

GREENEVO

7TH / 8TH EDITION



Republic
of Poland



Ministry of Climate
and Environment

GREENEVO
TECHNOLOGY ACCELERATOR



Funded by National Fund
for Environmental Protection
and Water Management



GreenEvo – Green Technology Accelerator is an innovative programme of the Ministry of Climate and Environment (before: Ministry of Environment) aiming to create favorable conditions for promoting Polish pro-ecological technologies on a national and international level. The main objective of the programme is to help small and medium companies to establish international relations and to provide them with adequate tools enabling dynamic development. Actions undertaken within the framework of the programme stimulate in a complex manner the development and strengthen the position of advanced green technologies in the process of the creation of a circular economy.

The project provides the opportunity to implement the presumptions of the most important strategic document regarding environment and water management, i.e. Polish “2030 National Environmental Policy” concerning the transfer of technologies and pro-ecological actions.

GreenEvo – Green Technology Accelerator Programme

ON THE HISTORY OF THE GREENEVO

The programme was launched as a consequence of decisions of the 14th United Nations Climate Change Conference, which had taken place in Poznań in December 2008. It is coherent with the ideas of the “Poznan Technology Transfer Strategy” adopted at the end of the summit, which aimed to increase the effectiveness of technology transfer through proper recognition of the needs in countries developing in this respect.

Until the present time the programme has had eight editions. During the first six of them, which took place in the years 2009-2015 a total of 74 solutions were selected and granted support. In 2018 all previous laureates were reviewed and their potential to continue to receive support within the framework of the GreenEvo was verified – as a result 34 pro-ecological technologies offered by 33 companies received further support.

Within the 8th edition in 2020 other companies offering 10 new technologies joined the group of the laureates.

ACTIVITY AREAS

- water and wastewater management
- waste management
- renewable energy sources
- energy savings
- air protection
- biological diversity conservation
- passive housing
- low-emission transport
- climate protection including technologies designed to reduce greenhouse gas emissions

GOALS

GreenEvo focuses on sustainable development of companies, green technologies, and as a result of the entire economy. The companies that become the laureates offer verified, implemented and highly efficient technologies, which helps to build a positive image of Poland all over the world. The GreenEvo laureates are reliable business partners, who are open to share their knowledge, experience and technologies with developing countries, dealing with locally existing environmental and climate challenges. The GreenEvo programme educates potential national and international partners on the topic of easily applicable pro-ecological technologies and intensifies the business activity of the GreenEvo laureates on an international level. It changes the way a company is perceived and managed - from traditional to modern, efficient and oriented towards actions stemming from social responsibility of the business.

BENEFITS

The GreenEvo programme constitutes one of the key Polish governmental tools supporting the process of transformation towards a sustainable economy and raising awareness regarding a responsible manner of conducting business activity. It is the best practice with respect to the cooperation between central authorities and companies. The programme has been from the onset launched and implemented by the government authorities, which undertook to guarantee the quality of offered technologies. The GreenEvo stimulates international transfer of green technologies and foreign activity of companies offering these technologies. The programme proves that Poland is able to actively participate in the international climate protection actions in accordance with the idea of sustainable development.

MISSION

Building the potential of Polish green technologies by changing the awareness regarding the innovative character of Polish companies and providing them with tools to efficiently expand on the foreign markets.

VISION

Creating a platform of knowledge and experience by changing the habits of the companies regarding their own sales and marketing actions and by supporting a modern attitude towards the promotion of companies by the authorities.



GreenEvo – Green Technology Accelerator is a project of the Ministry of Climate and Environment, which has been launched in response to the document elaborated by climatologists and environmental experts within the framework of the “Poznan strategic programme on technology transfer” adopted during the Climate Change Summit in Poznan in 2008. The GreenEvo project currently implements the presumptions of “2030 National Environmental Policy - the development strategy in the area of the environment and water management” adopted by the Polish Council of Ministers on July 16th, 2019.

Technologies supporting the protection of the environment and climate are no longer perceived as available solely for the richest recipients and their development is no longer seen as non-profitable. On the contrary, it all seems to prove that these technologies are becoming the most cost-effective. The importance of this sector is growing in direct proportion to the development of world's economies due to the needs related to the access to potable water and clean air, diversification of energy production, health protection and the drive to save resources. Moreover, in terms of sustainable development of the cities modern environmental technologies constitute an important tool in the transformation towards agglomerations that are more environmentally and socially friendly. As such GreenEvo technologies support climate policy of the Polish Government, in particular strategic projects of the Ministry of Climate and Environment i.e. the Clean Air Programme and the City with Climate Programme.

The main areas promoted by GreenEvo include: circular economy, electromobility, adaptation to climate change, sustainable development, electrical efficiency, renewable energy sources and resource-efficient economy. These fields have been outlined following an analysis of current trends, legal regulations and strategies, financial means (support programmes) available on the market as well as the needs of the countries – the recipients of the technologies related to the environment and climate protection. As a result, GreenEvo becomes a tool used to implement the above-mentioned The 2030 National Environmental Policy, which aims at providing ecological security and a high quality of life for all inhabitants.

The main incentive to continue the GreenEvo programme was the fact that the number of Polish companies offering environmental technologies has been dynamically growing year to year. This in turn stems from the growing demand for infrastructure and solutions from that field. The growth is also induced by the real profits of the entities belonging to the "green sector".

A large number of national companies offering green technologies constitutes a great

potential and offers broad opportunities. First of all, these companies are distinguished by a high level of technical skills of their employees. The market of environmental technologies is relatively young, mostly based on modern and efficient organisational solutions. Moreover, the Polish technical thought, supported by adequate funds for research and development has been admired all around the world and is characterized by a high level of innovation. It must be also underlined that the management staff of these companies working in a difficult and changing legal environment has learned to be flexible towards current problems and to take advantage of chances they get.

The global market of pro-ecological solutions and technologies is mostly based on the services provided for institutional clients, companies or public bodies. This is one of the reasons why the support of the Ministry of Climate and Environment is often crucial in boosting the best technologies on an international level. In developing countries the technologies are purchased with the support of aid funds and the governments provide support for their locally-based companies. The development of technologies is based, among others, on the result of research and development works and requires a significant amount of capital outlays. It is thus necessary to support these entities which have already succeeded in their first actions or to help them at the beginning of their development path. Thanks to its innovative formula the GreenEvo enables the growth of potential and promotion of Polish innovative solutions internationally. It also stimulates the growth of production volumes and employment rates within this sector. Furthermore, it creates a platform of cooperation between small innovative companies and big entities from the environmental technology sector.

I believe that the technologies qualified for the GreenEvo project have a chance for international success. The global market of pro-ecological solutions and technologies is growing dynamically and it is therefore important that we leave a Polish trace in that field as well.

Michał Kurtyka

Minister of Climate and Environment
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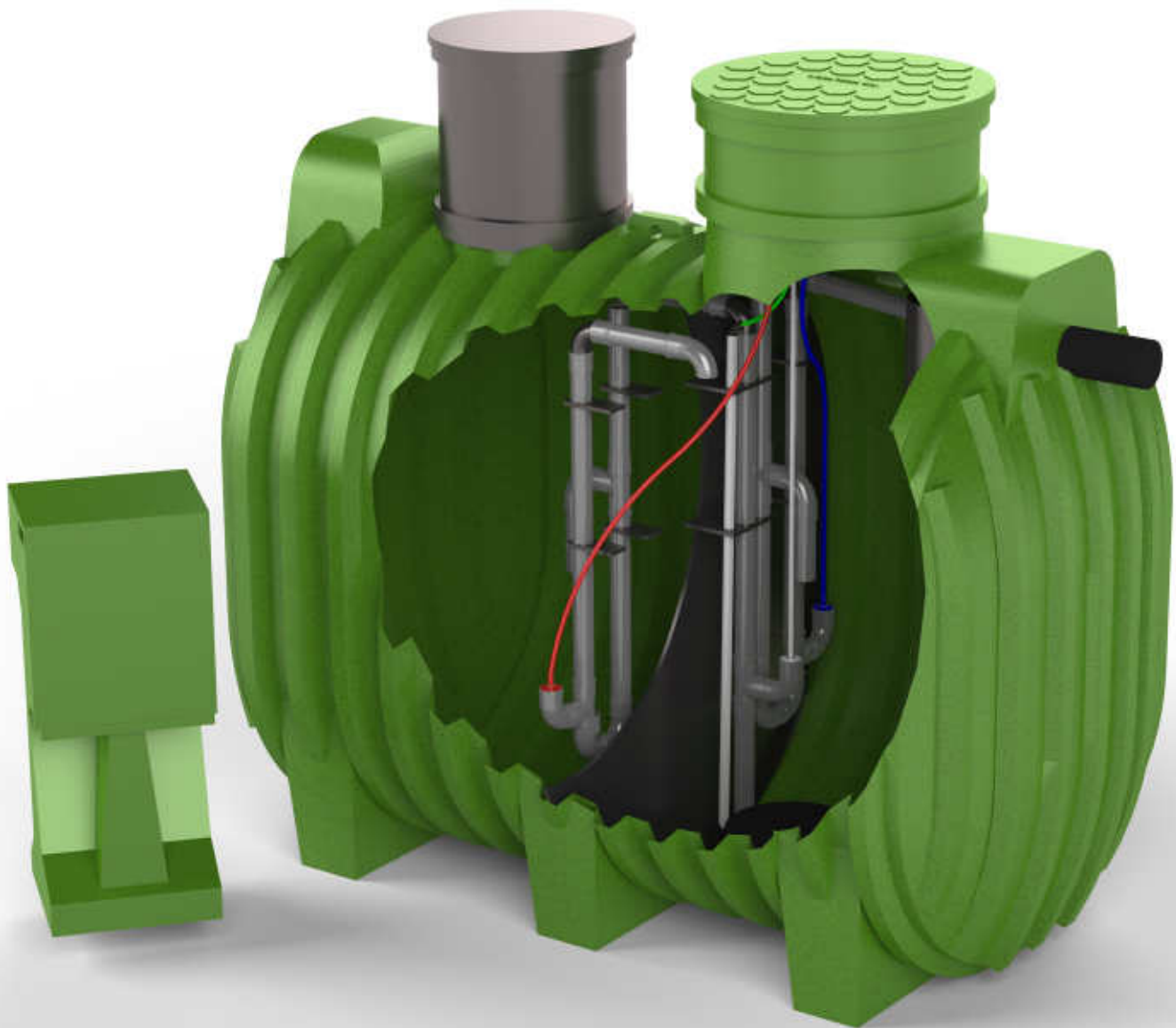
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NON-ELECTRICITY DOMESTIC WASTEWATER TREATMENT PLANT

Small wastewater treatment plants ARGOW are used to treat domestic wastewater from single- and multi-family households, agricultural farms, summer and other recreation cottages and public utility buildings which are not or cannot be connected to combined wastewater collecting systems. In contrast to competing solutions, the ARGOW wastewater treatment plant can operate in any terrain and climatic conditions, without using electricity, does not emit CO₂ into the atmosphere and ensures high wastewater treatment efficiency.

The non-electricity ARGOW treatment plant demonstrates the experience of Nature – the best environmentalist in the world. In ordinary wastewater treatment plants, the air is injected by blowers and pneumatic systems. Due to its natural aeration system and bacterial flora growth, the ARGOW technology combines the high-efficiency treatment using activate sludge and natural treatment processes using a biological bed. In addition, the bacterial flora emerging in the ARGOW treatment is much more diverse, ensuring its higher efficacy. The ARGOW technology is unmanned and uses no electricity. Moreover, it ensures high long-term treatment efficiency (as much as 95%). The solution can be adapted to locally produced tanks. It can be scaled up after many years have elapsed from the time when the treatment plant was built by adding new necessary elements. The ARGOW treatment plant includes no electrical or mechanical elements and for this reason the service period has been extended to 3 years.

