THE POLISH SCIENCE
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NEW Green Soul for Old KING COAL

From the Publisher

Another year of The Polish Science Voice *is drawing to a close (our readers have sent us many positive opinions, remarks and words of encouragement—thank you!), as is the first year of government by the Civic Platform and Polish People's Party (PO-PSL) coalition. It is neither proper nor elegant for a periodical like* The Polish Science Voice *to deal with politics, but this situation is special. As it was taking power, Donald Tusk's Cabinet announced that one of its priorities would be far-reaching changes to Polish science and higher education—changes for the better, of course, involving both organization and finance.*

The mission to develop and introduce these changes was given to Prof. Barbara Kudrycka and the Ministry of Science and Higher Education which she heads. Her dowry included political support, promises of substantial funding from Poland and the EU, a whole range of expectations, demands and ambitions of the scientific community and, last but not least, that community's awareness and habits.

A year ago we asked Prof. Kudrycka about her plans. Today Danuta Górecka asks about achievements. The minister has survived various challenges in her new capacity, having had to deal with many different tasks; life has not been a bed of roses. During this meeting, she seemed much more busy than a year ago, much more involved with details, including parliamentary details that are typical for any government minister. Her satisfaction with and exhaustion because of the past year do not seem to have affected her determination to continue. Matter-of-fact and focused on her task, the professor does not use the language of daydreams but I think that the success of her mission will qualify it to be called the biggest achievement in her life.

In the previous issue of The Polish Science Voice *we devoted a lot of space to the impact civilization has on climate. Today we continue the topic, especially because the fact that the Polish power sector is more than 90-percent based on coal, is forcing Poland to conduct an intensive search for new technologies that would better protect the natural environment. We highlight Warsaw's stance on the "climate package" and invite you to take a fascinating trip to several places where truly interesting things are happening.*

Plus, as usual, we report on a range of Polish inventions, and something unique—weight loss discoveries by Prof. Zofia Żukowska that have electrified America.

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Science Reform Gets Under Way... What's Next?

Prof. Barbara Kudrycka, minister of science and higher education, talks to Danuta Górecka.


Skurzak

In our interview at the beginning of this year, you promised far-reaching reforms of Poland's science and higher education systems, especially more rational use of funds earmarked for science and higher education in the 2008 budget by the Polish government (10 percent more than last year—and 27 percent more for science) and from European Union funds (4.5 billion euros up to 2013). The money was to be assigned for research exclusively by way of competitions. The ministry also planned to improve cooperation between science and business with regard to implementation programs and commercialization of inventions and research results. The goal was to ensure that the economy had an impact on what research was carried out, while universities were to open up to orders from businesses. As for higher education, the plan was to have flagship universities with the best courses as well as centers of excellence. Which of these rather revolutionary plans did you manage to carry out this year? Was it easy to convince the scientific community to accept such far-reaching changes?

The most important thing is that the scientific community began a very active discussion on the problems of science and higher education, and that it became very committed to the outlined changes. This helped us draw up a package of five laws designed to reform Polish science. The package is called "Building on Knowledge" and includes

the law on the National Research and Development Center, the law on the Polish Academy of Sciences, the law establishing the National Science Center that will manage the distribution of funds for fundamental research projects, a new law on Research Institutes (replacing the law on Research and Development Units); and the law on the financing of science.

The reform aims to improve the competitiveness of Poland's science sector compared with European and world science, by creating the necessary organizational structures and financing procedures. This will serve to improve the quality of Polish science. It will also increase the ties between science and business, because mechanisms will be implemented to increase the number of research and development results applied in business practice.

We will also introduce mechanisms to adapt the standards of Polish science to international standards and harmonize our procedures for financing science with procedures used by leading international institutions that distribute funding for research. We also want to see more young scientists gain access to funds for science. We are introducing regulations to help them in this. Another important element of the reform is to create conditions for the application of good scientific practice and scientific diligence. The reform also aims to help implement more effective methods for managing scientific centers and improving the standards of education and obtaining professional qualifications.

Of course, all these drafts have been presented for broad public consultation so that the ultimate changes would be compatible with the opinions of the academic community. The package of five laws will be submitted to the government for discussion this month.

Will there be more money for science in 2009?

In mid-September, during the Economic Forum in Krynica, Prime Minister Donald Tusk said that the proposed budget for next year provides for an unprecedented growth of outlays for science. He emphasized that a free and innovative knowledge-based economy is one of the pillars of our region's potential. This means science has become the government's priority. The money earmarked for science is almost 27 percent more than this year and totals zl.14 billion. We have managed to get an extra zl.304 million from the defense ministry for research projects involving security and state defense. This is the first such strong financial injection for science in recent history. It's worth adding that another zl.3 billion for science will come from European Union funds. With the budget money, that's almost zl.18 billion. This should also mean more funds for science from the business sector. Of course, I realize that the commitment of the business sector will largely depend on how much Poland is affected by the global financial crisis. I think, however, that focusing on innovation, research and development could be the best response to this situation.

As for higher education, we all know how costly it is. The state budget sets aside over zl.11 billion per year for it. It may come as a surprise, but the OECD has found that we spend more per student in relation to our GDP than the Netherlands or Italy—and also above the EU average. But, we are also aware that these funds are not always rationally spent.

Meanwhile, we have managed to obtain an extra zl.300 million for adjusting salaries, and we have secured zl.427 million in a special-purpose provision for higher education. In all, this adds up to zl.733 million in full support for this sector.

However, we are not carrying out a simultaneous reform of science and higher education, though we began consultations on changes in both sectors. The initial idea was to introduce the changes concurrently. After public consultation we decided that it would be best to undertake thorough reform in the science sector first. None of my predecessors ever undertook such a wide-ranging reform in the science sector. In the next stage, we will bring about significant changes in the higher education system, so that they can take effect as of the new academic year.

I would like to emphasize very strongly that for the first time in many years the Polish government has shown

For science, we have successfully designed the strategy of change and detailed solutions. For higher education, apart from the guidelines and laws, we also need to develop a long-term strategy.

people that the country's development and the financing of science are among the top priorities; that it appreciates the necessity of investing in science and increasing the outlays on research projects. I would also like to add that the government intends to see 2 percent of GDP (it was 0.56 percent of GDP in recent years) assigned for science and higher education by 2013. Such growth, combined with comprehensive reforms, can produce positive changes in Polish science and academia.

How long will it take for Polish science to become truly competitive globally?

This will certainly not be an easy process. There are many people in the scientific community who are not interested in change, people who make various demands with regard to the government and the national budget. But this community also includes many people with aspirations and ambitions not only for themselves but also for Poland's development. The decisive criterion is the mind set, not age. Our changes will open the door wider for many scientists who are dedicated to their scientific passion but who had to break those doors open up to now. Obviously this cannot happen overnight. The scientific community in Poland needs clear criteria of financing not only scientific projects but also investments in research infrastructure and educational facilities. We have to substantially increase funding for research laboratories and equipment.

Today the most interesting scientific results are obtained thanks to state-of-the-art research equipment. That's why we assigned more funds than before for this purpose in 2008. We also want to


Skurzak

see research equipment being used more extensively than it is now; we want to see facilities opening up to research teams from other universities or institutes.

Another important idea is to locate the most expensive equipment wherever the best Polish researchers work, which guarantees that the best results will be obtained. This isn't easy, though. Until now the criteria deciding about where to invest in research and educational infrastructure were arbitrary. We want criteria involving an evaluation of the quality of proposed research to be decisive. This is the purpose of new measures leading to the consolidation of teams, such as the institutes of the Polish Academy of Sciences, Research Institutes replacing Research and Development Units, or universities and even businesses. We envisage not only the establishment of scientific centers but also science and industry centers, to bring the business sector into these structures to a greater extent. All this will take several years. The objectives are well defined, and now we are developing the tools.

The Polish model of an academic career includes a stage involving a postdoctoral degree known as habilitacja. You suggested that the doktor habilitowany degree should be abolished, giving rise to protests from part of the scientific community, especially the older generation.

The model of an academic career that we proposed when presenting the guidelines for the higher education reform met with great criticism, though it had its supporters. That's why we have developed a new procedure for obtaining the postdoctoral degree. I hope this new procedure, which will also be submitted to consultation when we present our ideas for reforming the model of an academic career, will allow young scientists to attain research independence sooner rather than later. I think our work aimed at shortening the procedure for obtaining a postdoctoral degree, and also taking it out of the jurisdiction of the councils of the university departments where a given person is employed, will meet with the community's greater approval. I am also convinced the new principles will result in more transparent and reliable assessments of people's scientific achievements as well as ensuring an impartial evaluation of those achievements.

Speaking of academic careers, what is happening to the idea of students with a bachelor's degree being able to move straight on to a Ph.D.—as a professional and scientific degree?

We plan to form a special fund financing the youngest researchers who display unusual scientific talent as students. We want to enable them to obtain funds for research, but with the reservation that their proposed research projects fulfill at least the criteria for obtaining a Ph.D. Such talented people will be able to carry out their projects and obtain a Ph.D. under the care of a thesis supervisor. Whether they also defend their master's thesis during this time will be up to them. Introducing such a system, we want to show appreciation for and promote outstanding young scientists and open the way to academic careers to them. We want to seek out the greatest talents already after three years of university studies.

The technology platforms established in Poland, following the European model, are a sign of cooperation between industry, local government and science. How do you assess this cooperation? Of the 26 existing platforms, just three seem to have serious achievements: aviation, construction and security...

I am fully aware of this. The very idea of the platforms, or clusters, is excellent as it helps bind the business sector with science and research institutes, not only in terms of purchasing technology but also scientific cooperation with industry. One great example of such a cluster is the Aviation Valley in Rzeszów. We create the legal framework for such clusters, or technology platforms, to develop in Poland, but our support will be not only through the legal framework and the basis for their operation as set down in the law on the Polish Academy of Sciences and the law on Research Institutes. We also want to give these projects a boost once they are up and running. Clusters and technology platforms that have already achieved some success within the framework of cooperation between science and business will be able to receive a special stream of funding for innovative projects. However, we cannot state in the law that science and industry centers, whether in the form of technology platforms or clusters, will be given preference when applying for funding, because the determining factor will always be the quality of a given research project. Thanks to their collaboration with industry—and we will want to finance this kind of cooperation—they will be able to obtain grants not only for developing a research project but also for its implementation. We also plan that wherever possible, financing will be provided not just from the state budget but also from the business sector. People from this sector will also have an impact on how joint projects are carried out. Then, many of the platforms that are now dormant will be given a chance of waking up from their winter sleep.

A recent study of Polish people's intellectual potential yielded pessimistic results. Is it true we are a country of poorly educated, if not narrow-minded, people?

This evaluation contradicts the schooling index for the Polish population, which is very high. It's just that this schooling level doesn't always translate into quality of students' knowledge and skills. Often the causes lie in archaic teaching methods and archaic curricula, not always adjusted to modern-day needs. Universities, sometimes

even technical universities, seldom work with entities from the business sector that use the latest technologies, to allow teachers and students to learn about them. There are also many problems at the Ministry of Science and Higher Education itself, which has inherited a certain conservative approach to scientific disciplines in its operational programs for financing, for example, the innovative economy and environmental protection programs.

We also want to increase the mobility of our scientists, to see more of them traveling abroad. We have had a few successes in international cooperation; for example, we have finished drawing up the rules for financing involving the Polish-American Fulbright Commission, which will increase the number of Poles taking advantage of the Fulbright program. We have functioning agreements on scientific cooperation with Germany and Canada; and I have signed an agreement with France. We will continue developing this. We are working on a cooperation agreement with China. Our aim is for Polish scientists to take advantage more extensively of foreign visits in conducting their research or to support their teaching activities. I was surprised, though, to see how few people applied to our ministry to finance these kinds of visits. We have set up a special program for financing scientists' mobility; only about 30 people applied in the call before last, and 28 received a grant. That's surprisingly few.

