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POLISH TECHNICAL REVIEW

2/2020

SCIENCE AND INDUSTRY IN A COUNTRY OF CHANGES

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TITLE OWNER/WŁAŚCICIEL TYTUŁU:
National Council of Federation of Engineering Associations NOT
Federacja Stowarzyszeń Naukowo-Technicznych Naczelna Organizacja Techniczna
Czackiego Street 3/5, 00-043 Warsaw
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www.enot.pl, e-mail: sekretariat-prezes@not.org.pl

PUBLISHER/WYDAWCA:

WYDAWNICTWO *SIGMA-NOT*

SIGMA-NOT Publishing House Ltd.
Wydawnictwo Czasopism i Książek Technicznych
SIGMA-NOT Spółka z o.o.
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DTP COMPOSITION/SKŁAD I ŁAMANIE:
SIGMA-NOT Publishing House Ltd.
Wydawnictwo Czasopism i Książek Technicznych
SIGMA-NOT Spółka z o.o.
Ratuszowa Street 11, VII p., 03-450 Warsaw
phone: +48 22 818 09 18, +48 22 818 98 32
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e-mail: sekretariat@sigma-not.pl

OPEN ACCESS
QUARTERLY
e-ISSN 2657-6716
SINCE 1964

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Dear readers!

It's difficult to move away from the subject of coronavirus in private and business conversations. However, now we are wondering if there will be a second wave of infections (although the first one is not behind us yet), how will the economy behave and change our life in the long run. The attempts to find the answer to these and other questions, may be found, inter alia, in the material "Pandemia will pass, infrastructure will remain", by the Staszic Institute but are also undertaken by Maciej Dryjański – AVL Software and Functions Polska Department Manager, who highlights the future of the automotive industry.

The world is changing, and we have a huge impact on certain things, especially when it comes to climate and its global warming. The article by Dariusz Kubicki, Paweł Sędłak and Tomasz Stawicki presents international recommendations on climate protection and pro-ecological actions implemented by the Polish government. After all, we don't want Poland to be a desert with ecological slogans in the background (as on our cover).

with health wishes
Magdalena Borek-Daruk
Deputy Editor-in-Chief

MACIEJ DRYJAŃSKI FROM AVL SOFTWARE AND FUNCTIONS POLSKA ON THE AUTOMOTIVE INDUSTRY

MACIEJ DRYJAŃSKI Z FIRMY AVL SOFTWARE AND FUNCTIONS POLSKA O BRANŻY AUTOMOTIVE

AVL Software and Functions Polska: Established in 2015 to allow AVL Software and Functions Poland to serve its international clients worldwide, AVL Poland has a staff of more than 60 people and currently has 8 engineering skillset. This Technical Center has capability to develop and test electronic control units in house.

The company AVL Software and Functions in Warsaw involved in the generation of combustion control systems, electric and hybrid power units.

The department offers competences in the field of:

- analysis and development of requirements for vehicle control systems;
- system design and integration propulsion systems;
- functional safety;
- EMC;
- software development of high reliability control systems using the Model in the Loop methods;
- electronics design for electric drive propulsion systems;
- creating low-level software for control units used in vehicles;
- programming of control units used to manage chemical batteries.

Website: www.avl.com
LinkedIn: https://www.linkedin.com/company/avl-in-poland/

Polish Technical Review: *Why have you decided that opening a branch office of AVL in Warsaw would be a good decision?*

Maciej Dryjański *- Department Manager AVL Software and Functions Polska:* The decision to open a unit of AVL Software and Functions in Warsaw arose from the needs of the company, originally located in Germany. Moreover, that was caused by businesses generated in Poland. The German client was relocating parts of his activities to Poland, hence the opportunity of local support came into existence. Back then, it was decided that AVL should launch a small engineering team, consisting of two people who could support the German project. Yet, over time, the needs were larger and higher. Our team began to expand.

Together with my colleague, with whom I managed the company at that time, we realized that there is a high investment value in Poland. Hiring engineers here, locally, would be the right decision. We've started to create teams which have supported not only the client in Poland, but also our units in Germany and in Austria. And that, in short, is how AVL started in Poland. Starting from a small team of two persons, we've grown into a unit of sixty workers.

PTR: What were the preparations for the opening the office?

Maciej Dryjański: Our first meeting took place in a small office, which was actually an apartment. After two months of working there, we've found that there is not enough space for our projects. We've decided to start looking for another one. We have rented an office space for around 20 people, and in short time, this space was also too small for us as well. In reality, we have organized everything by ourselves at that time: the IT section, the whole infrastructure. We even chose the color of the floors and the walls. It can be easily said, that the startup atmosphere was in the air. We were only supported by the German budget.

PTR: As you've mentioned before, the Polish office of AVL has been open for five years now, and the startup atmosphere remains unchanged. How is it possible?

Maciej Dryjański: I believe that it stems from the fact that we

have started from scratch, and that everyone's ideas were included into how we're working right now. Of course, some of the concepts were hard to introduce, because we are covered by a global process control framework, so we have certain rules that must be followed. Despite this, I believe there is a really friendly atmosphere among our employers. They are curious and engaged people who put a lot of effort in both their individual tasks and joint ventures. We also have a small back-office support, so topics such as company events, ideas for cooperation, or self-development, are emerging mostly from the team.

I wouldn't say we are a startup as everyone imagines. We don't have swings at our desks, we don't come up with solutions during one week, although it may happen from time to time. Everyone's responsible for his own part of the task, which, for sure, gives an opportunity to put yourself in the ownership role and to strive for pride in your solutions and your team. All in all, we still have that sort of startup atmosphere. We try to create solutions, not problems.

***PTR:** How do you manage to lead 60 people? What techniques do you use to motivate your employees?*

Maciej Dryjański: Out of those 60 employees, around 40 of them report directly to me. I would really love to have a contact with each of them every day, yet it is almost impossible to achieve. Giving everyone a few minutes a day would leave me with not much time to follow my own tasks, which is why I focus on independence at work. I employ people who are motivated, who want to achieve specific goals and who come out with their own ideas and solutions. Although sometimes I do not agree to all of them.

However, when it comes to the techniques I use, I definitely try to give people the opportunity to solve problems by themselves, so they can come with an idea for a solution. Someone wise once said that people are employed to come with problems and solutions, not just come for the guidelines. If you have such independent employees in your team, if they are full of faith, optimism and willingness – you've won.

The cleverness and independence of our employees reassures me that they are not afraid of any challenges. In my opinion, leaders emerge from such courageous attitudes, and, over time, other smaller teams are formed under their guidance. Whether they are restructured and formalized in some way in or not, this is another aspect. What I focus on today are these local self-organizing teams with leaders who take great responsibility.

***PTR:** If we look into the heart of the company, what will we find there? What technologies are used in AVL every day?*

Maciej Dryjański: We use computers, this is probably the most valuable information. Once, I had the opportunity to talk to a person who has been working for AVL for 40 years and who will be retiring this year. It was his first and only job. He told me how AVL changed over time, from a company that employed 300 people worldwide, into a company which today employs 12,000 people on a global scale.

He remembers how in the 80s everyone still made mechanical sketches on drawing boards, at that time they had only a dozen or so computers in the whole company. He also talked about the implementation of the first pneumatic mail on the company's premises and how it changed and also fasten the communication. Another big step was when the first computers connected to the Internet appeared. Can you imagine that employees signed up timesheets to work on the computer or to use the Internet? Well, it was a completely different world.

At that time, I heard the history of the entire transformation of the company into the world of digitalization. What is more, a small circulation of documents appeared and all the data was digitally produced. AVL had also translated all its know-how into this digital world. New options appeared, such as simulation tools that we have created and continued to develop. We have also designed tools for collecting and processing big data. AVL also did calibration-related solutions, where experiments with 10 or 50 thousand variables could take place within one night. It was an amazing jump from the world based on the number written on a paper freehand, to the digital world.

What is the company doing in the digital world today? The most valuable information is data. More precisely, the information that we can develop during our own R&D project which we can later on use and transfer to our commercial projects. AVL is one of the top leaders that is able to use such kind of approach because each year we are investing around 10 % of our turnover into our own R&D know how. In the end, this is the most valuable part. Without innovation you cannot survive in such a rapidly changing engineering world.

***PTR:** How do you evaluate the development of the automotive industry in Poland in recent years?*

Maciej Dryjański: I would say feebly... It is said that part of the automotive industry amounts to over 20% of export in Poland and constitutes a significant part of Poland's GDP. However, we are still a country where only assembly takes place. We have a lot of factories. An example of this is Volkswagen, Opel, or Fiat. We also have a large number of Tier 1 or Tier 2 suppliers, mostly western companies located in Poland. Few business partners in the country belong to a group of large companies. They deliver things for the automotive industry in the western Europe. Yet, I believe there's a lot of small and medium enterprises with Polish capital.

When it comes to research and development, I think we are at the very beginning of this path. We're taking the first steps in this area. In my opinion, Poland and Polish engineers can still afford much more. Unfortunately, the problem may be the lack of financial capital and high competitiveness on the western market.

We could be much further when it comes to R&D (Research & Development.) Moreover, the government support could be adequate and interesting here. A lot of emphasis is put on supply chain of R&D activites in Poland, because Polish entities are also emerging there. However, how a Polish company that is designing cars can locate its development work in Poland? Will it continue to use the services of western companies? As for today, I can say

that I do not know a privately owned research company, which has Polish capital, able to design car parts especially in complex areas as electronics or Power Electronics. There is simply no such capital. The fastest solution is to transfer it from the west.
It is easy to buy a license, as it happened in the case of a small or large Fiat, but the trick is to start designing these solutions yourself, on a Polish territory, with Polish capital, with help of the local engineers.
It seems to me that this would allow Poland to gain a commercial advantage in the market. I see that capital is slowly beginning to grow, but it is still being transferred to Poland from the west. An example of this is the AVL company, our projects that we do locally in most cases are implemented for well-known manufacturers, components or vehicles around the world. Currently, the demand for our services on the Polish market is relatively small, but I hope it will be changed in near future.

***PTR:** Last but not least, how can the automotive industry be affected by the pandemic of coronavirus?*
Maciej Dryjański: I think it will have a huge impact on global industries.
The level of demand for new cars will drop significantly, and thus in the longer term all elements of the supply chain related to the automotive industry will drop as well. Expenditure will start to fall, there will be less demand for cars, production, less demand for parts and for research and development. I believe that the global demand for consumer goods will slow down. It will probably take 6 to 12 months for us to return to the same level as before the pandemic. Although before the outbreak of coronavirus, the number of cars sold also began to decline or stabilize.
In the long run, the global trend will return to normalcy. People will return to their habits. I think it is related to consumption needs which have not disappeared. They have just been suspended. Demand for less luxurious goods will return quite soon.
When it comes to the automotive industry in Poland, I think that Eastern Europe can benefit from it. Quite a large part of the supply chain will be moved from Asia to Europe. We have a fairly good chance to expand our production competences in the area of locating new factories, research and development sites for subsequent levels of the supply chain on Polish territory. In my opinion, not only Poland, but also the Czech Republic, Slovakia, Hungary, and Romania are the countries that can gain because of the location and cultural similarities associated with the European Union.

***PTR:** Thank you for your time and we wish you and AVL nothing but success.*

PANDEMIA WILL PASS, INFRASTRUCTURE WILL REMAIN

THE OFFICIAL POSITION OF THE STASZIC INSTITUTE ON THE PRESENT STATE OF INFRASTRUCTURAL INVESTMENTS AND THE DESIRED DIRECTIONS OF THE STATE'S POLICY

The Staszic Institute is the independent think-tank, dealing with the social problems in the context of the sustainable development. The group of co-workers of the Institute includes publicists, academic lecturers and experts.
Prof. Agnieszka Domańska, Ph.D. is the President of the Institute.

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The times of crisis such as the current pandemic, cause that the decision makers and often the public opinion, begin to think in a short time perspective and at the status of moral panic. It is reflected in the statements and postulates, formulated by the politicians and publicists, in relation to such problems as giving up the significant investments especially in respect of defence (purchase of F-35), infrastructure (building of the Central Communication Port) (Solidarity Transport HUB Poland) or other important road and railway investments. The Staszic Institute expresses the opinion that the infrastructural investments are the element which may greatly stimulate the economy in the period of crisis and slowing down, and help fighting with the unemployment.

At present, we deal with the situation of "now or never". The exhaustion of the EU funds as the basic source of financing the infrastructural investments in the successive EU perspectives decides on the fact that it is the last moment when we may change permanently our infrastructure with the support of the external financing.

The infrastructural sector in the period of COVID-19 (coronavirus)

Pandemic and the related problems have generally affected the construction sector although relatively to a smaller degree as compared to other branches of the economy. The work is more frequently performed at the open air, the manufacturers of the products have introduced the appropriate procedures and ensured the protection means, facilitating production; investors, GDDKiA (in English: General Directorate for National Roads and Motorways) and PKP PLK (Polish Railways, Inc.) have the financial means at their disposal for the implementation of the investments. It causes that the basic expectations of the sector is not the support of the Government but the possibility of carrying out the work and of producing the goods for the infrastructure on the level assumed in the governmental documents. We may, indeed, run the whole package of investment matters as not to make the branch the burden for the State and to work in the rate which is possibly least disturbed by the pandemic of Covid-19. According to the information of Polish Road Congress, it results from the averaged information that the companies assess their executive potential – especially in respect of staff – at more or less 73% of normal and planned potential.

Of course, pandemic brings real threats to the sector such as slowing down of the implementation of the commenced investments or even their interruption. It may be caused by the reasons such as absence of the employees, lack of sub-constructors, problems with obtaining the necessary materials, with logistics or quarantine after the disease of any worker. The discussed sector suffers also from the so-called prolonged effect – due to lower orders or lack of the orders for materials and products, and, in consequence, limitation or cessation of production by the companies, working in favour of the mentioned investments. Pandemic may also cause slowing down or interruption of announcing the tenders by the investors, being caused by frequent – during the time of Covid-19 – changes in

the mode of the work (remote work, suspension of the projects, closure of offices, etc.).