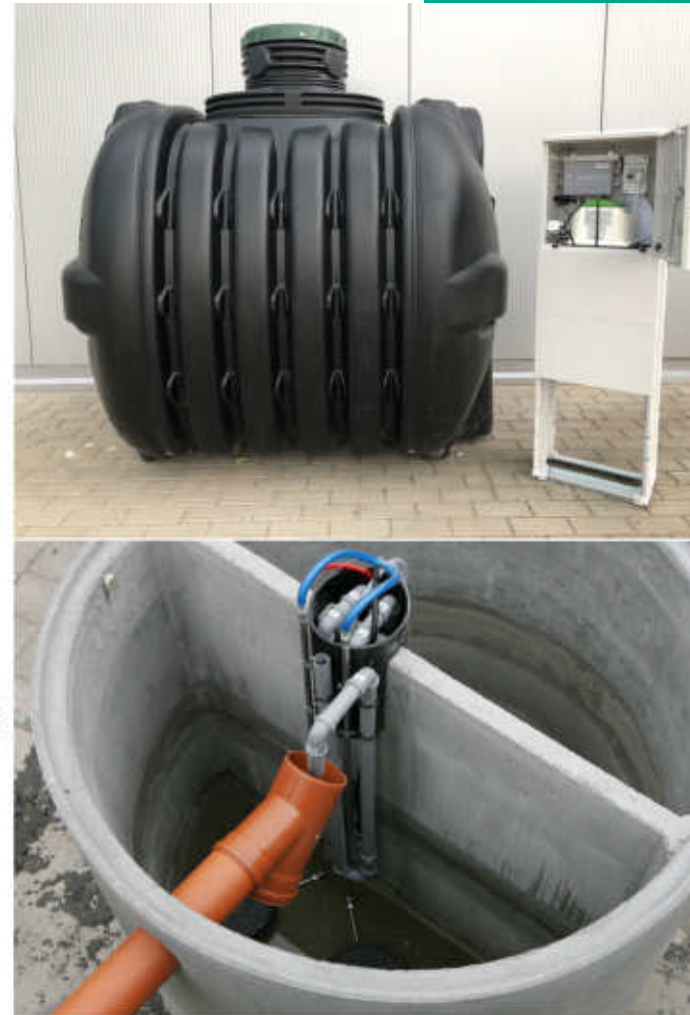
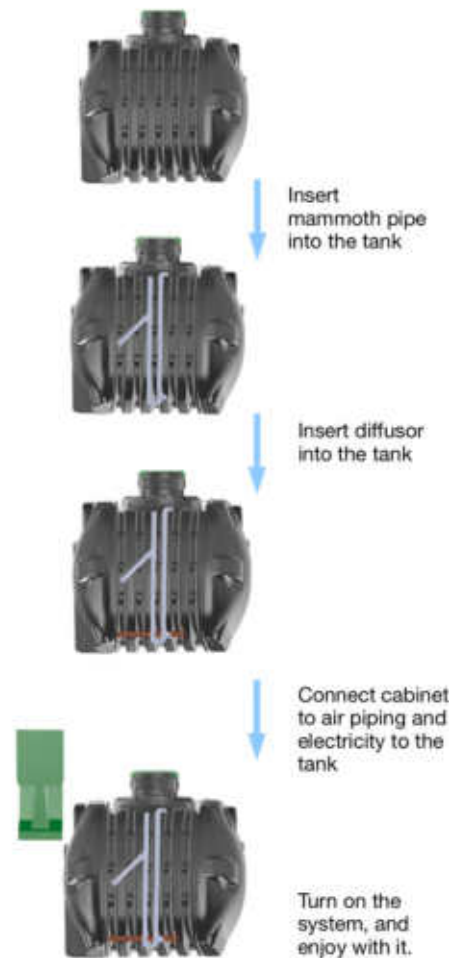
AVANTAGES DE LA SOLUTION :

- The operating technology without using electricity and mechanical elements (the energy intensity of the process is 0.00 kWh/d).
- A completely unmanned and quiet biological treatment plant.
- A short start-up period (up to 24 hours).
- High resilience to variable wastewater inflows.
- High long-term treatment efficiency (95%).
- Very low sludge production, sludge removal from the treatment plant every three years.
- Safe operation, a technology certified in the European Union (CE).
- Odourless treated wastewater can be discharged into rivers or lakes or can be re-used to irrigate farmland or orchards.

The ARGOW treatment plant can be installed on any sites where it would be expensive to build a combined wastewater collecting system and where the user would expect an unmanned solution with high treatment efficiency. The treatment plant can operate in any terrain, even without access to power supply. At present, ARGOW treatment plants are in operation e.g. in Lebanon, the United Kingdom, Zanzibar, Mongolia, and also on sites with the extreme conditions, e.g. those with temperatures reaching +50°C or at elevations of 2,000 m above sea level.

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QUMKAM® SBR ADAPTIVE SET



QUMKAM® SBR set is a high quality adaptive system dedicated for septic tanks, drainage treatment plants and cesspools. The implementation of the system can lead to the creation of a fully biological wastewater treatment plant, which is compliant with the European standard EN 12566-3 for any tank - concrete or plastic. Depending on the SBR type the QUMKAM® system guarantees a cleaning performance of up to 97,7% (BOD5) as well as 95,5% (COD).

QUMKAM® SBR is an advanced wastewater treatment plant operating on the basis of a low-capacity activated sludge technology in the SBR system (Sequential Batch Reactor) with an additional stabilising system for sewage sludge. The entire cleaning process is controlled by an automatic controller, which manages all operations of the treatment plant, such as aerating or sewage pumping by mammoth pumps. Such a solution enables the transition from a septic tank, drainage wastewater treatment plant into a fully biological wastewater treatment plant operating in accordance with the SBR technology, which is compliant with the European standard EN 12566-3.

The system is composed of only three elements, which can be assembled and prepared for operations in the septic tank in less than 60 minutes:

1. SBR CONTROLLER It is separated from its surroundings, secured in accordance with IP65 standard and equipped with a set securing from energy drops. The system operates on a plug&play basis. The controller is dedicated to treatment plants for 2 to 25 people. It does not require manual servicing - it is resilient to errors and mistakes of the user and it can be managed through a telephone application. It has been proven by faultless operations at more than 10,000 households.
2. SOLENOID VALVES

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Thanks to so-called quick disconnect couplings the valves are very easy to replace in case of a potential failure. The connection with the controller is provided through a telecommunication coupling IP65 and each controller may be exchanged/repaired on site. The valves are resilient to user's errors and may operate for at least 87,600 hours (10 years).

3. DIFFUSER, BLOWER, MAMMOTH PUMPS
The set consists of a membrane blower (60W for 6RLM), tube diffuser and a system of aeration pumps with all necessary connection elements. It all fits into two compact boxes, easy to transport and store. Each set contains a detailed assembly book.

ADVANTAGES OF THE SOLUTION:

- Fully automatic controlling system (plug&play) run through a telephone application.
- Silent and economic operations of the device, energy consumption up to 0,49 kWh/d.
- Easy assembly of the set in already existing or newly constructed septic tanks.
- Reliable operations confirmed by its application at over 5,000 treatment plants.
- High efficiency of wastewater treatment.
- Low costs of purchase and assembly.

QUMKAM® is truly a magic box enabling to transform a septic tank (a cesspool) into a modern treatment plant and to get rid of an unpleasant smell.

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ACTIVATED-SLUDGE METHOD OF SEWAGE TREATMENT

The BIOGRADEX® technology is used to treat sewage with activated sludge. The process can be used both in case of municipal and industrial sewage unless biological sewage treatment is not possible. The great advantage of that technology consists in the possibility to regulate the concentration of activated sludge in the tanks depending on the technological needs (in the winter - higher concentration, in the summer - smaller). However, there is no risk that the sludge will be washed out of secondary clarifiers, its "bulking" in the sedimentation tank. The application of the method in the process of sewage treatment allowing the degasification of the activated sludge before it reaches the secondary clarifiers enables to increase the concentration up to the level of 6,0–8,0 kg/m³.

High sludge concentration results in a significant reduction of nitrogen and phosphorus in the gutter. In the event of rain the sludge does not get out but it is gathered in the secondary clarifier even up to 0.5 m beneath the water level. Degasification of liquids just before they reach the clarifier results in the removal of mini gas bubbles both from the sludge blanket and the liquid itself. As a result the sedimentation in the clarifier is stable and the method itself results in the increase of the sludge concentration without the above mentioned defects.

ADVANTAGES OF THE SOLUTION:

- Decrease of the volume of bioreactor chambers over two times, which leads to the reduction of implementation costs.
- Stable operation of the treatment plant and much better results in clearing biogenes.
- Decrease in the treatment plant area and as a result decrease in negative impact on the environment.
- Reduction of the energy consumption during the process.
- Simple maintenance of the treatment process.

No other technology based on biological sewage treatment poses such features. The size and shape of facilities eg. existing chambers and sedimentation tanks is not an important factor - each existing sewage treatment plant can increase its capacity by up to 20-40%. It has been proven by projects implemented on both big and small facilities (from Q = 300 m³/d up to Q=100 000 m³/d for a single sewage treatment line). The BIOGRADEX® technology has been patented in Poland and many countries around the world. Facilities using that technology are located in Poland, Ireland, Estonia and Canada (Calgary).

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BIOLOGICAL WASTEWATER TREATMENT PLANT DAGAS BST-12

For facilities with various business profiles: public utility, chemical, oil refining, painting, coker plants, printing and food facilities, etc. the company Dagas offers a biological wastewater treatment plant DAGAS BST-12. That solution takes advantage of a so-called biological conveyor and is based on biocoenosis.

Biological wastewater treatment plant DAGAS BST-12 is composed of a joint line of anaerobic, aerobic and anoxic bioreactors, equipped with adequate fibrous conveyors with large open surfaces, where adequate biocoenosis is located. Each aerobic and anoxic bioreactor is in addition equipped with a valve connected to a blower transporting the air. At the beginning of the treatment process, starting from the side of sewage intake there are a minimum of three anaerobic bioreactors followed by aerobic and anoxic bioreactors, all of them amounting to at least four pairs.

In anaerobic bioreactors the fibrous conveyors hold anaerobic bacteria which are selected from a group of such bacteria as fermented, hydrolytic, denitrifying, reducing sulphates, heliogens and methanogens; in aerobic bioreactors - the organisms are selected from a group encompassing aerobic bacteria, protozoa, rotifers, crustacean, filter feeders, predators and fish; in anoxic bioreactors - bacteria are selected from a group of anaerobic ammonia oxidation such as Anammox, microorganisms reducing the ions of heavy metals, iron and arthrobacter. The process of biological wastewater treatment DAGAS BST-12 is conducted continuously without the retraction of activated sludge. The issue of sediment recirculation is non-existent and the technology significantly diminishes the amount of the excess activated sludge.

ADVANTAGES OF THE SOLUTION:

- Ten times less biomass in the treatment process.
- Four times smaller the volume of the bioreactors.
- Four times smaller the area of the treatment plant.
- Five times smaller the electric energy consumption.
- Costs of the waste logistics are limited to a minimum.
- Four times lower the costs of the construction of a wastewater treatment plant.
- Lack of activated sludge recirculation, one-direction constant process.
- Applicable to all types of sewage, including industrial and highly toxic such as sewage with dissolved organic substances, including xenobiotics.

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TECHNOLOGY FOR DRYING SEWAGE SLUDGE

For waste water treatment plants looking for waste management solution, we offer an ecological technology for drying sewage sludge in hybrid dryers, using renewable energy sources. This technology allows for environmental-friendly processing of sewage sludge and reduces its amount over than 3 times. Unlike the traditional dryers using fossil fuel, it is possible to dry sludge using low-cost alternative energy sources such as heat from biogas combustion, waste heat utilization from treated sewage, waste heat from cogenerator cooling and solar energy. This allows for drying of the sludge regardless of weather conditions and increasing of process efficiency.

The hybrid sewage sludge drying installations consist of drying halls similar to green houses with steel structure covered with polycarbonate or glasses plates. The main principles of drying operation is the solar effect and heating floor exploitation to water evaporation from sewage sludge. Inside the drying hall sludge is transported, aerated and granulated by a mechanical turning sledge device. The automatic ventilation system ensures humidity removal outside the drying hall. The drying technology causes wet sewage sludge to granulate during processing. As a result the mass and volume of sludge becomes more than three times smaller. This technology is one of the cheapest solutions for water evaporation. The evaporation of 1 tonne of water uses only 20-30 kWh electrical energy. The final product – dried sludge takes the form of a granulate and could be agriculturally or energetically used. The calorific value is similar to brown coal 12 MJ/ kg.

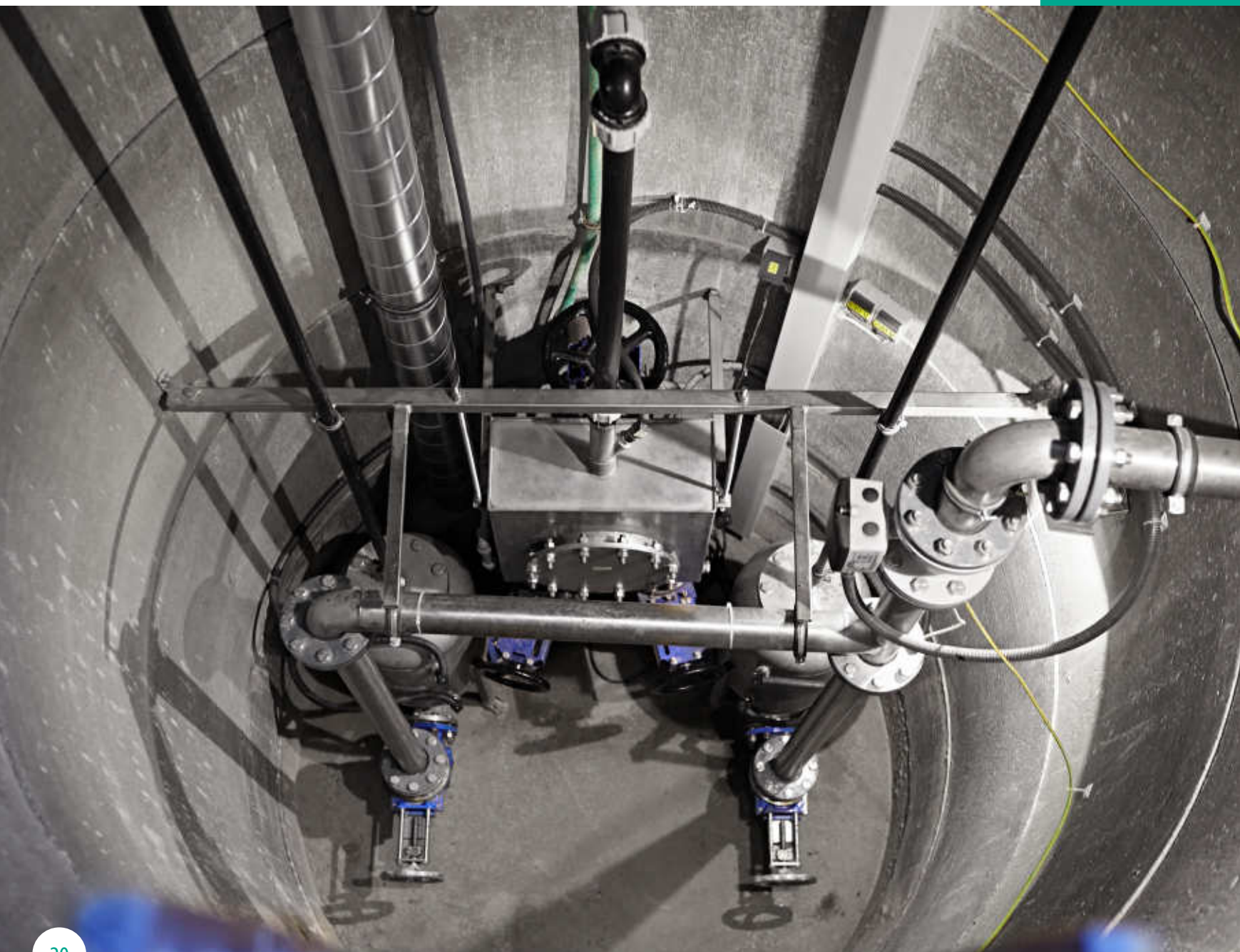
ADVANTAGES OF THE SOLUTION:

- Ecological technology allows for drying of the sludge regardless of traditional sources of energy – fossil fuel. No emissions of pollutants into the environment.
- The dryer could be an independent installation without providing conventional sources of energy.
- Cheap running costs and simple operation of the dryer.
- Full process automation, which does not require constant service.
- Over threefold mass and volume reduction of dried sludge.

