter will be protected by the current law and their more precise recognition will become possible. This approach will also allow to put part of the resource management initiative on the shoulders of the land owners interested in their recognition and commercialisation. A success of this initiative depends on overcoming the short-term format of planning in the mining sector, so typical of the present political system in this country. Local communities must be informed on the mineral resource potential present in their areas and must adopt informed decisions on their own development.

Production of resource documentation in particular municipalities of the Lower Silesian and Lubuskie Provinces, combined with setting up regional design offices will help to strengthen the competitive edge of those provinces by stepping up investment relying on local mineral, scientific, and human resources. Documentation produced in this way meets half-way the European Union's CSR guidelines (*see text – page 8*). The implementation of this project should be registered with the Juncker Plan and obtain its funding.

E.M.M.

Data on mineral deposits on municipal map portals

Village and town authorities are the actual managers of their areas. Their job is to meet the needs of their communities, run and maintain local infrastructures, make development strategies and plans. Decisions on current activities and development plans require access to reliable and updated information about the area involved. Spatial information is an important type of such information.

Municipal map portals are very handy in developing and publishing mineral deposit management plans. They integrate information coming from various available sources, put together and publish their own spatial information, facilitate communication with the community and, by this, support the municipal management process. Most Polish villages already have such map portals which integrate information obtained from various institutions responsible for their production under the current law.

Information coming from the Polish Geological Institute, the Ministry of Environmental Protection, and the County Starosts, is the most important from the viewpoint of mineral deposit management. The Polish Geological Institute offers a number of information layers concerning the geological structure, features and details of the localised deposits of various minerals sitting both, deep underground and rather close to the surface. Data released by the County Starosts comprise offer important information included in the farmland maps which are based on geological, geomorphological, hydrographic, and other available information and allow judging which area is good for farming. Studying the farmland maps may significantly help to reconnaissance areas selected as potentially hiding significant mineral resources.

Information on mineral resources is often present in local land-use plans and may serve as a starting-point for the inventory of municipal deposits.

This information pool should become a core part of Poland's Spatial Information Infrastructure which derives from the European Union's Directive INSPIRE.

Waldemar Izdebski, Ph.D., Eng., Department of Geodesy and Cartography, The Warsaw Technical University

„The good practice of municipalities' and counties' participation in building the infrastructure of spatial data in Poland”, <http://izdebski.edu.pl/index.php?akcja=publikacje>

Warta Bolesławiecka – a town under a lucky star



The 25th anniversary of the local government is an opportunity to size up its attainments, assess the missed opportunities, and to programme local development for the coming years. It is obvious that each level of the local government structure focuses on its budget and that the prospects for stable income equal prospects for a sustainable development. Re-industrialisation, that is, development through industry, is a common challenge that should be tackled jointly by the local authorities and investors. An exemplary case here is Warta Bolesławiecka, a municipality right at the very heart of an old copper basin. The town still cherishes the memory of a mining accident of 1967 in which 18 local people were killed and its residents remember the „Konrad” mine which was closed in 1990. Twenty-five years after, a „Sun of copper” will shine again on the local authorities and population of Warta Bolesławiecka. New research, the totally new and pro-community measures taken by the company KGHM in collaboration with the local people, have built a perfect atmosphere for investing, while the demons of the past have been replaced by a „new opening”. All this became clear to the participants in a gala meeting which marked the 25th jubilee of the Warta Bolesławiecka local government on May 30, 2015, in which the town fathers took part alongside with Provincial Marshal of the Lower Silesia Voivodship and KGHM officials involved in the project „I-MORE.”



Sun of copper will shine again

Interview with Cezary Przybylski, Provincial Marshal of the Lower Silesia.



This municipality is especially dear to you. The wheel of history has turned and all signs suggest that mining operations will be resumed here. This would be impossible without the local community's acceptance which the investor KGHM must win first.

As regards a friendly attitude of the Warta Bolesławiecka community towards KGHM's investment project, I have no reason to worry. I, myself, live in this village and those who know what kind of losses it suffers by having no mine in its area and those who understand how towns are developing, they all understand what they have lost. As regards the investor's attitude towards the local people, that is, the social responsibility of business, the company is now negotiating with the community, makes its points and tries to change their minds. Actually, municipalities get more benefits from such projects these days than they used to get in the past.

How do you find the presence of KGHM representatives at festivities commemorating the 25 years of local government. Is it an important part of the modern approach to the investor-local government approach?

By all means, yes. When you look at the people who listened to what KGHM officials were saying, you will see they were

interested in having the extraction process brought back to the old mining area. You will see local councillors who will make decisions on the spatial management plans. You will also see a never ending nostalgia accompanied by hope, which is close to certainty, that mining industry will be resumed here again one day. It is looked forward to not only by local residents, but also the residents of neighbouring villages because they hope for the emergence of a huge labour market surrounding the mine.

How is such a project seen from the perspective of the Province?

It provides new jobs, reduces social problems, and generates more income to the budget. KGHM is a global company and it makes a good impact on the entire Lower Silesian region. It is also important to discuss the extraction technology, the fact that froth flotation will be done underground and only the pure concentrate will be hoisted up, while all the waste will be used to fill up corridors and excavations. Another point for discussion is the cycle of environmental protection works. In the case of the „Konrad” mine, most of the people had been getting their water supply from the depth of 820 metres. It was a water with fantastic parameters and any conditioning process would actually spoil it. It can be just a value added to the production of copper and we all should remember that the whole world, Poland included, faces a problem of potable water shortage.

Interview granted to Tomasz Rabenda

Extraction will be back here...

Interview with Mirosław Haniszewski, Village Chief of the Warta Bolesławiecka Municipality



Extraction is coming back but the village has a bad experience with mining accidents. In the old days nobody would have consulted the local people on anything. But things are different today and you can now see copper company representatives invited to a ceremony commemorating the 25th anniversary of the local government.

The first days of the local government in Warta Bolesławiecka were marked with a 32% unemployment, a very obsolete infrastructures, and phasing down of the Mining Company „Konrad”. Although „Konrad” was closed 25 years ago, the village keeps gaining benefits from KGHM spin-off companies which are now using the property of the former Mining Company „Konrad”. These companies are the source of up to 70% of the local budget income and nobody has any hesitations about it today and nobody fears the mine anymore. Surely, we remember the tragic accident which happened nearly 50 years ago, this is nothing the mining industry can ignore, but when we hear what Manager of the Hydrotechnical Plant Rudna tells us, we are sure such an accident cannot happen again.