What has already changed and what can be changed quickly, without amending any laws, is better information policy, with broader information provided to the community about the possibilities of financing not only foreign research visits but research projects and research infrastructure. I am sure the scientific community will finally come to believe that it's worth applying for funding. I would like to mention that I sent tens of thousands of letters at the start of this academic year, informing all scientists about the possibilities for financing research projects, which we publish on our website, and I also asked them to take part in the consultation on our proposed draft laws.

The reform aims to improve the competitiveness of Poland's science sector compared with European and world science, by creating the necessary organizational structures and financing procedures. This will serve to improve the quality of Polish science. It will also increase the ties between science and business, because mechanisms will be implemented to increase the number of research and development results applied in business practice.

The new rules for financing research, with an increasing use of competition proceedings, are sure to lead to a more active stance on the part of scientists.

When you became minister a year ago, you said you would create a group of "flagship universities" in Poland, or schools where it is worth studying because they are the best, and that's also the reason they should receive financial support. Why did this plan cause such a storm in the community?

Mediocre universities were simply afraid that we would withdraw all their funding. Besides the academic community misunderstood us and didn't fully realize we wanted to finance the best departments, rather than whole universities. We want to call this a procedure for selecting Leading National Scientific Centers, allowing us to find out where there's the greatest concentration of scientific capital of the highest standard. We also want students to know where Poland's best physics or history department is, for example, and where the best scholars and lecturers are. The community knows this, but future students may not. We want the centers that employ the best scientists in Poland to get the most talented students. We also want them to employ the best specialists from other countries. That would be compatible with the policy of more funding for the best. This is the only way we can choose and create centers that stand a chance of competing globally.

I understand that next year will be a continuation of activities begun this year. The important thing is that you have managed to get things moving after a long time of stagnation in science.

I am only just trying to get them moving, but it's not easy. And I realize it's quite hard because there's a lot of sand in this machine. But the fact that after a year we have those five draft laws for reforming science already prepared shows there's a specific idea in place here. Early next year we will be working on the implementing regulations.

As for the reform of the higher education system, the idea is ready. Now we are working on it using a new methodology stemming from the government's newly adopted method for working on legislation.

To summarize this year: the ministry has managed to develop detailed solutions for science. What are the plans for next year?

For science, we have successfully designed the strategy of change and detailed solutions. For higher education, apart from the guidelines and laws, we also need to develop a long-term strategy. I'm glad that the Conference of Rectors of Academic Schools in Poland and the Polish Rectors' Foundation are involved in this work.

And that will take up the whole year?

I don't think so. The debate on these issues has already begun.

The Clean Coal Challenge

Marek Ściążko, director of the Institute for the Chemical Processing of Coal (ICHPW) in Zabrze, southern Poland, talks with Ewa Dereń.

Work is under way to establish a Center for Clean Coal Technologies in Poland's southern Silesia region. When will the center open and what will be its main goal?

We are currently completing all the paperwork necessary to apply for building permission. The project will be financed from funds held by the Polish Ministry of Science and Higher Education under the European Union's Innovative Economy program. So far the ICHPW and the Central Mining Institute (GIG) in Katowice, the project coordinator, have spent several million zlotys on documentation and design work. The center is expected to cost some 45 million euros to launch.

The project includes unique pilot installations such as pressurized coal gasification, the burning of coal in oxygen, and underground gasification. These installations will be located in three cities. Ground facilities to burn coal in oxygen and coal gasification for industrial purposes will be built in Zabrze close to the ICHPW headquarters. An underground coal gasification facility will be located in Wyry near Mikołów on the site of GIG's Barbara experimental coal mine. Meanwhile, Katowice will host a huge research facility with modern laboratories.

The pilot installations are the key to the whole project since there are no such test sites currently in Poland. There are also very few in Europe because of the high cost to build them. Pressurized combustion, known as oxycombustion, is still new in the world, as is specialized pressurized gasification. For this purpose we are creating a new type of reactor. We cannot compete in areas in which the world has outperformed us. Thus we want to carve ourselves new market niches. The center's facilities will allow us, on the one hand, to carry out research for the benefit of industry and, on the other, to become a major partner for both Polish universities and international centers.

In June, the ICHPW, together with GIG, signed a cooperation agreement with the National Energy Technology Laboratory (NETL) in the United States. What is the main goal of this agreement?

Our cooperation with the National Energy Technology Laboratory involves the exchange of information and academics and the carrying out of joint research and development projects. The agreement provides for joint efforts to improve the technical, environmental and economic aspects of technologies for the energy and chemical processing of fossil fuels. This particularly refers to coal gasification; modern technology to utilize carbon dioxide; its storage; the co-combustion of coal with other fuels; and the production of liquid fuels from coal.

The National Energy Technology Laboratory is part of the U.S. Department of Energy and currently consists of four research laboratories,

which are leading the way in the U.S. clean coal program. The NETL laboratories work with industry to design and implement advanced research and development programs aimed at producing clean energy from fossil fuels. Even though the U.S. did not sign the Kyoto Protocol, one of the national laboratory's priorities is to reduce carbon dioxide emissions. The level of U.S. achievement in the development of clean coal technology is the highest and thus I think our cooperation with the U.S. in this field is a huge opportunity. The know-how we will garner will allow us to undertake groundbreaking work. The ICHPW and GIG today are among the top research institutions in Poland working in this field and they are striving to turn Silesia into a major European research and development center with regard to clean coal technology.

The ICHPW has for years initiated undertakings within the energy sector in Poland. What are the institute's other priorities?

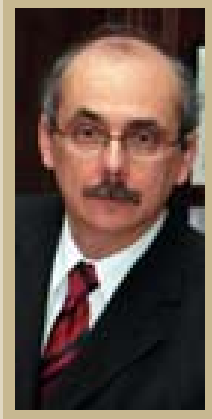
The ICHPW develops its own technologies, helps implement licensed technologies in industry, and leads the way in technological know-how and development. Our basic role was always to offer practical know-how, and this is exemplified by our newest, clean-coal-technology endeavor. We want to very quickly identify the best solutions for the energy sector. Everything points to the fact that the EU directive on reducing carbon dioxide emissions will shape what we do in the coming years. However, we must prepare ourselves for this and changes could be revolutionary. This is where the ideas for our initiatives—as well as our many other undertakings aimed at developing modern technologies for the energy sector—have come from.

Besides, we have been working for this sector for years. We created standards for renewable energy and developed biomass co-combustion technology. Everything that in this area has been implemented in Poland is the result of our work. We created the Labiomen national chain of supervised laboratories, which includes 35 research laboratories sited in power plants. These research the energy properties of solid fuels, biomass and fuel-biomass mixtures in particular. We set up the chain in 2005, and a national system based on concrete standards is in place today. In the "small energy" sector, we have developed new domestic boilers with ecological certification, known as the "green apple" certificates. Polish law does not require it but manufacturers realize the importance of meeting such standards in today's world.

Now the time has come to create procedures and technologies to deal with carbon dioxide. Issues tied to clean coal technologies are difficult for energy experts because of problems related to chemical processing. Of additional interest are technologies such as coal gasification that until recently were seen as unattractive for the energy sector. This is where the institute can play a role by solving combined chemical and energy problems and transferring technological know-how to industry.

Is it true that Carbon Capture and Storage (CCS) technology could increase the cost of producing energy by around 50 percent?

Additional energy is required to remove carbon dioxide regardless of whether Carbon Capture and Storage (CCS) technology is used or not. The efficiency of the process for this reason is reduced by 7-12 percent. Thus more coal or other fuel is required to produce the same amount of usable energy. These factors and the necessity to install additional equipment increase the investment cost for electrical energy production and thereby increase energy production costs by 50 percent, or even 70 percent, according to some estimates. However, we have no choice since the development of emission-free technology will be based on coal as the main fuel at least until 2050—and not only in Poland and Europe but across the world. The world in the long term does not have an alternative raw material to coal. In the second half of the 21st century we can expect significant changes to the way the world utilizes primary fuels because of their availability. Crude oil reserves will be depleted and natural gas resources will be limited. Inevitably, there will be a return to the widespread use of coal as the most readily available energy raw material in the world. And since it is proven that increased carbon dioxide emissions cause global warming, there is every reason to develop emission-free combustion technology. The disadvantage of CCS technology is



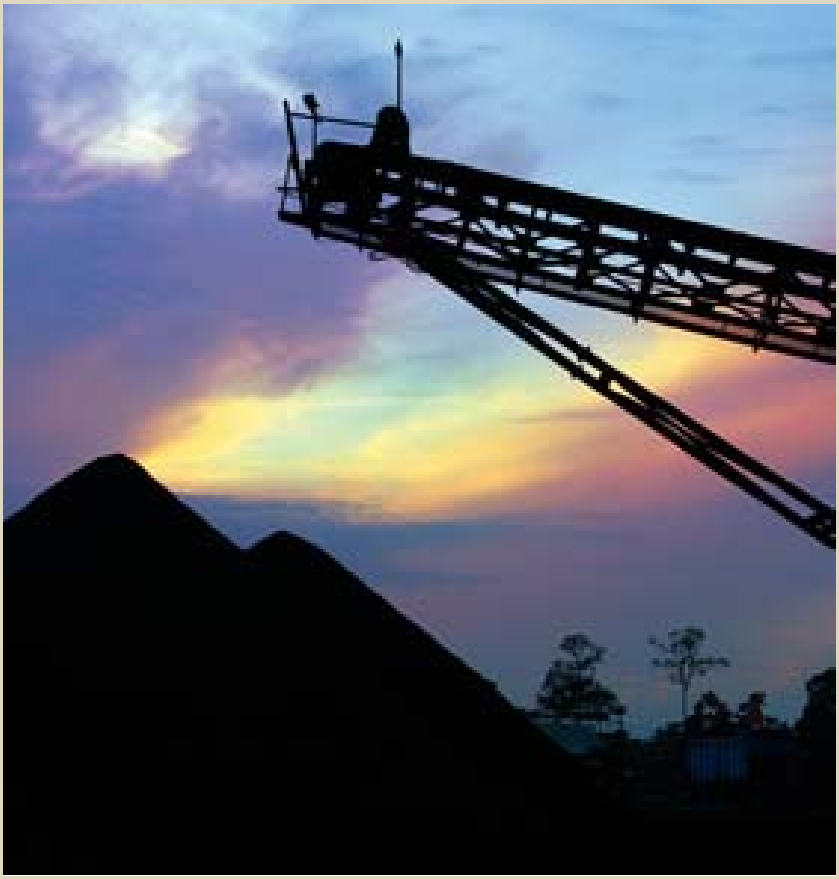
Marek Ściążko graduated from the Department of Chemistry at the Silesian University of Technology in Gliwice in 1975. He spent time as a researcher in the United States where he researched coal gasification at the Pittsburgh Energy Technology Center in 1980 and the effectiveness and economy of energy systems at the Energy Environment Research Center of the University of North Dakota in 1992. He headed a Polish-German research program that was carried out in 1987-1993 at the Silesian University of Technology's Center for Coal Processing. He has been director of the Institute for the Chemical Processing of Coal (ICHPW) in Zabrze since 1991.
Ściążko is a member of international energy task forces such as the European Commission's Advisory Group for Energy—DG Research, the Coal Advisory Group—Coal and Steel Fund, and the Technology Platform for Zero-Emission Fossil Fuel Power Plants (ZEP). He actively participates in developing energy policy for Poland as a member of the Energy Committee of the Polish Academy of Sciences (PAN) and as a supervisory board member of the Tauron corporation. He has 102 scientific publications to his name, which have appeared in both national and international periodicals, and holds 38 patents.

that more coal must be mined and burned to produce the same amount of energy compared with power plants that do not separate out carbon dioxide. There is still a lack of ideas and incentives for revolutionary changes in highly efficient electricity production and for using the captured carbon dioxide in chemical synthesis instead of storing it underground.