Meanwhile, Poland is found in the middle of investment offensive, especially in the field of roads and railways. The National Railways Programme assumes the expenses of PKP PLK on the investments in the current year at the level of 12.4 billion PLN. They will be the highest annual expenses of PLK: let's mention that in 2019, the discussed expenses amounted to 10 billion PLN (record sum). Despite the pandemic, the level of 12.4 billion PLN is possible. The condition includes the urgent settlement of the tenders under proceeding and announcement of the new ones.

Even if a part of the new tenders is implemented from 2021, the contractor will be able to buy a part of materials after the settlement of the tender in the current year and after having concluded the agreement. Such earlier purchases could be – until now – financed by PLK up to the level of 90%. There are no obstacles it could be 100%. Owing to this fact, it would be possible, as early as in 2020, to utilize the means on the account of expenses in the successive years. Moreover, there is no already space for moving the expenses and works for the successive years. National Railway Programme plans the sum of as much as 15.3 billion PLN for 2021! Additionally, the third EU perspective for 2021-2027 will be commenced in the next year and PLK has already documentations for the projects concerning the mentioned perspective in the "build" system, i.e. for quick implementation. ***So, until the end of 2023, Polish economy will meet with the race against time concerning the utilization of the means from the perspective for 2014 – 2020; the third perspective will be practically commenced in Poland in 2024 instead of 2021. Besides it, the announcements of the reform of the EU funds show that it may be the last real chance for obtaining such meaningful means for infrastructure.***

GDDKiA has also now a potential for maintenance and intensification of the work in the road segments. According to information, given by the Directorate, 95 projects, covering 1178 km length in total are implemented now; 16 tasks for 184.7 km are covered by tenders and 138 tasks concerning 2760.9 km in total are under the preparation.

It is therefore clear that the road sector pays also attention to the necessity of utilizing the potential of construction for stimulation of economic development what requires continuation of big investment programmes: "Programme of Building the National Roads", "Bridges for regions", "100 bypass roads (ring roads)" and investments at the *poviat* and community levels, co-financed from the Self-Governing Road Fund. ***The road sector indicates the keeping of financial liquidity as the priority; it is dependent on all entities: purchasers, contract engineers, general contractors and sub-contractors. The postulated solutions include; introduction of partial payments, lowering of guarantees, and a simplified access to credit lines, with the payments subsidized by the State.*** In the years of the previous crises in the construction sector, many companies were enrolled by banks on the so-called "black lists". Nowadays, the same firms are a chance for the banks. If the banking sector finances them, it will obtain the interests. ***The acceleration of the work receipt, issuance of Interim Payment Certificates and invoicing are the way to accelerating the money turnover.***

We cannot forget that pandemic has additionally deepened the problems and pathologies, harassing the Polish infrastructure sector, such as big movement of the dates of announcement and settlement of the tenders. In the previous years, KPK (National Railway Programme) has been never implemented in accordance with the earlier assumptions; to-day, the delays may be even greater. There was a common practice to shift the non-performed work to the successive years. So, KPK of September 2015 assumed the expenses for the years 2021 – 2023 as follows: 7 billion PLN, 3 billion PLN and 1.9 billion PLN, respectively. The recent ones, dating to September 2019 amounted to 15.3 billion PLN, 12 billion PLN and 8 billion PLN, respectively.

The next problem during the recent two years concerned big differences in price offers of the contractors in relation to the prices, estimated in the tenders. The exceeding cases, amounting to several dozen percent cause prolongation of the procedures and, also, annulations of the tenders. The scale of the problem is illustrated by the fact that the sum of crossing the limit, measured as a difference between the lowest offer in the tender and the price, established by PLK in the discussed period is higher than 10 billion PLN.

Infrastructural investments as the best anti-crisis tool

Economic history – also in the case of big crises beginning from the thirties of the 19th century – shows that just the infrastructure investments ate the best possible anti-crisis protection and a driving force of economic development and generation of the work places. ***The infrastructural investments are just the element which may, to the greatest degree, stimulate the economy in the period of crisis and slow down and may help fighting with unemployment. Besides it, the infrastructural investments are implemented, as it was mentioned, in the long-time perspective.*** The circumstances are changing and the implemented infrastructural investments decide – for decades – on the strength and economic safety of the State, perspectives of the economy and quality of life of the societies. Moreover, we have finally the situation of "now or never" type. The exhaustion of the EU funds in the successive EU perspectives as a basic source of financing the infrastructural investments and, also, geopolitical changes give a critical meaning to the infrastructure investments, being implemented here and now.

Paradoxically, the present situation may support the solution of certain problems of infrastructure sector, including those ones generated by the coming crisis. The branch which has struggled with the labour shortage for few years may absorb (also due to a low entrance barrier) the workers who lose their work in other sectors, especially in the situation of the exit of thousands of employees from Ukraine. Therefore, the lack of new orders and tenders may be connected with the catastrophic situation in the work market – the employers cut the costs and will be forced to reduce the employment and lower the remuneration.

Therefore, in order to keep the strength of the infrastructural sector as a type of flywheel of Polish economy in the period of slow down, Polish State should stimulate the development of economy via investments on infrastructural projects, giving an impulse to the successive sectors and branches. The State institutions play a key role in respect of planning and communication concerning the new investments in the road and railway infrastructure. The determination is needed in order to continue the programme of development, with the effective utilization of the EU means in the present perspective and in the successive years.

The European Union has admitted the transfer of the means for the struggle with the pandemic; however, the infrastructural investments should be the last ones which could be considered for such operation. The economy of the State will resist the restrictions for a defined period of time and more it will be shorter, the greater will be the activity of the entities, especially in those areas where – with the introduction of the appropriate insurance – the discussed activity is possible. Undoubtedly, the infrastructural investments belong to the mentioned areas, not only due to the possibilities of implementing but also due to the quantity of the involved subjects and the relating employment. It would be better that the mentioned labourers could receive the remuneration from the employer and not stay on the expense of the State, being supported by the money moved from investments.

The rate of the announcement and settlement of the successive tenders are equally important. The status of the investments' implementation will determine how quickly the Polish State will be able to get out from the crisis. Moreover, crisis generates the occasion to repair the problems which are harassing the sector every day, i.e. simplification of the tender procedures, requiring good quality and good practices instead of dictate of the lowest price, reliable settlement of the contracts.

Besides it, ***the State should stimulate the activity of banks to ensure financing of the activity of the entities, involved in the implemented infrastructural investments.***

What should be financed and how?

The attitude of the banks to the whole process connected with the discussed investments and to the implementing companies has not been recently enthusiastic. It resulted from the reasons, lying on the side of the state investors, GDDKIA and PKP PLK as well as on the side of contractors.

The first ones did not ensure the organization of the investment processes at the time and level adopted in the governmental documents and the second partners – when competing in the tenders – offered the prices, being often by tens of dozens lower in comparison to the prices estimated by the investors; in consequence, it was at the cost of profitability. And finally, let's mention the behaviour of the state's institutions: in the successive years, the governments approved the failures to perform the infrastructural investments in the previous year and moved the expenses into the next years. In effect, we had and we have still the passive attitude of the banks in relations with the companies, especially in the field of the railway investments.

The period of epidemic is a paradoxically good time for change of the discussed attitude and change of the practice. At present, the effective implementation of the infrastructural investments lies in the interest of the Polish State. The mentioned investments will be also a basic instrument in returning of the country's economy to equilibrium after Covid-19. Hence, the government and the state institutions have a duty of ensuring such activity of the banks as to stimulate and not to make difficult – as it is today – reaching of the universally expected targets. It is just the State which is a guarantor of transferring the means from the budget as well as from the EU funds, for the infrastructural investments. The State approves, by the legal acts, the appropriate programmes, including the expenses for investments. The state therefore should create the conditions for their implementation and enforce the performance of the programmes. The effective financing of the investment processes by the banks is one of the deciding conditions. Without it, many companies will not be able even to take part in the tender, e.g. due to the lack of the means for a guarantee of performance.

The univocal, strong message of the government, as addressed to the financial institutions and, especially, to the banks is necessary; it is also indispensable to introduce the mechanisms which would result in change of the banks' attitude to the infrastructural investments and, in consequence, constructive relations with the implementing companies. The prolongation of the passive position and activities of the banks will create undoubtedly the serious difficulties in reaching the targets not only of the particular sector but of the whole country in connection with the infrastructural investments. The action of the government must be quick and effective.

Summing up and conclusions

In the conclusion of the above, the Staszic Institute stresses that in the period of the pandemic and the approaching crisis and slow down, the continuity of the infrastructural investments and announcement of the new tenders by the state investors – GDDKIA and PLK will be a real and effective assistance. The structural investments are the element which may – to the greatest degree – stimulate the economy in the period of crisis and slowing down, and help in the struggle with unemployment. Besides it, the structural investments are implemented in the long-time perspective during which a lot may happen: the natural disasters, epidemics, crises as well as the periods of prosperity. Nevertheless, the circumstances are changing and the infrastructural investments decide on the strength and economic safety of the state, perspectives of the economy and the quality of life of the societies for decades.

Warsaw, April, 29, 2020

Dariusz KUBICKI, Paweł SĘDŁAK, Tomasz STAWICKI

DOI: 10.15199/180.2020.2.1

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EFFECT OF INTERNATIONAL AGREMENTS CONCERNING THE CLIMATE PROTECTION ON THE ENERGY POLICY OF POLAND

WPŁYW POROZUMIEŃ MIEDZYNARODOWYCH DOTYCZĄCYCH OCHRONY KLIMATU NA POLITYKĘ ENERGETYCZNĄ POLSKI

Summary: *In the paper, the effect of the recommendations of the international communities, connected with the promotion of the idea of the necessity to protect climate and counteracting the global warming on Polish environment-friendly solutions, as implemented by the Polish Government and the related legislation have been presented. Also, the project of developing the assurance of the energy security of Poland in aspect of international agreements, aiming at the reduction of GHG (greenhouse gases) emissions and counteracting the unfavourable climate changes has been discussed..*

Keywords: *global climate changes, greenhouse gases (GHG) emission, energy policy, energy security of Poland, environment-friendly legislation*

Streszczenie: *W pracy przedstawiono wpływ zaleceń społeczności międzynarodowej związanych z propagowaniem idei konieczności ochrony klimatu oraz przeciwdziałaniu globalnemu ociepleniu na polskie rozwiązania proekologiczne realizowane przez rząd polski i związane z nim ustawodawstwo. Omówiono również projekt rozwoju zapewnienia bezpieczeństwa energetycznego polski w aspekcie porozumień międzynarodowych mających na celu zmniejszenie emisji gazów cieplarnianych i przeciwdziałaniu niekorzystnych zmian klimatycznych.*

Słowa kluczowe: *globalne zmiany klimatyczne, emisja gazów cieplarnianych, polityka energetyczna, bezpieczeństwo energetyczne Polski, ustawodawstwo proekologiczne*

Introduction

A dynamic civilization development, initiated by the industrial revolution in the 19th century, has been based upon the fossil fuels, used in manufacturing processes and in energy production. Utilization of fossil energetic raw materials in a wide scale has brought about the emission of enormous quantities of gases and dusts to the earth atmosphere. The contamination of atmosphere caused the changes in the climate of the earth which are observed in a form of the increase of the incidences of sudden atmospheric phenomena and rise in the mean temperature. The international communities, as being worried about the development of unfavourable phenomena related with the climate of the Globe, have undertaken the measures aiming at stopping of the unfavourable trend of warming up the climate. The mentioned measures are directed to the reduction of gases' emission by affecting the economic policy of the countries and promotion of „clean technologies" in the industrial production and obtaining the electric energy.

The elements of energy policy of Poland which counteract the global climate changes and mitigate the consequences of the mentioned changes, result directly from the Constitution of Poland and legal standard of the communities, which Poland belongs to: international – the United Nations (ONZ) and the regional one - the European Union (EU). The implementation of the adopted therein commitments is the main driver of climate regulations in the national legislation.

In the Constitution of the Republic of Poland, the texts connected with the environment protection are found in Articles: 5, 31, 68, 74 and 86. It is worth to cite here the fragments of art.5: „*.... The Republic of Poland... as being guided by the principle of sustainable development ensures the environment protection...*" and of art.74: „*.... Public authorities run the policy, which ensures the ecological safety for the contemporary and future generations...*" [1]. The mentioned provisions guarantee the active participation of the Polish Government in development of legal standards aiming at natural environment protection to all citizens of Poland living at its territory, and observing them by all citizens and enterprises, operating at its territory.

The membership of Poland in the United Nations (Polish: ONZ) has also affected the necessity of adapting Polish legislation to the regulations and recommendations, signed by the international community. During the Conferences of the United Nations on the Environment and Development, being also called the Earth Summit and held in 1992 in Rio de Janeiro, the United Nations Framework Convention on Climate Change (UNFCCC) was signed. The Conferences of the Parties (COP) is the highest organ of the Convention [22]. Its meetings are periodically organized every year. During the Conference duration, the provisions and recommendations, aiming at the climate protection, are established. The Conferences of the Parties during which the binding commitments were adopted include: 1997 COP-3 Kyoto (the Kyoto Protocol), 2012 COP-18 in Doha (the Doha Amendment) and 2015 COP-21 Paris (the Paris Agreement).

The Kyoto Protocol [23] was the main UNFCCC instrument in the struggle with the global warming and it contained the targets, binding the Parties of the Convention until 2012. The main assumption of the Protocol was the reduction of therein mentioned greenhouse gases' emission at least by 5%. The additional obligations, affecting the emission of GHG which were found in the Kyoto Protocol were as follows:

- Increase in the energetic effectiveness,
- Development of renewable energy sources,
- Development of technologies, the task of which is to absorb carbon dioxide,
- Limitation and reduction of the level of greenhouse gases' emission in transport sector,
- Limitation or reduction of methane emission in the sectors of waste management, manufacturing processes and transfer and distribution of energy,
- Activities, aiming at the reduction of the emissions generated by forestry management sector, and from agriculture,
- Running the scientific studies with the target to shape the awareness of the society and information on the varying climate,
- Encouraging to activity and introducing the reforms and measures, aiming at the promotion of the emission reductions.