„Konrad” continued to feed and develop the towns of Warta Bolesławiecka, Bolesławiec, and Złotoryja, even after it was shut down. Visits like the one today certainly have a good effect on people’s views. Former miners have an association here. They are all retired now but their work made it possible for the local authorities

to carry out road and sewage building projects. The required funds were earned by those people.

Our biggest tax payers are the Mining Company Lubin and the Hydrotechnical Plant Rudna. A municipality can develop and build its future only with funds coming into its budget. Our greatest hopes are connected with the KGHM-planned investment in the copper deposits at Wartowice. The drillings done by now show that the project will generate profit, especially when the government abolishes the mining tax.

How do you find the current collaboration with KGHM?

We had a breakthrough in the years 2008-2009 when the company came back, and made some successful drillings. That coincided with the planned construction of wind farms. Then we realized these two things cannot work together because the wind farm may rule out the construction of the mine. The mine will offer new jobs but the wind farm will not, so we had an easy choice. We also expect that local people will get very good water, good for drinking as it comes without conditioning, like they did in the past when copper was extracted here and now KGHM studies show this is possible because nothing has changed here.

We have a mining vocational school here which attracts so many candidates for mining students that only one of 2-3 applicants can be accepted. The school leavers are now commuting to work at the new mining basin 50 kilometres away but meetings like this and information provided by the investor persuade them to build their houses here in a hope that they will get new jobs here soon.

T.R.

* * *

Eng. Grzegorz Lipień, M.Sc. – manager of KGHM Polska Miedź S.A. Prospecting Department



My first contact with the geology of this area goes back to my high school years when I was a student of the Geological Vocational School and we did our practical classes in bore holing. I was responsible for documenting the nearby deposits of white clay for pottery. The Warta Bolesławiecka municipality, like its neighbouring villages, has a unique in Poland potential for development based on its mineral deposits, not only the copper ores but also sand rock, limestone, anhydrites, aggregates, and ceramic clays.

This region also offers a very nice landscape and its yellowish sandstone of many shades, often used as building material before World War II, distinguishes this area from other regions and it should be protected in some way. A region so rich in minerals should have

its spatial management programme addressing its mineral potential so as the documented deposits and the promising areas can become a local asset and a proposition for investors.

By the time when Jan Wyrzykowski discovered copper deposits near Lubin in 1957 this municipality had been the most promising area for documenting copper ore deposits. A very costly bore holing programme had been carried out here but it was abandoned soon after the news of copper discovered at Sieroszowice and Lubin. Only now KGHM, with a concession in hand, will complete the prospecting work started in the 1950s. The fact that the deposit here is much smaller than the one in Lubin and the „Konrad” mine produced a lower-quality concentrate obviously played a role in the decision to phase out copper production here. After time, looking through the lens of legal and economic changes which have taken place in this country, we can say that closing the

„Konrad” mine was not altogether a disaster for the local community and its material interests.

Yet, things have changed much by today, the local community and the investor are negotiating all the key features of the planned mining project, while industrial fees and taxes come as a rich source of municipal income. Contemporary technical and financial models of mining projects take into consideration all the operation costs, including the liquidation of the mine and recultivation of natural environment after its close-down. Our studies show that about 2 million tonnes of copper are buried underground in the area of the municipalities (see map) and hydrological studies suggest that underground water will not cause problems in building the mine and its further operation.

The ore resource in this deposit will ensure copper production for 20-25 years and the municipalities pursuing their respective development policies and benefitting from the higher

incomes and industrial infrastructures, can programme their future by creating alternative income sources and new jobs. We want the planned mine to be high-tech, we want its construction to be a testing ground for new technologies applicable in copper mining.

There is no reason to fear present-day mining because it is totally different from the old-style mining – local communities are now fully informed about how things are in their area and they will make the final decision about its shape. Development opportunities are there. As soon as KGHM finishes its geological reconnaissance and the technical design is available, the documents will be displayed for inspection, comments and any necessary modifications. Contemporary business companies, mining plants included, must operate in a responsible way to respect the local specificity and avoid generating unwanted conflicts and disapproval of the local residents. ■

Eng. Mariusz Czop, M. Sc. – The Stanisław Staszic University of Science and Technology in Kraków, Faculty of Geology, Geophysics, and Environmental Protection, Department of Hydrogeology and Geological Engineering.



We are messengers of good news (together with Grzegorz Lipień, -ed.) because the mineral deposit in our area is abundant and promising and, at the same time, it is the area where KGHM has located its strategic project of getting access to deep deposits sitting more than 1,000 metres down. We must go that deep because the deposits closer to the ground level are already depleted or will soon be. Working deep underground at the Sudeten monocline, we find difficult geological conditions with high temperatures and dense salinas. Quite recently, it has been discovered that there are no such problems here in the Grodziec syncline where the rock temperature deep down is low, there are no gas hazards, and we can get a very clean water into the mine.

Our studies are done to describe the deposit and provide a new definition of the hydrogeological conditions in that area. We will certainly not go ahead with building a mine here, if we find that the water resources cannot be adequately protected or we would reduce them in any significant way.

The planned mine must, first of all, be modern, that is, it must employ innovative technologies and equipments. Instead of having a shaft and a traditional structure of the mine, we prefer to get reach the deposit via a sloped heading that can be dug by a dedicated header machine which moves on leaving behind a well supported excavation. A similar technology is used in drilling underground railway tunnels. The second pondered innovation is to locate preliminary processing underground and to store the waste there too. It is also important to note that the rock mass

in the Grodziec syncline contains no salt which makes it good for construction and other applications. There is no problem with post-mining water management because hydrological surveys confirm that potable water is available at all the underground levels and it can be used for household, industrial, and crop watering purposes.

The project of getting access to deep deposits is known by its abridged name „I-MORE” which means that we want to get more from the identified deposits. It is carried out by a scientific consortium of the KGHM Research Centre Cuprum, the University of Science and Technology, the Wrocław University of Technology, the Central Mining Institute, and the Mine Construction Company. The project consists in finding an advanced technology of reaching the deep deposits in order to explore it and give a boost to the development of local communities, and also to trigger re-industrialisation and further development of other spheres of life.