The hybrid sewage sludge drying technology using alternative energy sources is successfully used in Kłodzko (Poland), where it is applied in the Centralna Słoneczna Suszarnia Osadów. The process of drying is conducted in a drying hall using solar energy, and under-floor heating delivered by a hybrid heat generating using renewable energy, created by heating-pumps which recover energy from the treated sewage. The dryer enables an annual yield of 1300 t of sewage sludge processed into granules with an average dry substance content of 80%. Hybrid dryers also function at the waste water treatment plants in Iława and Łomianki (Poland).

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EPP PNEUMATIC SEWAGE PUMPING STATION

For water and sewerage companies which face the problem of municipal sewage putrefaction in the pressure sewage systems the company EkoWodrol offers an EPP pneumatic sewage pumping station - innovative Polish technology consisting in pneumatic sewage pumping. As oppose to traditional systems equipped with pumps, a pneumatic pumping station refreshes pumped sewage, prevents them from putrefying and guarantees safe and hygienic operation. The technology enables to entirely empty the pressing pipeline using the same device, which shortens the time sewage remain in the pipelines.

The EPP pneumatic pumping station is used in placed where the construction of pumping system would be difficult or impossible. The technology enables to transport sewage over very large distances and heights using compressed air without the need to install pumps. Moreover, the technology is environmentally sound: in order to prevent the putrefaction of sewage the system uses a natural agent - the air instead of chemical compounds or water the resources of which are largely limited. The compressed air is used efficiently which enables to reduce the consumption of electrical energy.

ADVANTAGES OF THE SOLUTION:

- Refreshes pumped sewage and prevents putrefying during transport.
- Allows periodic aeration and entire emptying of the pressing pipeline using compressed air.
- Sewage pumping over very large distances or heights (pumping pressure to 13 bars).
- Allows the possibility to adjust the efficiency of the pumping station to the current needs of the users without replacing any equipment.

The technology has been implemented in the pumping station operating since 2011 in Przybyszewo k.Leszna. The parameters of that system are the following: flow capacity $Q_p = 15,6$ l/s and head $H_p = 2,35$ bar. That was the first time we used an external shelter which guarantees comfortable and safe service and operation of the device. The facility satisfies the requirements of the European norm PN-EN 12050-1.

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HYDROPHYTE BIOREACTOR WITH A BIOPREPARATION

For local authorities and the inhabitants of single- and multi- family buildings which seek a quick and easy-to-build wastewater treatment system, we offer a hydrophyte bioreactor with a biopreparation. Compared with competing solutions our technology is completely environmentally sound, cheaper to use and its operation does not require specialist knowledge, since automatic devices have been eliminated from it.

The hydrophyte bioreactor technology is an eco-innovative solution which ensures high-efficiency removal of organic compounds and nutrients from wastewater. Its design eliminates the impact of unfavorable weather conditions (e.g. sub-zero temperatures) on filter performance, maintaining it high throughout the year. The designed system of mineral and organic layers provides proper hydraulic conductivity and even spatial distribution of treated discharge into the soil. Moreover, its structure solution enables the bioreactor to be used under high groundwater level conditions. In addition, this technology prevents the emergence of oxygen depleted zones in the lower layers of the bioreactor, inhibiting the growth of anaerobic bacteria and, as a result, protecting mineral layers from clogging. Furthermore, the technological system of the hydrophyte bioreactor is supported by a biopreparation containing humic acids. Biopreparation affects the buffering capacity of the hydrophyte filter, adjusting and stabilising its chemistry and enhancing its biological activity. This activates the effective mineralisation of organic compounds contained in wastewater. The technology is based on 3 inventions and draws on the results of its own research.

ADVANTAGES OF THE SOLUTION:

- High efficiency – the elimination of more than 90% of organic pollutants.
- Resilience and high tolerance of changes in pollutant loads and fluctuation in flow.
- The construction of the bioreactor takes one day.
- Low investment outlays and operating costs.
- The biopreparation used is environmentally sound.
- The dosage of the biopreparation enhances the efficiency of nitrogen and phosphorus removal from wastewater and the biodegradation of organic substances.

The synergy between the bioreactor technology and the biopreparation contributes to high efficiency of wastewater treatment. Since the technological system uses the biological processes mimicking natural wetland environment, it requires only periodic, uncomplicated on-site labor. Due to these advantages, the technology is very popular among residents of rural areas and local authorities in Poland.

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ANAEROBIC MEMBRANE BIOREACTOR ANOXYMEM®

AnoxyMem® is a proprietary system elaborated by the company SYMBIONA thanks to years of research. It provides the highest efficiency of anaerobic wastewater treatment or the efficiency of methane fermentation process maximising biogas yield/production of green energy.

It is a high-efficient anaerobic membrane bioreactor (AnMBR), which combines features of a classic anaerobic CSTR reactor based on the idea of a fermenter with the benefits of a membrane separation. A semi-permeable barrier made of specially designed membranes separates the permeate from the biomass, returning the latter to the methane fermentation reactor. It guarantees a very high efficiency of the fermentation system in a very short time without stopping the methane fermentation process and with a high load of the reactor (up to 15 kg of the COD/m³). Special construction enables the increase in the production of biogas of even more than 30% in comparison to standard methane fermentation solutions. This zero-emission system is not spacious - it requires 4 times less space than other anaerobic reactors - and the monitoring, potential repairs and expansion are very easy.

AnoxyMem® may treat, depending on the configuration:

- Wastewater containing from 60 000 to 200 000 mg/l with up to 99,7% of COD removal on a single anaerobic step.
- Mixtures of sewage and organic/production waste containing grease or suspensions of up to 10% of dry matter, with high concentration of biomass in the reactor, reaching the highest reduction of dry organic matter on the market.

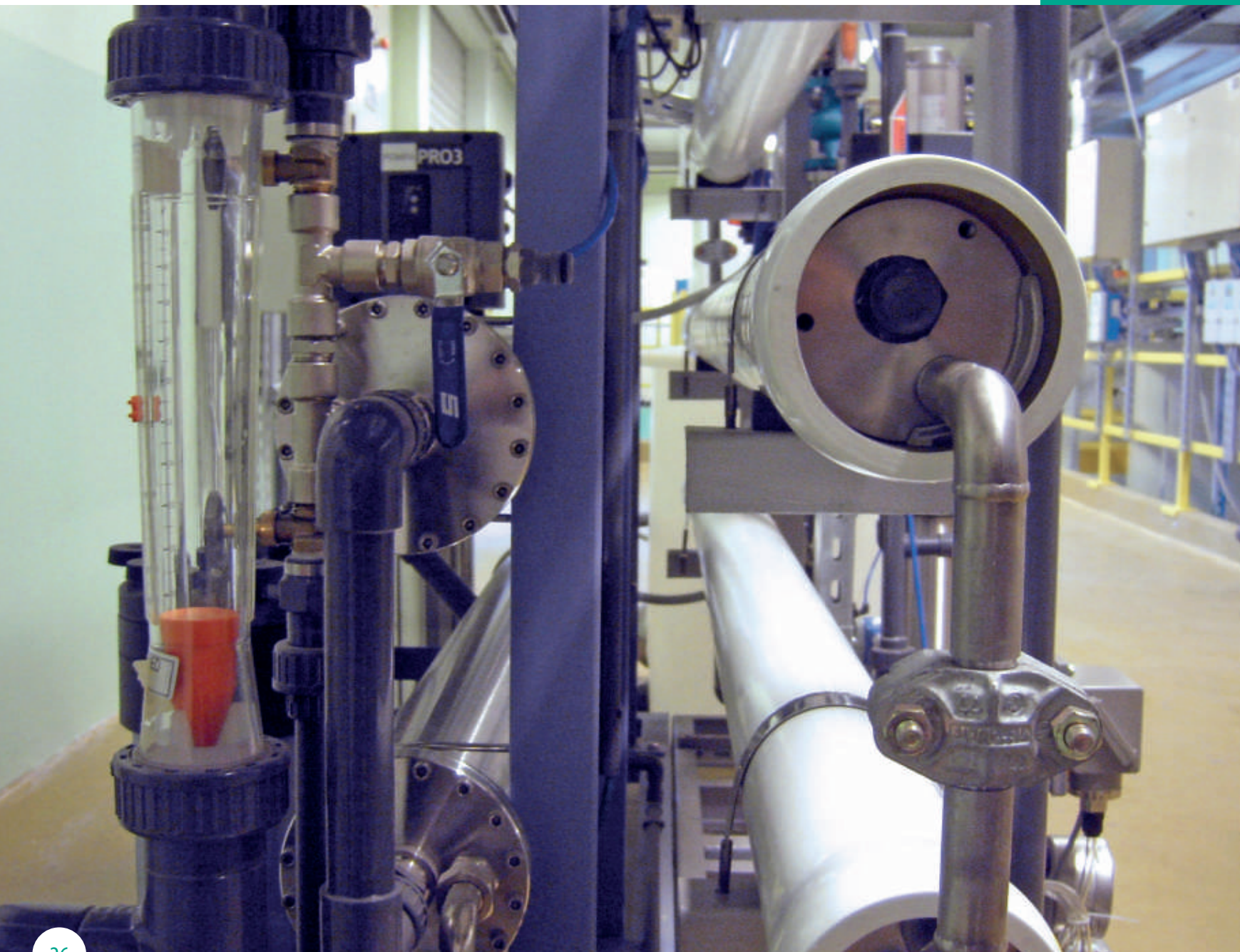
ADVANTAGES OF THE SOLUTION:

- Wide range of the bioreactor operations - sewage, sludge, sludge mixed with sewage, production waste - even up to 10% of dry matter.
- Very significant reduction in parameters - COD up to 99,7%, dry organic matter up to 86%.
- Maximum biogas yield - more self-produced green energy to cover the needs of the plant.
- Treatment of wastewater or a mixture of sewage and waste/sludge without a prior removal of suspension and grease.
- Facilities smaller than classic reactors, with higher treatment parameters and greater production of green energy.
- Low COD level in the effluent (does not require an intensive and expanded post-treatment) or in the clean water from the reactor if operating in the SFC functionality (a separated fermentation chamber).

AnoxyMem® is dedicated to food manufacturers (dairy industry, production of sweets, bioethanol, alcohol, etc) and to all other facilities, where the sewage is highly polluted, sludge contains grease and a high level of suspension. The technology can also be used in the public utility sector as a way to intensify the gasification of sewage sludge. The system is fully compliant with the requirements of a circuit economy.

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ROVAPO® TECHNOLOGY

No emissions, no waste, no problems with clean water recovered from industrial waste products. In this one sentence you can describe the technology of ROVAPO™, which enables the production of very clean technological water. ROVAPO™ is a closed water circulation technology that minimizes energy consumption and resulting waste products. It is a technology as clean as the water it generates. ROVAPO™ also means a high level of water recycled for repeat use (up to 95%).

ROVAPO™ is an original solution supported by a range of patents. It is part of the technology family named “zero liquid discharge” and enables full recovery of water from sewage.

Depending on the industry, the ROVAPO™ system enables the recovery of demineralised water of <10ms, e.g. for galvanizing production, superclean deionised water, e.g. in photovoltaics or pharmaceuticals, or water with parameters allowing its repeat use in production processes. ROVAPO™ technology encompasses a range of treatment levels, allowing the achievement of the established goal: selection of streams and chemical treatment, membrane systems and evaporation systems. ROVAPO™ technology has been designed for waste products from galvanizing processes and hightech industries. The basic configuration can be interchangeably supplemented with components for use on other waste products – initially treated chemically and biologically with an active sediment and ultra-filtration membrane (MBR AeroMem™ Reactors). In the newly-developed ROVAPO-HF configuration, it is possible to fully clean wastes from the extraction of shale gas.

ADVANTAGES OF THE SOLUTION:

- It enables the recovery of water from waste products with an efficiency level above 98% (including recovery of high-quality water from waste subjected to biological filtering).
- It is based on original programming that steers the automated functioning of the installation, independently of varying quantities and compositions of waste from production, as well as ensuring a constant output level from the unit.
- It reduces to a minimal level the amount of waste output – the one waste product is a concentrated deposit from the chemical element and concentrated salt from an evaporator containing approx. 50% dry mass.

The first investment using ROVAPO™ technology was designed and installed “ready to go” in 2006 at the aviation facilities of Augusta Westland PZL – Świdnik. It was Poland’s first modern waste treatment plant with a fully closed water circulation from the new galvanizing plant. Instead of galvanization waste products in a classic treatment process being led to the municipal sewer system, high-quality demineralised water is produced from sewage with strictly defined and guaranteed parameters. It is returned to production processes in a modern galvanization plant servicing the production of aviation parts. In 2010-2019 a new ROVAPO™ installations were activated, in particular in aviation and automotive industries.