During the Summit which was held in Doha 2012 COP-18, the amendment to the Kyoto Protocol was adopted, being also called Doha Amendment [24]. The mentioned amendment established the second reference period for the countries – signatories of the agreement and it covered the period of the years 2013 – 2020 and obliged its members to reduce the emissions by at least 18% up to 2020.

The recent Agreement was developed on December 12, 2015, during COP-21 in Paris; it was the Paris Agreement [25] and established the principles of the climate protection from 2020. The main assumption of the Paris Agreement was to determine the measures, leading to the reduction of global warming to the level below 2°C and striving at the limitation of the temperature rise to 1.5°C.

Poland was the associated member of the European Union since 1994 and on the 1st of May, 2004 it became the full-right member of the European Union. The membership in the EU meant, simultaneously, the adoption of all recommendations, developed for the Member States and the adaptation of the energy policy as well as that one connected with the environment protection to the respective requirements. The European Union is a leader in the international environment in the respect of reaching the climate targets and sets up the more ambitious tasks than the international community, associated in the Organization of the United Nations. The EU perspective for 2012 – 2020 (with the consideration of Doha Amendment) established the target in a form of climate package „3 X 20" (reduction by 20% of GHG emission, increase of energy effectiveness by 20% and reaching 20% of the energy share from the renewable sources, and 10-% participation of bio-fuels).

After the Paris Agreement, The European Union has also submitted the collection of documents „Clean Energy for all Europeans", being called also the Winter Package. Its purpose was to determine the energy and climate policy of the EU, in the perspective 2030, in respect of renewable energy sources, energy effectiveness, emission of greenhouse gases and electric energy inter-system connections. The established targets to be reached include: at least 32-% participation of the energy from the renewable sources in energy balance of the EU; improvement of energy effectiveness by at least 32.5 %, reduction in GHG emission by at least 50% in the total EU economy (compared to the level of 1990) and creation of electric energy inter-system connections, integrating the EU energy market with the capacity of at least 15% of peak power.

Apart from the earlier indicated articles of the Constitution, international agreements and the European Union legislation relating to the environment and climate protection in legal regulations of the republic of Poland, we may distinguish the key problems relating to the energy policy and environmental protection:

- Act of April, 10, 1997 (Energy Law [3]),
- Act of July, 17, 2009 on the management of emissions of greenhouse gases and other substances,
- Act of 28, April, 2011 on the greenhouse gases emissions trading system [5],
- Act of April, 15, 2011 on energy effectiveness [6],
- Act of April, 27, 2001 the Law of environmental protection [7],
- Act of 20, February, 2015 on the renewable energy sources [8],
- Act of December, 8, 2017 on power supply market [9].

The following governmental institutions deal with the problems connected with the energy and environment protection within the frames of the Government's activity: the Ministry of the Environment, the Ministry of Energy, Office for Energy Regulation (URE), Agency of Energy Market (ARE), National Centre of the Studies and Management of Emissions (KOBIZE) and the Centre of Information on Energy Market (CIRE).

The mentioned above institutions have developed the following documents:

- National Action Plan 2010 [10],
- Poland's Energy Policy up to 2030 [11],
- Energy Policy of Poland in 2040 – PEP 2040 [12],
- National Action Plan in favour of energy and climate [13].

The mentioned above documents determine the directions of activities of Polish Government in order to ensure the energy security to Poland and to protect the environment.

Legislative solutions in Poland

The Republic of Poland, as being the member of the UN did not have any problems with fulfilling the provisions of the Kyoto Protocol because its obligation of reducing in accordance to the Protocol was equal to 6% and the adoption of 1988 as the basic year was exceptionally favourable for Poland. CO_2 emission from the energy sector in the period of 1988 – 2012 was decreased in Poland by 27% due to the economic collapse, connected with the systemic transformation of the state (Fig.1) [2]. The economic transformations have led to the reorganization of agriculture, decline of many state enterprises, transformation of a part of industry sector via privatization and change of the production profile.

Supposedly, such easy fulfilment of the obligations connected with the emission reduction, practically without the efforts and changes in economic policy, has not been quite favourable for Poland. It made only the successive ruling elites to become convinced that the climate targets may be reached without the engagement (creation of coherent and long-term plans of the economy development and coherent legislation) and, additionally, that financial advantages may be gained when trading the allowances for CO_2 emissions. After consideration of the emission reduction, being required by the Kyoto Protocol, Poland received the emission allowances for the whole period of the Protocol's functioning, also based upon the so favourable basis of 1988. Since 2014, we have observed, however, a constant rise of CO_2 emission (cause by economic development and the increase of demand on electric energy) what is a worrying phenomenon in the context of satisfying the requirement of the Amendment to the Kyoto Protocol, being also called the Doha amendment. The emission of GHG, as equivalent of CO_2 emission, according to the sectors of economy in relation to the basic year is presented in Fig.2.

The European Union, including also Poland, has adopted the mechanism of trading of the emissions, as specified in the Kyoto Protocol (Emission Trading System, EU ETS) and is systematically improving it. At present, in the third stage (2013 – 2020) instead of national limits, the consolidated limit for the whole EU is employed; it covers more sectors of economy (45% are covered from by the EST mechanism) and the greater amount of greenhouse gases.

The basic method of giving the emission allowances consists in their sale; those being allocated on a free basis are covered with the harmonized principles. Every year, the allocated limits are lower [15]. The EU ETS Directive provides that a half of the means obtained from the trading of the emission allowances (Emission Allowances – EUA) – 1 tonne of CO_2) is supposed to be located in the non-emission undertakings or emission-reducing (limiting) ones. In return for derogation allowances which are – in Poland – freely transferred to carbon-dependent energy sector, the energy-producing companies were supposed to invest in modernization of infrastructure and gradual independence on one energy raw material. The energy companies were supposed to promote and develop the investments connected with obtaining the energy from Renewable Energy Sources (in Polish: OZE) the settlement of the correct location of the means, coming

Fig. 1. CO_2 emission from fossil fuels in Poland in the years 1960 – 2017

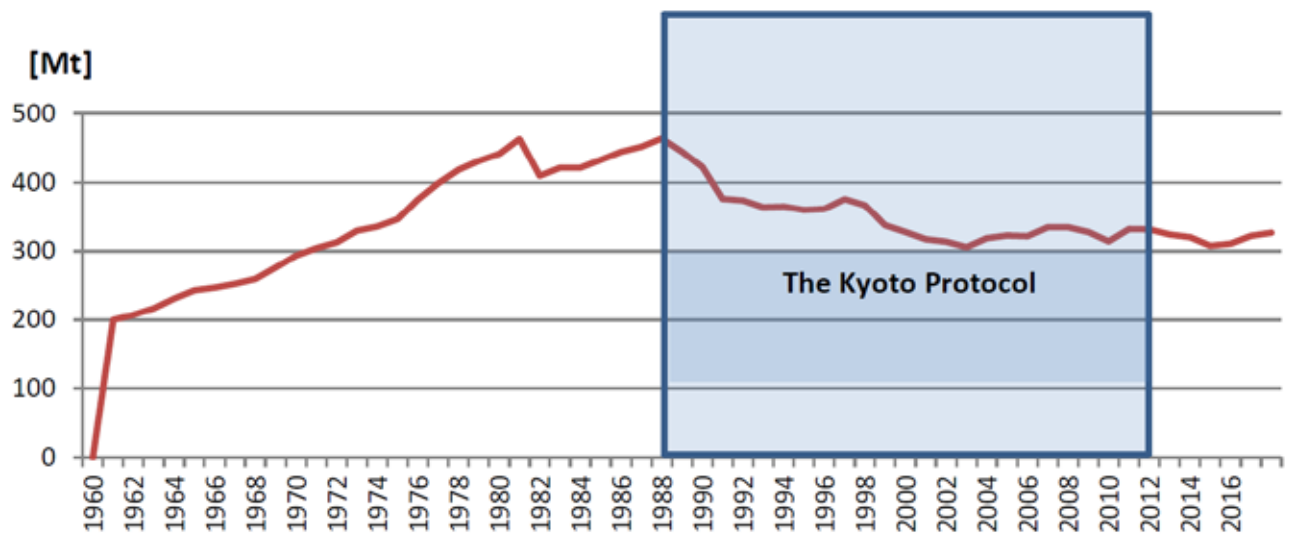
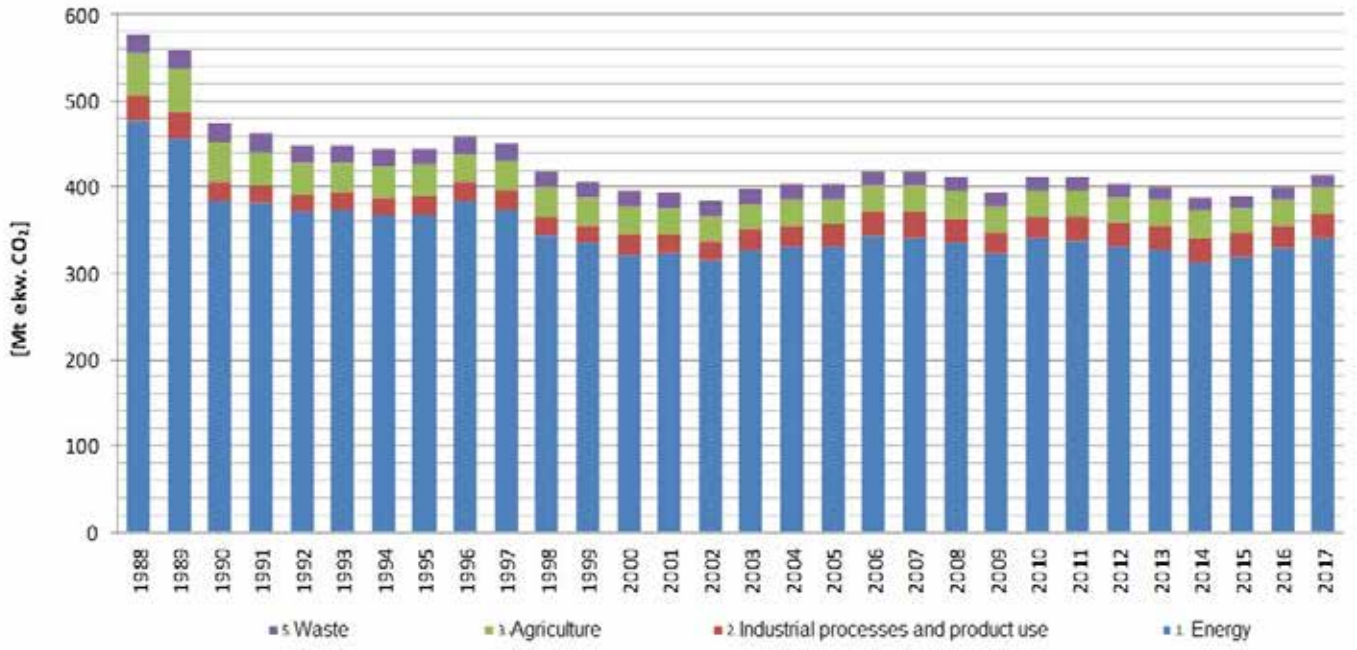


Fig. 2. CO_2 emissions (equivalent) in Poland in annual scale (blue arrow – year and basic level of the Kyoto Protocol) [14]



from trading of allowances and their level is much difficult due to a lack of transparency of the investments as well as accounting in the particular countries [16]. In Poland, a part of the means from the EUA trading, as provided in the EU ETS Directive, was directed to the problematic modernization of carbon blocs for co-incineration of biomass – what was expected to reduce the emissions from carbon. At present, Poland has 110 million of the non-utilized allowances of the derogation emissions (period of 2012 – 2020) and it notified the European Commission (June 2019) about the will to sell the mentioned allowances. At present price of the emission allowances being found on the level of 25 – 27 Euro/tonne of CO_2 [17], it gives enormous sums which could feed the climate-protecting energy undertakings.

The national target of Poland in respect of the participation of the energy from the renewable sources in a final gross energy consumption in perspective of 2020, in the „3 X 2" package has been outlines at minimum 15%. The real reaching of the mentioned target according to the State as a half of 2019 is problematic and it was confirmed by the European Court of the Auditors in its report [18]. After 2020, it may result in high costs of static transfers of „green" energy from the countries which would reach their goals in excess.

Since 2005, the system of support of the producers of „green" energy had functioned in Poland in a form of „green" certificates (different colours, according to the source and type of energy production) and the replacement payment. The discussed system was changed in 2018 by the feeds-in-tariffs (Feed in Tariff, FIT) and feed-in-premiums (Feed in Premiums, FIP). The prosumers (prosumer is a person who produces and consumes a product – translator's note) are encouraged by a specific network „storage service", offering the possibility of free-of-charge accounting of 80-% or 70-% (depending on the power of installation) excess of electric energy, being earlier introduced to the networks by their installations.

The clusters of energy are very interesting, climate-promoting solution, promoted by the Government. They were introduced by the change of the Act on OZE (renewable energy sources) and other laws [19]. Formally, the definition of the energy cluster is referred to a civil law agreement, concluded between the physical persons, legal persons, scientific entities, research institutes and, also, units of territorial self-governing organs. Its activity subject covers production and equalization of the demand, distribution and turnover of energy (including that one from the renewable sources) or the selected (by the cluster members) particular elements under the condition of activity within the distribution network (own, or of Distribution System Operator; in Polish: OSD) with a rated voltage lower than 110 kV. The area of the energy clusters should not exceed the area of 5 communes (gminas) or one poviat (administration units of lower degree in Poland). The purpose of the clusters is to develop the distributed energy in the environment-friendly way, with the utilization and satisfaction of local resources and needs, to improve the local energy security with the preservation of the economic target due to innovativeness.