A feature of mining industry is that one job in the mine generates 3 to 5 jobs in associated businesses surrounding the pit. The very construction of a mine which costs an estimated several billion zlotys is a huge development spurt. Then come taxes and other charges paid by the mine for long decades. We will publish the results of our studies on the current basis and 2-3 years from now, when the project is over, a new mine concept buttoned up, and when we eventually convince even the biggest sceptics who doubt in the technical feasibility of exploring deposits 1,200-1,500 metres deep, we will demonstrate that it is economically viable and the mine can earn decent profits for the investor and, first of all, for the municipality of Warta Bolesławiecka. ■

„Poltegor–Instytut” Institute of Open Cast Mining

Mining, power engineering, environmental protection

„Poltegor–Instytut” the Institute of Open Cast Mining is the only Polish research institution whose competence covers the whole range of problems related to the management, exploration, processing, exploitation, and re-cultivation of raw materials extracted with the open-cast method. The mission of the Institute is to develop and implement on industrial scale innovative technologies, processes, methodologies, and technical solutions applicable in open-cast mining and in the whole area of environmental protection.



Jacek Szczepiński,
Ph.D., Eng.,
Director,
„Poltegor – Instytut”
Institute of Open
Cast Mining

The beginnings of „Poltegor – Instytut” date back to 1950 when a few design offices in Silesia opened their outlets in Wrocław and then converted them into the Lower Silesian Mining Design Office (DBPG). A merger of DBPG with the Lignite Scientific Research Centre (GIG) in Wrocław in 1968 made up the Central Research and Design Institute of Open Cast Mining–Poltegor and this one was re-named „Poltegor – Instytut” the Institute of Open Cast Mining and the Poltegor–Design in 1991 (since 1992 to-date it is a limited liability company).

All activities of the Institute are inseparably connected with the development of open-cast mining, especially with the lignite

units control systems and technological documentation for prototype rubber, rubber-metal, and rubber- fabric components.

Currently, the Institute focuses not only on open-cast mining but also on power engineering and environmental protection which are inseparably connected with mineral extraction. The Institute also produces environmental impact reports, works on noise protection and prevention of soil degradation, and carries out projects in mine and engineering structure drainage, estimation of underground water resources, water intakes, and their protection. This work is supported by the most advanced software for modelling deposit conditions and plotting multi-dimensional digital models of deposits, modelling water flows and mass carried by underground water currents, and spatial modelling in GIS system. Biotechnology and waste recycling are also important areas of the Institute studies, as well as the thermal and biological conversion of

We develop innovative, clean, and environment-friendly technologies for the extraction of minerals and we implement new technological solutions. We do comprehensive research in the field of environmental protection, machine diagnostics, thermal conversion of natural raw-materials, and the seismology of rock mass.

and rock extraction. It gained its expertise in design and research covering geology, mining, engineering, and environmental protection during the construction and modernisation of lignite mines in Bełchatów, Turów, Konin, and Adamów, sulphur mines in Machów and Piaseczno, and rock quarries in Kujawy, Morawica, Krzeniów, Klęczany, Góraźdże, Józef and many others.

The Institute invents advanced concepts for the management and extraction of deposits, innovative production technologies, original software, monitoring and control systems supporting the extraction processes. The Institute is a national leader in the field of open-cast rock blasting. We have made a major input in the production of machines for lignite mining industry, in this, KTZ systems for continuous extraction, diggers, belt conveyer systems, stackers, and support machines and equipment: transporters, feeder-stackers, starters, vulcanizing units, clinometers, metal detectors, and many others. The Institute designs innovative hydraulic power

organic materials. The Institute takes an active part in research and development projects aimed at rolling out advanced technological solutions for efficient use of the natural environment and building the strategy and concepts for the reduction of energy consumption and emission control.

The Institute's activities are performed by a 70-strong team including research workers and technicians with vast professional experience gained in Poland and abroad. They get support from 12 technical laboratories 4 of which hold a PCA accreditation. A bi-monthly Open Cast Mining published by „Poltegor – Instytut” has a history longer than 50 years and is the only magazine in Poland which writes on the whole of open-cast mining sector.

We have taken part in the projects carried out under the Operational Programme Innovative Economy, the National Research and Development Centre, and the Central Europe Programme as a leader and as a consortium member. In 2015, we collaborated with

PGE Górnictwo i Energetyka Konwencjonalna S.A.'s branch Kopalnia Węgla Brunatnego Bełchatów on launching projects subsidized by the Research Fund for Coal and Steel (RFCS) and investigating smart systems for monitoring landslide danger in lignite mines and smart solutions reducing the break-down rate of wheel excavators operating in tough rock conditions. Further project applications are now being prepared for such programmes as: Horyzont 2020, Biostrateg, LIFE, Interreg Europa, and RFCS. We are carrying out the projects in collaboration with key research centres in Poland and abroad.

Collaboration with our industrial partners is also very important for the Institute. The most important of those partners are: PGE GiEK S.A. branch Kopalnia Węgla Brunatnego Bełchatów and PGE GiEK S.A. branch Kopalnia Węgla Brunatnego Turów, PAK Kopalnia Węgla Brunatnego Konin S.A., PAK Kopalnia Węgla Brunatnego Adamów S.A., PAK Górnictwo Sp. z o.o., KGHM Polska Miedź S.A., MPWiK in Wrocław, Kopex-Famago S.A., Siemens Sp. z o.o., Stomil CZ, Actemium/BEA GmbH and Vattenfall Europe Mining AG. We are doing our research and development projects in Poland and in other countries. Our solutions have been shown at many international conferences in the United States, China, Australia, India, and many other countries.

The attainments of „Poltegor – Instytut” have been widely appreciated as we have won a number of prestigious awards, prizes, and distinctions in the recent years, among them, an award at the International Exhibition on Inventions, Research and New Technologies EUREKA in Brussels, Concours Lepine in Paris, and at INPEX in Pittsburgh. These attainments have earned the Institute a Bachelor's Cross and Officer's Cross of the Order of Invention granted by the Belgian Supreme Decorations Committee and, in Poland, the title of Innovation Leader and a Lower Silesian Business Certificate. The Institute's work includes several dozen patents, monographs, hundreds of press articles, and many conferences it has organised for domestic and international participants.

The current financial perspective 2014-2020 provides that business will have a larger share in funding research and development and, in this way, it will become much more involved in scientific research. Living up to the new market conditions and to the competitiveness in the research and development sector is an extra stimulus for permanent technological advancement and innovativeness of our work. „Poltegor – Instytut” is well prepared for both, the role of research work leader and for providing massive support to Polish companies implementing projects under the Operational Programme Intelligent Development. ■

Agreement of Lignite Producers

We Defend Coal!