In CCS technology, carbon dioxide is captured and stored underground. Are there any other options?

To date the technology for carbon dioxide capture and storage was never used in industry and thus there is a lack of procedures and standards in this area. However, fuel firms' experience should be taken into account. They have for years been storing carbon dioxide underground in excavations remaining after crude oil and natural gas extraction. In the U.S. there is already some 4,000 km of pipelines to transport carbon dioxide. In Europe, Norway has the most know-how in this area. Of course, there is a big difference between the level of current know-how and the eventual needs of the energy sector. Most often power plants are sited close to a large conurbation and thus the transportation and storage of carbon dioxide must be absolutely safe. A carbon-dioxide storage facility must be above all completely leak-proof. This condition is certainly met where the carbon dioxide is stored underground after the extraction of crude oil or natural gas. Other potential storage options such as water-bearing strata, coal seams or salt-water reservoirs may not offer such certainty and it is necessary to check whether these are suitable to do the job.

In Poland there are two opposing schools of thought on the subject of carbon dioxide storage. One says that up to 80 percent of the country's area could be used for the underground storage of carbon dioxide; the other holds that this is not possible geologically. Poland also has no "holes" underground resulting from crude oil or natural gas extraction, while storage under the sea bed is not an option since the Baltic Sea is too shallow.



Which opinion do you think is closer to the truth?

Both ways of thinking are in fact premature. So far Poland has not seen coordinated and widespread efforts to create a map of storage possibilities and their potential capacities. Such data gathering commenced just this year and is being carried out by the Polish Geological Institute, the Central Mining Institute (GIG), and the AGH University of Science and Technology. The work will take three more years to complete. The point is that we need this data now. We are making the first decisions today regarding the building of emission-free installations, including the pilot power plants under the EU program, and we do not know where we can safely store carbon dioxide.

This is key information that is required for the planning of a new CCS power plant, because we must know whether to locate it close to a coal mine or a carbon-dioxide storage facility. Unfortunately, with regard to work on carbon dioxide storage, we are very far behind some other EU countries. To be able to even think of building an experimental power plant we must catch up pretty rapidly.

Also, as a member of the supervisory board of Tauron Polska Energia SA holding company, which owns the Southern Poland Power Company (PKE) that is currently building an emission-free power plant in Kędzierzyn, I can reveal that we are also planning our own geological surveys.

We cannot yet say very much in certainty about conditions for underground carbon dioxide storage in Poland. However, we can rather say with all certainty that carbon dioxide storage under the Baltic Sea is not possible. Should we decide to transport carbon dioxide to the sea, it would probably be to the North Sea since its geological structure is known and is being monitored and managed because of crude oil extraction. This would be a safer and cheaper option than creating new storage areas in the Baltic Sea.

Going for Zero Emissions

The Polish Clean Coal Technologies Platform, established in February this year, brings together the largest suppliers of energy in the country and actively lobbies for the development of a zero-emission coal-burning program under which carbon dioxide emissions would be trapped and stored underground.

Following meetings concerning the European Union's Climate Package and a summit between EU heads of state in Brussels, it turned out that the modernization of Poland's energy sector would demand more money than the previously thought zl.22 billion and that most of these costs would be borne by individual users of electricity. It was also confirmed that Poland is at the forefront of research on clean coal technologies and the recycling of power-plant waste.

Poland's coal-fired power plants, which are faced with huge investments over a period of more than 10 years, are pursuing a research and development program in collaboration with other EU-funded technology platforms working on zero-emission combustion and power plant waste-disposal technologies, such as the European Technology Platform for Zero Emission Fossil Fuel Power Plants (ETP ZEP).

The Polish Clean Coal Technologies Platform was launched Feb. 25 during a meeting at the Ministry of the Economy as an initiative by Swedish energy company Vattenfall and Poland's National Contact Point for EU Research Programs.

Apart from Vattenfall's Polish subsidiary, the platform includes: PGE Polska Grupa Energetyczna SA, Południowy Koncern Energetyczny SA, Elektrownia Kozienice SA, EDF Polska Sp. z o.o., Dalkia Polska, CEZ Polska, Electrabel Polska SA, and Zespół Elektrowni Ostrołęka SA.

The platform aims to concentrate on developing clean energy technologies that can be used in Poland as well as on solving the problems involved in the safe transport of carbon dioxide and its storage in geological strata. The platform also intends to spread awareness of all aspects of clean coal technologies, including their environmental impact.

Surmounting obstacles

As Jacek Piekacz of Vattenfall Poland remarked at the platform's launch, there are many obstacles to introducing clean coal technologies (CCT) in Poland. This explains why the energy companies involved in this project have decided to unite their efforts in modernizing Poland's energy supply and implementing CCT, Piekacz said.

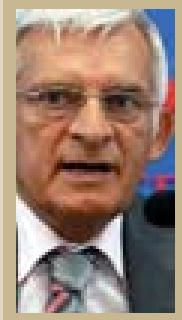
The first measure of the Polish Clean Coal Technologies Platform's success will be building the country's first carbon dioxide capture and storage plant, Piekacz said. Vattenfall has already built such a plant near the Polish border in Germany. It is a pilot installation for the capture, liquefaction and underground storage of carbon dioxide.

Dariusz Bogdan, the deputy economy minister, said, "The EU Energy and Climate Package calls for a radical reduction in carbon dioxide emissions by 2020, but CCT implementation and carbon dioxide storage are still relatively expensive—which makes this initiative all the more important."

The platform has joined the European debate on CCT. It has become an informal lobbying group, promoting the Polish initiative to capture, liquefy and store carbon dioxide underground within the EU.

The platform's another area of action is the implementation of CCT. Experts say the radical reduction in emissions planned under the EU Climate Package will increase the cost of energy production in Poland. Meanwhile, the negative impacts of the EU's low ceiling on carbon dioxide emissions are already being felt by several sectors of Polish indus-

The Broad Picture



Prof. Jerzy Buzek, former Polish prime minister, a member of the European Parliament and its rapporteur on the development of energy technology in the European Union:

■ The European Union has set itself some ambitious environmental goals up to 2020: a 20-percent growth in energy efficiency, a 20-percent drop in carbon dioxide emissions, 20 percent of energy consumption to come from renewable sources, and 10 percent of motor vehicle fuel consumption to come from biofuels. This means a huge challenge for Poland.

I think that what could and should develop well in our conditions—as far as renewable energy is concerned—are biogas plants. Electricity from gas produced from plant waste—a fully renewable source—is a good option. The devel-

opment of biogas facilities is also a huge opportunity for rural Poland, for farmers.

The best wind conditions are in coastal areas, and that's where wind farms will be set up. Solar energy in our climate can be and is used as a supplementary source of heat, but on a relatively small scale. Then there's geothermal energy. So far attempts to use geothermal energy have given little cause for optimism, though of course it should be utilized as much as possible, wherever possible.

However, this kind of production is dispersed and conducted on a small scale, or in the case of wind farms—a variable scale. Incorporating this energy into the whole system would require modification of the existing network or building a whole new intelligent power grid covering the entire country.

If Poland obtains 15 percent of its energy from renewable sources in 12 years' time, it will still have to produce the rest by other means. I don't think we can avoid the necessity of building nuclear power plants. From two nuclear power plants, we would obtain another 15 percent of energy for our overall balance—unless we focus on conservation because there is no doubt that we waste an exceptionally large amount of energy in Poland. Perhaps then we won't have to build nuclear reactors.

The remaining 70 percent will come from coal and coal only—our national treasure. We have to learn new, environmentally-friendly technologies for utilizing our coal resources. That's the most important thing for Poland. I am convinced that mastering clean coal technologies will allow Poland to maintain its energy independence and keep a relatively low price for energy.

try. Underground carbon dioxide storage and CCT are an opportunity to limit these negative aspects of lowered emission ceilings.

CTT: What's in a name

Clean coal technologies are any type of technology meant to improve the efficiency of extraction, processing, or conversion of coal or waste utilization after its burning or chemical processing. The main goal is to reduce the effects of these processes on the environment and avoid the degradation of whole ecosystems, as was the case 20 years ago.

Clean coal technologies can be applied to:

- initial extraction and mechanical processing of coal
- transport, storage, quality selection and normalization
- coal combustion (mostly for energy production)
- use of coal waste produced during processing or burning

A fundamental aspect of CCT is extraction efficiency. This is measured by the percentage of coal extracted from the deposits. To minimize costs, in Poland's coal industry, coal is extracted in surface mines wherever possible. This leaves a large percentage of coal still in the deposits. Besides low efficiency, this carries the risk that the remaining deposits settle in unpredictable ways, causing more mining damage.

Coal processing, on the other hand, aims to rid coal of impurities and obtain a fairly standardized product. Obviously, in this type of standard processing it is not possible to obtain coal, which when burned, would not produce waste emissions, often above legal norms. However, it does allow the mechanical removal of non-combustible and harmful impurities.

According to the Central Mining Institute (GIG,) early-stage purification, through the removal of water and harmful impurities, raises the efficiency of the conversion of coal's chemical energy to electrical energy or heat by 2-3 percent, depending on the coal's quality. Coal can be enriched to a higher degree through so-called deep enrichment. Coal is first crushed and then subjected to one of the following demineralization procedures: oil agglomeration, heavy liquid separation, flotation, chemical separation, or electroseparation. Coal fuel after this processing is nearly free of impurities and has a high energy yield. But the cost of these technologies outweighs the benefits of high-energy coal. The research on this aspect of CCT is one of the most important yet expensive in the whole CCT chain.

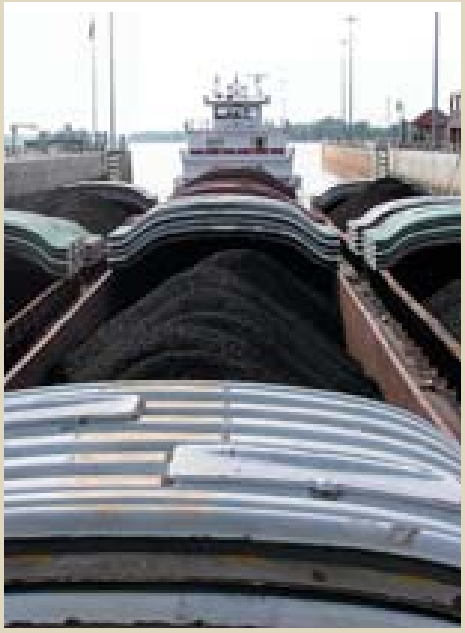
A lot can also be done on the transport and storage side, experts say. According to GIG and based on statistics from Poland, the EU and the United States, more than 60 percent of mined coal is used within 50 km of the extraction site and only 10 percent is traded on the international market. However, coal is often stored for a long time, four months being the norm within the EU. The problems with transport and storage are mostly linked to loss and environmental impact. Studies led by CCT researchers recommend abandoning open-air heap-type storage and open unsecured transport. Loss due to transport and storage can be minimized by the use of substances based on heavy oils that form a hard surface

layer on the stored coal and prevent movement and dispersion caused by wind.

The most active area of CCT research is the last stage of coal use, namely combustion and waste reuse. This is where the highest levels of loss and pollution occur. Zero-emission energy production from mined fuels is one of the main areas of action for the European Technology Platform for Zero Emission Fossil Fuel Power Plants.

Even the cleanest combustion leaves waste products. CCT research points to the possibility of extracting minerals from them and creating admixtures for building dams, embankments and roads, for example.