We should also mention the co-incineration of biomass and coal which was, in the intention of the successive governments, the main element of reaching the climate goals. The power companies, utilizing mainly the coal as energy resource were supposed to introduce the biomass addition to be combusted in the traditional energetic boilers. The EU limitation of the support for such solution, the decrease of classifying the climate effect by coefficient 0.5 and the limitation of the biomass import, and in consequence, its high price, have caused a significant reduction in the quantity of the co-incinerated biomass. On the other hand,

it should be stressed that the quantity of the biomass, used in the installations where it is the main source of heating and electricity energy has not been changed.

One of the methods for increasing CO_2 absorption, connected with the forest biomass is the Carbon Forests Project (in Polish: LGW) belonging to the State Forests, being commenced in 2017 at the territory of 12 000 ha [20]. It consists in the increase of CO_2 absorption by the appropriate treatment procedures in the forests, including planting, introduction of forest underwood, etc. In 2018, the auction of Carbon Dioxide Units (JDW in Polish), generated in the mentioned project (30 thousand tonnes of CO_2) and bought by the state power enterprises. The mentioned undertaking should be evaluated as a pilot-research study. The measures taken within the frames of LGW are the treatment operations, necessary for forest cultivation; their general effect may be determined below 0.01% of Poland's emissions.

The Act of 8 December 2017 on the power market [9] is the important element of energy policy. Its intention is to compensate the power enterprises for the maintenance of generating power reserves which may ensure the safety of Electric Power System (in Polish: SEE) of Poland. It will be implemented via the payments, determined during power auctions. The mentioned safety could be threatened in the periods of a lack of generating factors for renewable sources which are supposed to have an increasingly greater participation in the energy mix of our country. When concluding the long-term contracts (until 2035), Poland wanted to subsidize - by power payment – the coal-based energy plants for which the European Union does not anticipate such support in the provisions of the Winter Package if the emissions of installations exceed 550 g CO_2/kWh. Finally, it was agreed upon in June 2019 that the binding period of the mentioned contracts would extinguish in July 2025. After the mentioned date, the units, the emissions of which do not exceed the standard of the Winter Package, will be able to apply for the power contracts. The recipients of electric energy will find – apart from the OZE payment and the so-called transition payment (the stranded costs) – the additional new position in a form of power payment in their bill for electricity.

Polish energy plans and environment protection

The main assumptions of the long-term energy policy of Poland for the coming years have been contained in the document „ENERGY POLICY OF POLAND UP TO 2040" (PEP 2040), developed by the Ministry of Energy in 2018. When referring to the project of the Energy Policy of Poland PEP 2040, we have to state that it is very conservative and maintains the present state of our energy, based now in 80% upon coal. The suggested solutions are promoted by big energetic companies, based on the coal energy. It is inconsistent with the guidelines, contained in the international agreements, both in the European and all-the-world scale. It will bring the problems to Poland in respect of the fulfilment of the obligations resulting from the international agreements and concerning the reduction of the greenhouse gases emissions. Keeping the high energetic dependence on the centralized energy system, dependent on one power source and maintaining the monopoly of energy-carbon based enterprises is not favourable for generation of distributed generating sources. The conservative nature of plans results from the stable and foreseeable scale of energy production in the traditional systems and easy possibility of controlling the generating process. The energy security of the country cannot be, however, based only and solely upon the fossil fuels (principally, only coal) and the plans consider the diversification of the energy sources only to an insignificant degree. The expected participation of the fossil sources was established at the level of 60% in 2030 and of the elements based upon OZE (renewable sources) only at 21% what is rather a moderate value in comparison to other EU countries. It is planned to compensate the size of demand on energy by the development and modernization of carbon-based energy plants and deciding on nuclear energy (9GW in 2043). The utilization of nuclear energy and, in fact, its creation from the very beginning in our country stays in the contradiction to the trend prevailing in the EU countries, i.e. departing from the mentioned above solution. It may be observed that the whole plan is based on maintenance of dominating primate of a large-scale energy. It should be mentioned that many countries are departing from the large-scale energy in favour of the distributed energy distributed energy based on OZE. The implementation of the mentioned plan will cause the adoption of more modernizing trend of Polish energy which would differ from the present world directions. The dates of launching the particular blocs of nuclear power plant, as provided by PEP, are problematic due to the fact that any location, financing sources or (the most important problem) the suppliers and technology have not been chosen until now. Moreover, the process of acquiring the competences by the appropriate staff is several years; it is a very significant matter as Poland does not have any competences in this field. It is also important that 80% of the costs if the discussed investment will go to the economies of other countries.

The document does not consider the necessity of counteracting and reducing the effects of the anthropogenic climate changes what remains Poland's obligation since the moment of signing the Paris Agreement. The discussed project does not clearly refer to the climate targets, adopted within the EU frames; it only states the necessity of such negotiating of the regulation provisions which would not weaken the competitiveness of the Polish economy. There is also a lack of at least mentioning the research work on the negative CO_2 emissions. All climate scenarios IPCC (Intergovernmental Panel on Climate Changes) have adopted the assumption of operating of such installations at the scale having a significant effect on climate as early as from 2030. The mentioned technologies include CDR (Carbon Direct Removal), CCS (Carbon capture and Storage), BECCS or BioCCS (Biological Energy Carbon Capture and Storage).

IN PEP 2040 project, the energy effectiveness has been situated as the eight, last item what may mean that it is not perceived as the important instrument, serving for rationalization of energy requirements. Its real importance is decidedly higher

and especially, in relation to agriculture. The agricultural sector could not only rise up the productivity but also reduce CO2 emissions coming from cultivated soil and energy consumption in manufacturing processes due to the popularization of better agricultural practices. The quality of the soils would be improved and the awareness of the farmers – in respect of modern cultivation methods – would be developed. The energy effectiveness has a great meaning in construction and industry where the greatest progress was achieved. Especially in building, it is planned to lower the energy consumption owing to the introduction of the new standards, reducing the energy consumption and promoting the low-emission and passive construction [21].

The development of OZE sources and energy storage systems, the real and expected decline of their prices has not been noticed by the authors of the discussed project. The investments in ZE are considered in the document as the necessary fulfilment of the energy – climate policy of the EU. The recognition that the resources of renewable energy have a strategic character and not the supplementary one would be crucial for the report and, in consequence, for its basic theses. A lack of confidence in OZE may be found in a fragment of PEP 2040: „... market of electric energy has been strongly deformed due to functioning of subsidized renewable energy sources (OZE) characterized by a high instability of work and priority of introducing the energy to network...". Meanwhile, in the years 1990 – 2016, the subsidies for coal mining and carbon energy amounted to 230 billion PLN; the further subsidizing will mean a sum of equal to 155 billion PLN in the years 2017 – 2030 (excluding the external costs); the subsidies for closing of manufacturing plants as adopted by the European Commission constitute only few percent of the mentioned sum [22]. On the other hand, the support for OZE in the years 2005 – 2016 amounted only to 33.6 billion PLN, 50% of which were destined for co-incineration in the state energy enterprises.

Summing up

Poland, with its structure of energy production, based mainly on carbon, in the perspective of the coming years and the restrictions, connected with the climate protection may have the problems with the fulfilment of the obligations, resulting from legal standards, imposed by such institutions as the EU and Organization of the United Nations. Lack of coherent, multiannual vision of the energy development and the multi-annual neglecting, connected with the development of energy systems and technologies of the energy generation put the difficult tasks before the Polish government. The indecisive policy concerning the diversification of the energy resources, chaotic legislative measures of the successive governments, uncertainty of the law's stability (dynamic changes in the existing legal standards), undecided policy of moving the energy to the renewable sources, slow distribution of the sites of the energy generation make that Poland is not perceived as a leader of the energy transformations with a low and, ultimately, negative CO2 emission.

The initiative, inspired by the Government of Poland and implemented by the State Forests (State Forests National Holding), being aimed at increase of CO_2 absorption in the forests in spite of its microscopic scale, is consistent with the guidelines of the Kyoto Protocol. We should also mention the announcement of the Minister of Energy informing about establishment of Modernization Fund which would receive the means from the sales of 110 million allowances for the emission in this year; they would be used in modernization of our energetic system.

In conclusion, when considering the current measures, undertaken by the Government of Poland, and the plans for the future, concerning the energy policy, we should state that the fulfilment of the obligations, resulting from the membership in the EU and UN requires as follows:

- Stabilization of the energy and legislative policy for many years, being independent on the changes in the political sphere (lack of the populist activities of the successive governments),
- The successive replacement of traditional, based on the fossil fuels – carbon, by the pro-ecological solutions based on OZE (Renewable Energy Sources),
- Giving the long-term priority to the environment-friendly solutions in the energy production,
- Intensive raising public awareness via indication of environmental and climatic threats, the sources of their generation and the resulting consequences,
- Running the intensive studies concerning ensuring the energetic security with the utilization of OZE sources,
- Propagation of activities supporting the counteracting the climatic changes, commencing from the waste sorting, style of life, etc.,
- Reliable information of the costs as well as possible social and material advantages of the energetic transformations, with the aim to achieve the social consensus in this matter,
- Good orientation towards and harmonization of the changes in the structure and distribution of production as well as consumption of energy in ETS and non-ETS sectors,
- Running the research and implementation work on the negative CO_2 emissions.

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Article reviewed
Received: 18.05.2020 r./Accepted: 12.06.2020 r.

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MODERN AGRICULTURE

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DOI: 10.15199/180.2020.2.2

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FERTILIZATION AND SOWING FROM UNMANNED AERIAL VEHICLES

NAWOŻENIE I SIEW Z BEZZAŁOGOWYCH STATKÓW POWIETRZNYCH

***Summary**: In the paper, the modern technologies, utilizing unmanned aerial vehicles, drones, in sowing the seeds and distribution of fertilizers on the fields, have been described. Their construction, the examples of the application and the operating parameters have been presented. In the article, there have been also given the examples of the laboratory tests of the effect of the air stream, produced by rotor of drone – multicopter on the surface distribution of the sown seeds.*

***Keywords**: unmanned aerial vehicle, drone, precision agriculture, agricultural aviation, sowing*

***Streszczenie**: W artykule opisano nowoczesne technologie wykorzystujące bezzałogowe statki powietrzne, drony – do siewu nasion i rozsiewania nawozów na polach. Opisano ich budowę, przykłady zastosowania, podano parametry operacyjne. W pracy przedstawiono również wyniki badań laboratoryjnych nad wpływem strumienia powietrza wytwarzanego przez wirniki drona – multikoptera na rozłożenie na powierzchni rozsiewanych nasion.*

***Słowa kluczowe**: bezzałogowy statek powietrzny, dron, rolnictwo precyzyjne, agrolotnictwo, siew*

Introduction

The unmanned aerial vehicles, drones are used in agriculture, first of all, in spraying the plants, monitoring the cultivations and soil analysis. They may be also utilized in spreading of mineral fertilizers and sowing of the seeds. The advantage of the drone application in agriculture consists in the possibility of performing the operation in the specified parts of the field on the small surfaces of crops in a short time. Sowing of the plants with the application of drones may be applied in the organic (ecological) farming as well as in the traditional agriculture. Multi-rotary drones are the most popular constructions of drones which may be adapted to the performance of various types of work in agriculture. Their advantage includes the possibility of drone to stay in the air motionless or to move in any direction with the speed independent on the height level and load of the performed work. Together with the development of the precision agriculture, drones have become more and more popular, especially as the devices which supply information on the state of cultivated crops owing to the flights with the assembled hiperspectral high-resolution cameras. The drones with cameras are also helpful in the development of maps [1]; they supply information on the condition of the field and the demand of the plants on nutrients [2; 3]. The additional advantage of the drones consists in the possibility of moving over the fields without compaction of the soil, damage of the plants and without the necessity to use the tramline systems. In most of cases the drones are driven by electric batteries which do not cause the contamination of the environment and contamination of the plants and soil with the exhaust fumes which are produced during the traditional work with the use of agricultural tractors.

Sowing from drones

During the use of grasslands, a part of grasses is lost; thus, on the pastures, there are created the empty places, deprived of plants, which are exposed to the intensive development of weeds and not much valuable grass species. In consequence, the productivity of the grassland is decreased. It refers most frequently to the irregular, small areas of land, occurring in

different parts of the field, being difficult for repeated sowing of the plants on their area. The sowing of the plants, using the drill, suspended under the drone may be a solution for the discussed problem. The producers offer already the constructions of drones, destined for sowing the seeds [4]. The seed drill is used for aero-sowing of the seeds.

The Canadian company CFR – Innovations produces the small UGS-1 drills which were so designed as to be easily installed on the drone and not exert any destructive effect on the stability of the drone's flight (Fig. 1). For seed broadcasting from the drone, the seed drill with the rotating set of pipes was used; it may give an irregular distribution of the seeds in the field. As flying platforms for the drill, the hexacopter DJI S- 900 as well as octocopter DJI S-1000 are usually employed. The eight-rotor construction of DJI S- 1000 ensures better safety of flight. In the case of failure of a single rotor, or even two of them, the problems do not cause a threat to the stability of the drone's flight. The discussed machine has folded arms owing to which its transport is easy. It is equipped with electronic chassis which is hidden during the start. It is made from the best available materials, plates and pipes from carbon fibre 3 K, aluminium parts which are anodized and also, thick and light plates made from carbon fibre at the base of each engine.