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ANOXYBED™ TECHNOLOGY

For bioethanol, wine, dairy cheese, milk and juice producers who need a stable and economical effluent treatment solution, we offer the AnoxyBed technology – a high-rate tower anaerobic reactor. On the contrary to the classical biogas technologies, Anoxy-Bed ensures a sustainable and stable biogas source, balanced treatment results and low investment costs.

The AnoxyBed technology is a very efficient tower anaerobic reactor. The main element enabling the development of methane-producing bacteria, is a floating bed with biomass. The reactor reduces pollutants and, at the same time, converts them into biogas providing a sustainable and safe energy source. Moreover, the treated effluent requires only slight additional treatment before it is discharged into the sewage system or river. AnoxyBed can efficiently operate at higher suspension rates at the input and lower temperatures than those of classical anaerobic reactors (26-37°C). The problem of an unexpected biomass escape from the reactor is also absent. The technology is capable of operating on a continuous or cyclical basis, according to the wastewater inflow. The technology enables an effective operation of the system. Its capacity allows to treat wastewater ranging from 2,000 mg/l of COD (chemical oxygen demand) to very high concentrations, even 20,000 mg/l of COD. The technology proves to be attractive for economic reasons the technology is attractive in economic terms and ensures fast return in a two-years operation period.

ADVANTAGES OF THE SOLUTION:

- Effective COD reduction to 92%, the BOD reduction to 95%.
- Allows for methane production at a level of 0.45m³ of biogas from 1 kg of COD.
- Efficient operation – for a small surface area of the wastewater treatment plant, e.g. 350m², and the pollution load of 7,000 kg/day of COD.
- A significantly lower investment level comparing with traditional biogas solutions – the installation occupies less space.
- The technology structure prevents the biomass medium from escaping from the reactor.
- The technology can utilise the existing infrastructure – tanks, pipes – reducing the cost and time of its implementation.

The first application of the technology in Poland, works at a large plant producing apple juice concentrate. The quantity of treated effluent varies from 1,000 m³/d COD to 10,000 mg O₂/l COD. After the AnoxyBed reactor, the effluent is additionally treated at/in the MBBR reactor. Such treatment removes all contaminants so that the effluent may be discharged directly into a watercourse. The wastewater treatment plant occupies only about 500 m² of built up space, allowing the production plant to expand further. Due to its special design, it has no impact on the environment; as it does not emit odours or cause noise pollution.

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SYMBIO BIOMONITORING SYSTEM

The SYMBIO biomonitoring system from the PROTE company is an early warning system against the contamination of water intended for consumption. It combines the natural, dependable bioindication method, based on living organisms called bioindicators, with modern technology that enables automatic water monitoring and archiving the data. SYMBIO sets the current standards for water security.

The system operates based on bioindication. Eight specimens of the freshwater mussel (Latin: *Unio tumidus*), placed in the SYMBIO flow-through tank, are equipped with a probe that co-operates with a magnet stuck to the mussel's shell. The probe records the degree of each mussel's openness and its natural bio-rhythm comparable to human's ECG.

The data is sent to a controller that processes it, and further, to a computer, which visualizes and archives it, and provides reports. It enables us to evaluate the current system operation, and to keep track of the mussels' activity in the past. Mollusks are sensitive organisms, thanks to which the water utility company, every single second, receives the information, whether the water is suitable for consumption. A sudden closure of the mussels' shells indicates an adverse change in the parameters of water. In such a case, SYMBIO generates an alarm, to which the laboratory can quickly react, taking water samples for analysis.

As SYMBIO is an online system, it can send an alarm signal to a selected e-mail address or mobile telephone number. The mussels work in the unit monitoring the water for three months. After that time, they go back to the lake from which they came, and a new set of organisms, which will monitor the quality of water for another quarter, is installed in the system.

ADVANTAGES OF THE SOLUTION:

- One of the most efficient technologies for water monitoring, proven by years of experience of the PROTE company (50 units operating in Poland, supervision over water quality for more than 10 million people).
- It enables a quick reaction in case an adverse change in water parameters is detected.
- The system operation increases the sense of the security of the potable water users, and it is a commonly accepted method of water monitoring.
- It guarantees a better perception of the image of its users, as the natural methods using living organisms are becoming more and more common and reliable.

At present, the number of operating SYMBIO biomonitoring systems enables us to think of it as a new standard in terms of methods incorporating freshwater mussels for monitoring water intended for consumption, production, and technological purposes.

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THE PROTE-FOS LAKES RECLAMATION TECHNOLOGY

The PROTE-fos Lakes Reclamation Technology is a comprehensive service dedicated to private and public entities that own or manage water reservoirs affected by progressive eutrophication. The final results achieved with the PROTE-fos technology are: obtaining a clear-water state by halting the process of phytoplankton blooms caused by cyanobacteria, as well as improving water transparency. The PROTE-fos Technology involves blocking phosphorus directly in the bottom sediment during its controlled resuspension, followed by its permanent consolidation. Only the inactivation of phosphorus in the sediments excludes the re-bloom of water after its purification.

The PROTE-fos Technology is mainly a method of chemical inactivation of phosphorus in the lake's bottom sediment, as an element which is responsible for generating algal blooms in the lake. For the best possible results, the PROTE-fos method is facilitated with individually selected complementary techniques (biological and mechanical ones). The innovativeness of PROTE-fos involves the controlled application of chemical substances directly into bottom sediment with the use of the patented, two-module vessel PROTEUS. Thanks to such a comprehensive and individual approach to each lake, the PROTE-fos method effectively accelerates natural self-cleaning processes which occur in it.

ADVANTAGES OF THE SOLUTION:

- Innovativeness – the method is unique and less radical than previously used solutions (such as dredging of bottom sediments, pumping/filtering of water).
- Comprehensiveness – the technology contributes to the restoration of balance in the entire water reservoir, it does not consist only in chemical blockage of phosphorus.
- Confirmed effectiveness – the method has been successfully implemented over several lakes in Poland and oversea areas (Bay of Puck).
- Scientifically-proven efficiency - the technology utilizes the latest knowledge regarding water ecosystems and their functioning.
- The guarantee of positive ecological result - the possibility to implement a project based on a guaranteed result agreement.

PROTE-fos technology has received numerous awards (including the Polish Promotional Emblem TERAZ POLSKA and a Gold Medal of the POLEKO International Ecological Fair) and positive feedback. The European Commission awarded the comprehensive reclamation of two lakes located in Gniezno (Lake Jelonek and Lake Winiary) as one out of five best projects co-funded within the Life+ program. It was all due to obtaining a positive ecological effect (the permanent improvement of water transparency, an increase in biodiversity and the reduction of phytoplankton bloom).

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OZONE WATER TREATMENT SYSTEMS

Treating water for all branches of industry with the use of ozone and quartz filtration is a simple, ecological and safe way of obtaining the highest quality water possible. WOFIL installations are fully computerised and monitored over the Internet. As a result they can be installed anywhere in the world and we can be sure to receive a convenient and rapid service.

WOFIL offers technologically advanced water treatment systems using ozone technology and free radicals, without the need to apply artificial chemical substances such as chlorine, coagulants or potassium permanganate. The technology is completely safe, environmentally friendly and based fully on processes occurring in nature. The only difference is that ozoning processes take place much faster and can be fully controlled. The universality of the technological solutions allows the technology to be used in many branches of industry, such as in drinking water production for municipal water systems, bottled water and beverages, as well as in producing water for cooling applications in the energy industry. The ozoning technology is also used in washing and disinfection of bottles and packaging, as well as in the washing and disinfection of fruits, vegetables and meat, and also in pools and spas. By dividing the installation into modules of technological sequences, the manufacturer guarantees a high reliability of the installation as well as uninterrupted operation during service inspections and repairs. Multi-block ozone generators used in the solution enable the alternating functioning of individual blocks, as well as the possibility of their expansion.

ADVANTAGES OF THE SOLUTION:

- For assembly of a WOFIL installation or modernization of an existing water treatment station, only a small area is needed.
- There is no need to employ highly qualified technical crew to operate the system.
- Minimization of the risk of production outages and lowering of operating costs.
- The work of one or several ozone generators enables its output to be adjusted to current needs as well as to reduce wear and tear.
- The technology and unit possess the appropriate permits, certificates and certifications.

WOFIL installations are characterized by ease of use and years of flawless functioning. The design foresees the possibility of working at 50% over capacity during periods of increased demand for water. In special cases the system can be overloaded to twice its capacity. Installations are prepared to process water of extremely negative parameters. In 12 years of operations the company has installed approx. 200 "ready to go" water treatment stations in Poland and has conducted activity on the Romanian and Ukrainian markets.

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STREET LIGHTING MANAGEMENT SYSTEM

The APANET Green System technology is recommended for companies, local government authorities, resident communities and entities that search for solutions reducing the costs of outdoor lighting and lowering CO₂ emissions. The smart street lighting management system APANET enables to rationalize the consumption of electrical energy and as a result reduces the level of CO₂ emissions. It uses traffic volume data and the readings from the weather stations to adapt the lighting system to the current traffic conditions, no more than it is required by the legal regulations and is necessary for security reasons.

The modernisation of the lighting consisting in the implementation of the management system enables the electricity consumption savings reaching of up to 70% and the reduction of costs related to the lighting system servicing of up to 55% thanks to a full control over the infrastructure. In the event of a malfunction the system automatically notifies the servicing team about the location and the source of the failure. The team does not need to turn off the power supply to find and remove the system malfunction. The main advantage of the APANET system consists in the use of open communication protocols at each stage of data transfer, which is confirmed by the certificate issued by the organisation LonMark International. Openness and interoperability are the key features of the modern systems as they allow for an integration and mutual communication between the systems that are part of the Smart City project, including in particular the ITS system. Our openness can be confirmed by specific installations such as the lighting system in the section of A1 highway - a project in which APANET system has been integrated with weather stations and radars monitoring road traffic volume. We will also soon be able to take pride in the integration with ITS system that is currently implemented in Tychy. The access to the system

is possible through an internet browser with the use of the encrypted protocol HTTPS/SSL (providing security for users) from any device that has access to the Internet: computer, tablet or smartphone. The communication between lamps is possible through existing power supply cables (European LonWorks PLC standard). Therefore, there is no need to install additional communication cables.

AVANTAGES OF THE SOLUTION:

- Management of outdoor lighting - individual and automatic powering on or off as well as power restriction functions.
- Monitoring the active and passive electrical energy consumption of the lamps and other devices powered from the same installation, such as Christmas lighting, monitoring, electric vehicle charging station, etc. Constant measurements of active and passive energy, power coefficient and THD.
- Detection of correct lamp functionality and in the event of a system malfunction the appropriate authorities are automatically notified.
- Reduction of the energy consumption even by 70%, reduction of management costs by 50% and reduction of the CO₂ emissions by more than 55%.

Openness and interoperability are the key features of the modern systems as they allow for an integration and mutual communication between the systems that are part of the Smart City project, including in particular the ITS system. Our openness can be confirmed by specific installations such as the lighting system in the section of A1 highway - a project in which APANET system has been integrated with weather stations and radars monitoring road traffic volume. We will also soon integrate with ITS system that is currently implemented in Tychy.

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TECHNOLOGY OF FAST CONSTRUCTION OF PASSIVE AND ENERGY-EFFICIENT HOUSES

For construction companies and developers constructing residential buildings who want to expand their offer by adding passive and energy-efficient buildings with are durable and the maintainance of which is cheap, the company IZODOM offers a comprehensive construction technology. The solution proposed by IZODOM enables a fast construction of high quality and durable energy-efficient buildings without the need to lease expensive construction equipment or to hire additional specialists.

That technology proves that the construction process does not need to be long, complicated nor expensive and that the heating and air conditioning costs are not always high with respect to residential building. It gives to local construction companies a possibility of erecting single-family and multi-story buildings in which the heating and air conditioning costs may be even ten times smaller than in traditional solutions. IZODOM, operating since 1990 in 43 markets in Europe, Asia and Africa, has elaborated a set of materials used for the construction of substructures, walls, roofs and rood insulation which are most useful when there are no qualified workers or heavy construction equipment. Thanks to large and light elements the construction process can even be five times shorter than in traditional technology and the launch of construction works requires only trainings offered by IZODOM. The company has at present an unquestionable leading position among European suppliers of advanced technologies for passive housing. Moreover, as one of 300 companies in the world it has been distinguished by the united Nations Environment Programme "Caring for Climate". The company offers free consultations and elaborates appraisals of construction projects. It does not impose the construction in accordance to its own designs, but adapts the technology to local

architecture and climate conditions. For larger projects the company is able to install a local production plant of the construction materials.

ADVANTAGES OF THE SOLUTION:

- Heating and air conditioning of houses built in the IZODOM technology are ten times cheaper, the buidlings are warm in the winter and cool in the summer.
- The buildings are designed to last for over 100 years.
- Houses can be erected in seismically active areas, up to 6 degrees Richter.
- IZODOM enables to local companies to shorten the construction process by five times without the additional investments in equipment and new specialists.

IZODOM has at present an unquestionable leading position among European suppliers of advanced technologies for passive housing. As one of 300 companies in the world it has been distinguished by the united Nations Environment Programme "Caring for Climate". It has erected over 19 000 buildings among others in Germany, France, Sckandinavia, Russia or Ukraine. The IZODOM technology was used to erect 3000 villas in the United Arab Emirates and the royal palace in Morocco with a utility surface of 10 000 m². The company holds construction certificates and permits required by the European Union, ISO certificate 9001:2008 as well as a wide range of information materials for constructors.