Polish lignite mining represents worldwide standards. It is one of the best economic specialties of our nation. Polish technical universities, research and design institutes, and production plants with their technologies and machines are very well known and highly valued in the world. Poland is one of the few countries which hold all the trump cards required to carry on lignite extraction and to step it up quite significantly. Lignite has a stable and well defined market in this country and is almost all used for the production of electric energy. Poland extracted 63.7 million tonnes of this fuel in the last year and the share of electric energy generated from this carrier is stable fluctuating only between 30-33% for many years now. Lignite is the cheapest source of electric energy and an important factor stabilising its prices in the Polish power and energy system.

Established in 1992, the Union of Employers of the Agreement of Lignite Producers has, since its very beginning, served the cause which is extremely important for the state by undertaking many measures to support and promote lignite mining. The Agreement of Lignite Producers not only protects and represents the interest of its members. A major objective of the Agreement is also to make any effort possible to support an all-round development of the lignite industry, ensure multi-directional applications of the main and accompanying minerals, and to reduce the environmental impacts of the mining industry. The Union of Employers of the Agreement of Lignite Producers has long been building friendly conditions for the work of the employers and, hand-in-hand with public partners, it has worked to build a modern work environment in the sector.

The Tripartite Team for the Lignite Industry is such an effective plane for co-operation where a tri-lateral dialogue of the sector is held in order to bring closer together the interests of employers and the public side with the participation of the government. The Agreement fully implements these tasks by working out joint positions on various issues important to the state policy and to the interests of employees and employers. The Union has long and untiringly promoted the lignite sector and dialogue-prone attitudes not only in the national economy but all over Europe. It does it, among other methods, by increasing the Agreement's presence on the international forum of the European Association of Coal and Lignite EURACOAL. Worked in this way, the co-operation plane strengthens the position of solid fuels among other competitive energy sources and represents the

coal industry on various European forums by promoting this fuel and shaping its future. A number of individuals who represent companies operating in the lignite sector were and continue to be the strength of the Agreement of Lignite Producers. The organs of the Agreement of Lignite Producers are: the General Meeting of Ordinary Members, the Board of the Agreement, the Management Board, and the Audit Committee. The function of Chairman of the Management Board of the Association of Employers of the Agreement of Lignite Producers is performed by Stanisław Żuk,

nation's energy security much stronger. This is particularly important in the context of attempts made to link the prospective development of Polish industrial energy production with imported gas and oil. In the light of recent European developments, getting supplies of those fuels from current sources seems extremely unpredictable, especially as their prices show fluctuations of major consequences to the state budget. Therefore, a rational use of lignite resources, especially the exploration of new deposits, should be made one of the top priorities of the national policy on energy.

Historically, this country has relied on coal and it cannot suddenly and swiftly change this. The development of mining and energy generation based, first of all, on native fuels requires further development of mines, power stations, and businesses serving that sector, altogether providing jobs to dozens of thousand people.

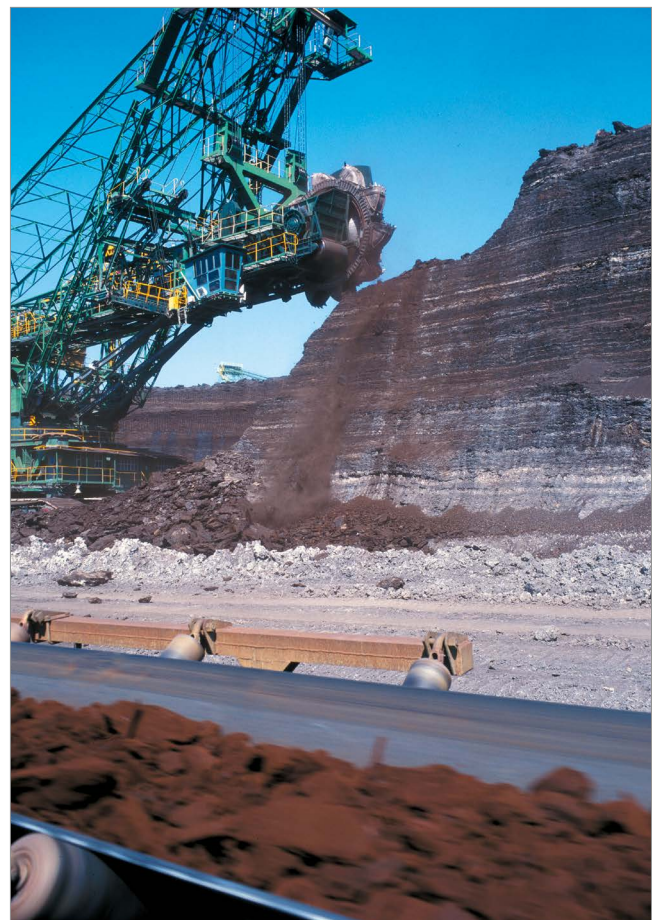
Deputy Chairman of the Management Board of PGE Górnictwo i Energetyka Konwencjonalna S.A., and President of the Agreement's Board is Jacek Kaczorowski, Chairman of the Management Board of PGE Górnictwo i Energetyka Konwencjonalna SA.

The Association of Employers of the Agreement of Lignite Producers is a recognized public partner in Poland and Europe, it represents mining enterprises and production companies, designers, and scientific research institutions which work for the Polish lignite industry. The Agreement claims a membership of 15 business entities. These are: PGE Górnictwo i Energetyka Konwencjonalna S.A. in Bełchatów, PGE Górnictwo i Energetyka Konwencjonalna S.A. Branch Kopalnia Węgla Brunatnego Bełchatów in Rogowiec, PGE Górnictwo i Energetyka Konwencjonalna S.A. Branch Kopalnia Węgla Brunatnego Turów in Bogatynia, PAK Kopalnia Węgla Brunatnego „Konin” S.A. in Kleczew, Kopalnia Węgla Brunatnego „Sieniawa” Sp. z o.o. in Sieniawa Lubuska, PAK Górnictwo Sp. z o.o. in Konin, FUGO S.A. in Konin, Kopex-Famago S.A. plant in Zgorzelec, Sempertrans Sp. z o.o. in Rogowiec, Poltegor-Projekt Sp. z o.o. in Wrocław, IGO Poltegor-Instytut in Wrocław, SKW Biuro Projektowo-Techniczne Sp. z o.o. in Zgorzelec, BESTGUM Spółka z o.o. in Rogowiec, RAMB Spółka z o.o. in Bełchatów, Przedsiębiorstwo Transportowo-Sprzętowe „Betrans” Sp. z o.o. in Bełchatów. Historically, this country has always relied on coal and it cannot suddenly and swiftly change this. The development of mining and energy generation based, first of all, on native fuels requires further development of mines, power stations, and businesses serving that sector, altogether providing jobs to dozens of thousand people. Hard coal and lignite mining may and should be the guarantor of Poland's energy for many decades into the 21st century. Electricity obtained from native fuel, especially lignite, is and will continue to be the cheapest energy in the foreseeable future. When analysing the criteria of economic competitiveness, we must observe that lignite is the leader in its category these days because the cost of generating electricity from lignite is lower than burning hard coal for energy.