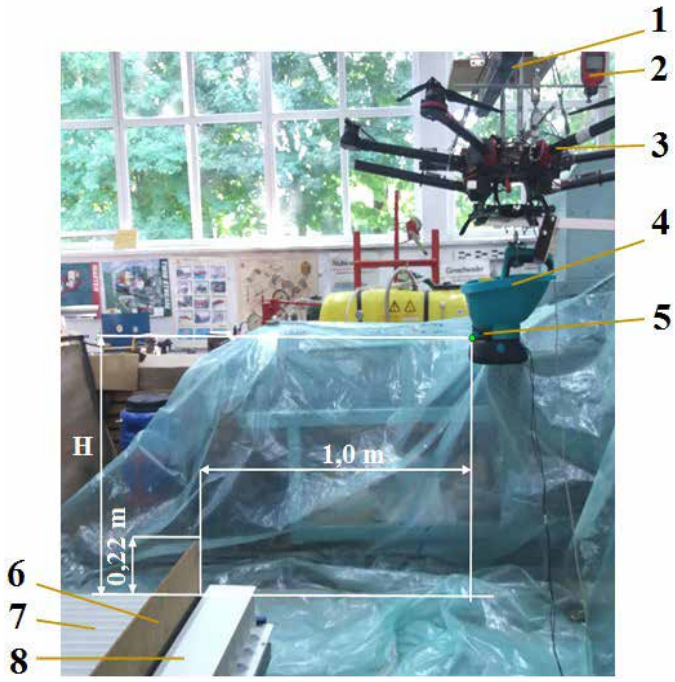
Fig. 1. DJI drone with the connected drill USG-1 during sowing [9]

IThe combination of electric manual seed distributor Scotts and rotary drone, as presented in Fig. 2 may be another example of drone spreader.

There are also developed non-professional constructions of the units, consisting in connecting the manual seed spreaders with the drones. The example of such device may be seen in the combination of electric-battery operated disc seed drill Greenmil and drone DJI 900 [5]. The seed drill, possessing the container of 2.7 dm^3 capacity was attached to the drone, equipped with the propellers with dimensions 15 x 5.2 inches (inch = 2.54 cm). The total weight of the drone with the seed drill amounted to 10.6 kg. There were performed studies on the influence of the air stream, generated by the drone rotors and necessary for generation of the thrust, enabling keeping the drone at the height over the surface of a field, on the transverse distribution of the seeds, falling on the groove patternator under the drone (Fig. 3).

Fig. 2. DJI Matrice 600 UAV with the connected manual electric seed drill Scotts [8]

Fig. 3. The research stand:1 – the holder, attaching the drone to the trolley, 2- tachometer, 3 – drone, 4 – seed spreader, 5 – spreading disc, 6 – vertical cover, 7 – groove patternator , 8 – horizontal cover [5]



The drone was moving on two heights: 1.0 m and 0.5 m over the groove patternator. The studies were conducted on the principle of comparing the transverse distribution of seeds, being spread from the seed drill at the operating rotors of the drone – with the air blow, and without the work of the drone's rotors – without the air blow. It was found that during the spreading of the seeds with the application of electric seed drill, installed under the drone, the air stream generated by the drone's rotors, necessary for maintaining the drone at the height of 0.5 m and 1.0 m over the groove patternator, had a significant influence on the transverse distribution of the falling rye seeds. The air blow changed the flight path of the seeds, spread with the use of rotating disc, and abbreviated their way of flight. It was also found that the velocity of the air deriving from the drone's rotors could blow and move the seeds which felt on the plane [6].

Drones are the remotely controlled devices, employing radio signal used by man with the aid of the broadcasting station. The flight of the drone may also occur on the earlier planned

Fig. 4. A map of the field generated with the application of Mission Planner software [9]

route, automatically, with the set course of auto-pilot and GPS coordinates. The flight will be fully automatic when the flight controller Pixhawk is employed. The drone may be guided by the enclosed controller during manually operated flight or using laptop or tablet with the application of free software Mission Planner during autonomic flight. Pixhawk has a function of safe ensuring of the drone and its automatic come back home in the cases when the device loses a signal or when the charge of batteries drops down. Owing to the system of the flight controller, the operator may program earlier the points and plan of the drone's flight (Fig. 4). In the future, the autonomic flight of the drone according to the route, programmed on the grounds of digital map of the field and planning the performance of sowing operations in the fixed points will be helpful in generation of seed drill robots [4].

Multifunctional flying platforms

German producer of spreaders for mineral fertilizers, Rauch company, offers the equipment for spreading a granulated mineral fertilizer and small seeds. The spreader for fertilizers is attached to the platform with the propellers and electric engines, being found on eight arms [10]. The total weight of the equipment together with the spreader is 80 kg. The weight of the load being present in the reservoir of the spreader is equal to ca. 30 kg (Fig. 5).

The discussed drone may work with the speed of 40 km/h. It may reach the places, situated at various height levels and perform the treatment over the territories with a variable inclination of the field surface.

The sets, offered by Zhuhai Yuren Agricultural Aviation are the example of construction of the set, designed for the needs of crop fertilization and sowing the seeds for agriculture. The

Fig. 5. Drone Agronator by Rauch: 1 – frame. 2 – reservoir, 3 – granulated fertilizer spreading disc [10]

mentioned company suggests two basic models of drones: Grain flyer 3 WDM8-20 and Flyer 3 WDM 4-10 [11]. Grain Flyer 3 WDM 8-20 is a rotor-based device which, together with the additional replaceable equipment (to be installed on it) is destined for performing different operations of the field. The discussed set is shown in Fig. 6. The platform is constituted by four-arm octocopter with double rotors on each arm. The carrying platform is equipped with the control system and batteries, ensuring power supply for the drone itself as well as for the equipment installed on the drone. Owing to the possibility of exchanging the equipment, the discussed set may be employed in operation of fertilizing with the granulated fertilizer, spreading the seeds, spraying the plants with the plant protection agents against the pests and application of liquid fertilizers as well as dissipation of powders. During the mentioned treatment, the drone control system enables control of the flight velocity and the rate of the employed liquid. The company offers also drone Grain Flyer 3 WDM 4-10 which is a considerably smaller unit. It was designed for the treatment on the small and medium fields.

The company Beijing TTA Aviation from China produces also the drones with the devices for distribution of granulated fertilizers and for sowing which cooperate with the drone (Fig.7). The same platform is destined for the following treatments: spraying of the crops, application of liquid fertilizers to the plants, sowing and spreading of granulated fertilizers. The reservoir of the drone has a big inlet which facilitates loading of the seed or fertilizer. Owing to it, we may avoid spilling of the sowing material during loading and also, its time is abbreviated. The internal waterproof constriction makes that cleaning of the reservoir is very easy. It is enough to pour water inside the reservoir in order to clean it. Owing to the possibility of a quick disassembly of the reservoir, serving for seed sowing and spreading of the fertilizers and being suspended on the drone, it is possible change its application as quickly as during 10 minutes. The parameters of the reservoir are as follows; the weight of the platform – 5 kg according to the data of the company; the total loading capacity – 20 kg, the dimensions of the reservoir: the length – 500 mm, the width – 500 mm and the height – 750 mm.

Drone by TTA is easy in service and is characterized by a stable and reliable operation. The construction of the spreading disc of the reservoir has been developed in such a way that the granulated is evenly distributed during its spreading. The width of spreading the fertilizers may be regulated by the choice of the rotary speed of the disc and the height of the drone's flight (Tab.1). The width of sowing the seeds is dependent of the height of the air raid. Together with the increase in the width of spreading, the yield of the equipment, as calculated per one flight, is increasing. It is connected with the amount of electric energy, accumulated in the battery. After filling the reservoir for each successive flight, it is also necessary to exchange the battery in the drone.

Fig. 6. Grain Flyer 3 WDM 8 -20 with the exchangeable adapters: 1 – drone, 2 – reservoir for spraying the liquid substances, 3 – reservoir for spreading, 4 – reservoir for powders' dissipation [11]

Fig. 7. Drone of TTA company, serving for spraying, and for sowing and spreading of fertilizers: 1 – drone serving for spraying, 2 – device for sowing and spreading of fertilizers, 3 – drone for sowing and spreading of fertilizers [12]

Tab. 1. The parameters of the work of TTA drone, serving for spraying, sowing and spreading of fertilizers [12].

Type of treatment	Size of granulate (mm)	Rotary speed	Height level of flight over the crops (m)	Width of performing the treatment (m)	Yield (ha/flight)	Time of flight (min/flight)
Sowing	**≤8**	High	1.0	10.0	1.00	6.0
		High	2.0	14.0	1.33	6.0
		High	3.0	18.0	2.00	6,0
Fertilization	**≤8**	Low	1.0	12.0	0.67	10.0
		Medium	1.0	17.0	0.87	8.0
		High	1.0	22.0	1.00	6.0
		Low	2.0	16.0	0.80	10.0
		Medium	2.0	20.0	1.00	8.0
		High	2.0	30.0	1.20	6.0
		Low	3.0	24.0	1.00	10.0
		Medium	3.0	28.0	1.33	8.0
		High	3.0	36.0	1.67	6.0

Summing up

When comparing the sowing of the seeds and spreading the fertilizers by the traditional method and that one with the use of drones, we may recognize that the main advantage of using the drone consists in the fact that the drone, flying over the crops, does not damage them, the soil is not packaged and the fertilizer is well distributed. The treatment of spreading may be performed over the growing plants during 10 minutes at the territory of 1.5 ha. Sowing and spreading of the fertilizers carried out by the traditional method is connected with the physical work of a farmer in the field. During the discussed operation, the plants may be easily damaged by heavy machines and the soil is packed what is unfavourable phenomenon. The discussed treatment being performed by ground machines is connected with high costs of work. Sowing and spreading of fertilizers, carried out with the use of drones in connected with a quick automatic spreading and easy operation of the equipment.

The advantage of the combination of drone and seeding machine (seed drill) includes also the fact that sowing may be performed in hard-to-reach places. The examples are the rice plots in China, situated at different land levels – the so-called terrace cultivations. Many pastures in Europe are also situated on the hills and on the uneven territory (in relation to the level) [7]. The drones enable the farmers to distribute the seeds quickly and effectively not only on the hills but also on the wet territories (wetland) and in other place where there is no possibility to reach by machines.

In the case of degraded pastures (places with a loss of plants), the drones facilitate a quick performance of sowing and fertilizing the discussed areas. They allow distributing the seeds quicker than by the application of ground seed drills on small areas situated in different places of the pastures. The drones used for sowing may distribute the seeds up to 40 times quicker than in the case of the application of manual spreaders.

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Article reviewed
Received: 11.02.2020 r./Accepted: 31.05.2020 r.

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DOI: 10.15199/180.2020.2.3

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SUGGESTIONS OF DEVELOPMENT OF AGRICULTURAL FARMS, SPECIALISED IN MILK PRODUCTION

SUGESTIE ROZWOJU GOSPODARSTW ROLNYCH SPECJALIZUJĄCYCH SIĘ W PRODUKCJI MLEKA

***Summary**: In the paper, the development of dairy farms was described; different factors, determining the development of milk production were considered. They include, for example, the application of modern technical and technological solutions.*
The development of milk-producing farms requires constant investments and extending their activities e.g. by a direct sale. In the article, the financial-economic analysis of investing on a given farm was carried out. It has revealed that such investment is profitable and brings advantages. The planned investment is characterized by many strong points and the most important one includes a financial stability of the farm and the openness of the owner to novelties. The weakest side of the investment is a big distance from the site of milk sale. It has been found that the competitiveness of Polish farmers is affected by innovations and modern technologies, introduced to the farms.

***Keywords**: agricultural farm, dairy cattle, milk production, innovative technologies*

***Streszczenie**: W artykule opisano rozwój gospodarstw mleczarskich i wzięto pod uwagę różne czynniki determinujące rozwój produkcji mleka. Obejmują one na przykład zastosowanie nowoczesnych rozwiązań technicznych i technologicznych.*
Rozwój gospodarstw produkujących mleko wymaga ciągłych inwestycji i rozszerzenia ich działalności, np. przez sprzedaż bezpośrednią. W artykule przeprowadzono analizę finansowo-ekonomiczną inwestycji w danym gospodarstwie. Okazało się, że taka inwestycja jest opłacalna i przynosi korzyści. Planowana inwestycja charakteryzuje się wieloma mocnymi stronami, a najważniejszą z nich jest stabilność finansowa gospodarstwa i otwartość właściciela na nowości. Najsłabszą stroną inwestycji jest duża odległość od miejsca sprzedaży mleka. Stwierdzono, że na konkurencyjność polskich rolników wpływ mają innowacje i nowoczesne technologie wprowadzane do gospodarstw.

***Słowa kluczowe**: gospodarstwo rolne, bydło mleczne, produkcja mleka, innowacyjne technologie*

Introduction

The situation on Polish dairy market in 2015 was affected by two opposite tendencies. One of them was liquidation of dairy quotas and, hence, a greater freedom in undertaking the decisions by milk producers and processors. The second tendency includes the consequences in exceeding the dairy quotas and the related financial penalties [20].

Modern technical-technological solutions in the dairy farms have the influence on the increase in profitability, supplementation of knowledge on the dairy herd as well as on more effective time management. The profits, resulting from the application of innovative technologies are meaningful and affect the generation of the successive modern solutions [18].

The introduction of modern technical and technological solutions in agricultural farms has a principal meaning due to the adaptation of Polish agriculture to the EU requirements and rising of the economic effectiveness of the farms [4].

Innovation in the agricultural sector must consider the specificity of the discussed sector of economy, first of all, biological and spatial character of production; it is connected with the long manufacturing cycles, dependence of production on the quality of agricultural manufacturing space and seasonality of production [9]. Reorganization of production in the farm may be related to the change of the production direction, diversification of the income sources or organization of the farmers in the producers' groups and transfer of modern technologies connected with the introduction of the precision agriculture [8].