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MONOLITHIC LOAD-BEARING STRUCTURE FROM FOAMED POLYSTYRENE

This unique energy-efficient construction technology is the solution for investors, developers and construction companies seeking high profits. Unlike other available technologies, our solution helps to achieve a passive housing standard (zero or plus energy) with costs similar to traditional construction. An average building takes only six to eight weeks to erect. Buildings can also be erected on land with very low bearing capacity, and no heavy equipment or highly qualified employees are needed to do that.

The unique M3 SYSTEM technology enables low cost production in regards to construction and maintenance, residential buildings whose heating /cooling costs are approximately seventy percent lower than those of traditional buildings. The Expanded Polystyrene (EPS) in the form of prefabricated elements forms the supporting structure and, at the same time, thermal insulation of the building. This technology allows for fast and efficient construction; a four-person team can erect a building in just four weeks. This technology provides the ability of establishing a low cost manufacturing facility for the Expanded Polystyrene (EPS) monoblocks.

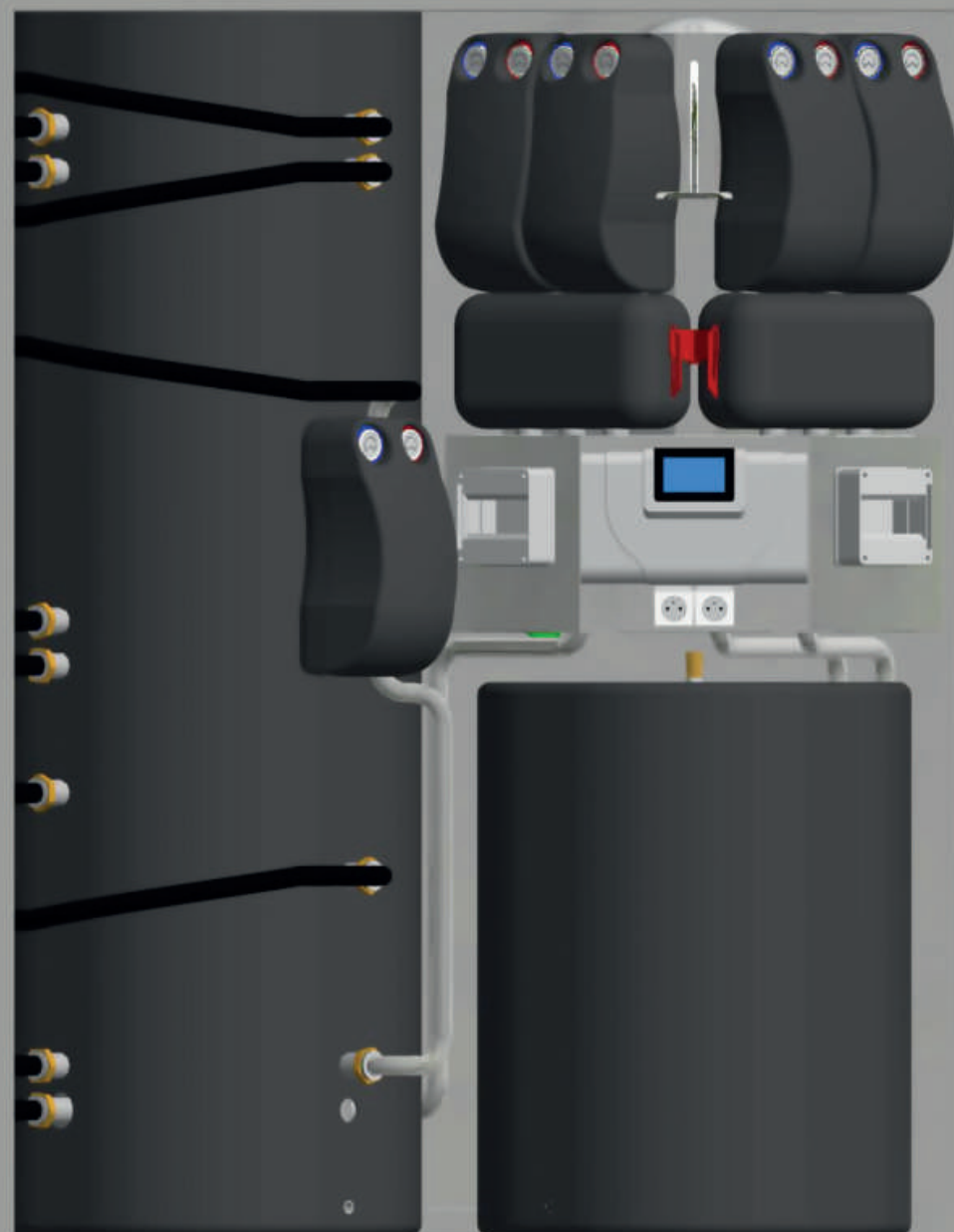
ADVANTAGES OF THE SOLUTION:

- This technology allows for building modern, functional, economical and energy efficient residential buildings.
- Due to the material's low weight, it is easy to transport, unload and assemble the building.
- The inexpensive construction can be easily erected on any type of land, even land with low bearing capacity.
- This technology allows for a passive housing standard (zero or plus energy) with small additional costs.
- It enables for an innovative and portable plant manufacturing platform.

BASF is our Strategic Partner in implementing the technology worldwide; on local markets we work with EPS producers receiving BASF products. The contractor invests only in special line for cutting out elements from EPS blocks supplied by a local supplier.

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INTEGRATOR SMART

For the owners of single-family houses, Makroterm has developed an innovative system of heating and air conditioning, as well as domestic hot water supply, based on optimally combining renewable and conventional energy sources. It ensures a standardized, quick installation, low operating costs, and optimum performance of the entire system. Consolidation of distributed energy sources into one system allows households to save energy, improves home comfort and energy security through diversification of sources of heat.

Makroterm offers an integrated heating and cooling solution for your home. It uses solar collectors and biomass energy in conjunction with a heat pump or conventional boiler. The heart of the system is the INTEGRATOR module which connects and distributes streams of energy, playing a role of a heat and cold buffer, and optimizes the working of various heat sources. The technology enables for the connection of any heat sources - renewable and traditional with any receiver: floor heating, recuperation, heaters and fan coil units. Hot tap water is processed in a hygienic way. An intelligent control system with a remote access ensures an optimum operation of heat sources and receivers. Solar power can automatically be stored and used for space heating purposes. There is no problem with overheating of the solar installation. In turn, the biomass device can be used as the main source of heat for the building, providing space heating and hot tap water in the absence of sunlight. The system is also adapted to work with another source of energy – a conventional boiler or a heat pump. Using a heat pump in conjunction with fan coil units additionally allows active space cooling.

ADVANTAGES OF THE SOLUTION:

- Heating and cooling in houses consolidated into one integrated system, and synergy of renewable energy sources.
- Large savings on the building's operating costs, and energy security of the household.
- Modular and standardized installation system, optimized and harmonious equipment operation.
- Possibility to disconnect individual devices while maintaining continuity of operation.
- Installation can be programmed according to individual user needs.
- Prevention of solar installation overheating.
- Easy service and maintenance of the installation.

The system works thanks to full synchronization of all those devices. A control device supplied with the system ensures an automatic operation of the equipment and the effect of synergy. An important feature of the INTEGRATOR is the function enabling blocking of the operation of heating devices, in order to avoid duplication of energy sources, which allows for optimal use of system components. The presented system is unique, as it allows the integration of several energy sources and an innovative consolidation of heating and cooling systems. This increases comfort and reduces the costs of operation. The positive effect on the environment brought about by the use of energy from renewable sources is also significant.

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THERMODYNAMIC CONSTRUCTION SYSTEM H-BLOCK®

For general contractors, construction companies and developers who offer their customers energy-saving residential and public utility buildings, we propose innovative thermodynamic construction system – H-Block®. In contrast to traditional technologies, it enables fast installation of warm, well-insulated, air-tight and cheap to run buildings by using lightweight and very resilient construction and insulation elements.

Solcraft Ltd specialises in the production of the new-generation energy saving and environment-friendly construction and insulation system H-Block®. H-Block® is a box shaped structural insulated panel made of polyurethane foam permanently combined with wood-based OSB panel. H-Block® panels are connected with special LHB joints also filled with polyurethane foam in order to ensure air tightness of a building. The polyurethane core is resilient to the impact of most organic solvents, acids, bases, insects, rodents, fungi, moulds, water and temperatures of up to 230°C. Its insulating properties do not change over time and it does not age or absorb moisture. Polyurethane foam core integrated with I-beam construction and OSB, provide H-Block® with unique mechanical properties: bearing capacity of external walls up to 4 floors, beamless ceilings, reduced roof structure. Although H-Block® is mainly used as a load-bearing element, it can also be applied to fill in wooden, steel or ferro-concrete structures. It is worth to mention that H-Block® is world-class thermal insulator, which makes it a perfect material for the construction of energy efficient and passive buildings.

ADVANTAGES OF THE SOLUTION:

- A lightweight, resilient and energy-saving construction material.
- Very good insulating properties of the building – no need to use traditional heating/air-conditioning systems, no heat loss, lower heating costs of the building (by as much as 50 PLN a month for a 100 m² house).
- Thin walls in the H-Block® technology – a larger useful area for the same built up area.
- Quick assembly of residential buildings and public utility sites.
- Resilience to solvents, acids, bases, insects, rodents, fungi, moulds, water and high temperatures.
- The insulating core does not change over time and does not age.

The construction of a house using the technology of prefabricated H-Block® panels is cheaper by as much as 55% than that of the timber frame technology; among others, due to the savings ensured by the short duration of the construction, low water and power consumption and a small quantity of waste. The H-Block® technology has been used e.g. to build the first passive housing estate in Poland and a passive office building.

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GEOHERMAL HEAT PUMPS

For individual clients or institutions, which need a cost-efficient, environmentally-sound and maintenance-free system for heating premises and tap water and for air-conditioning WSK Kraków offers a geothermal heat pump VATRA. The company delivers high-performance devices with heating power from 6 to 240 kW and more, zero direct emissions of toxic compounds in the atmosphere and equipped with a control system enabling the connection of the pump to all kinds of installations.

The heat pump VATRA is a heating-cooling device which collects heat from the ground and transforms into the energy used for heating and cooling buildings and heating tap water. Geothermal heat pumps are used by individual households as a heating-cooling device as well as by the industrial sector (greenhouses, cold rooms, swimming pools) for heating and cooling public utility buildings. The heat pump VATRA is distinguished by a high efficiency ratio (4,5) which results in a significant reduction of heating/cooling costs in comparison to traditional methods. Moreover, the VATRA technology does not emit any compounds that can be harmful for natural environment. The pump is very durable and operates in silence. Heat pumps produced by the WSK Kraków are used as independent basic energy generators or in cogeneration systems, where the operation of the heat pumps is combined with other generators such as GCHP (gas combined heat and power) or solar panels. The heat pumps manufactured by WSK Kraków take advantage of lower heat resorts such as ground resources, technological and waste heat, water reservoirs, wells as well as a water pipe bypass. The novelty among the VATRA range is a heat pump named Dual Inwerter, which due to its two-level system and a maximum power supply temperature of

85°C may operate both with low-temperature installations, in particular with floor or wall heating systems and with installations dedicated to operate on the level of 85°C. The pumps may work on level 1 (60°C) without the need to operate on the higher level (85°C). That dynamic temperature division enables to use weather algorithms for each heating circuit. The heat pump VATRA Dual Inwerter is designed for heating and air-conditioning premises with a surface of at least 500 m².

ADVANTAGES OF THE SOLUTION:

- High performance device - lower bills for heating premises/air conditioning/heating tap water.
- Maintenance-free - there is no need to spent time on maintenance of the device; easy and user-friendly control over the the operation of the device.
- Silent operations.
- Zero local emissions of pollutants by heat pumps - positive impact on the natural enviroment, clean environment.
- Waste-free operation; the installation does not require and specific place for stocking fuel.

The recipients of the VATRA technology are the following: industrial compounds, public institutions and individual clients. The technology of heat pumps produced by WSK Kraków has been used among others at the Centre of John Paul II "Do not be afraid" in Kraków, in the Convent of Discalced Carmelites nuns in Łódź, the Primary School in Mniszów, the Cultural Centre in Witkowo and in many others public utility buildings as well as in residences and houses of individual clients.

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DEFIBRATECH 1.0 TECHNOLOGY

DefibraTech 1.0 technology applies to the production of fibrous pulp from lignocellulosic fibres from agricultural biomass (cereal straw) as well as to the production of composite boards of low and medium density. The use of an agricultural biomass, which is a quickly renewable raw material, absorbing CO₂ during growth helps to reduce the carbon footprint of the final product.

The boards of low density serve as an insulator in the energy-efficient and pro-ecological construction industry. A high thermal capacity and a low heat transfer coefficient of the material provide protection of the buildings against overheating in the summer and excess cooling in the winter. Moreover, the material has a high capacity to protect against impact and airborne sounds, being therefore used as an acoustic insulator. Boards of medium density produced from fibrous pulp are used in furniture and packaging industries.

The essence of the invention lies in the way of manufacturing fibrous pulp, which then are then used to produce the boards. Cereal straw is ground to a form of stems of 10 do 50 mm, which then undergo hydrothermal processing in a temperature below 50° C. A moist pulp is pumped in between the grinding discs of the defibring unit until single fibres appear, which are then squeezed by a screw press. The product is then scarified to receive a fibrous pulp, which at the end undergoes a drying process.