Poland has vast deposits of this fuel and building national energy sector on the foundation of domestic resources makes the

Lignite mining commands an experience of nearly 70 years gained at various areas where lignite is produced and processed, experience in methods of extraction, designing the mines, deposit drainage, removal of soil, selection of machines and vehicles, maintenance management, and environmental protection. The advantages of lignite and the development strategy are an input the lignite industry is making to ensure stable supplies of the cheapest fuel available to the national power sector.

A.P.



Raw-materials and future of the world

Professor Krzysztof Szamalek – the Polish Geological Institute; Department of Geology, the Warsaw University



The Ricardo paradigm says that as the time flows, the human kind keeps using resources (including mineral resources) whose quality constantly declines and this increases the cost of obtaining those minerals. Meeting the needs of human kind requires using minerals in the production process. We can, therefore, be sure of an incessant demand for mineral raw-materials (i.e., goods and products too) but there may be a gap in the supply of minerals. This should, of course, be considered as something possible only in a remote future of 100-200 years from now or, perhaps, even more than that.

Substitution, discovery of new deposits, reaching the increasingly deep resources, using deposits poorer than before, recycling – this is how the supply of mineral raw-materials are all the time being supplied to the economy which meets the human kind's needs. The permanent growth of the world's population is accompanied by a permanent growth of extracted minerals. Scientists are responsible for studying the long-term development trends and drawing conclusions and building theories allowing us to avoid a dramatic shortage of raw-materials or to minimise its consequences.

Convention on the Law of the Sea (which entered into force after some political frictions in 1994). Although the world's oceans and seas are subject to all types of geological studies, especially, since the latter half of the 20th century, the recognition of potential mineral resources there is still insufficient. We keep seeing reports on new minerals which can be used as raw-materials.

News from Japanese researches was a great surprise (but certainly not the last one) in 2011 who reported that silts found on the ocean bottom near the Japanese islands contain significant levels of rare earths elements (REE). Supervision, inspiration, and control over geological studies in the ocean is performed by the International Sea-Bed Authority). In future, it will be responsible also for the supervision over the extraction of oceanic minerals. A number of world countries (including Poland as part of the Interoceanmetal organisation) have carried out wide-scale research into oceanic resources. These studies focus not only on analysing the deposits (their origins, forms, chemical structure, mineral composition, and size) but also on technological issues (possible extraction and processing of a given mineral), and technical questions (materials and structure of off-shore mining and processing installations).

Mineral raw-materials are unevenly distributed on the planet, not to say they are distributed in an unfair way. Some regions of the world are especially privileged here. Poland is in a group of countries rich in mineral deposits (i.a. lignite, hard coal, copper, zinc, lead ores, native sulphur, rock).

We might consider the outer space as our reserve of raw-materials but any effective (and economically viable) management of those resources will become possible only in a very remote future. On the other hand, the resources of the global ocean (meaning all the oceans and seas of our world) are a well-recognized source of minerals for humanity.

Minerals present in the world ocean can be divided into several groups of raw-materials:

- energy carriers (crude oil, natural gas, gas hydrates, hard coal and lignite),
- metallic minerals (polymetallic nodules, polymetallic massive sulphide ores, slimes and silts containing metals, cobalt crusts, placer deposits of metal ores),
- chemical (salts, sulphur, phosphor nodules, barites),
- rock (sands, gravels),
- noble (paydirt, sands containing platinum, diamonds and gems, amber, pearls, corals).

Such precious and vast mineral deposits give hope and encourage their management. Thus, it becomes clear why mankind needed more than 30 years to adopt in 1982 the International

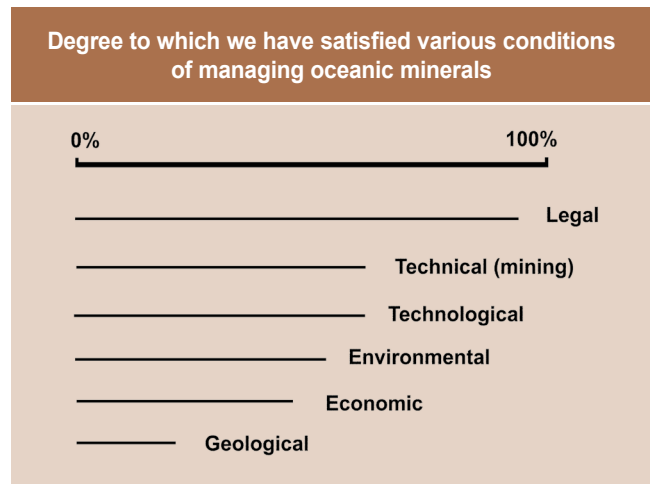
The size and time of starting industrial-scale production of minerals from the ocean bed will depend on economic factors. With high prices of minerals, the cost of hoisting them from sea bed, although still higher than on land, will cease to be a barrier for their management. Surely, environmental protection may become a barrier. Mining intervention in the fragile and sensitive environment of the ocean (especially firmly bonded and mobile benthos) is a potential threat. All projects involving the management of oceanic minerals must take into account the threats to the ocean's organic world and prevent them. The author's subjective opinion on the level of readiness and meeting the criteria of oceanic minerals management is shown in the graph.

The sea has been a place of mineral extraction for many years now. These minerals were mainly crude oil and natural gas, but also cassiterite (tinstone), octahedrite, and rutile (sources of titanium). Gold, platinum, diamonds, and other gems are also obtained from off-shore sources. Sea-bed deposits give us also hard coal, sulphur, sands, gravels, phosphorites, salts and sea water is a source of metallic magnesium. We should expect the proportion of hydrocarbons obtained from the sea to grow significantly in the coming decades. Very deep sea waters inaccessible until two

decades ago are now intensively explored. The discovery of vast oil deposits in deep Atlantic basins by Brazil in the recent decade and a similar discovery in the Mexican Bay and off Angolan coast indicate new potential deposits to explore. Accumulations of methane clathrate (solid blend of water and methane) are with no doubt very abundant unconventional deposits of natural gas. They are found under the sea bed and just on its surface. This resource is now estimated as larger than the gas resources on dry land altogether. Gold was found in massive sulphide ores close to the Papua New Guinea coast. The company Nautilus has applied for an extraction concession there several years ago. If I can avail myself of making a new subjective assessment of the order of managing new oceanic minerals in the coming years, this order would be as follows:

- polymetallic hydrothermal sulphide ores (source of gold, copper, cobalt, zinc, and other),
- methane clathrates (natural gas),
- polymetallic nodules (manganese, chromium, copper, cobalt, nickel),
- cobalt crusts (cobalt, copper, nickel),
- silts and loams containing metals (rare earths elements, copper, nickel, gold).