Marek Mejssner



In Pursuit of Clean Coal

Piotr Kędzierski, Head of Communications at the Polish subsidiary of the Swedish energy company Vattenfall, which helped launch the Polish Clean Coal Technologies Platform:

The security of energy supply has been one of the most frequently debated topics these days, which is only natural because the price and availability of energy sources have an immediate effect on the economy.

Economic growth and prosperity are impossible without access to energy. At the same time, the impact of energy production on the environment is not just local, but global, which is something we began to fully realize only recently. Coupled with the simple truth that the deposits of fossil fuels will run out one day, the great interest in energy security comes as no surprise.

The definitions of security can differ in their scope, but I believe the security of energy supply deserves a broad definition that includes such notions as long-term and global effects on the climate. I am not entirely convinced by the claims that Poland should obstruct European efforts for climate protection in order to protect its own energy security. As far as the choice of methods to achieve this goal is concerned, we have to be tough in the negotiations, but a single-fuel energy sector based on coal is bound to encounter problems sooner or later. Coal is not a renewable energy source and not all coal deposits are fit for economically justified extraction. For the sake of its own energy security, Poland needs to seek new energy sources and develop clean coal technologies, as they are called. After all, coal as such is not a problem for the EU and the United Nations; it is the carbon dioxide generated during the process of burning coal that is the problem. Several months ago, Vattenfall launched the world's first installation for the research of carbon dioxide capture and storage (CCS).

The work on the CCS technology is in progress and might prove to be a chance to reconcile coal with the European and global objectives in climate protection. If pessimistic scenarios come true—and long-term threats have to be taken into consideration in issues of energy security—then global climate change may harm the Polish economy. For this reason, Poland's energy security needs broad consideration in a global perspective.

Polish fuel giant PKN Orlen, one of Central Europe's largest refiners of crude oil, has thrown off its reputation as a polluter and successfully reduced its negative impact on the environment. It has also established a special subsidiary, Orlen Eko, to take care of the corporation's operations in areas such as waste generation and the management of that waste.

At the end of October, Orlen Eko launched a thermal installation for processing toxic waste, one of the most modern facilities of its kind in Europe. Veolia Water Systems built the facility at a cost of over zl.105 million, starting construction in June last year. The installation is capable of processing 50,000 metric tons of waste annually. It is also the first facility in Poland that treats waste from outside sources, including municipal sewage.

The installation for the thermal processing of toxic waste consists of waste preparation and transportation facilities, two separate waste combustion lines, and systems for the harnessing of resultant heat energy and the purification of exhaust fumes. The installation is primarily designed for the treatment of oil refinery waste but can also be used to treat dry residue from municipal sewage treatment plants. All waste is mixed together prior to treatment to achieve the best results.

According to Orlen experts, the installation meets all environmental protection regulations such as gas emission levels, operational parameters and the quality of the final waste. It also conforms to the European Commission's IPPC 2008/1/EC Directive in terms of Best Available Techniques (BAT).

"This is the best available technology," says Zbigniew Heidrich, a professor at the Warsaw University of Technology's Department of Environmental Engineering. According to Heidrich, the technology guarantees the safe combustion of sewage. Many cities, among them Łódź, Cracow and Szczecin, have chosen this plant to treat their sewage.

PKN Orlen managers say that the underlining reason for building the installation was the need to meet European Union environmental standards. In 2004, gas

Fuel Giant More Eco-Friendly

emission levels from PKN Orlen's Płock plant did not meet EU conditions. Orlen thus decided to modernize its treatment system for refinery and petrochemical waste and to this end established Orlen Eko.

The company manages some 155,000 tons of waste every year, of which some 33,000 tons is thermally treated. Some of this waste comes from farms, orchards, fisheries, and food processing plants. It also includes pesticides; waste from the processing of crude oil, coal and natural gas; and waste generated during the production of plastics, paints, lacquers, adhesives and greases in the chemical sector.

"We are continually improving our environmental protection standards," says PKN Orlen CEO Wojciech Heydel. "In 2007, we carried out over 700 various ecological projects on the sites of our fuel stations and fuel storage facilities to the tune of zl.138 million, or 70 percent more that a year earlier. In our production plant in Płock, we spent over zl.122 million on endeavors to improve environmental protection and significantly reduce the emission of sulfur dioxide from our thermal power plant."

PKN Orlen's environmental protection measures in 2007 included improved water and sewage management, prevention of fuel-product seepage into the ground, reduction of air-borne pollution, and noise reduction. According to the company's 2007 Environmental Report, these projects significantly reduced emissions of sulfur dioxide (by 31 percent), particulate matter (by 23 percent) and other air pollutants.

Last year PKN Orlen began to modernize its fuel stations by introducing sewage separators, hermetic seals on installations, measurement probes, and improved seals on tanks to prevent pollution through seepage into the ground. In all, PKN Orlen spent over zl.70 million on these measures.

Orlen Eko takes part in the Responsible Care program that is endorsed by the chemical sector all over the world and serves to promote activities to lessen the sector's negative impact on the environment. The Polish company also supports the endeavors of Płock's Regional Center for Education in Ecology, whose aim is to promote environmental protection among children and young people, and participates in promotional events such as Earth Day and Clean Up the World.

The Płock refinery has its own "green police," which inspects and monitors production processes to ensure that the environment is not harmed.

In February this year, Orlen Eko was named a "Company Close to the Environment" for prioritizing environmental protection in its development strategy. The company also won the title of "Polish Ecology Partner" in the "Friends of the Environment" ecological competition held under the auspices of Polish President Lech Kaczyński.

Julia Pawłowska

Containment Systems

The containment systems preventing the leakage of fuel at PKN Orlen filling stations and fuel terminals are installed to minimize any harmful environmental impact and improve working and living conditions for people in the impact area.

There are two types of containment systems at PKN Orlen filling stations. The first and most important one is designed to prevent fuel vapor emissions in the process of pumping fuel from tank trucks to underground tanks. The second one is designed to prevent fuel vapor emissions at the pumps in the process of filling up with gasoline. The system directs vapor emitted from the car tank back to the underground fuel tank with the use of a vacuum pump.

Protecting Falcons

This year marks seven years since PKN Orlen teamed up with the Sokół Association for Wild Animals aiming to restore the Polish population of peregrine falcons. Eighteen fledglings have hatched so far in nesting boxes placed on PKN Orlen premises. The birds are monitored all year round. The company regularly reviews the nesting boxes, produces photo and video documentation of the nesting falcons and rings the fledglings. In 2007, four fledglings hatched in a nesting box installed on the chimney of a heat-and-power generating plant on PKN Orlen premises. It has been confirmed that all the eggs were laid by the same bird. A pair of peregrine falcons has nested on the premises of the oil refinery in Płock and produced fledglings for the seventh year running, which is extremely rare for this species.

Toward EMISSION-FREE Power Plants

At the beginning of this year, the European Commission unveiled its Flagship Program to build 12 trial power plants by 2015 using Carbon Capture and Storage (CCS) technology. Poland has applied for permission to host at least one such facility.

According to Prof. Jerzy Buzek, a former Polish prime minister and now a member of the European Parliament, it is possible to build even two such facilities in Poland. "However, we have to hurry because other countries want to build them as well," says Buzek, who has been involved in the development of clean coal technology for years. "And then it could happen that the European Union (EU) will help finance the facilities that appear first. These facilities need to be built by 2015 since the trial phase is set for between 2015 and 2020. At the end of the trial phase, dependent on the results, CCS technology is to be widely implemented."

So far the Flagship Program has attracted 43 projects from 12 EU member countries. The majority of projects, nine in all, have come from Britain. The Netherlands has put forward seven projects, Norway six, and Germany five. Poland has three projects. There are several potential locations in Poland for such a facility, but the most probable seem to be in Blachownia near Kędzierzyn and on the site of the BOT Bełchatów power plant. The first would use hard coal for fuel, the second brown coal. A joint project between Zakłady Azotowe Puławy nitrogen plant and the Bogdanka mine offers huge potential. To date, implementation procedures for pilot power plants in Bełchatów and Kędzierzyn are the most advanced.

For the pilot program BOT Bełchatów power plant has two projects in place: a 858 MW power generation unit that uses CCS technology to separate carbon dioxide from emissions and a 950 MW unit that uses Integrated Gasification Combined Cycle (IGCC) technology to capture carbon dioxide.

According to Henryk Majchrzak, chairman of the BOT Górnictwo i Energetyka (BOT GiE) mining and energy group, a feasibility study for the 858 MW unit has been completed and it could go into operation in 2010. Low- and emission-free projects for energy production from mined fuels will be an important direction for the BOT group's future development since these are the standard fuels used in BOT GiE's power plants.

Meanwhile, the emission-free power plant in Kędzierzyn that the Katowice-based Południowy Koncern Energetyczny (PKE) energy corporation intends to build, is one of the most innovative Polish projects because it combines power and chemical modules. The planned power plant will generate more than one form of energy—polygeneration—producing electricity, heat and synthesis gas (syngas), and will capture and store resultant carbon dioxide in a process known as geosequestration. Combined electrical and thermal energy production and the production of syngas allows for efficient use of primary energy generated from fuel and low emission levels while keeping costs at a satisfactory level.

The facility will be sited in Kędzierzyn-Koźle and will be a joint venture between PKE and Zakłady Azotowe Kędzierzyn nitrogen plant. The two partners Oct. 2 signed a letter of intent to build a modern power plant that will generate electricity, heat and syngas for the chemical sector. Its main aim will be to replace Zakłady Azotowe Kędzierzyn's existing power generation installations on all its sites with a common, modern, energy-generating facility. The project would lessen the risk of power failure at the Kędzierzyn-Blachownia industrial complex and would be a base on which to build an emission-free power plant.

Polygeneration

The term "polygeneration" means an energy supply system that delivers more than one form of energy to the final user. For example, electricity and heating can be delivered from one polygeneration plant.

The basic fuel is hard coal, which fires the gasification equipment and the IGCC technology. The use of this technology results in a significantly more efficient power plant, compared with a conventional coal-fired one, and makes it far more ecological. Water consumption is halved and emissions of nitric oxide, sulfur dioxide and carbon dioxide meet all European Union norms.

This method of generating electricity from fossil fuels—typically coal, pet coke or oil—produces fewer emissions than conventional coal generation alternatives, but at a considerably higher cost.

In a conventional coal power plant, coal is pulverized to a very fine powder and burned. The heat is used to produce steam, which in turn spins a turbine to generate electricity. This generation process is referred to as the "steam cycle."

In an IGCC facility, coal is fed into a vessel called a gasifier, where heat and pressure cause the coal to be converted to combustible gas compounds, or "syngas." This syngas is cleaned to remove sulfur and other contaminants before it is burned in a combustion turbine, which spins a generator.

Additionally, the exhaust heat from the combustion turbine is recovered and used to produce steam in a boiler that spins another generator. Thus, the "combined cycle" portion of IGCC—both a combustion turbine cycle and a steam cycle—are used to produce electricity.

Although gasification is commonly used in the chemical industry, only a few IGCC projects have been built worldwide for electric generation.

The projects thus far have provided valid demonstrations of performance characteristics for anticipated capacity, efficiency and environmental emissions.

However, they have also shown that higher cost and lower reliability make this technology more expensive than conventional coal generation.

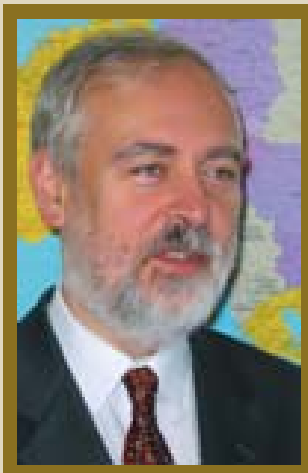
Polish attempts to store CO_2

While the technology to capture carbon dioxide from flue gas is relatively well developed, the serious problem of how to store it is yet to be solved. Poland does not have as good underground storage facilities as do countries which have extracted crude oil or natural gas reserves, thus leaving behind natural storage chambers underground. Storing carbon dioxide under the sea bed is not an option since the Baltic Sea is too shallow.