The innovative technology helps to decrease the energy consumption during the production process (in comparison to the production of fibrous pulp from wood) as the process requires less thermal energy to heat technological water and less electric energy in the defibring process. The use of quickly renewable waste raw materials and the reduction of the use of synthetic additives causes the composite board to become a product, which has a capacity

of being fully reprocessed. Once used, the boards can be composted and are biodegradable.

ADVANTAGES OF THE SOLUTION:

- Use in the production process of quickly renewable agricultural biomass, absorbing CO₂ during growth, which helps to reduce the carbon footprint of the final product.
- High thermal capacity and good insulation properties of the product cause it to be used in the energy-efficient and pro-ecological construction industry.
- Biodegradable, easy to reprocess after the end of product life cycle.
- Production technology protected by the European patent validated in Poland, Germany and France.
- Completed process of certification of the final product confirmed by the CE mark and DIN CERTCO Biobase certificate.

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REDUXCO CATALYTIC CONVERTER

For power stations, cogeneration plants, heat power production plants, and also for the transport industry (sea, land and air cargo) seeking a solution to help reduce fuel use, lower emissions of pollutants into the atmosphere and increase efficiency in the burning of all types of fuels, we offer the REDUXCO catalytic converter. Unlike the competition, our technology ensures that the internal heating surfaces of boilers remain in good technical condition and operate soundly and stably. It is the only product of its kind to offer such a range of functions.

The REDUXCO catalytic converter is an innovative Polish product that improves the combustion efficiency of fossil fuels. It is a fluid chemical substance that lowers the energy of activation of a chemical reaction, which as a result increases the speed of oxidation of hydrocarbons, reduces fuel consumption and reduces the emissions harmful gases emitted such as CO, CO₂, NO_x and SO_x. It has been registered in accordance with the REACH Regulation under the number 01-2119406877- 30-0000. The product is not classified as dangerous to human health or the environment. It has passed all necessary tests and possesses all required certificates. The REDUXCO offer includes a REDUXCO combustion catalyst, dosing installation, free installation, training concerning general operation of the installation and maintenance.

ADVANTAGES OF THE SOLUTION:

- Reduction in fuel consumption (coal, gas, biomass, diesel, petrol).
- Reduction in emission of harmful gases: CO₂, CO, NO_x, SO_x.
- Cleaning of heating surfaces of boilers and maintaining their good technical condition.
- Easy dosing and relatively low cost.
- Significant reduction in PM emissions and unburned hydrocarbons HC in combustion engines.

REDUXCO technology can be installed in every place where the energy and industrial sectors are characterized by high energy consumption and the necessity to limit the emission of pollution into the environment. Currently, Dagas is conducting extensive research with leading Research Institutes in the field of combustion and combustion engines in particular, diesel engines, where we were able to significantly reduce PM emissions and smoke opacity. The REDUXCO solution for internal combustion engines is ideal for sea and road transport where large reductions in fuel consumption and emissions were and can be achieved. REDUXCO solutions contribute to reducing urban smog produced by road and transport.

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TRANSPORT NOISE AND ENVIRONMENTAL CONDITIONS MONITORING STATION

Our company is engaged in designing, production and implementation of advanced measurement systems on daily basis. Several years of experience in that field and the character of people gathered in our team influenced our decision that the environment protection market will be the sector in which we wish to gain a leading position. At present we are focusing on preventing negative changes in the environment and on amending the current status. We are thinking about the legacy that we will leave to future generations and about the necessity of human race to adapt to inevitable climate change.

The ENVIRO station is used for continuous and long-term registration of noise levels, vibration, vehicle traffic intensity, temperature, air humidity, atmospheric pressure, wind speed and direction, precipitation and measurements of air quality. The station may also serve as a mobile measuring system installed in a trailer. The maintenance of the station is possible through any internet browser.

ADVANTAGES OF THE SOLUTION:

- Long-term monitoring.
- Mobile and stationary versions.
- Easy use and maintenance.
- Possibility of modification with the use of any additional components.
- Perfect quality-price ratio.

The ENVIRO station was implemented in several of the largest cities in Poland, the Czech Republic and Vietnam. It has been used to monitor the environment, create modern traffic management algorithms in ITS systems as well as in the health sector to predict the frequency and reasons of medical rescue teams interventions to help people vulnerable to air pollution and bad meteorological conditions.

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EMERGENCY POWER SUPPLY SYSTEM PULSTAR BASED ON ECOLOGICAL FUEL CELLS

For industrial and production facilities, health care centres, transport, telecommunications, and IT sector which need an uninterruptible power supply system that generates electrical energy, we offer an emergency power supply system PULSTAR based on ecological fuel cells. Unlike competing conventional solutions with classic batteries, we offer ready-made power supply systems with fuel cell working on electrical grid and long-lasting individual receivers, ensuring the continuity of power supply in the event of an outage without any problems during exploitation.

The PULSTAR backup power system is based on an ecological energy source – fuel cells. By delivering hydrogen and air, we receive electric energy and clean water as a by-product. The cell functions silently and is very small in comparison to an aggregator/battery. It can be installed in any chosen space. A standard large bottle with hydrogen ensures the system will operate at a power of 1kW for 8 hours. The fuel cells directly convert energy contained in chemical reactions into direct current energy. This transformation is highly efficient and makes a very minor impact on the environment.

ADVANTAGES OF THE SOLUTION:

- An innovative, ecological power source based on PEM-type fuel cell.
- Failure-proof system thanks to monitoring of the fuel cell's functioning, registering of the feeder's functioning and raising the alarm in case of an outage using the Automatic Management System (SAN 3).
- Safety is ensured by the use of redundant hydro-

gen anti-leaking safeguards and power surge protection, short circuit safeguards, etc. with the RS-232 interface.

- Modular construction.
- High stability of voltage and output current and low pulsation of output current.

The PULSTAR power supply system was implemented and it has been in use by 4 clients – the Gdańsk University of Technology, the Łódź University of Technology, the Warsaw University of Technology and the Silesian University of Technology. The delivered power supply systems are composed of the following elements: a fuel cell with a power of 1.2 kW, a DC/DC converter stabilising the tension from the cell, an inverter allowing for powering the system with alternating current receivers, and also a cooperation of the system with a low-voltage distribution network. The system is equipped with a monitoring system that allows it to be controlled remotely and meters all of the system's operating parameters. PULSTAR systems offered to research and development enterprises are used for conducting research on both the fuel cells themselves and the system in its entirety. In addition, delivered technology enhances the didactic programme with the newest technologies in the area of electrical energy production. PULSTAR guaranteed power supply systems have been implemented in their entirety by clients. The first implementation took place already in 2003.

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BIOMASSER® BRIQUETTING TECHNOLOGY OF MOIST NON-WOODY BIOMASS

BIOMASSER® is a technology of machinery used for production of briquettes from straw designed and manufactured by a Polish family company ASKET® with 35 years of tradition. BIOMASSER® SET, which is a compact set with productivity up to 320 kg/h, constitutes a perfect solution for communities that may turn local biomass into a full-value fuel. BIOMASSER® MULTI with productivity up to 1440 kg/h, will in turn be suitable for clients with significant amount of raw material. BIOMASSER® MOBILE is a transportable briquetting production line built on its own chassis, which can be easily transported and which allows for the briquettes production at the site where the raw material is stored.

The uniqueness of BIOMASSER® technology consists in the fact that it uses biomass of up to 30% moisture content, which does not require to be dried before briquetting. The briquettes are 100% natural and can equally well replace coal or wood used for heating, cooking or serving as kindlings. The ashes left after their combustion are a perfect fertiliser, which is in line with the concept of circular economy. Briquettes contribute to climate protection as the technology is carbon neutral - the amount of CO₂ emission during the combustion processes balance the amount of CO₂ absorbed by these plants during vegetation. The caloric value of the briquettes amounts to 15,5-17,5 MJ/kg, which is the equivalent of dry wood. A wide variety of local non-wood raw materials such as straw, hay or reed as well as the manufacturing process that does not require the use of any glues or additives prove the practical application of BIOMASSER® briquetting technology being in line with the ideas of zero waste and sustainable development.

ADVANTAGES OF THE SOLUTION:

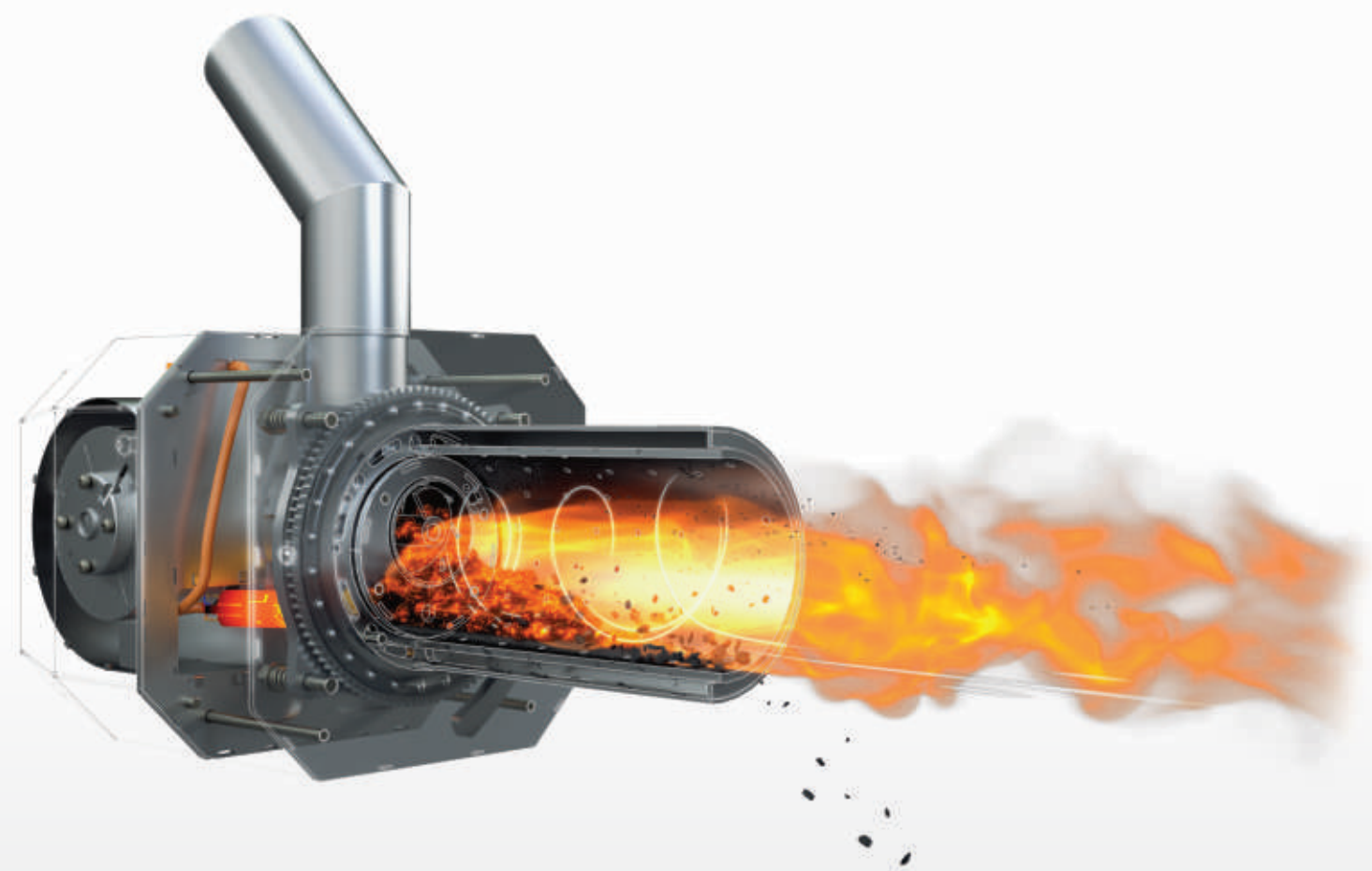
- Stationary and fully mobile lines, easily transportable to the place of raw material storage.
- Processing straw of moisture content up to 30%, so it doesn't require drying before briquetting. Such approach eliminates cost of purchasing a dryer, it's operation and maintenance.
- Flexible configuration of productivity by adding next briquetting modules.
- The first technology in Europe which received EU ETV Statement (Environmental Technology Verification) - eco-innovative technology supporting the climate protection.

BIOMASSER® has been the first machine in Europe to obtain a Verification Statement within the framework of the European Commission program the Environmental Technology Verification (ETV) – Statement no. VN201400001, which proves its eco-innovative features and cohesion with climate protection trends. In 2018 the company delivered and launched two fully transportable BIOMASSER® MOBILE lines within the European Commission tender proceedings "Supply of equipment for green energy and integrated waste management to support regional development in Belarus" which were installed in a local biomass processing facility. ASKET® delivers its solutions to almost 30 countries around the world: from northern Sweden, several European countries, African countries to Australia.

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KIPI PELLET BURNERS

For all of those that wish to reduce the heating costs and that search for a convenient and maintenance-free solution Technical and Engineering Company of Jan Gumkowski recommends Kipi pellet burners with a rotary chamber. As opposed to rival solutions the Kipi burners are distinguished by an innovative structure of two rotary chambers - external (blower chamber) and internal (combustion chamber). It enables the burner to clean itself from ashes and slag and ensures an automatic operation of the equipment.

Kipi burners are known for their high quality and innovative cleaning mechanism. In comparison with traditional pellet burners which need to be cleaned even 2 times per week, the Kipi burners require a single servicing per heating season. Moreover, the burners are failure-resistant even despite the possibility of burning pellets of inferior quality. Furthermore, the modular design of the burner enables a more simple and faster installation than in case of rival products. The Kipi burners advantage also consists in the applied construction solutions such as reliable bearings, which have an impact on the durability of the product. The Kipi burners help to optimise heating processes and contribute to the benefits of economic, organisational and operational nature.