The contemporary agriculture is subjected to very dynamic changes and development in many aspects, in particular, *via* application of innovative machines and equipment in

manufacturing processes. In the farms, many new technologies have been introduced; they improve the conducted work, affect the time and energy saving and in-time performance of the operations; they increase also significantly the quality of farm management and by this, production capacities of a given farm. Apart from new machines and technologies, we have also to mention a development of communication and transfer of information in agriculture. At present, the agriculture requires defined, specialized, reliable and current information. A farmer must update his knowledge as well as the tendencies and prognoses in the agricultural sector in which the specialization is carried out [15, 1]. In respect of modern animal breeding, a special attention should be paid to such instruments as genetics, technology of cattle management and monitoring, technologies of milk production, modern reproduction and farm management systems [22]. The number of farms, possessing modern equipment including standard application of computer is increasing every year; however despite their potential, farmers utilize specialist software in a small degree although it supports farm management and development. The farmers are not aware of their potential; they do not know the full possibilities of computerization [6, 3, 13]. The so-called decision-supporting systems [11] and the systems of animal monitoring [22] become more and more important.

The changes concerning the new technical and technological solutions are recorded in the field of animal production. Most of them are connected with the modernization of farm premises, adaptation to the hygienic and veterinary requirements, set by the receivers of agricultural products (e.g. milk), increase of the number of animal population, improvement and facilitation of service work and ensuring the appropriate animal welfare [16, 19]. Modernization in the cowsheds included, first of all, rebuilding and assembling new equipment. The systems of animal service, removal and storage of manure and animal feeding systems have been mechanized and automated (Fig. 1 – Fig. 4). The milkshed is a fundamental component of animal protection from the harmful effects of external factors and it should be so designed, constructed and equipped as to meet all requirements of animal welfare [17, 21].

Fig. 1. View of milk barn with feeding corridor [photo made by the employees of the Institute]

Fig. 2. Milking parlour of „herringbone" type [24]

Fig. 3. View of a milking robot [photo made by the employees of the Institute]

Fig .4. Cooling tank for milk [photo made by the employees of the Institute]

Introduction of modern technologies, employed in the milk production causes the improvement of the conditions of animal management, effectiveness of feed utilization as well as improvement of working conditions and decrease in labour consumption. The increase in a raw material production is a result of the mentioned changes. A high yield and minimization of work outlays may be obtained via introduction of modern systems of the milk production in a farm e.g. owing to the application of milking robots (Fig. 3) or milking parlours (Fig. 2) [2, 8]. The farms equipped with automatic milking system may monitor milk quality and animal health state more precisely.

Apart from the introduction of modern technologies, the modern methods for development of agricultural farms, specialized in milk production include also a direct sale of the raw milk, using automatic milk vending machine („mlekomat" in Polish) [10], what allows obtaining the additional income, besides selling the milk to a dairy plant.

The aim, the scope and the methods of the studies

The aim of the conducted studies was to develop a conception of farm development in aspect of increasing the production profitability. The scope of the studies included the analysis of a dairy-specialized farm on the grounds of the agricultural farm, situated in the Mazovian voivodeship, Ostrołęka province, Goworowo community. The studies were conducted in the period of October 2016 until March 2017 based upon the analysis of the materials collected during the visits at the agricultural farm and the documentation received from the owner of the farm. Also, SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the planned investment in the farm was carried out.

The total area of the farm at the moment of analysis was equal to 102 ha. The cultivation of maize and cereal mixtures was the main direction of vegetal production in the farm. The population of the animals consisted mainly of the dairy cattle (91 heads), including 63 HF cows.

Additionally, the materials, obtained from the companies dealing with the production of milk vending machines were utilized. Finally, there was developed the conception of the change in the distribution of the produced milk, adding the direct milk sale ([project).

The results of the studies and discussion

The main investment which is expected to bring the additional incomes obtained from the farm is a milk vending machine. As the farmer does not possess a sufficient amount of his own means for financing the discussed investment, the solution will come from the means obtained from the preferential credit of NT (New Technologies) line. The financial-economic analysis considered a specificity of the studied farm, the success of which would depend on some different factors, including the most important ones: demand on milk from „automatic machine" and failure-free performance of the mentioned device. The example of the milk vending automatic machine is given in Fig. 5.

When undertaking a decision on the purchase of milk vending machine, we should expect certain formalities; first of all, a farmer should submit the application to the competent veterinary service and Sanepid (Sanitary Inspection). It is necessary to obtain the confirmation of the technological project of the plant, on the way of the administrative decision of the provincial veterinary surgeon and then, to obtain the entry in the register of the plants, conducting the economic activity in a form of direct sale. The sale of raw milk is then subjected to supervision of Veterinary Inspection. In the case of the milk sale from the automatic vending machine it is necessary to ensure

Fig.5. „Mlekomat" – Milk vending machine [23]

the appropriate protection from contamination and unfavourable atmospheric conditions.

The choice of the appropriate device and its location is a very important issue. The farmer may sell the raw milk in automatic device which is situated at the territory of his farm, market or e.g. retail shop. However, the choice of the proper place includes not only its situation e.g. near trade supermarket but also the respective distance from the farm. The longer is the distance, the higher become the costs of milk delivery. In the light of the present costs of fuel, it may be a very important element which affects the profitability of the whole investment. A simplified cost and income analysis concerning automatic milk vending machine based upon the data from T-milk company has been given below.

The purchase of the milk vending machine is the greatest expense born by the farmer. At present, there is a wide offer on the market in this respect; the cost of the simplest device is 30 000 PLN; the most expensive one – more than 100 000 PLN. The choice of the appropriate version (more expensive, cheaper) should be very reasonably analysed because it decides about the time of the investment return and, consequently, the undertaken risk. It was demonstrated that the purchase of the most expensive version caused that the return of the investment was prolonged in the period of up to 2 years.

When analysing financing of the investment, i.e. the purchase of automatic milk vending machine, we should take into consideration that the companies offer the sale in instalments, leasing or credit. The calculations given in Tab. 1 assume the purchase of the device with financing obtained from the credit with interest rate equal to 9.87% ·year^{-1}. The own input of the farmer is 20% of the investment value. The cost of the credit service during the first year in investing (interests) at the investment = 35 000 PLN would amount to ca. 2800 PLN. The payments for location are widely differentiated; the more convenient is the place, the higher the payments are. The monthly expense is found on the level of 200-500 PLN (300 PLN was adopted). The payment for electric energy is 100-250 PLN·month^{-1}. In the case of the analysed farm, the payments 100 and 200 PLN were adopted.

When analysing the outlays on the milk transport, the distance of 100 km in one direction and twenty passages per month were adopted for calculations (Goworówek – Warsaw). The remaining costs are found on the level of ca. 500 PLN (e.g. cleaning agents). The costs of service during the first two years are not born (the period of guarantee is 2 years + additional insurance for the successive three years in the price of milk vending machine).

The sale of milk being possible to be reached during a year is about 40-50 thousand litres. The selling price of milk in vending machine is shaped on the level of 3 PLN·litre^{-1}. The prices are rather differentiated and may reach even more than 4 PLN. On the other hand, the prices of milk obtained by the farmers in the dairy plants differ very much from the presented above costs and they amount to 1.3 PLN·litre^{-1} – 1.8 PLN·litre^{-1}. In the calculations, the actual price in the analysed farm was adopted, i.e. 1.65 PLN·litre^{-1}.

With the mentioned above assumptions, the surplus of income from the sale of milk in the milk vending machine in relation to the sale in the dairy plant is equal to 74 000 PLN and 82.500 PLN in the remaining examples. We should pay attention to the fact that the mentioned surplus comes from the difference in the price of milk sale in the vending machine and in the dairy

Tab. 1. Simplified financial-economic analysis of the studied farm in the case of the purchase of milk vending machine (prices in PLN) [own elaboration]

Variants	VariantI	Variant II	Variant III	Variant IV
Investment costs	35 000	60 000	85 000	125 000
Costs of credit service (interests)	2 763.6	4 737.6	6 711.6	9 870
Payment for the place	3 600	4 800	6 000	6 000
Electric energy	1 200	1 200	2 400	2 400
Milk transport	20 000	20 000	20 000	20 000
Other costs	500	500	500	500
Costs in total:	**28 063.6**	**31 237.6**	**35 611.6**	**38 770**
Annual sale in litres	40 000	40 000	50 000	50 000
Selling price per 1 litre in vending machine	3.5	3.5	3.5	3.5
Sale value	**140 000**	**140 000**	**175 000**	**175 000**
Price of milk purchase per 1 litre at dairy plant	1.65	1.65	1.65	1.65
Value of milk sold to the dairy plant	**66 000**	**66 000**	**82 500**	**82 500**
Surplus of income from milk vending machine	**74 000**	**74 000**	**92 500**	**92 500**
Surplus of income – costs	**45 936.4**	**42 762.4**	**56 888.4**	**53 730**
Return of investment in the years	**0.761923**	**1.403102**	**1.494153**	**2.326447**

plant, that is, it makes the additional income of the milk producer. We should also stress that the considerable costs are generated by transport (distance Warsaw – Goworówek). When bearing in mind the existing demand on such healthy and traditional products, we may expect development of selling markets; owing to this fact, it will be possible to invest additionally (e.g. the purchase of the successive milk vending machine and placing it in another site in Warsaw).

SWOT analysis

SWOT analysis is the universally employed and recognized method of strategic analysis of a given enterprise. Due to its universal application, the discussed method may be employed in the identification of significant problems and their solutions in the agricultural sector; it may be applied when considering the strong and weak points of different planned investments. It facilitates the assessment whether a given investment has a chance for development and bringing the appropriate incomes. It also allows undertaking the proper measures enabling the effective activity as well as allowing forecasting the chances and threats to a given undertaking [5].

On the grounds of the above SWOT analysis it may be stated that the planned investment has many strong points where financial stability of the farm and open attitude of the owner to the changes are the most important elements. On the other side, the weak point on the planned undertaking includes a long distance from the place of the milk sale.

According to Jankowski and Sosnowski [2011], specialization of farms in milk production and their concentration, the increasing number of dairy herds and the increase of milk yield are the main determining factors of obtaining the stable sources of incomes by the farmers. In the examined farm, the number of dairy cows and their yield is increased every year.

The increase in cow milk yield and production performance in the farms plays a decisive role in the improvement of profitability [13]. In the examined farm, the own capital played a significant role but in the case of financing the investments, foreign capital was also meaningful.

According to Kałuża and Gintar [2014] the modern technical and technological solutions concern all domains of agriculture, from furnishing of farm premises, via agricultural machines and equipment, computerized systems, precision agriculture and biological progress to the investments, giving the additional income source. In the analyzed farm, a constant development is recorded: equipment of the cow house, application of computer in the farm for herd management and well equipped machinery park. The modern technology includes the purchase of automatic milk vending machine which will become the innovation on a local market and, simultaneously, it will bring the additional source of income.

The agriculture is subjected to dynamic changes in order to adapt to the existing social and economic conditions [Borusiewicz 2009]. The examined farm belongs to the highly developmental, dynamic units, being flexible to the needs of the market and the requirements of the consumers. The way to success consists - first of all - in modernization of infrastructure and production engineering, introduction of innovative technological solutions and application of the modern management methods [12]. The owners of the analysed farm are open to the new technologies what is manifested in the application of appropriate computer systems for farm management and searching for innovative solutions such as purchase of automatic milk vending machine and its use in the direct sale.

Tab. 2. SWOT analysis (own elaboration)

Strong points of undertaking	**Weak points for investing**
• Farm has a convenient communication with a planned targeted site of milk vending machine • Owner of farm updates his knowledge and possesses a long time experience • Farm specialized in milk production • Very well equipped park of machines and agricultural devices • Possession of own capital and the possibility of obtaining credit for planned equipment • Well established market position gives a guarantee of stabilized incomes • Obtaining of natural raw material – what is very much desired on the market	• Considerable distance to the milk sale place (100km in one direction) • Relatively high price of milk vending machine
Chances for investment	**Threats to the investment**
• Increase of popularity of organic food consumption • Margin higher than in the case of the sale carried out by other channels	• Technological barrier, problems connected with the operating the milk vending machine by the consumers, • Difficulties with the obtaining the permit for installing the milk vending machine in the attractive places

Summing up and conclusions

Investing in development of the dairy farms is profitable and brings many advantages. The planned investment, presented in the publication, has many strong points and its implementation will allow increasing the incomes coming from milk sale and developing outlet market via utilization of the new forms of direct sales of the raw milk in the devices, called automatic milk vending machines ("Mlekomat" in Polish). The sale of the milk in the discussed form brings also profits for the consumer who may buy any quantity of fresh non-pasteurized milk at any time of the day or night; it may lead to the increase of milk consumption. At the beginning, a farmer must bear high costs of purchase of the discussed equipment from his own means or obtaining a credit; he must plan appropriately the transport matters as not to increase his expenses. Despite the born costs, he may expect a considerable surplus of the income, coming from the milk sale from the discussed automatic machine as compared to the direct sale to the dairy plant. Owing to the increased income, the farmer may develop further his farm and invest in the purchase of the successive vending machine in order to increase the sale.

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Article reviewed

Received: 29.01.2020 r./Accepted:20.05.2020 r.

115 YEARS OF WARSAW HOUSE OF ENGINEER OF NOT

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Bronisław Hynowski talks with Jerzy Rożek, M.Sc.Eng., the President of the Warsaw House of Technical Engineer.

Bronislaw Hynowski: Polish technical environment revealed the unusual inventiveness when establishing the Engineering Association in Warsaw, in 1898, and as early as one year later it addressed the initiative of constructing their own House of Engineer in Warsaw where all decisions were undertaken by the representative of the Russian invader. How did you manage in the case of building the impressive investment under the so difficult conditions?

Jerzy Rożek: The contemporary Council of the Association which used the hired rooms, discussed the subject of the building almost during each meeting; during the General Assembly of the Association held on March 8, 1901, the Council submitted the proposal concerning the necessity of commencing the active efforts aimed at purchase of the plot and building their own seat in Warsaw. The mentioned meeting not only adopted the proposal of the Council but also appointed two commissions:

- Technical commission composed of two members of the Council (Piotr Drzewiecki and Aleksander Rosset) and two architects (Władysław Marconi and Bronisław Rogóyski); the aim of the commission was to develop the organizational and technical conditions which should be met by the future building;
- Financial commission, consisting of 30 members whose task was to „think out the ways of gaining the means for building and to consider, together with the previous commission, the proposals submitted to the Association and concerning the purchase of the place (square) for construction of the discussed building". The initiator of the idea of building the house was, inter alia, Brunon Tyszka.