Training well-qualified people to do the recognition and management of oceanic minerals is a time-consuming process. To anticipate the inevitably approaching necessity of starting the management of raw materials obtained from the sea, we must invest in such studies as the geology of the sea, off-shore drilling, research



methods at sea, sea mining. In Poland, such studies have already been commenced, among other things by opening new fields of study (sea mining) at the AGH University of Science and Technology and the University of Szczecin. The future of the world's minerals is in the ocean and in countries that will have managed to get prepared for it and able to reach for the vast resources waiting there. ■

Author of many papers on oceanic mineral deposits, among them, „Surowce mineralne mórz i oceanów” 1998 ed. by R. Kotliński & K. Szamalek, W. Mizerski & K. Szamalek „Geology and mineral raw materials in the ocean” 2009. Poland’s representative at the International Sea-Bed Authority and Interoceanmetal in the years 1994-1997 and 2001-2005.

German Energy Transition

Triumph of modernity

Dr Christian Hey – Secretary-General of the German Advisory Council on the Environment



Decisions concerning the German Energy Transition in the years 2010-2011 focused on three main areas:

- closing the nuclear energy phase by 2022,
- development of renewable energy

sources to produce 80% of the electric energy and cover 60% of the whole energy demand by 2050,

- setting the national energy target until 2050 (an 80-95% drop against the 1990 figure).

The government also defined a number of transitory objectives and measures. Germany is on the right way, although it is not quite free of problems, contradictions, and setbacks.

Before that decision, Germany was going through never-ending, often controversial debates over those three issues. As a matter of fact, these debates continue until today. The

energy transition has evolved amidst numerous conflicts. It is a resultant of struggling opposite opinions on the relation between modernity and natural environment. This conflict is 40 years old now. Questions related to energy are highly political in Germany. They strongly divide the nation, its political parties, and regions. One of the biggest successes of the government’s decision to go for energy transition is that it has produced a certain kind of consensus after many decades of principal disputes.

It was a debate on various concepts of modernity described by a German sociologist Ulrich Beck. Traditional modernity is associated with the assumption of linear instrumental rationality, such as, for instance, economic growth, technological progress and, especially, growing labour productivity, functional differentiation of high performance, and controlled risk. However, the theory of „reflexive modernity” claims that unplanned side-effects of traditional modernity may also be a real driving force of change.

If nuclear threat, climate change or, an excessive depletion of natural resources one day destroy the very foundation of economy and society, an ordinary modernity will not be possible any more. Side-effects have their consequences. This is a new reflexive element. Unwanted side-effects should be prevented. The decision to start energy transition is a triumph of arguments provided by reflexive modernity in the national debate.

This can be seen in the three dimensions of that debate:

- the economics of energy transition,
- the nuclear risk,
- the role of state policy on the climate.

Economics of transition

Germany is the most industrialised country in Europe, hence the cost is a very important part of the debate – cheap energy is widely believed as a source of competitive advantage. Traditionally, nuclear energy is considered cheap, while renewable energy is thought to be rather expensive. This argument has been successfully dismissed in the debate.

First, when we count up all the hidden costs of nuclear energy, that is, the cost of storing and final neutralisation of nuclear waste and the cost of responsibility for nuclear threats, this energy will turn out to be the most expensive of all.

Second, renewable energy goes cheaper and cheaper with time. While the safer nuclear plants of the third generation are

Climate debate

Towards the end of 1980s, the debate reached a consensus on the key role of climate policy: first, a national target of 25% was set until 2005, then 40% until 2020, and finally 80-95% until 2050 and these targets enjoyed general support and were adopted by the government.

However, the issue keeps stirring controversies till now. The main point made by the opponents is that it is „too small to save the world“. Climate is viewed as a global or, at least, pan-European problem which does not affect individual nation-states. This is why measures undertaken at the national level cost a lot but produce little effect. This is why, they claim, we should rather wait until global harmonisation in this field trusting in centralised solutions and systems, such as, the European Union Emissions Trading System. But the leading German climate activists have a reply – the multi-level management concept: when top-down processes fail, why should we not take advantage of the bottom-up process:

- we observe a global spreading of innovation in natural environment policies pursued by individual countries and their successes are monitored, copied, and shared,
- leaders make alliances and encourage international negotiation – without the participation of leading actors on this scene, no ambitious international order will ever be reached,
- we must appreciate the numerous and mutual benefits offered by national climate policy: clean air, innovative technologies, employment, safer and more efficient energy.

In 1999, Polish renewable energy plans were comparable with the German plans. But those plans have never been carried out. At that time, both countries strongly relied on coal energy and a conventional energy mix. Later on, the two countries began to follow different directions. The question is: why?

increasingly more expensive, wind and solar energy are getting cheaper and closer to the critical point. Thus, from the reflexive point of view, renewable energy is a cheaper source. In this way, energy transition enhances the development of green energy, ecological modernisation, and even the third industrial revolution by combining in itself the renewable era with the digital era.

Nuclear risk

Danger has been in the focus of nuclear energy debates since the 1970s. The alliance of nuclear energy advocates claimed that Germany, as the technologically most advanced country in the world, is able to make this complex and risky technology safe. On the other hand, the opponents used nuclear threats to make their main point saying that potential destruction and long-term consequences are uncontrollable. The Fukushima disaster proves that unpredictable catastrophe may happen even in such a technologically advanced country as Japan. Then, terrorism became a new argument against it after September 11, 2001.

This means that even a small country can do a lot: the best example for this is the global roll out of feed-in tariffs in more than 60 world countries, including China, or the spread of regional ETS systems all over the world.

Yes, there is something known as the „German specificity“, things deeply rooted in German tradition, but a lot more reasons and concepts are found everywhere else. The dispute between ordinary and reflexive modernity continues all over the world. Maybe the fact that a partial victory of reflexive modernity took place in Germany and not in any other country is somehow related to its institutions and public movements. The German political system offers reflexive modernity supporters many opportunities to show up and act. This system encourages the enthusiasts of change. On the other hand, closed political configurations and centralised systems can kill reflexive modernity. ■

The author took part in a conference in Warsaw on June 18, 2015. The conference heard the report: „Citizens rich in resources. A White Book of managing natural resources in Poland“. The conference included a debate over the natural resources management in Poland.