ADVANTAGES OF THE SOLUTION:

- Savings - thanks to the synergy of all pellet's advantages and an innovative burner.
- Comfort - thanks to a maintenance-free operation and the possibility of a remote control over the burner.
- Ecology - thanks to the reduction of ashes and slag, dust and CO₂ emission into the atmosphere.

The Kipi burners are used by the leading pellet chamber manufacturers as well as for modernisation of boilers such as oil, coal or gas fuelled boilers, both of 3rd and 4th class (the list of manufacturers and fitters is available at www.kipi.pl). A wide range of Kipi pellet burners' power (from 5 to 300 kW) leads to their usage both in households, public utility facilities and industrial compounds in the whole Europe.

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MOVING STEP GRATE BURNER

Moving step grate burners offered by the group CWD have a wide range of applications. They enable combustion of ground biomass in household and industrial heating boilers as well as of waste and sewage sludge using the line of thermic waste transition (TPO). Our company provides complex services in the above-mentioned field: construction of biomass boilers or the line of thermic waste transition.

The unit for automatic biomass combustion in a step grate burner operates in the power range of 30 kW to 2000 kW. The technology used in the boilers produced by the brand Cichewicz enables continuous combustion of different types of biomass, in the form of both pellets and briquettes, irrespective of their grain size or moisture content. The combustion process is distinguished by the minimised generation of by-products, such as fly ash, scale or slag. A moving step grate operating in the burner automatically re-moves fly ash and slag from the furnace, while a unique air distribution system enables biomass combustion in the highest energy efficiency class. The burner can be used in new furnaces and boiler-houses, as well as to modernise the already existing heat sources, i.e. oil- and coal-fired boilers. The heat generated is used to heat rooms and to produce domestic hot water. Moreover, an advanced control technology enables on-line management of the unit. Furthermore, the solution includes automatic ignition and power modulation, reducing fuel consumption and ensuring energy savings.

ADVANTAGES OF THE SOLUTION:

- A universal system enabling the efficient combustion of most biomass types available on the market in one unit.
- A moving step grate with a self-cleaning system.
- Automatic ignition and unmanned, continuous and balanced operation of the burner.
- High thermal efficiency and reduction of CO and dust emissions – a unit in the highest energy efficiency class.
- A wide operating power range from 10 kW to 300 kW – even up to several MW in cascade systems.
- A versatile application e.g. in boilers, heaters and different furnace types.

The technology has been applied all over the world. Three units with a total capacity of 1,050 kW are used by a private clinic in northern Greece, where the total purchase costs of the units paid back already after two years from their installation. In turn, in Lithuania, in the area of Kaunas, two units with a total capacity of 700 kW heat a dozen or so municipal buildings in one of the local housing estates. This solution is also in operation in Germany, the Netherlands, Belgium, France, Ireland, Scotland, England, the United States and Ukraine. Thanks to the participation in the GreenEvo program the step grate technology has been applied in the line of thermic waste transition with thermal and electrical energy recovery. The technology has been implemented in boiler-houses all around Poland as well as in Romania, Lithuania and Estonia. The company has also expanded the operation power range up to 700 kW.

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ARCHIMEDEAN SCREW

For owners of small hydro plants and other investors planning a construction or a modernization of small hydro plants, we offer individually designed Archimedean screw with an active fish-ladder. The uniqueness of the adopted solution consists in the use of a system of two Archimedean screws, in which one (ascending line) produces electrical energy and the second (descending line) transports the ichthyofauna up the river course. The descending line produces a few times more energy than it is needed for the operation of the ascending line. As a result the system has a positive energy balance and the excess green energy may be commercialized and constitute a source of income.

The Archimedean screw manufactured by the company Enerko Energy Sp. z o.o. with an active fish-ladder is dedicated to micro and small water power plants. It may be used with very low waterflow. Such features as: open structure, large operational space filled with water, open no-pressure system, low turbulence level or low rotational speed make it a silent and environmentally sound technology. As a result the technology can be used in protected natural areas, because it satisfies rigorous environmental requirements. The structure of the screw enables the reduction of costs related to the construction of foundations for the hydroelectric generating set during the assembly works and later operation. Moreover, such type of fish-ladder reduces significantly the area it occupies and the consumption of materials.

ADVANTAGES OF THE SOLUTION:

- Individual solution for rivers with variable water courses and low waterfalls.
- Can be used in protected natural areas, including rivers with protected fish species.
- Easy operation, low maintenance costs.
- High energy efficiency of the water trail.

The Archimedean screw with a fish-ladder was implemented in Poland in Starogard Gdański. The investment was located in the city centre, thus the available area was strictly limited. The use of an active fish-ladder the occupied area was decreased to a minimum. The entire device generates yearly approx. 780 MWh of clean, green energy, ensuring at the same time a full, two-direction passage for fish at this part of the river.

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BIOMASS BOILERS

For households, companies or public utility facilities situated in rural areas which would like to cut heating costs in a simple manner, we offer EKOPAL biomass boilers. In contrast to stoves fired by fossil fuels, in our technology unprocessed and readily available vegetal raw materials which constitute waste (e.g. straw) can be used as a cheap and environmentally sound fuel.

The EKOPAL technology is distinguished by a so-called "counter-current combustion system" applied in it, which ensures a correct straw gasification process and the combustion of the gas generated, and, as a result, it guarantees a low carbon oxide (CO) content in the waste gases. The boiler has a preliminary straw gasification chamber, a chamber where the gas generated is burned and a pipe heat exchanger. Compared with competing solutions using coal combustion, this technology enables a substantial reduction in the emissions of pollutants, i.e. diminishing SO₂ emissions by 88%, those of NO₂ by 32% and those of CO by 79%. The air injected into the straw combustion chamber partly prevents dust from escaping from it and thus reduces its content in the waste gases.

ADVANTAGES OF THE SOLUTION:

- Reduced CO content in the waste gases.
- A substantial reduction in the emissions of gaseous pollutants into the air, i.e. SO₂ emissions reduced by 88%, NO₂ by 32% and CO by 79%.
- Reduced dust content in the waste gases.
- An environmentally sound heat source using available raw materials and vegetal waste.

An investment in the EKOPAL technology is completely cost-effective, both for users who have their own straw and for those who buy it on the market. In certain cases, the investment can pay back even in two years. Since 1993 we have already manufactured several thousand biomass boilers and developed a number of solutions enabling heat generation from cereal, maize and rapeseed straw, energy willow, wood, wood chips, sawdust and other types of biomass. As a result, several boiler types have been developed to meet different operational requirements and power demand levels. They operate both in Poland and abroad, e.g. in Scotland, Denmark, China, Romania and Russia.

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BURNER FOR BIOMASS PELLASX

For individual customers and companies which would like to cut their heating costs and reduce their CO₂ emissions, we offer a burner for biomass, which can be simply and quickly mounted at practically any type of traditionally applied boilers. In contrast to other solutions of this type, due to an overpressured combustion and a patented system of fuel mixing in the furnace chamber, our burner is safe and practically maintenance free, even when using low-quality pellets.

PellasX burners for biomass are the highest quality and technologically most advanced solutions available on the market. The fuel in the burner is biomass in the form of pellets, oats or pits. An advantage of our solution is that there is no need to make expensive changes to the existing installation and that the burner can be mounted at any type of boiler – using oil, gas or solid fuel. In addition, the burner is distinguished by the smooth adjustment of settings and automatic ignition, as well as the sustaining of fire after the predetermined temperature has been reached and the feeding of fuel. The solutions applied in PellasX burners are unique. We use the overpressured combustion technology which eliminates the backburning problem. The patented system of fuel mixing in the furnace chamber extends the time of maintenance-free operation. A broadband Lambda sensor is available in all models, improving the combustion process and reducing the fuel consumption. All the burners are made of heat and acid resistant steel and equipped with the best parts available on the market, allowing for the sales of a product with the highest quality and technology.

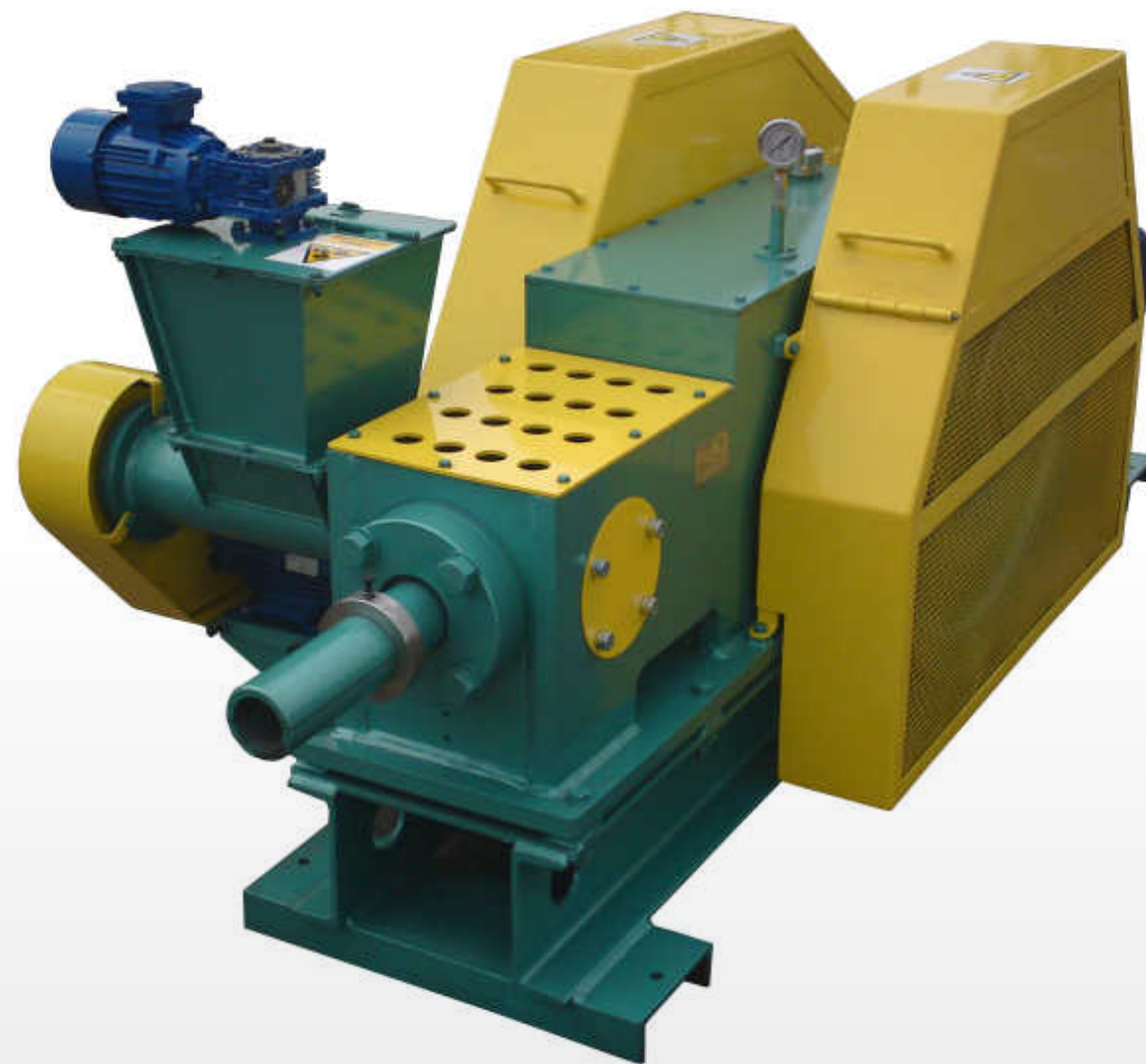
ADVANTAGES OF THE SOLUTION:

- Technology of a rotary furnace or a movable grate enables the burner to self-clean from ashes and slag.
- Patented system of fuel mixing in the furnace chamber extends the time of a maintenance-free operation of the burner.
- Safe operation of the burner, due to the application of the overpressured combustion technology.
- Reliable operation of the device, due to an automated ignition process, flame control and cleaning.
- Modern control system, available through Internet (website and special application).
- CO and CO₂ emission reductions compared with the heating solutions which are traditionally applied on the market.

Due to a large power range of PellasX burners for biomass (from 5 kW to 500 kW), they can be applied at both households, bakeries, hotels, public utilities, schools and production halls or warehouses.

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TECHNOLOGICAL LINE FOR BRIQUETTE AND PELLET PRODUCTION

For individual investors and large companies, farmers, sawmills, fruit-farmers, palm and olive growers, furniture and floor panels manufacturers as well as for all those who need to dispose of waste originating from agriculture or forestry, we offer a technological line for briquette and pellet production. As oppose to competing solutions, our technology is versatile and enables the processing of practically every type of biomass available in the world, both into briquettes with a diameter of 50 to 70 mm and into large pellets with a diameter of 20 to 22 mm.

The most important part of the technological line for briquette and pellet production is the briquette press type BT-60. It enables the production of briquettes without additional binders, with different diameters (50, 60 and 70 mm) and length (25-800 mm), as well as pellets with a diameter of 7 to 22 mm. In addition, thanks to our technology, it is possible to manufacture briquettes not only from cereal straw, but also from sunflower, peat, lignin, rapeseed, maize and soya straw, hay, grass, sawdust, chips, energy plants (e.g. miscanthus), rice husk, lignite and charcoal, soot from the pyrolysis of tyres, cardboard, waste paper, dry waste from fruit and vegetable processing industry etc. Our technology is competitive thanks to the lowest purchase costs in relation to its productivity and operation of machinery.