Poland also lacks suitable legal regulations for the underground storage of carbon dioxide. "With regard to the storage of carbon dioxide, Poland trails far behind other European Union countries," says Marek Ściążko, director of the Institute for Chemical Processing of Coal (ICHPW) in Zabrze. "To be able to even think about building an experimental emission-free power plant, we must quickly catch up to other countries."

Still, Poland has garnered some experience in amassing carbon dioxide underground. In 1995, Poland was the first country in Europe to use technology to amass carbon dioxide in gas reserves in Borzęcin. The then Institute of Mining of Oil and Gas (IGNiG), which today is the Oil and Gas Institute, and Polish oil and gas firm PGNiG built the first European industrial facility to store acidic gases that were a byproduct of natural gas extraction. Over a period of 12 years, almost 3 million cubic meters of gas containing carbon dioxide was pumped into this facility. This was a unique, experimental test site and as such was chosen for further and detailed research under the auspices of the European Union's Seventh Framework Program.

Ewa Dereń



EU FLAGSHIP PROGRAM

Andrzej Siemaszko, Government Group of European Technology Platform for Zero Emission Fossil Fuel Power Plants:

A critical solution for combating climate change is a wide-scale deployment of Carbon Capture and Storage (CCS) technology. Without CCS, the EU's target to reduce CO_2 emissions by 60 percent by 2050 is simply not achievable. In 2006, the European Technology Platform for Zero Emission Fossil Fuel Power Plants (ZEP) outlined the technology and deployment "roadmap" necessary to achieve this goal.

The Flagship Program was presented for the first time in 2007. The program was developed by ZEP experts—scientists, industry and environmentalists, united in their support for CCS as a key solution for combating climate change—within a portfolio of solutions, including renewable energies and energy efficiency.

The Flagship Program is targeted at the development of 10-12 full-scale CCS demonstration projects integrating all aspects of CO_2 capture, transport and storage—including technology, infrastructure, the environment, health and safety, legal and regulatory issues and funding. A Europe-wide network of demonstration plants should be operational by 2015 to ensure the strategic goal is met: to make CCS commercially viable for all new fossil fuel power plants by 2020.

Global climate change is a serious environmental challenge that requires credible action. It is clear that coal will remain the backbone in the global supply of energy. To reduce emissions of CO_2, we have to develop and implement Clean Coal Technologies such as coal gasification (for instance IGCC), improved and highly efficient combustion (such as oxy-fuel) and post-processing which can be accompanied by carbon capture and geological sequestration.

Poland is in a very specific situation since its production of electric energy is 96-percent dependent on hard coal and lignite. Poland has (some say unfortunately) become a focal point of European Energy-Climate Policy. The total cost of modernizing the power sector and building new power plants is estimated as 50 billion euros. For instance, the largest European single-source CO_2 emitting power plant in Bełchatów (PGE) has announced a strategy for retrofitting existing units of 4,500 MWe and developing a new clean 858 MWe unit.

Having very rich coal deposits Poland wants to take a lead in developing and implementing other Clean Coal Technologies. There are plans for a pilot plant in Poland to demonstrate Underground Coal Gasification technology developed by Prof. Bohdan Żakiewicz. Southern Poland Power Company PKE together with Kędzierzyn Nitrogen Company ZAK have announced the construction of the first clean energy-carbochemistry complex in the EU with CCS producing both electric power and synthetic fuels and fertilizers. There is information that Puławy Nitrogen Company may follow suit. Production of synthetic fuels from coal would improve Polish security of energy supply with respect to imported oil and gas. Poland together with northern Germany have potentially the largest European on-shore deep saline aquifer reservoir suitable for CO_2 sequestration in Mesozoic sediments. Recently, a national program for defining the best sequestration sites has been launched.

Poland needs European support to manage all the challenges it is facing. If Poland succeeds in transforming its economy towards a low-emission one, it will be success for all of us: Poland, Europe and the whole world.

Poland and the CLIMATE-ENERGY Package

A special European Union summit in Brussels in December will be a battleground over the contents of a legislative package to fight climate change.

Since the document will affect the economies of EU member states for many years to come, Poland has a vital interest in the contents and may even exercise its right to veto the package.

"We want an energy-climate package that will not jeopardize our economies," Prime Minister Donald Tusk said Nov. 5 in Warsaw after a meeting of the presidents of Poland, the Czech Republic, Hungary, Slovakia, Lithuania, Latvia and Estonia.

The controversial legislation, prepared by the European Commission, would require the EU to cut emissions of carbon dioxide by 20 percent before 2020. All 27 EU member states and the European Parliament are expected to reach an agreement on the package by the end of this year. "We hope we can come up with a joint stance to lobby for a wise climate package at the EU summit in December," Tusk said.

In October, heads of EU countries and their governments agreed that a political compromise on the energy-climate package would first have to be made at a summit meeting of EU leaders. With that agreement, Poland secured for itself the right to veto the proposed package, because decisions at EU summits have to be made unanimously. The Polish economy depends on coal-based technologies for some 95 percent of its energy, and the government contends that the Commission's ambitious plans to cut CO_2 emissions would result in soaring electricity prices.

Under the Commission proposal, as of 2013 all rights to CO_2 emissions in the energy sector will have to be sold at special auctions.

According to a recent report from Société Générale bank, prices of CO_2 emission rights will reach 80 euros per metric ton in 2013, or four times the current price.

The bank's calculations differ considerably from estimates by the Commission, which believes that fears of impending sharp price increases are exaggerated. Brussels estimates prices will only rise a little above 30 euros.

The Polish government challenges the Commission data, which it regards as unreliable. Several reports have shown that if passed in its present shape, the new legislation will have a disastrous effect on electricity prices.

"We do not want to obstruct the energy-climate package, but to help design it responsibly," Tusk said, adding that the new EU member states have joined forces in an attempt to require the EU to prevent uncontrollable price fluctuations in CO_2 emission rights before the package is adopted. The new member states also want the EU to take into consideration the specific economic conditions of individual countries, especially those economies, such as Poland's, that heavily rely on coal. "We shall not pursue the spurious hope that a single country, especially in our group of countries, which are poorer than the richest member states, might be able to negotiate a package that could satisfy us all," Tusk said.

Tusk pointed out that in the past few months, the whole world has witnessed speculative attacks on currencies, which has been a painful experience. "Imagine a situation where prices of CO_2 emission rights are overly free to vary," Tusk said. "A system like that would be an easy target for a speculative attack, resulting in absolutely unjustified price increases."

Tusk said the new EU member states are seeking maximum allowances for countries that will have to invest the most in curbing CO_2 emissions. "This way, individual branches of the power industry could avoid collapse," he said. The premier added that the countries represented at the Warsaw meeting had made a "gigantic effort" in the 1990s and reduced their CO_2 emissions to a much greater extent than even the largest European countries. "All of us only expect one thing, and that is a fair assessment of the differences at this starting point; a fair assessment of the effort, the sweat and tears which our countries have spent to truly curb CO_2 emissions, so that Poland, Lithuania and Hungary are not treated the same as Denmark, Sweden or France when the quest for clean technologies begins."

Foreign Minister Radosław Sikorski said that Poland wanted the climate package to succeed, but in a shape that the Polish economy could handle. "We will back a package that fulfills these goals," Sikorski said flatly. "A package that defies them will be vetoed." He added Poland would be "happy not to have to use a veto."

Jerzy Buzek, Poland's prime minister from 1997-2001 and now a member of the European Parliament, considers the gaining of the right to veto the energy-climate package one of the greatest successes in Poland's history of negotiations with the EU. "We found understanding for our argument that Poland was in a very special situation when it came to CO_2 emissions and that special situation had to be respected," Buzek said. "Under the current proposals, as of 2013 the emission of every ton of CO_2 will have to be paid for." Poland's proposal is that "those who have the best possible technologies in a given industry branch or in the energy sector should not to have to pay at all," said Buzek. Only industries with inferior, less efficient technologies that cause higher CO_2 emissions would still have to pay. Buzek said this will result in much lower costs of CO_2 emissions, because then one group of producers does not pay, and those who do pay will only cover the difference between their emissions and the lowest possible emission rate.

Although initially Poland found it hard to persuade its partners to back the idea, after many months it succeeded with the Czech Republic, Bulgaria, Romania and others. It would be a tremendous success if the EU accepted the Polish proposal in December, Buzek said. And now that Poland has the support of other countries, its proposals are likely to be approved for enterprises such as cement mills, steel mills and chemical plants.

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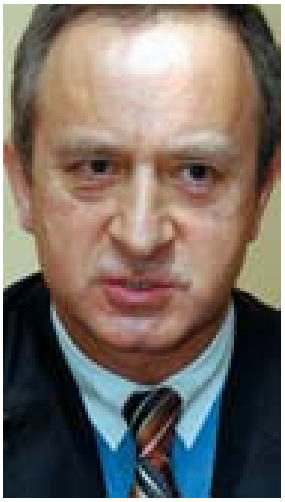
Tackling CLIMATE Change



Janusz Reiter, special envoy of the Polish government on climate, talks to Andrzej Ratajczyk.

The 14th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP14), to be attended by several thousand delegates from over 190 countries, will be held in Poznań in the first two weeks of December. How important will this conference be for Poland and the world?

The UN climate change conference in Poznań will be held one year before the Copenhagen conference at which the parties to the convention are to make decisions concerning a new global agreement on climate protection. The Poznań conference is not supposed to produce any breakthrough decisions but to lay the groundwork for such decisions. This means that if the Poznań conference is a failure one can hardly expect success in Copenhagen. The Poznań conference will not be as spectacular as the conference in Kyoto, where the Kyoto Protocol imposing obligations on countries to reduce greenhouse gas emissions was adopted, or next year's conference in Copenhagen. But the meeting in Poznań will definitely be very important for the future of the whole climate process. The Poznań conference will also be of special importance for Poland because it will be the largest political meeting ever held in the country. Additionally, it is probably the first opportunity for Poland to play a leadership role in a process of global significance. So it will be a very important development in the context of building up Poland's political competence and authority in the world.

What topics will participants in the Poznań conference discuss?

The topics are associated with the UN climate change convention and have been divided into four blocks: reductions in carbon dioxide emissions, adaptation to climate change, funding and technology transfer.

The debate on carbon dioxide emissions will be focused on how to reduce these emissions, and how to set new emissions norms for individual countries and groups of countries. It is clear that developed countries will be expected to commit themselves to reducing emissions, while developing countries will be obligated to take other, not yet specified, measures.

The second important topic will be the problem of adapting to climate change, a problem that is particularly challenging to countries with weaker economies. The point is that climate has already changed to some extent and this has affected people in many parts of the world. As a result, we need not only to counteract climate change but also adapt to it. This requires making a great effort while not all countries are able to do so.

This problem is associated with the third topic of the conference, which is funding, and questions about who should provide the money, how much and for what purposes, and who should receive the money. These problems are very difficult to solve.

The fourth topic is centered on technologies which can be helpful in adjusting to climate change and which are needed to reduce carbon dioxide emissions.

Discussion on climate change is a very important process, one connected with the economic interests and development needs of all the countries involved, that is virtually all the world. The primary objective is to work out a compromise which would be fair to all countries and which would not divide the world into winners and losers. Working out a compromise every country would want to support is a sort of mission impossible, but I believe it is feasible. The Poznań conference is where we will be seeking a global compromise.

But isn't the global financial crisis likely to hinder efforts aimed to counteract climate change?

I am sure that most people involved in the process to counteract climate change believe the crisis is not an obstacle to reaching a compromise on climate protection. They believe the new global climate consensus will be a sort of a new economic consensus. It will incorporate a new modern energy sector, one that will be more stable and less dependent on such changeable factors as oil and gas prices. The new energy sector will be more diversified, which will mean more energy security to all countries.