During the common meeting with the Economic Council of the Association, held on 5, June 1901, the both Commissions decided to submit – to the General Assembly of the Association – the proposal for the purchase of the plot of ca. 2100 m^2 (then – 6400 square ells) situated at Włodzimierska street 3/5 (nowadays Czackiego street) for 120 thousand roubles. At the moment of signing the notary act, the sum of 20 thousand roubles was required and the remaining sum became a mortgage debt for 3 years and 6% in average as interests.

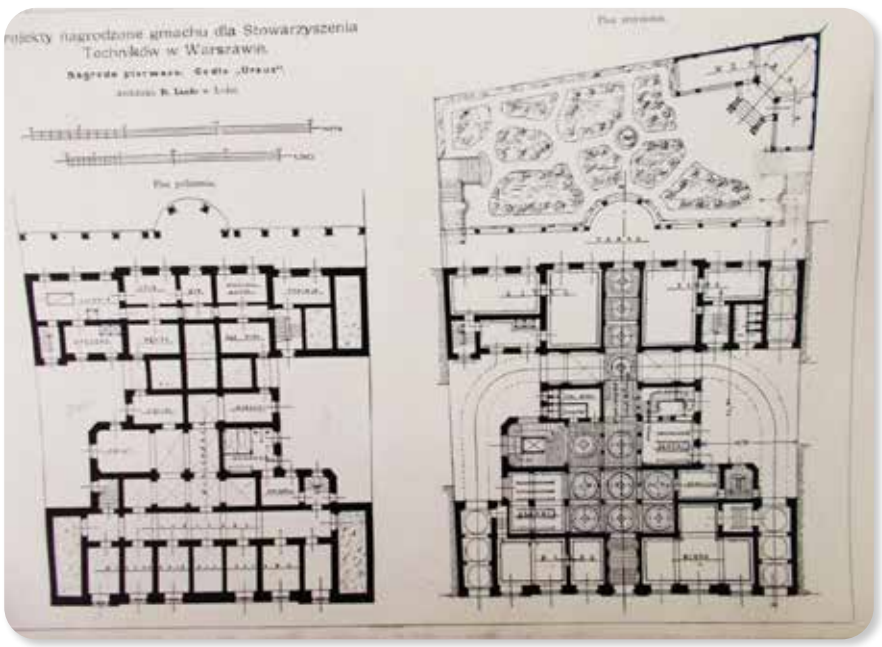
To implement effectively the discussed undertaking and the appropriate surveillance of the investment run, the General Assembly of the Members of the Association (6 June 1902) elected the special committee consisting of the following persons: Piotr Drzewiecki, Kazimierz Loewe, Aleksander Rosset, Jan Sieklucki and Brunon Tyszka. The Committee was authorized to following operations: announcement of the competition for project of the building, choice of the project, choice of the constructor and entrepreneurs and all operations „indispensable for the quickest implementation of the building". The announcement of the competition for the project of the building of the Association of Engineers in Warsaw was placed in „Technical Review" no 33, dated August 1902. The conditions of the competition were interesting. Apart from three awards equal to 500, 250 and 150 roubles. There were considered only the projects of the members of the Association of Engineers in Warsaw. The Association reserved also a right to but the non-awarded projects at the price of 100 roubles.

BH: Can we say – after the elapse of more than one century from the discussed period – that the engineers of that time could accurately anticipate the meeting of the expectations of the engineering environment?

JR: In my opinion, even very accurately. I would like to cite several from the remaining conditions of the discussed competition: „The building shall correspond to the needs of the Association and as the institution concentrating a social life of the members and, simultaneously, having the scientific and research targets. The building may have four floors. The ground floor shall include the rooms with the separate entrances, destined currently for lease as offices and in the future, for various institutions connected with the Association such as: offices, stid6y rooms, editorial offices etc. The specific rooms of the Association shall be found on the first, second and, eventually, on the third floor. Kitchens, auxiliary rooms, living rooms for the service and clerks may be situated in attics (mansard) or on the basement level. There are necessary the following rooms: 1) the main entrance, cloakroom with a waiting room, large and appropriate for the mentioned above rooms, with elevator for 6 persons in the staircase; the office [two rooms, ca. 40 m^2 in total]; 3) the room of the Economic Council [ca. 30 m^2]; 4) the main room for technical meetings, general assemblies and social meetings for 350 persons, with the scene, screen for projections and 2 small rooms near the scene [ca. 275 m^2]; 5) 2 small working rooms for the commissions and departments (ca. 60 m^2); 6) library [ca. 50 m^2]; 7) reading room [40 m2]; 8) a room for technical collections [25 m^2]; 9) major dining room for 280 – 300 persons, sideboard room with the lifts, buffet [ca. 240 m^2 in total]; 10) two smaller dining rooms for 50 persons [ca 80 m^2 in total]; 11) 3 cabinets near the dining room [ca 80 m^2 in total]; 12) snooker room [3 snooker devices, ca. 65 m^2]; 13) room for playing cards [may be in 2 parts, ca. 120 m^2 in total]".

Apart from the above, it was planned that all rooms would be accompanied by sanitary utility rooms, kitchen, pantries, cellars for storage of the products and the special basement rooms for wine, washing room, bathroom with a shore room, the room for technical equipment (lighting, heating, ventilation) and flats: a) 2 rooms with a kitchen for authorizing officer (intendant), b) 3 rooms for restaurateur, c) 1 room for lunch lady, d) 1 room with the kitchen for senior waiter, e) 2 rooms for scullery maids and farm labourers, f) 1 room for doorman, g) 1 room for watchman. Besides it, in the depth of the possession, the garden was planned; eventually with verandas and terraces on the first floor, communicating with the rooms of social meetings. The rooms and their entrances shall be so projected as to create a separate apartment for sparing it to the members of the Association for the private social meetings. The designers had also to consider the possibility of developing the building in the future.

Projection of cellars and ground floor derived from the project with "Ursus" emblem



BH: It should be admitted that the requirements were not easy to be met...

JR: In spite of this fact, 13 projects were submitted in total. The Commission for the evaluation of the projects, as being called the „competition court" gave the first prize to the project of the architect D. Lande from Łódź, with the „Ursus" emblem, the second prize - to the project of the same author (D. Lande) with the emblem „Engineer for Engineers" and the third one – to the project of architect Jan Fijałkowski from Warsaw, with the „Gniezno" emblem. The awarded projects were exhibited for one week (1 – 7 December 1902) in the flat at Królewska Street, 5. Despite the granted awards, after a precise consideration of the projects, the following text could be read in the „Report on the activity of the Association in 1902": "The Commission came to the conclusion that any of the submitted projects was not suitable for the implementation due to the cost, exceeding the anticipated sum and due to the configuration on the plan. We decided, therefore, to think over a new project, using the material resulting from the submitted projects. To this end, a limited competition was arranged again. W. Marconi, Br. Rogóyski and J. Fijałkowski were invited to the mentioned competition".

The conditions of the new competition were based on the principles of financial calculation and were aiming at the maintenance of the building of the Association at the level of no more than 10 000 roubles per year. The decision was undertaken to entrust the author of the best project with the task of constructing the building. Due to this reason, the Commission gave up the offer of the author of the projects, distinguished by the first and the second award as it was the person not living in Warsaw. The second competition resulted in a choice of the well thought project of the building, convenient in its configuration. Its author was Engineer Jan Fijałkowski and he also became instructed with the task of implementing the construction work. On the other hand, the authors of the most important sections of the documentation were as follows: engineer architect W. Marconi (construction), Eng. C. Rodkiewicz (central heating and ventilation), Eng. K. Karczewski (lighting).

Architect Jan Fijałkowski, Eng., utilized skilfully a quite vast square (ca.2100 m2) for construction of two main pavilions: frontal one, situated on the first and second floor, destined for the needs of the engineering activities of the Association, and the back pavilion, on the same level of the floors, destined for the social purposes. In the middle of the mentioned pavilions, there was situated a staircase with the side galleries which were the convenient connectors of the both pavilions. Owing to it (as it was demanded during the second competition), the building was erected with the consideration of two natures of the Association: the scientific-technical (engineering) and the social institution.

Overall view of the building according to the project by architect Jan Fijałkowski, Eng


Rys. 15. Widok ogólny według projektu. Arch. J. Fijałkowski.

The construction was commenced on July, 31, 1903; the solemn laying of the foundation stone had place on September, 5, 1903 and as early as in November 25, 1905, the building was given to the Association of the Engineers for use. Simultaneously, the building work was accompanied by the preparation and the implementation of external and internal decoration of the building. In „Technical Review" no. 10 of 1904, there was announced the 12th Competition of Warsaw Artistic Society for the projects of the sculptures which were assumed to decorate the front of the building, situated at Włodzimierska street, according to the following conditions: 1) the projects for the allegoric group, decorating a top of the building's front; 2) the projects for 2 single figures for the mentioned front; 3) the sketches shall be performed in gypsum and have the following dimensions: a) for the group – the height of 80 cm and b) for the figures – the height of 80 cm.

The prizes for the best projects were: groups – 300 roubles and for 2 figures – 200 roubles. The subjects of the composition were optional, corresponding however to the building which was maintained in a style of the late French Renaissance. The authors of the rewarded project were entitled to perform a model in

gypsum to be next carved in Pińczów limestone; the dimensions should be as follows: for the groups – 2 m and for the figures – 1.15 m. the payment for the gypsum models were equal to 600 roubles (group) and 200 roubles (2 figures). The Competition jury granted unanimously the reward of 300 roubles to the piece of art, bearing the emblem „Dedalus and Icarus" by Zygmunt Otto. Finally, Mr Otto made three sculptures from the limestone for the House of the Engineer. The group representing Dedalus and Icarus was placed on the top of the building. The remaining two sculptures - Archimedes and a woman with a radium ray was placed on the front of the building at the height of the second floor.

BH: The front of the building is impressive. Even if we do not enter the Czackiego street, we must perceive the outstanding front façade of the building of the House of Engineer....

JR: Yes, indeed, the façade is impressive, exceptional and enchanting; primarily, it was even more interesting. The top was decorated with the sculpture performed from limestone by Zygmunt Otto; it represented old Dedalus, father of mythological engineering and architecture, creator of Labyrinth, and his visionary son, Icarus who wanted, on the wings glued with wax, to rise up to the bright, sunny lands of ideas. It is the juxtaposition of realism and idealism in the engineering and art, practical life conditions and ideal aspirations of technique which does not know the borders for its development. The discussed masterpiece accented the axis of the building and was a significant element of the composition. Unfortunately, the sculpture was damaged during the World War II.

According to the project of the architect Jan Fijałkowski, the building was constructed with three-floor, seven-axis façade with two-floor pedestal. On the pedestal, there was placed two-column portico, staying in a perfect harmony with the composite capitals (caps of columns), ended with the tympanum, interrupted at its base. The space of the mentioned front piece with the interrupted beaming was filled with a bib outwardly curved cartouche. Over it, there was an inscription reading ARTIBUS TECHNICIS MCMIV and above it – a head of woman with the cover similar to an open shell. The cartouche was supported by two, freely sitting, and semi-naked figures of women in dishevelled dresses. They were both oriented to the cartouche – one woman pointed her right hand to the head of another woman above the cartouche and the second woman kept a laurel wreath in her left hand. Under the cartouche, there was a lion's head. Many such heads were found on the facade of the building.

On the corners of the balcony at the second floor, in the central avant-corps („fore-body"), there are two preserved-until-

now figures, also by chisel of Zygmunt Otto. They represent the extreme stages of the contemporary engineering: Archimedes, using his machine and lever, and a modern female figure, keeping shining radium in her hand. Application of the act of the Nobel Prize Laureate (1902) in order to express, in the allegoric form, the newest achievements of science is an evidence of a big creativity of the author and quite a big courage in this respect. The sculpture's form was skilfully adapted to neo-baroque decoration of the facade.

The axis of the building in the upper part is emphasized by the until-now existing deep-seated entrance portico with two columns made from black marble. It contains the inscription reading: FEDERATION OF THE ENGINEERING ASSOCIATIONS.

Vertical composition of the facade was additionally stressed by two extreme projections crowned with the peaks in a shape of arch and with four-shell dome with small lanterns. At the lower part, you could find the passage gates leading to small yards; they were linked with the cradles and had a rich sculpturing. They have survived until now. The central part above the main entrance had a characteristic cradling roof (Delorme roof).

BH: Not only the facade is impressive. We may also see a lot of interesting things inside the building of the House of Engineers.

Deep-seated entrance portico with the columns made from black marble.

Lighting of the main hall facilitates the admiration of the rich and precise decorations

JR: The attention is attracted by the entrance hall and the main staircase, the upper part of which at the third floor is decorated by plafond by the painter artist, Stanisław Bohusz-Siestrzeńcewicz. It was probably the only one plafond in Warsaw which was painted as plafond, not as image. It presented „Renaissance", i.e. marching of humanity towards the better future. The discussed plafond was destroyed during the World War II and during the building during the Warsaw Uprising. We may see its black-white photography only in the archival copies (No. 50-51) of the „Illustrated Weekly" of 1905 and in No. 18 of „Technical Review" of 1907.

Despite the careful searches in archives, museums and libraries, it was not possible to find any coloured image of the discussed plafond. Due to this fact, the attempt to reproduce the mentioned piece of art of the painter was not undertaken.