Poland is richest in minerals and geological resources in all European Union

Things must change

Policy on geology and raw-materials

Poland is EU's richest country in terms of mineral deposits and geological resources. We must not forget that minerals are only a part of the whole geology because we should also look at other geological structures which can be used for storing various substances or, in other words, for building container-less storage facilities (finished fuels, crude oil, gas, CO₂, radioactive materials, military, and other purposes – we can make money on the storage business but, at the present moment, we command the smallest storing capacity in the European Union). The policy on minerals requires extensive professional knowledge. Poland is pursuing a virtually backward policy on minerals. Segments of this policy have been allocated to



Professor Mariusz-Orion Jędrysek, Ph.D., Eng. – Head of the Department of Applied Geology, Geochemistry, and Environmental Management at the University of Wrocław.

hamper investment, deplete the resources and, to say the least, are complex beyond the needs – any geological and mining enterprise today must pay about 20 different charges at the time when Polish geological companies are dying. We have inefficient or, as a matter of fact, harmful system of concessioning geological and mining projects – concessions seem to be distributed at random (?). We are facing a wave of legal actions between the State Treasury (four big cases are at the court right now) and, eventually, many cases under international arbitration. Poland has lost control over its title to many important concessions and geological information. This nation has a great asset of underground wealth but seems unable to use it. As a result, Poland's role on the global mineral market is undeservedly small and it

Poland is pursuing a virtually backward policy on minerals. Segments of this policy have been allocated to different other policies and, as a result, different minerals ended up managed by different government ministers (divisions of the state administration).

different other policies and, as a result, different minerals ended up managed by different government ministers (divisions of the state administration). The fact is that the mineral profile determines the economic profile (including the power profile) and the geopolitical profile of the state – not the other way round. Any rank different than that causes losses to the nation's wealth (examples: sulphur, shale gas, hard coal and even lignite, metals, etc...) and losses in the related minerals (e.g. noble gases, some rare metals, mineral waters, etc.).

Missing things

Missing organisation by the state is the main cause of this mineral catastrophe, namely, missing policy and management of the geological and mineral potential, missing tools, missing expertise of decision-makers (political figures from outside the industry hold high positions in the sector). The Geological Survey does not have a status of a state organ – providing tools and sources of reliable knowledge to the government – missing are also an efficient geological administration at the central and local government levels, long-term planning, management of geological structures (container-less storage), documentation made to international standards, risk assessment and control, preventive measures, effective work for the United Nations International Sea Bed Authority, efficient policy on renewable energy sources (energy sources, climate, ozone, pollution, sea, water...). Poland has an irrational, truly harmful legislation and a similar tax system which

enjoys rather insignificant position in designing, implementation, and application of the EU law and other international agreements (including UN treaties). We are also wasting some past gains on the international arena (e.g. the agreement on geological prospecting in Mongolia – it seems that Germany took our place there several years ago) – and we may even lose KGHM (I warned against this risk many times in the years 2011-2012). Poland is facing a major threat to her mineral security (which also means a threat to energy security). An industry that could be blossoming experiences growing unemployment, corruption, illegal extraction, shadow zones, and smuggling instead. In some cases, companies and even local authorities must dodge or breach the law just to be able to carry on operating. If these things do not change, we will not escape profiteering, hostile acquisitions, and selling away business and mineral deposits for a fraction of their actual value.

Fair business hates lack of transparency, instability, unpredictability, discretion, incompetence, sticky hands, political puppets, etc. All this increases the risk which is much higher than the risk of geological prospecting – hence the expectation of high reward for the risks taken. At the end of the day, it is the State Treasury and the nation who are losing, while banks gain on selling more expensive loans to investors. All this either drives investors away or leads to overexploitation of the most profitable „takes” and to the loss of deposits. My estimation is that the sector's losses and lost profits altogether have amounted to several hundred billion zlotys in the recent years.

Rescue

The necessary rescue must include the appointment of the Polish Geological Survey (PSG) as a professional state authority built on the foundation of what is there now (no extra cost) and based on part of the resources of the Polish Geological Institute (PIG) which, being a scientific research centre, cannot itself operate as a state organ without running into a conflict of interests.

The PIG used to be such a state service nearly 100 years ago, after which it evolved while the legal environment, raw-material policies, and state requirements kept changing. But it is important to continue its tradition and save the staff's jobs. It is also necessary to reform the geological administration and mining supervision, and to reinstate the advisory institutions. All this should obey the principle that positions in the sector are manned by outstanding experts in this profession. The aim is to build a system (PSG) supporting the government administration (PM, several Ministers), local government authorities, and investors (sic!) with expert knowledge.

A clause should be added to the Polish Constitution to protect deposits and geological structures as the wealth of the whole nation, a new geological and mining law should be passed, and a mining code should also be adopted and implemented. We must restore the system of managing the risk, implied profits, multi-scenario planning, global market surveying („raw-materials game”), assessment and pricing our own resources, flexible concession contracts (to make the owner-investor relations reasonable), building a sea-going ship for prospecting and exploitation...

All that would streamline Polish mineral policy, increase its effects, reduce investor's risk (it would also reduce the expected risk compensation), offer about 10 thousand new jobs every year (that is, up to 50,000 potential jobs), increase the State Treasury's income by some 1 billion/year, increase the geopolitical role and security of Poland, rationalise spatial planning, make the local communities better off, improve the quality of natural environment, and it would also improve the underground water management.

We can do it! ■

The author has been campaigning for the adoption and implementation of a Mineral Policy in Poland ever since he took the office of Deputy Minister of Natural Environment and the Chief Geologist in 2005. He was doing it at the time when Europe believed that any geological and mining projects were harmful. His campaign also included inspiration of a public debate, delivering hundreds of lectures and publication of many papers, especially in 2011 when he won a seat in the Sejm (Lower House). He started a nation-wide debate on the mineral policy which actually introduced this concept to the political and economic language and initiated shale gas and oil prospecting in Poland. His campaign had a mass media response, especially in the Nasz Dziennik and Rzeczpospolita dailies which began to write on the subject, and other titles also published more or less comprehensive reports. Mariusz-Orion Jedrysek – Head of the Department of Applied Geology, Geochemistry, and Environmental Management at the University of Wrocław, a Deputy to the Sejm (Law and Justice Party PiS), Head of the Parliamentary Group for Raw-materials and Energy, Deputy Chairman of the Committee for Environmental Protection and Fuels (www.jedrysek.eu). In the years 2005-2007, he served as Deputy Minister of the Environment and the Chief Geologist, from 2006 to 2007 he was President of the United Nations International Sea Bed Authority. Full text of this paper is available from the Web site: www.geoland.pl.