Of course, the problem is more complex because what counts in politics is not only reality but also how it is perceived. The way in which many countries perceive the current crisis may be seen as an obstacle to making new climate protection commitments.

The stance of the new U.S. administration will be very important in this respect. If the approach of the new administration is open and bold it will have a positive impact on other countries' positions. There are many signs indicating that the Barack Obama administration will be more open to climate change problems than the George W. Bush administration was.

Isn't it a problem for the organizers that Poland is critical of the European Union's energy and climate plan designed to reduce carbon dioxide emissions by a fifth?

I don't think so. I think that if the energy and climate plan is to be adopted it has to be fair to all European Union countries, not only some of them. It has to take into consideration different conditions existing in individual countries, including Poland, which generates 95 percent of its energy from coal. If the EU adopts a plan taking into account the economic realities of individual countries it will be an important signal for the world that a bold compromise is possible, a compromise protecting the climate and at the same time addressing economic interests and meeting the development needs of the countries involved.

Power of Virtual Reality

The Virtual Reality Center run by the i3D company in the southern city of Gliwice is capable of generating interactive three-dimensional images that help engineers learn to operate complicated machinery, or allow designers to stroll through an aircraft, changing its shape, size and interior in an instant.

The Virtual Reality Center, which is the largest facility of its kind in both Poland and all of Central and Eastern Europe, works for clients such as U.S. aircraft manufacturer Boeing, which chose i3D over other companies around the world because the Gliwice facility is capable of creating fully interactive, three-dimensional images of aircraft being designed by the American corporation.

A three-dimensional image offers depth perception for aircraft designers. They can change their technical parameters or interior decoration with just a few clicks of a mouse. One example is the Boeing 787 Dreamliner, a plane whose production will be launched next year. A virtual model of the plane can be seen at the Virtual Reality Center in Gliwice.

3D technology makes it possible to look at the plane from all sides, go inside, check the seat adjustments, and feel the texture of the upholstery. It is also possible to look into the engine, see how it runs, take it apart and thoroughly examine each component.

Images are projected onto a cylindrical screen that gives the observer the impression of being completely immersed in a world that only exists in computer memories. The screening room with a teleconference system, launched this summer, seats 28 people. The screen, 10 meters long and 3 meters high, can display images with a resolution of 3600 x 1200 pixels.

From fun to business

Virtual reality is for many associated mainly with Imax movies and computer games. But it is also finding an increasing number of business applications.

"Reality becomes virtual—this is the motto of our company," says i3D's Marek Koźlak. "The development of technology allows reality to be reproduced better all the time, or even created in the virtual world. Thanks to motion sensors, we can get on the plane, look under the seat, check how the adjustment lever works. Compared with this technology, methods like those using PowerPoint software are simply archaic."

The technology makes it possible to design various objects in a virtual reality, but also learn how to operate machinery, practice surgery, or decorate a room that does not yet exist. This is the future of fields such as industry, medicine, education, tourism, and commerce, Koźlak says.

Foreign partners

The i3D company was established in 2001 by engineers from the Silesian University of Technology in Gliwice. In 2006, the company opened a "service and excellence" center dealing with interactive visualizations based on EON Professional technology. This was the first such facility in Central and Eastern Europe. It was set up at the Science and Technology Park in Gliwice as a joint project by i3D and its foreign partners. These were EON Reality, a global producer of 3D interactive visualization software, and a consortium of hardware suppliers including projector manufacturer Christie Digital, graphic card producer nVidia, projection screen manufacturer Stewart, and computer giant Microsoft.

i3D works closely with the Silesian University of Technology and plans to set up a Virtual Reality Laboratory together with the school to train top-caliber specialists in this area.

i3D relies on a work force of 18, but plans to create 50 more jobs for programmers and graphic designers by the end of next year.

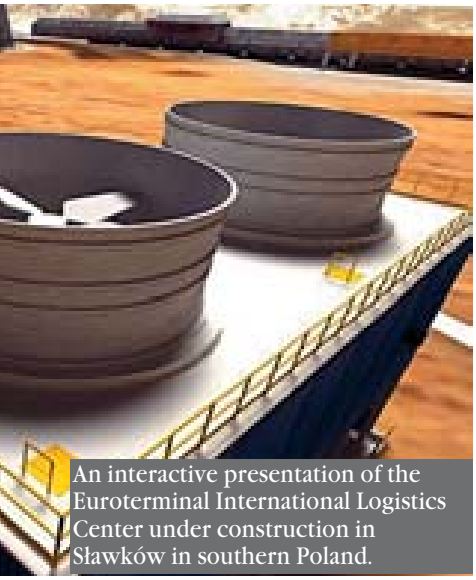
"I'm confident we are at the threshold of a 3D visualization boom," says i3D chairman Jacek Jędrzejowski. "In 2006 the penetration rate for this technology in companies was only 1.4 percent; this year it has gone up to 3.5 percent."

Last year i3D held a symposium entitled "Reality is Virtual" to draw the attention of specialists from industry and medicine as well as the scientific community to the opportunities that 3D visualization techniques offer in training people and in designing products and facilities. A similar symposium, entitled "The Natural History of Business," will be held this December.

A world that does not exist

The i3D company creates a virtual reality by developing interactive applications and making use of 3D projection systems. The possibilities for using these applications are diverse. The company offers

Business as usual in 3D: The Uniserv company strutting its stuff



An interactive presentation of the Euroterminal International Logistics Center under construction in Sławków in southern Poland.

methods for moving around virtual buildings and facilities whose construction is still at the planning stage. Users can also tour virtual museums and historic buildings; visit historical sites that have been reconstructed in a virtual reality; prepare operating instructions and maintenance manuals for machines requiring complicated procedures; develop training applications to upgrade staff qualifications; create virtual stores; develop company and product presentations for marketing purposes; create product catalogues for use on the internet; and develop simulators to work together with movement tracking systems.

"In all these applications the user has complete control over whatever they are observing," Koźlak says. "Looking at a house, for example, they can open a window, turn on the TV, or take a ride in the elevator. Looking at a car, they can use the door handle and get inside. This level of interactivity is especially important for anything that is expensive, hard to access or complicated to show in the real world."

3D methods also work well for equipment that is physically easy to show, but requires complicated operating instructions—for example aircraft turbines. The technology can be used to prepare a maintenance manual for practically any device, Koźlak says. "Almost anyone will be able to service complicated mechanisms after they see and perform every activity in the virtual world," he adds. "The possibility of virtual practice eliminates errors in the real world. This is especially important whenever time is of the essence, for example in power plants or various crisis management systems."

Training applications are another example of what 3D images can be used for. "We can make a control panel for almost any equipment," Koźlak says. "The equipment will be virtual, but the panel will be real. The future user can gain proficiency without even seeing the real thing. The real equipment does not have to be used unnecessarily and thus wears down less quickly. Training costs can also be reduced substantially."

Virtual museums and operating theaters

The first project handled by i3D was a three-dimensional visualization of a new terminal at Katowice-Pyrzowice Airport. This was followed by other projects, including an application for a virtual tour of the Guido underground mining museum in Zabrze, southern Poland. The company also developed a virtual model of the interior of the Bombardier luxury jet and a training application for an emergency oxygen supply system used during accidents in coal mines. i3D experts also handled an interactive presentation of the Euroterminal International Logistics Center under construction in Sławków in southern Poland.

One of the applications developed by i3D offers a walk outside a cathedral in Porto, Portugal. The virtual model of the cathedral was created on the basis of 30,000 photos. "Of course, it is also possible to design an application allowing people to go inside this cathedral," Koźlak says. "The issue of preserving cultural heritage is especially exciting in the context of 3D technology because we can recreate something that no longer exists. We are working on the revival of a Jewish district and synagogue in Lublin, eastern Poland. Based on written sources, pictures and other buildings from the same period, we are 'rebuilding' a nonexistent part of the city that people will be able to walk around. Similarly, we are able to reconstruct the ruins of medieval castles—not just what they looked like, but the conditions of everyday life there."

Apart from handling projects for clients, i3D works on its own projects. One example is the Heart, an interactive 3D model of the heart being developed together with Polish and international scientists. In the first stage of the project, the model will be used to train students, and later to design virtual operations.

The company has also developed an application for developers to design virtual housing estates and decorate homes. The application makes it possible to move around objects and arrange the interior at will.

Touch-free navigation

In addition to supplying applications for use with state-of-the-art hardware, i3D delivers complete projection systems. One such product, previously unknown in Poland, is a screen made from a special kind of plastic film that creates an illusion of objects suspended in midair.

The company is also eyeing technology that enables touch-free navigation whereby an image is projected onto a pane of glass or a specialist 3D monitor, and interaction takes place through finger navigation. i3D also offers autostereoscopic displays allowing viewers to watch 3D visualizations without using special glasses.

3D technologies are still rarely used in business and education, i3D experts say, but they are bound to become more popular soon. There are already information centers, help desks and trade fair stands fitted with this type of projection systems.

Television broadcasters are also preparing to embrace 3D technology. The world's first 3D television has already started broadcasting in Japan, Koźlak says. According to the Christie Digital company, a global giant in the manufacture of projectors, next year should see some 8 million 3D TVs sold in the United States.

Ewa Dereń

How Stress Can Make You FAT

Polish scientist Zofia Żukowska led a team of researchers in the United States that discovered the mechanism by which mice gain weight when under stress. Experts say this kind of mechanism may also apply to humans. If so, it could revolutionize medicine as well as cosmetology and plastic surgery.

The researchers, working at the Georgetown University Medical Center (GUMC) in Washington, D.C., have developed a "vaccine" that adds or removes fat in specific places in the bodies of laboratory animals. The results of their research work have been published by the premier biomedical research journal Nature Medicine.

Prof. Żukowska and her U.S. associates, including plastic surgeon Stephen Baker and oncologist Michael Johnson, have proved that while you can lose weight due to short-term stress, a long-lasting state of nervous tension induces weight gain. This would explain why people living in constant stress get fatter than they should considering their calorie intake. The most important thing about this research is that Żukowska has learned to control and influence this mechanism.

Stress + food = weight gain

To gain an insight into the mysterious relationship between stress and weight gain, the GUMC scientists conducted a series of experiments on mice. They fed some of them the equivalent of junk food, adding up to a high-fat and high-carbohydrate diet; the other mice received standard food. All the animals were subjected to prolonged stress. They were kept in cold water for an hour each day or locked in the same cage with aggressive alpha males.

It turned out that the stressed-out animals who ate normally did not gain weight, while those on a high-fat diet did. Interestingly, this weight gain was much greater than the scientists expected considering the animals' daily calorie intake.

"The mice gained twice the amount of weight they should have," says Lydia Kuo, a medical student who worked with Żukowska's team as part of her Ph.D. "Eating the same amounts of the same food as the unstressed animals, they became fatter. That means their metabolism must have changed."

The research also showed that the stressed mice started showing symptoms of metabolic disorders and cardiovascular diseases. The animals in this group quickly started displaying glucose intolerance, hypertension, blood vessel inflammation, and fat deposition in their liver and muscles.

Food for thought

The researchers decided to investigate the causes. They found that the main role was played by two biological molecules, the neuropeptide Y (NPY) and the neuropeptide receptor Y2 (Y2R). The neuropeptide is a protein hormone that serves as a neurotransmitter and is found in the medulla oblongata, the hypothalamus and the autonomous nervous system. Its role is to regulate the body's daily rhythm, response to stress, sexual function and hunger (it increases the appetite). NPY also augments the action of noradrenaline (narrowing the blood vessels) and regulates the immune system's response to infections by activating immune cells to seek out pathogens and suppressing them when they are no longer needed. The neuropeptide's release increases after physical exertion, under the influence of stress and as a result of irritation with high-frequency electrical impulses.