Historical and contemporary photos of the main staircase

We should also pay attention to the representative conference room having a height of 9 m and area of 328 m^2, situated at the third floor. It was called earlier the main lecturing hall with the adjacent rooms, enabling also its utilization for other purposes, and namely: as a meeting room, for concerts, theatre performance etc. On the wall from the side of the street, there are three big semi-circular closed areas, covered with glass. The discussed room had very abundantly decorated walls and ceiling with two

big chandeliers which may be admired only in the archival copy of „Technical Review". Opposite the big representative room, there was a large dining room (height 7 m, area 152 m^2) which was lighted by 3 chandeliers. In the discussed room, banquets and solemn parties had place; there was also a small scene with a small elevation and, in the vicinity, a heraldic room. The entrance to the terrace and garden, situated behind the back pavilion led from the dining room via loggia which played a role of winter garden during the winter time.

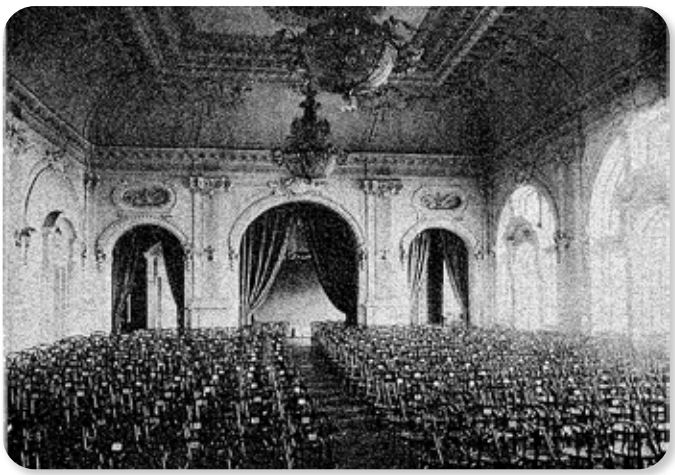
The wars left the durable traces in the House of the Engineer which are even not perceived by the contemporary users of the building.

Financial state of the Association, as being weakened as a result of the World War I was many times the subject of care and considerations of the Council. In 1915, they planned to address the more wealthy members of the Association, living in the Empire, for a loan. The flow of the events did not allow developing the mentioned action of self-assistance. Since the beginning of the World War I until July of the reporting year (1915), the upper rooms of the building of the Association were occupied by the hospital of the Polish Committee of Sanitary Assistance on a free basis but under the condition of returning the costs of renovation of the rooms and these parts of the building which were changed due to the needs of the hospital. The mentioned costs were not returned as they were expected to be paid by the Union of Lands, the authorities of which left Warsaw in a hurry. The Council authorized its member, Mr. Majewski, evacuated into the depth of the State, to receive the sums due to the Association from the Union of Lands and to store the money until the return to the country. The incomes from the tenants, inhabiting the building were considerably decreased because the Council had to lower the payment few times.

The Association played – as before – its public and civil service, giving asylum or sojourn to different institutions of public service, freely or only for return of the maintenance costs of a given flat. Thus, the letter of the Commission of the Care of Public Buildings of the Citizens' Committee resulted in granting a free utilization of the room for the office of the mentioned commission. For example, the Department of the Enlightenment of the discussed above Committee asked the Association to hire freely the room for 3 weeks, for the lectures of the persons, teaching the illiterates. The Council granted a heraldic hall for this purpose. The Council decided to support the attempts of the Circle of Architects in respect of opening the lectures on rural building and hired the heraldic hall at the sum of 300 roubles for the whole year.

During the World War II and occupation of Warsaw, the House of Engineer was destroyed very much. Due to the Nazi raids and bombs falling on Warsaw, the third and fourth floors were burned in September 1939. The damage caused by fire covered also the plafond on the ceiling of the main staircase, painted by artist Stanisław Bohusz-Siestrzeńcewicz. The buildings on the both corners of Czackiego street and Świętokrzyska street were also completely destroyed. After the fall of the Warsaw Uprising in 1944, a special „brand-commando", established for the damage of the buildings in Warsaw, set up the fire at the remaining part of the House of the Engineer. The fire burned down the abundant interior fittings and, also, rich molding ornaments by the sculptor Jan Gardecki. We may find them on old photos. The fire destroyed completely the ceilings, situated on wooden beams and caused the falling down of many partition walls. Many sculptures, including the figures of Dedalus and Icarus, being visible earlier at the top of the building, were damaged, as wll. The fire weakened considerably the side walls.

Historical view of a large conference hall and its contemporary images after renovation



Big efforts of the engineering environment resulted in reconstruction of the House of Engineer after the war damages, including the representative hall on the third floor. The systematic renovation and modernization covers not only the rooms. The House of Engineer has the plans of revitalization which are implemented gradually in the particular stages as the House gives all the time the active support to the engineering associations. In 2014, some very significant constructions were performed. The first stage from the programme of the building revitalization was implemented, i.e. desiccation and damp insulation of the walls in the building's cellars. The fire-signalizing system in the building, together with its connection to the monitoring at the State Fire Brigade was performed in 2015. Also, the necessary lightning protection system was installed. The both mentioned installations have significantly contributed to the rise of the safety of the persons, staying in the building and also protected the building from the possible fire events. Warsaw House of Engineer (WDT) Ltd. conducts the repairs and furnishes the conference rooms with the audio-visual devices. The mentioned conference halls are utilized for conferences, training, cultural and social meetings, organized by Engineering Associations and FSNT NOT as well as for the concerts, New Year Parties, prom nights for the youth and events for external entities.

The Management of WDT NOT Ltd. has implemented one of very important stages of revitalization and modernization of the House of Engineer in Warsaw – the project of constructing a new lift, travelling from the basement floor up to the 3rd floor where the greatest conference rooms are situated. The mentioned lift was launched in June 2016. Many changes in the interior part of the building, implementing the successive stages of revitalization were carried out. The molding was supplemented and the main entrance to the building, hall at the basement floor and the main staircase were reconstructed. In 2018, the major renovation of the Presidium Hall on the 2nd floor and of the adjacent corridors and of the corridor at the 5th floor in the over-built part (1968) was carried out.

A lot of the work in the 115 years old Warsaw House of Engineer was undertaken and performed on the occasion of the 100th anniversary of regaining the independence by Poland. The implementation of the successive stages of revitalization i.e. front facade and courtyards and the remaining parts of the building is anticipated for the next years (it is dependent on the financial capabilities of WDT NOT). The above mentioned work at the building and care of the technical condition of Warsaw House of Engineer NOT is performed with the purpose to serve the next generations of technicians and engineers for at least the next 115 years as the House of Engineer, although being more than 100 years old, is completely modern entity; it has a charming secession architecture. Therefore, there are many scientific-research conferences, symposia, debates and trainings

Entrance to the new lift on the basement floor

organized by the Engineering Associations and the units of the Federation, various organizations have their seat in the building: the Chief Management of FSNT NOT, 17 boards of the major engineering associations, Warsaw Council of FSNT NOT with many divisions of the particular associations belonging to NOT and the editorial offices of scientific and technical periodicals. As early as in 1996 the matters of purchase of the rooms in the building at Świętokrzyska street 14 (from Czackiego street to staircase A) were officially regulated; they were integrally linked with the building at Czackiego street 3/5. The conference rooms of Warsaw House of Engineer are also often a place of social meeting of the technicians and engineers, frequently with the families in the case of different occasions and jubilees.

Thus, the tasks which constituted the basis of the assumptions of building the Warsaw House of Engineer are still implemented and developed. The maintenance of the building, being as a well-known nest of engineering environment in the centre of Warsaw, which was constructed by the Association of the Engineers in 1905 during the Russian invasion – in spite of the changes in the system and economy during a century – is our common duty i.e. of Polish technicians and engineers.

BH: I thank you very much for the interview and reminding a very interesting history of this unusual object.

KING OF POLISH RIESLING

KRÓL POLSKIEGO RIESLINGA

Riesling is one of several hundred contemporarily known strains of grapevines but at the same time, it belongs to the top ten of the most recognizable and popular strains. It is considered that it was „invented" by the Germans: certain traces indicate that German King Ludwig, who reigned over the Rhine River territories at the 2nd half of the 9th c. B.C., was its father. The first reserved records where the name of Riesling is mentioned (a bill from the vineyard of the Monastery of the Cistercians) dates back to the middle of the 15th century and the name Riesling, derived from Germen Russling (Russ = dark tree) or Rissling (rissig – coming from reissen = to tear) just originates in the mentioned period. The discussed strain, being named in a form consistent with to-day transcription, was mentioned the first time in 1552, in a Latin text of herbal book by Hieronymus Bock.

Anyway, it seems that the Germans have cultivated Riesling for ages, and 60% of all Rieslings all over the world derive just from the discussed above place. Hence, where the Polish Riesling, as mentioned in the title, comes from? Well, it appeared owing to the changes of the borders after the World War II – in the Zielonogórskie voivodeship where the German cultivated grapevine earlier, the Poles became successful later. It did not come, however, instantly; the so-called real socialism was not favourable for development of vineyards and wine production. As late as in the nineties of the 20th century, it was possible to find out and identify old, wild sprouts of grapevine. Marek Krojcig – the man whom I call today the King of Polish Riesling, has accomplished this work. The warming up of the climate was helpful but the idea of reconstructing the vineyard and wine manufacture was the most important factor.

The first new planting at the territory of the old vineyard and its vicinity were made by Krojcig in 1996 and the official sale of wines from that place was commenced in 2010. When I heard the first time about the wine from Górzykowo (it was in 2014), Marek Krojcig and his wife Barbara managed already 6.5-hectare vineyard „Old Wine Mountain" (in Polish: „Stara Winna Góra") and the adjacent atmospheric hotel. Initially, the majority of the produced wines (ca.70%) was consumed at the site but gradually, the external sale was commenced. It began from the

interest of the known importer and distributor Robert Mielżyński in Krojcig wines and introducing the Rieslings from Górzykowo to his offer.

In 2014, production of wine in Stara Winna Gora amounted to ca 25 thousand bottles annually; the most interesting products were: Lyrical Riesling and Riesling from Pradolina (in English: ice-marginal valley). The mentioned wines were first found in the offer of Mr Mielżyński what became a very good promotion of them. And that's where I met the discussed wines the first time. They made a perfect impression even when compared (absolutely incidentally) with the simultaneously consumed excellent New Zealand wines: Marlborough Sauvignon Blanc from Little Beauty.

From the beginning, the both Rieslings of Krojcig had– depending on the vintage – 10 to 10.5% of alcohol and were very drinkable. I tried to drink them in cold Poland as well as in hot Africa (yes, it took them with me there!), with the same good impressions.

Although manufacture of good wine from the Riesling strain in Poland is – due to the climate and short period of vegetation of grapevine – very difficult, the opinion about Krojcig Rieslings was early positive and the recognition came after release of vintage 2013. Although dry Lyrical Riesling 2013 was determined as thrifty in aroma and strongly acidic, it was simultaneously indicated that the discussed wine would become more favourable after resting in bottle for 1 – 2 years. In turn, the semi-dry Riesling from Pradolina '2013 attracted the attention by its excellent, typical-of-the-strain, pleasant fruity aromas and noble taste in the mouth and a good structure and length. The terms „dry" and „semi-dry" as used in definition of the categories of the discussed wines require certain comments but about that in a moment.

So much is about the vintage '2013 of Krojcig wines. And what was the next one – 2014? Lyrical Riesling of that year was delightful due to its typical Riesling aroma – with flavour of citrus fruits, green apples and peaches and somewhat like

a smell of spring (wet catkins?). It had a lot of body and was mineral, crystal acidic and long. Its back label had the inscription reading „dry wine" and such was its receipt though indeed, it was rather semi-dry Riesling but a very acidic one; the mentioned acid was perfectly balanced by the residual sugar. During the „blind" degustation I would indicate Mosel as the place of origin of the tested wine, so chapeau bas!

The second Riesling from Krojcig, coming from Pradolina in 2014 vintage was felt as a pleasantly semi-dry wine (though in aspect of the residual sugar content it was rather semi-sweet, and such was information on the back wine label), strongly fruity (flavour and taste), bodied and long. It made the impression of more extractive than Lyrical Riesling but was still very fresh. Especially, I liked its sensible (especially at the finish, aftertaste) flavour of sweet pineapple.

It is impossible to describe all vintages by Krojcig in one article – moreover, Mark did not focus his attention on the Rieslings exclusively. When I met Him again in 2018, he presented his new wine from the strain Pinot Gris, coming from 2017. It was very aromatic; his smell reminded me hard candies but the taste rewarded everything: it was extractive, fresh and perfectly acidic. And flavours of apricot, peach and taste of candied fruits were delightful.

What was the comparison with the both Krojcig Rieslings dating to 2017 vintage? Lyrical Riesling was – as usually – more acidic than that one from Pradolina; it had also a good extractivity and almost required some meals to accompany. As compared to it, „Pradolina" seemed to be like a meditation wine – it had a perfect balance, quite a lot of body and very light herbal nuances. I liked it more than the previous vintages of the discussed wine.

To-day, Krojcig offers wines of 2018 vintage and apart from Rieslings and Grey Pinot, also few other wines of his production. The novelties include white semi-dry wines: Traminer (for meals of Italian kitchen, fat fishes and spectrum of cheeses), Saphira („wege" meals, and Asiatic kitchen) and „upgraded" version of Riesling from Pradolina, corresponding to German Auslese (choice of grapes from the selected bunches). Krojcig has also produced his rosé wine (the so-called Autumn Wine fits very well into various salads) and red wine (Regent, good for delicate roasted meals).

It is not the last word of Krojcig as a wine producer. For now, we should appreciate a class of wines which are produced at this moment. I participated once in the „blind" degustation where the Rieslings from Górzykowo conquered really good French wines from Bordeaux and Italian wines from Trentino-Alto Adige.

The success never comes itself; I am absolutely aware of the effort which had to be put by Krojcig into the work to reach such quality of wines. He undoubtedly deserves a Title, mentioned in the beginning of the present article. I do not know better Polish Rieslings although I tasted at least several of them.

Andrzej Kusyk

The illustrations come from the Internet page of Mr Krojcig http://winna-gora.pl and http://pixabay.com

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