A rig with drilling support and remote control systems

A new direction in the project „Smart Mine KGHM”

Underground working conditions are very special and demanding. High temperatures in which miners are working is related to the depth of headings, sometimes reaching 1,200 metres down and a limited access to light produce an overwhelming sense of being squeezed by the enormous rock masses overhead. Work in the face is one of the most difficult and most dangerous jobs which is why the people who work down there are given increasingly advanced and innovative self-propelled drilling rigs which ensure the optimum safety and comfort of work.

Manufacturing a mining machine – a drilling or bolting rig – which offers as many functions as possible crowns a process of long studies and testing many concepts. It always includes many inspiring meetings with machine operators and managers. They pay most of their attention to the comfort and safety of work, the machine's reliability, strength, and efficiency measured by the number of boreholes which – most importantly – must be made precisely as in the blast plan. Drilling machine operators are responsible for a variety of tasks so they need a rig that can work in extremely

tough conditions in the mine and, at the same time, gives them a reasonable comfort of work.

The Mine Master company of Wilków is a manufacturer of underground mining machinery and equipment which enjoys very good reputation on the world markets and its engineers perfectly understand the needs of their customers. Mine Master have long worked to meet those needs half-way by applying increasingly advanced solutions to their machines. While carefully listening to what the underground machine operators want, Mine Master engineers and designers keep improving their products to make the operators' work safer and more productive. The new requirements which this mining machinery producer is now about to meet are closely connected with the current strategic objective of KGHM Polska Miedź S.A. This objective is to implement advanced technologies indispensable in developing smart mines and these, above all, rely on the intellectual potential of every worker and seek to minimize their physical effort these days.

In order to meet those needs, engineers have designed an innovative product, a self-propelled drilling rig Face Master 1.7 L.



The vehicle is armed with dedicated automation and drilling support system (FGS) for precision boom targeting at pre-selected angles and for precise boreholing according to a previously downloaded blast plan. The current advancement of computerisation in KGHM mines (progressing with the SYNAPSA project) will allow remote downloading of blast plans from the office to a rig down in the heading. The other way round, reports on the rig's work and such data as the number, length, and visualisation of the finished boreholes, as well as their comparison with the blast plan, will be uploaded to the control room overground. The systems responsible for targeting the

the upcoming International Copper Ores Mining Congress in Lubin (September 16-18, 2015) a totally new and innovative method of transmitting machine monitoring data directly from the face up to the control room, for which the system uses high-voltage cables. It is an innovative solution so far used only in Australian mines which enables secure data transmission directly to and from a machine working at the most hazardous place. A key feature which significantly improves the safety and quality of the Face Master 1.7 L operator is its highly advanced and air-controlled cabin. Packed with unique solutions, the cabin gives the operator comfortable and safe conditions for

Self-propelled drill rig **FACE MASTER 1.7 L** – INNOVATION IN MINING



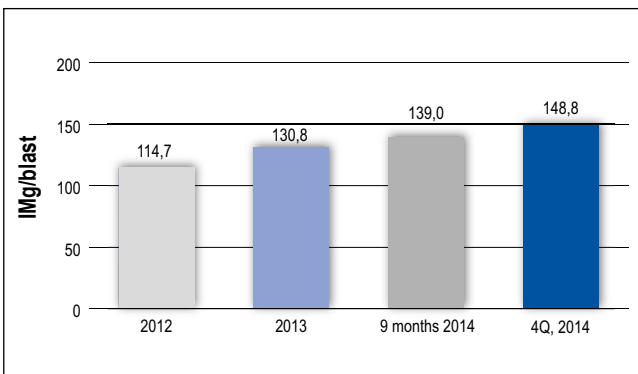
boom as defined in the blast plan which are installed on Mine Master drilling rigs allow the operator to optimise the drilling precision and monitor the process quality on a computer screen. The performance of this innovative solution have directly translated into measurable economic effects obtained by users of this equipment – the KGHM ZG Polkowice-Sieroszowice, which are operating three Mine Master rigs with computerised drilling support systems at one of their headings. The machines are performing beyond any expectations: reports from ZG Polkowice-Sieroszowice say the machine was cutting an average 20 cm more at a time and its output/blast grew by 10 Mg (T).

Using an example of the unique functionalities of its drilling and bolting machines, the Mine Master company will present at

performing each of his tasks without getting out. This significantly improves the operator's performance and helps him to maintain a perfect quality of the drilling controlled by computerised derrick targeting systems close to the plan amidst changing conditions in the machine's environment. An extra advantage of this machine is its newly-designed fully hydrostatic propulsion which offers a traction quality unseen before.

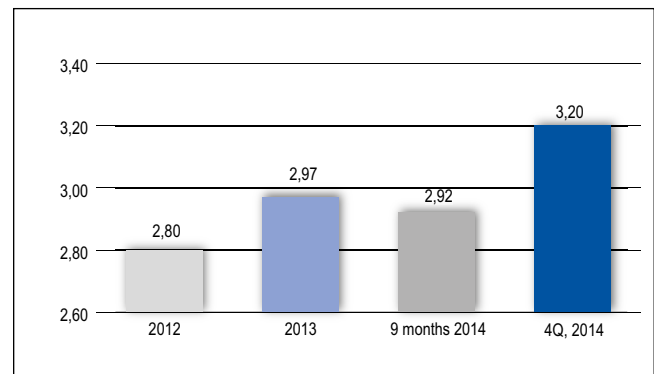
A compact structure and perfect stability allow the machine to roll on very rough surfaces of mining excavations. This speeds up extraction and, at the end of the day, improves the business results of the clients whose satisfaction with our products gives us the best references. ■

Excavated mass



Comparison of performance measured with the excavated mass. 4Q, 2014 – equipping the whole section G-32 ZG Polkowice-Sieroszowice with support system drill rigs. (Data released by ZG Polkowice-Sieroszowice).

Cuttings



A comparison of average cuttings. 4Q, 2014 – equipping the whole section G-32 ZG Polkowice-Sieroszowice with support system drill rigs. (Data released by ZG Polkowice-Sieroszowice).