Żukowska's team discovered that there is a special neurochemical route in the body that is responsible for seeing NPY released into the blood under the influence of stress, which causes fat to start depositing in the animal's body. This mechanism is activated in two types of fat tissue cells: endothelial cells lining the blood vessels and fat cells themselves.

To prove they were right, the scientists injected NPY into different parts of the mice's bodies. They discovered that both NPY and Y2R are activated during stress and are directly responsible for the development of obesity and metabolic syndrome, a set of interrelated factors that contribute to the development of atherosclerosis, type-2 diabetes, and cardiovascular diseases, including heart attack and stroke. Further experiments showed that blocking the NPY receptors prevents fat from depositing and leads to rapid weight loss. Just two weeks after receiving a blocker for this molecule, the mice started getting thinner.

"We couldn't believe such manipulation of fatty tissue was possible at all," Żukowska says. "Various experiments lasting over four years confirmed our suspicions, at least with regard to mice." She hopes the mechanism could be similar in humans. This is suggested by the fact that stress-inducing situations, such as frequent clashes with our boss, our child's chronic disease or everyday traffic jams, cause us imperceptibly to change our diet to a high-calorie one, which can lead to obesity with time.

One important aspect of Żukowska's discovery is that it proved that NPY directly affects fatty tissue, and not only the brain, experts say. "These are the first studies to show that stress has a direct impact on the accumulation of fatty tissue in the body, weight gain and metabolism as such, and that it has nothing to do with the brain," Kuo says. "It's simply a physiological response from fatty tissue."

Great expectations

"We hope our discovery will lead to the development of tools to help treat metabolic syndrome and obesity in humans as well," says Żukowska. "We have observed that the weight loss in mice that we have achieved reduces the fat deposition in their livers and skeletal muscles as well as limiting their glucose intolerance (pre-diabetes state), insulin resistance, hypertension, and various inflammatory diseases. We hope that blocking Y2R might work in people the same way it does in rodents. Further research is needed, however."

Today metabolic syndrome and related diseases have reached epidemic proportions. In 2000 in America alone, 60 million people suffered from metabolic syndrome. "Though we don't expect that people will be able to eat anything they want in the future and still look like film stars just by blocking their Y2R, we do hope our discovery will help improve human health," Żukowska says.

Perhaps in the near term the research could also be applied in cosmetology and plastic surgery. Physiologically implanting fat, using NPY injections, could be used in face rejuvenating treatments, breast, buttock and lip enhancements as well as face reconstruction. The researchers say this method would not only be simple, cheap and safe but also effective and permanent—the effects would last throughout the patient's life.

Another benefit from the discovery, one that takes advantage of the possibility of "shedding" fat from places where it is undesirable by blocking Y2R, could be a revolutionary treatment for obesity eliminating the need for complicated liposuction operations or stomach-shrinking surgery and replacing them with simple injections.

Dr. Roxanne Guy, who chairs the American Society of Plastic Surgeons, says a lot more research is needed before the method can be used on humans, but even today it is possible to imagine that supplying a long-lasting and natural wrinkle filler or a non-surgical method for removing excess fat would revolutionize modern plastic surgery.

Julia Czechowicz

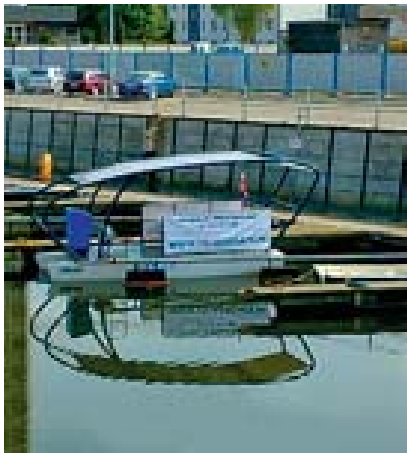
Prof. Zofia Żukowska graduated from the Medical University of Warsaw and obtained her Ph.D. degree in 1979. She specializes in cardiovascular physiology and hypertension. In 1978-1980 she was a lecturer and researcher at the Medical University of Warsaw's Internal Medicine, Hypertension and Angiology Clinic, and worked with the U.S. National Institutes of Health in 1980-1986. She has been a professor at Georgetown University since 1986 and currently heads the Department of Physiology and Biophysics and the Stress Physiology and Research Center of the Georgetown University Medical Center.

Żukowska is a member of many scientific societies, including the American Physiological Society, the Council for High Blood Pressure Research, the Council on Atherosclerosis, the Society for Hypertension, the Polish Academy of Sciences, and the Society for Neuroscience. Her publications have appeared in leading medical journals all over the world, including Science, American Journal of Physiology, Proceedings of the National Academy of Sciences, and the Journal of Pharmacology and Experimental Therapeutics.

She received an award from the Polish Cardiac Society in 1980 and the Nicolaus Copernicus Award for Excellence in Neuropeptide Research in 2002. In 1989 she won the Adele Melbourne Holmes Award from the American Heart Association.

A Boat Powered by Solar Energy

Engineers from the Ocean Engineering and Ship Technology Faculty of the Gdańsk University of Technology in northern Poland have designed and built an experimental passenger boat powered by solar energy.



The boat, called *Solar*, was singled out for praise in the Innovation 2008 contest at the Industrial Technology, Science and Innovation Fair in the coastal city of Gdańsk. Powered by energy generated by photovoltaic panels, it is the first such boat built and operated in Poland. For six months now it has been sailing through Gdańsk's canals and plying the waters of the Bay of Gdańsk in both good and bad weather.

The *Solar* was built in 2008 and the money for its construction was provided by the Regional Fund for Environmental Protection and Water Management in Gdańsk. Other sponsors included the Ocean Engineering and Ship Technology Faculty of the Gdańsk University of Technology. Prof. Janusz Rachoń, rector of the Gdańsk University of Technology, and Paweł Adamowicz, mayor of Gdańsk, lent their names to the undertaking. The boat's designers are Wojciech Litwin, Wojciech Leśniewski, Karol Niklas, Dariusz Duda, Arkadiusz Łabuć, and Paweł Dymarski.

The *Solar* is over six meters long and 2.5 meters wide. It achieves a top speed of 12 kph, but its most economical speed is 8 kph. It has a crew of one or two and can take 10 passengers on board. It is driven by a 5 kW propeller known as an azimuth thruster. Each of the 12 photovoltaic panels on the boat's roof has a power output of 120 W. The *Solar* can sail for 12 hours in cloudy weather before the batteries run out. It was officially unveiled and launched May 24 on the Motława River in Gdańsk. The boat is moored in a local marina and is still undergoing trials.

Visitors to this year's Industrial Technology, Science and Innovation Fair in Gdańsk could also see other original watercraft built by Litwin and Duda together with students from the Korab Students' Research Circle at the Gdańsk University of Technology. These included an original pedal boat called *Rektor* and a solar-powered regatta boat.

Both the pedal boat and the regatta boat have performed well at international regattas. The Rektor won the International Water Bike Regatta in Zagreb, Croatia, this year.

The *Rektor* is a combination of a pedal boat and a catamaran. Although it is tall, the addition of two catamaran hulls makes it uncapsizable and greatly reduces water drag. It is called *Rektor* in honor of Janusz Rachoń, former rector of the Gdańsk University of Technology and now a senator who strongly supports the Korab circle.

The *Rektor* can move forward and backward at a speed of around 20 kph. It is easy to maneuver and has a high towing power. The designers say their invention, built for regattas and in keeping with regatta regulations, could also be used by centers organizing active vacations.

The solar-powered regatta boat also attracted much attention among visitors to the fair. It had been built especially for the Solar Challenge regatta in the Netherlands.

"The Solar Challenge is a grueling race," says Duda. "You have to sail 240 kilometers, divided into several stages, using only solar power. The organizers provide solar panels to create a more even playing field for all the participants. You have to design a regatta boat with a set power output. We have a one-person and a two-person boat and have been competing successfully."

The Korab Research Circle brings together students who design and build human-powered and solar-powered watercraft. They regularly take part in international competitions such as the annual International Water Bike Regatta in Croatia and the Frisian Solar Challenge and Zeeuwse Zonnebootrace regattas in the Netherlands.

Piotr Bartosz

A Revolutionary Braking System

The ALFA composite—AL for aluminum and FA for fly ash—is a new high-performance material that can be used to make ultra-light aluminum brake discs.

The ALFA brake discs are the results of research carried out at the Foundry Research Institute in Gliwice in southern Poland and the institute's collaboration with scientists at the Motor Transport Institute in Warsaw. The brake discs won the Gold Medal and a commendation at the 2007 Eureka innovation fair in Brussels.

Cheap and eco-friendly

Metallurgists have been carrying out research for many years on composite metals—metals combined with either another metal or a ceramic or organic compound. Many of a metal's mechanical properties are enhanced when it appears in a composite form, such as its ability to withstand stress, fatigue and temperature fluctuations; its elasticity and heat conductivity. Oxides, carbides and nitrides have been used to date as composite materials.

The innovative use of fly ash in Gliwice has resulted in a competitive metal composite for its properties combined with an eco-friendly solution because fly ash is a problematic waste product of power plants and foundries. Moreover, from an economic point of view, the production of composite metal with fly ash as a component and the making of products from it is significantly cheaper.

Aluminum was chosen as the base metal for ALFA brake discs. Fly ash is mixed with a relatively soft aluminum alloy at an approximate ratio of 1:5. Such a combination of metal and a ceramic compound results in material strength comparable to that of cast iron. According to the designers of the ALFA brake discs, the technology introduces a whole new way of thinking about the material used in the construction of brake systems.

Besides being significantly lighter in weight, the new material reduces the maximum temperature at which the heating system needs to work. Furthermore, the life expectancy of these new brake discs is much longer. They are expected to work faultlessly for hundreds of thousands of kilometers. Moreover, this technological know-how could be applied to both mass car production and the manufacture of racing cars and special-purpose and luxury vehicles, in addition to rail transport and aviation.

Polish proposal

The Eureka competition judges were particularly impressed with the ecological and economic benefits of the ALFA brake system. The use of fly ash as a component of the composite metal helps solve the problem of what to do with this environmentally harmful waste product and reduces its storage requirements. At the same time, fly ash is a cheap raw material in abundant supply. Further research into the use of fly ash as a component of composite metals could not only result in another unique product like the ALFA brake system but also bring to light new possibilities for using it in various sectors of the economy.

Engineers at the Foundry Research Institute say their ALFA technology will result in the development of new materials that could replace some modern construction materials, particularly composite materials containing silicon carbide or aluminum oxide. Such new materials are available on the European market but are expensive and difficult to use when cutting around objects. The most promising physical property of fly-ash composite metal for application in foundries is the resultant metal density and its thermal properties. The composite metal's high melting and softening temperatures and low heat-conduction factor make it suitable for foundry molds.

Safer driving, better fuel economy

The Foundry Research Institute and the Motor Transport Institute are trying to identify the usefulness of this new composite material for brake discs in passenger cars. Laboratory research and practical tests are being carried out to assess how well the new brake discs withstand real road conditions. According to the ALFA designers, their material and construction design could in the future revolutionize the prevailing approach to friction systems whereby heavy metal-alloy brake discs are used. Meanwhile, the use of ALFA brake discs made with lightweight components significantly streamlines the braking system and makes for a more comfortable driving experience with better fuel economy. The high heat conductivity of the composite material, together with its improved resistance to heat fatigue, will have a direct effect on driving safety. Moreover, the production of parts from this aluminum alloy composite is significantly more economical because of lower electricity usage and the utilization of fly ash, which is, after all, a waste product.

Ewa Dereń

Seeing Through Metal

Scientists at the Computer Engineering Department of the Technical University of Łódź have developed a system for analyzing the geometric features of metals and alloys at high temperatures.

The system helps metallurgists as they search for new materials based on a combination of various kinds of metals with the aim of eliminating lead-tin solders that are hazardous to health. That entails defining the physical and chemical properties of metals and their alloys.

The Łódź research team, led by Prof. Dominik Sankowski, includes Krzysztof Strzecha, Ph.D.; Marcin Bąkała, Ph.D.; Anna Fabijańska, Ph.D.; Tomasz Koszmider, M.Sc.; and Adam Rylski, Ph.D. Their system can be applied in many sectors of industry that make use of state-of-the-art soldering technologies, such as aviation.

The Łódź scientists have worked together with materials science and engineering experts from the Warsaw University of Technology, the Częstochowa University of Technology, and the Technical University of Łódź.

"Our research is complementary," says Sankowski. "We work out algorithms that enable automated measurement of material properties, while our colleagues from other cities conduct direct tests while looking for optimum solutions."

The system registers what it "sees" and processes data in the form of concrete, repeatable results. The metal sample is melted in a special device at a temperature of up to 1700 degrees Celsius. The sample assumes a spherical shape in the process. Its properties are determined on the basis of images that are transferred for further analysis involving image processing and special algorithms.

Similar methods have been developed in other countries, but the Łódź system is more precise and more efficient, Sankowski says.

The method won a silver medal at the International Warsaw Invention Show in 2007 and a gold medal at the 6th ARCA International Fair of Innovations in Zagreb, Croatia, in September this year.

BSZ

Industrial Processes in 3D

Researchers at the Technical University of Łódź have found a way to obtain three-dimensional images of industrial processes such as the flow of oil through a pipeline or the passage of grain through a silo—without resorting to invasive methods.

The scientists, led by Prof. Dominik Sankowski, work at the Computer Engineering Department of the Technical University of Łódź. They have developed a three-dimensional tomography method to analyze the gravitational flow of industrial particulates. The method makes it possible to obtain detailed information on various industrial processes.

In the project, Sankowski has worked with researchers including Prof. Richard A. Williams, Dr. Robert Banasiak, Dr. Zbigniew Chaniecki, Dr. Radosław Wajman, Dr. Krzysztof Grudzień, and Dr. Andrzej Romanowski.

"Tomography imaging not only provides information that makes it possible to show the course of industrial processes, but, above all, to control them," says Sankowski. That involves highly developed data processing algorithms.

In classic tomography, physical and chemical phenomena occurring in industrial systems are examined with the use of sensors that only permit two-dimensional measurements. The Łódź researchers have developed a new tomographic sensor that permits three-dimensional imaging. The system consists of a measuring unit, or a tomograph, a multi-electrode sensor with flexible electrodes adapted to application needs, a special measurement protocol, and dedicated software.

The new technology makes it possible to obtain more information about industrial processes from cumulative measurements. The data is processed into a 3D display on the screen. "We use fast dedicated software or 3D image reconstruction algorithms that recreate the interior of a given vessel or a process, and fast multiprocessor computing stations," says Sankowski.

This kind of tomography is used in other countries as well, but the Polish scientists are among the world's leaders in this field, Sankowski says.

The department's research focuses on the development of new Electrical Capacitance Tomography (ECT) designs involving twin-plane systems and 3D sensors, with new image reconstruction algorithms that make it possible to increase spatial resolution, combine different modalities of tomography, and allow 3D measurements.

Producers need more information about optimum material storage and dosage methods to be applied in production in order to improve product quality, and to effectively control the production process.

The new technology won awards at a number of international exhibitions last year, including a silver medal at the International Warsaw Invention Show, a special award at the Taipei International Invention Show, and a gold medal at the 56th Brussels Innova International Eureka Contest in Brussels.

BSZ

Polish Iris Recognition Software Wins Award

An iris recognition method developed by Polish researchers at the Technical University of Łódź won second prize at an international competition organized by the University of Beira Interior in Portugal.

The IrisStation software, referred to as "a high-resolution iris image acquisition system for biometric applications," was developed by Wojciech Sankowski, M.Sc., under the supervision of Prof. Andrzej Napieralski at the Department of Microelectronics and Computer Science of the Technical University of Łódź.

The method also won a gold medal at the 56th Innova International Eureka Contest in Belgium in November last year.

Most iris recognition methods use camera technology, with subtle infrared illumination reducing specular reflection from the convex cornea, to create images of the detail-rich, intricate structures of the iris. Converted into digital templates, these images provide mathematical representations of the iris that yield unambiguous positive identification of an individual.

"We obtain a mathematical description of the structure of the iris and then compare it with the data stored in a database to identify the person from the photograph," says Sankowski.

Irish recognition has increasingly been the focus of research and discussion in recent years. Iris recognition is the process of recognizing a person by analyzing the pattern of his or her iris. In other words, the biometric authentication process uses pattern recognition techniques based on high-resolution images of the irises of an individual's eyes.

The recognition and identification of the iris is one of the biometric methods for identifying people. The method has various applications in areas such as security systems, criminology and medicine. It serves to prevent unauthorized access to ATMs and computers, prevent entry by outsiders into secure buildings, register check-in and check-out time at workplaces and border crossings in countries such as the United States and Australia, and to diagnose early symptoms of Alzheimer's disease.

The iris scanning method is based on the unique pattern of the iris of every individual. Many experts say the technique, in comparison to the analysis of such biometric traits as fingerprints and even DNA, is much more reliable and precise. The iris is said to be the best ID of an individual.

"A number of iris pattern-based identification systems are available on the market today," says Sankowski. "However, their effectiveness is limited, which poses a barrier to many potential applications. Hence the importance of further research, which will make it possible to apply the technology in such demanding systems as ATM networks."

The Technical University of Łódź Department of Microelectronics and Computer Science has conducted research on iris scanning methods for several years. Its IrisStation system outperformed 27 other designs from across the world in the University of Beira Interior competition. These included entries submitted by countries such as China, Portugal, South Korea, the United States, Italy, and Spain. This year's competition finalists could publish the results of their research in an international specialist periodical entitled *Elsevier Image and Vision Computing*.

Julia Pawłowska

14th-Century Settlement Unearthed on Biebrza River

Polish archeologists uncovered the remains of a 14th-century settlement on the banks of the Biebrza River during construction of a ring road around the town of Sztabina in the Podlasie region in eastern Poland. They have found thousands of objects belonging to people who once lived in the area.

The archeologists have uncovered human graves and pits used for storing food. One of the most interesting finds is the remains of palisades that enclosed the settlement.

"Preliminary analysis of the wood shows that it dates from the 14th century," says Jerzy Siemaszko, director of the Regional Museum in the northeastern city of Suwałki. According to Siemaszko, the settlement covered an area of some 3-4 hectares on the Biebrza River.

Antibacterial Clothing to Help Fight Transmittable Diseases

Hospital aprons that do not allow bacterial and fungal growth and antibacterial underwear could soon be available thanks to research being carried out by scientists at the Gdańsk University of Technology in northern Poland.

Researchers in the university's Chemical Technology Department are using nanoparticles of precious metals, particularly silver, to achieve this goal. "We are striving to bind nanoparticles of precious metals, silver in particular, to neutral molecules in a bid to produce antibacterial and anti-fungal material," says the department's Adriana Zaleska, Ph.D. "Such material could be used to make underwear to prevent the growth of microorganisms on the garments. I think the material should be for specific uses such as hospital uniforms or for garments most prone to bacterial infestation like underwear and uniforms." Clothes made from material with antibacterial properties would prevent microorganism growth in hot climates and also prevent the spread of infection in the event of an injury.

Meanwhile, chemists from the Nanoco company in the southern Polish city of Tarnowskie Góry have developed methods for the production of bactericides, fungicides, deodorizing agents and bactericidal polymers. All these methods rely on the use of nano-silver, or silver molecules that are the size of one-millionth of a millimeter. The molecules are suspended in water and can only be seen under an electron microscope. Applied to any surface, the biocide kills all microorganisms from bacteria to fungi.

Tests conducted by Nanoco in Polish health centers have shown that nano-silver effectively kills bacteria. Spraying it on the walls and floors in the rooms where patients stayed, as well in the bathrooms, kept the surfaces free from pathogenic microorganisms for as long as 14 days. Such a lasting effect results from the fact that microorganisms are unable to develop immunity to silver. This is particularly significant in fighting antibiotic-resistant bacteria strains that plague hospitals, such as Staphylococcus aureus, Salmonella typhi, Klebsiella pneumoniae, Neisseria or streptococci. Silver is effective in the case of 99.9 percent of bacteria and fungi, the chemists say.

The development of nanotechnology has enabled scientists to make full use of silver's germicidal properties. With its molecules broken down to nano size, they have achieved a much larger active surface, and unprecedented bactericidal power. One gram of silver, fragmented down to nano scale, has an active surface of hundreds of square meters.

Nano-silver also opens up new vistas for the clothing industry. Garments impregnated or made with the use of nano-silver fibers can prevent the growth of bacteria and the resulting odors.

Improving Survival Chances After a Heart Attack

The death rate in Poland for patients who have suffered a heart attack can be reduced thanks to the use of intravascular ultrasonography and optical coherence tomography (OCT), says Dr. Dariusz Dudka from Cracow's University Hospital.

A team of researchers led by Dudka has carried out three operations that were broadcast live to the United States as part of the Transcatheter Cardiovascular Therapeutics (TCT) conference, the world's largest educational meeting specializing in interventional vascular medicine.

The death rate caused by heart attacks in Poland is 3-5 percent. This percentage can be reduced still further. According to Dudek, intravascular ultrasonography allows doctors to clearly see images one-tenth of a millimeter in size, but with the OCT method magnification is increased to one-hundredth of a millimeter. Thanks to this technology, an invasive cardiologist can see a heart-attack patient's coronary vessels almost as clearly as he would through a microscope. Thus the doctor can precisely prescribe treatment, the type of stent—a small spring that is placed within a blood vessel to unblock it—that should be used and identify the best technique to prevent thrombosis.

Compiled by Tadeusz Belerski

Polish Students Help Discover an Asteroid

Students from High School No. 13 in the northwestern Polish city of Szczecin, who took part in the International Asteroid Search Campaign organized by the United States' National Aeronautics and Space Administration (NASA) and the Astronomical Research Institute based in Charleston, Illinois, discovered an asteroid on the Main Asteroid Belt, the region of the solar system located roughly between the orbits of the planets Mars and Jupiter and occupied by numerous irregularly shaped bodies called asteroids or minor planets.

This is not the first asteroid discovery of the Polish students since they had already found several last year and in the first half of this year. Their latest discovery is the result of work for a campaign that began in early October this year. The campaign's aim is to discover as yet unknown small objects within the solar system. These objects, not very large asteroids in particular, are closely watched to establish if they pose any potential threat to the Earth. Their orbits are checked to ensure that they are unlikely to hit our planet at any time in the future.

Krzysztof Będkowski and Jakub Zaborowski are the two students who discovered planetoid K08SK9B Oct. 6. They worked under the guidance of their physics and astronomy teacher, Tomasz Skowron.

Patrick Miller from the Astronomical Research Institute, who is the main coordinator of the International Asteroid Search Campaign, has confirmed the discovery. Details of the new asteroid will be passed on to Harvard University's Minor Planet Center, which collects information on small bodies within the solar system for the International Astronomical Union (IAU) and NASA.

The International Asteroid Search Campaign, also known as the International Astronomical Search Collaboration, is an educational outreach program for high schools and colleges, provided at no cost to the participating schools.

The Astronomical Research Institute is a not-for-profit research organization geared toward education in the field of near-Earth objects and near-Earth object observations conducted under NASA's Near Earth Object Observation Program.

Observations of near-Earth asteroids (NEAs) are important to the astronomical community to determine the potential impact hazard these asteroids pose to Earth.

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