ADVANTAGES OF THE SOLUTION:

- A multi-task line – one briquette press enables the production of both briquettes of different diameters and pellets.
- Versatility – the capacity to process practically every type of waste of forest or vegetal origin.
- High-efficiency production of fuel oil from biomass (e.g. 500-750 kg/h from sawdust, 350-500 kg/h from cereal straw, 500-700 kg/h from rapeseed straw, 500-700 kg/h from soya straw, 500-550 kg/h from hay, 600-700 kg/h from lignin, 500-700 kg/h from cardboard /waste paper).
- The lowest ratio between the price of the line and the production of 1 tonne of a final product.

At present, our technology is applied in many European countries (Belgium, Belarus, Bulgaria, the Czech Republic, Denmark, Spain, the Netherlands, Lithuania, Latvia, Moldavia, Germany, Russia, Romania, Serbia, Slovakia, Ukraine, Hungary, Italy) as well as in Japan.

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SECONDARY DUST EMISSIONS MONITORING SYSTEMS

The celluguard® technology is dedicated for coal-fired power stations, heat and power plants, mines and facilities that struggle with a problem of secondary dust emissions of gasiform substances at landfills. The method consists in a hydrodynamic application of a flexible, reinforced and liquid coating to dust-emitting surfaces. In comparison to traditional methods the company Agata offers a much cheaper, more durable and a fully environmentally sound solution.

The celluguard® technology constitutes an innovative solution to a problem of secondary dust emissions at landfills of different kinds of dust-emitting raw materials. The method provides a possibility to neutralise the following substances: combustion by-products (fly ashes and slag), mine dumps (aggregates and minerals), post-flotation ore waste, dust-generating railway wagons, furnace waste, sedimentary sludge, coal dumps, street dust. The method is decidedly cheaper than other technologies used on the market to date, both in terms of its purchase costs as well as its operational costs, as the security measures against secondary dust emissions need to be undertaken only once a year. Moreover, these measures guarantee a longer-lasting protection in comparison to traditional methods such as water sprays and a better protection of bituminous masses due to the eco-reinforced coating. As a result the protective layer on the surface is durable, flexible and resistant to various weather conditions. In addition, it can also be applied on slanted surfaces such as escarpments or embankments.

ADVANTAGES OF THE SOLUTION:

- The highest protection efficiency due to eco-reinforcement.
- Four degrees of protection durability: 1, 3, 6 and 12 months.
- Environment-friendly, biodegradable technology.
- Improvement of air quality in the vicinity of landfills.
- Elimination of unpleasant odours at landfills.
- Protection and monitoring of water and wind induced soil erosion.
- Simple and one-off application.
- Important water savings.

The celluguard® technology has been approved by leading companies in Poland. It was delivered among others to the post-flotation waste reservoir of KGHM Polska Miedź S. A., the slag and sludge landfill ENEA in Świerże and Połaniec, the post-production waste landfill in the Michelin Tyre Manufacturing Plant in Olsztyn, mining waste dumps at TAURON Wydobycie, mines and quarries of LAFARGE as well as to numerous sea ports of discharge.

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Laureate of the 7th edition



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FLY ASH AND SLAG MIXTURES PRODUCTION TECHNOLOGY FLUMIX

The FLUMIX mixer processes production waste from metallurgical processes (slag), fly ash and lime dust into good-quality construction materials – cement and cement-based mortars. Compared to our competitors we offer capacity of 40-80 t/h with much lower energy consumption. Our unit is also distinguished by its mobility, as installations can be moved to any selected site within one day and the entire technology can be fit into two standard containers.

The FLUMIX technology is used in the construction and road building industries and in the production of cement and mortars based on cement, fly ash, slag and lime dust. The solution manufactured by the Company Biko-Serwis Ltd GLP is a complete technology, which operates in the automatic mode, with integrated visualisation and the feature of a possible smooth change in composition. The key part of the technology is a fluidised mixer which achieves a perfect homogenization effect without any moving elements. In addition, the mixer is a highly productive unit with low energy consumption, distinguished by an energy demand even 20 times lower than that of competing solutions.

ADVANTAGES OF THE SOLUTION:

- 20 times lower production cost as a result of the use of a fluidised mixer.
- A fully automatic process.
- Mobility – the installation can be moved to another site within one day and the whole of equipment can be permanently kept in two containers which are easy to transport.
- Economy of space – the FLUMIX technology makes production buildings redundant.
- The high quality of the final product – ensured by accurate dosing, effective mixing and additional pulverisation of the material in order to avoid caking.
- Real-time production – silos for the final product become redundant, since the mixtures are produced in a continuous manner, with large productivity, and are loaded directly into the customer's tankers.

The FLUMIX technology emerged as result of own research and development work on the behaviour of loose materials carried out in cooperation with the AGH University of Science and Technology in Cracow. It should be mentioned that an application has been filed for the patent protection of the unit in Poland.

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STABILISATION OF HAZARDOUS WASTE AND ITS SOLIDIFICATION WITH SULTECH® SULPHUR CONCRETE

The Sultech® technology turns hazardous waste into useful and safe products, implementing a highly demanded concept of circular economy. The product of the technology is 100% recyclable and meets low CO₂ emission levels. The production process does not require the use of water, concrete or other chemical substances.

Marbet Wil Sp. z o.o. offers its original technical and technological solutions, covered by patents, that enable the recovery of hazardous waste through the processes of stabilisation using sulphur polymer Sulstar® and solidification into products dedicated to railway, road and hydrotechnical engineering. The Sultech® is a technology covered by the patent UPRP 205151 and it constitutes a solution for disposing solid waste such as dust, ash, sand or slag, while eliminating the need of landfilling. The stabilisation and recovery (economic reuse) of hazardous industrial waste in polymer concrete Sultech® is particularly useful in case of the stabilisation of waste containing heavy metals (copper, lead, iron, arsenic, cadmium, zinc, nickel, molybdenum, cobalt, etc.) which are chemically bonded to create sulphides that are insoluble in water. Other substances are inserted into a matrix and stabilised in a low-absorbent and tight material.

ADVANTAGES OF THE SOLUTION:

- Elimination of costs and technical challenges related to the landfilling of hazardous waste.
- Clearing the areas designated for landfills.
- Conversion of waste into safe and useful products.
- Very good utility properties of the product: high mechanical strenght, full corosion resistance in an agresive enviroment (acids, sewage, sea water, brine).
- 100% recyclable.
- Low CO₂ emission.
- Verification and practical application of the technology.

The Sultech® composite created from waste is a thermoplastic material with high mechanical strenght and a full resistance to corrosion in an agresive environment such as concentrated acids, sea water, sewage or brine. Utility parameters enable its use in hydrotechnical, road or railway industries for drainage systems, shoreline reinforcements, kerbstones, road barriers, pavement slabs, etc.

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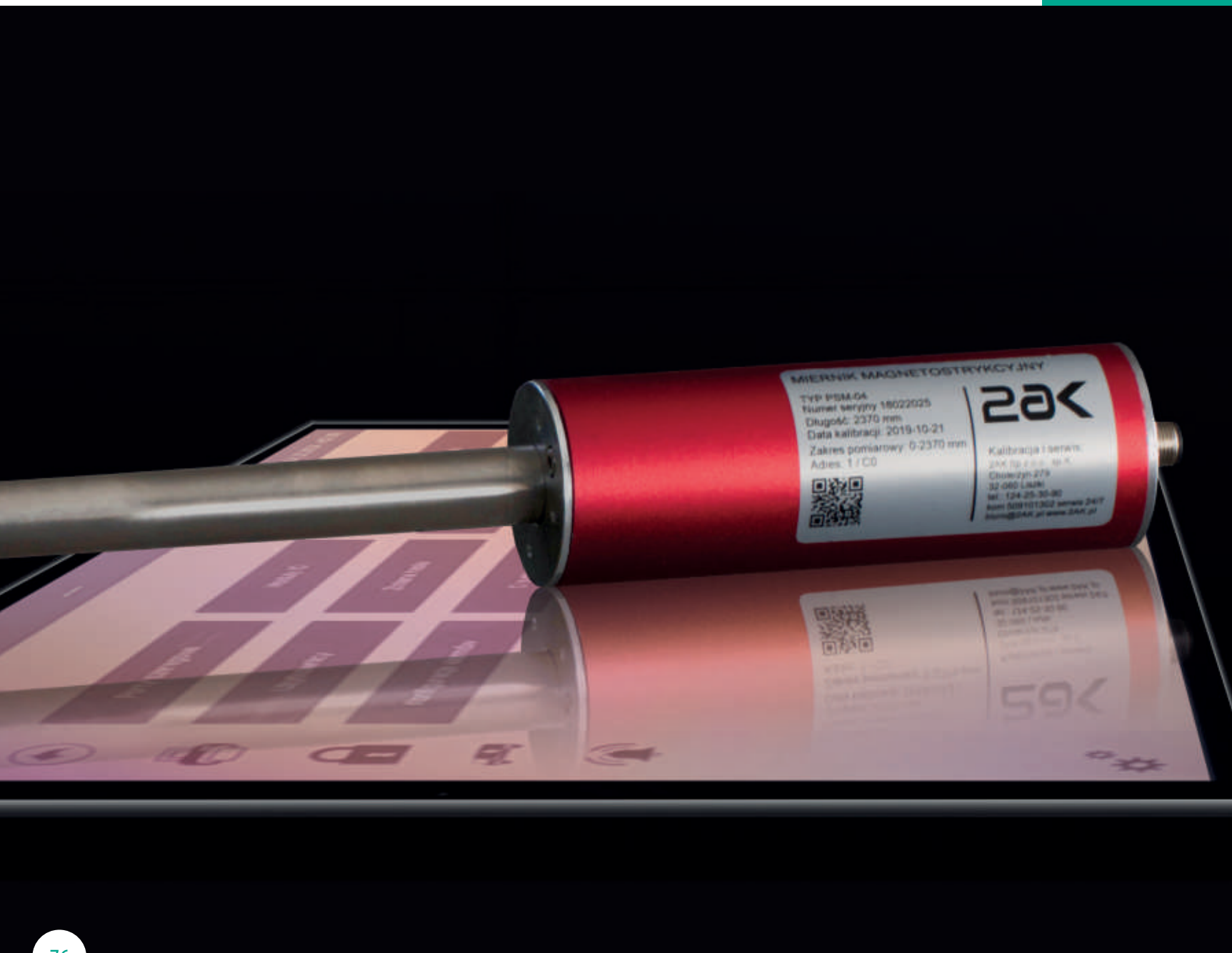
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TANK CONTROL - CENTRALISED REMOTE RISK MANAGEMENT SYSTEM FOR LIQUID EXPLOSIVE AND DANGEROUS PRODUCTS - INCLUDING FUELS

Thanks to a network of liquid and steam sensors 2AK Tank Control enables to monitor the storage and transmission of liquid explosives, such as fuels, alcohols and others. Environment protection and explosion-proof safety receive in the era of Industry 4.0 a convenient and reliable tool dedicated for Environment Protection Divisions/Departments or Maintenance Divisions/Departments. The data readings from the control systems have been supplemented with their recordings and reporting, all in real-time. It is a perfect solution for every company handling liquids.

The company Petroster-Serwis has elaborated a universal monitoring system for tanks of explosive and dangerous liquids named 2AK Tank Control. The greatest advantage related to its implementation is a constant, remote and safe monitoring of tank tightness where dangerous liquids are stored that enables to prevent a potential leak of dangerous substances into the ground. Thanks to a wireless data transmission technology users are not restraint by cables, ground structure or adaptive capacities. Data is collected by a cloud software and available through a computer browser. And yet the data is kept in safety. Moreover, there is a possibility of using wireless sensors monitoring temperature, humidity or air pressure, which gives full knowledge of process incidents in a given location. The solution is used by compaignies from any industrial, fuel (oil), tranportation and food sector and or any other industry that involves the storage of dangerous/explosive/toxic lliquids. Thanks to a wireless data transmission technology a user is not restraint by cables, ground structure or adaptive capacities. Data stored in the cloud is safe and always available. In addition, there is a possibility of using wireless sensors monitoring temperature, humidity or air pressure, which gives full knowledge of

process incidents in a given location. 2AK Tank Control provides a constant flow of information regarding the tightness of a tank system that is made available to the operator immediately (it is not an interval surveillance system). The provision of reports and data regarding the operation of the system is a particularly valuable element of that system, which enables the elaboration of the environemnt safety management policy applicable within a given facility/petrol station/refinery.

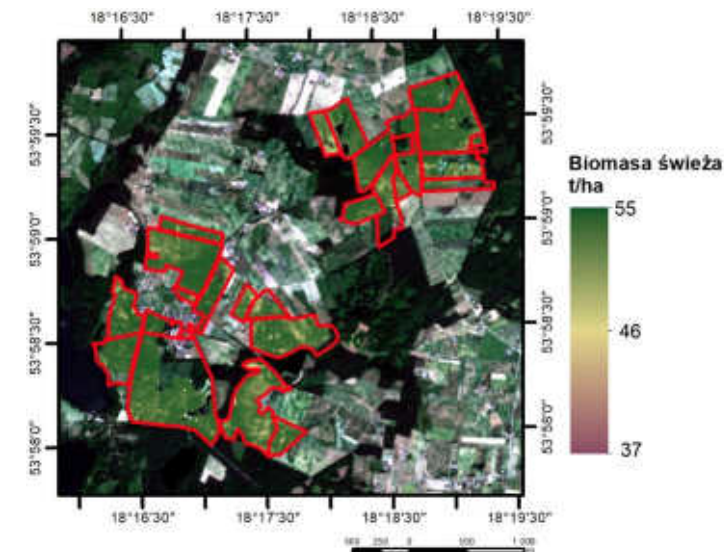
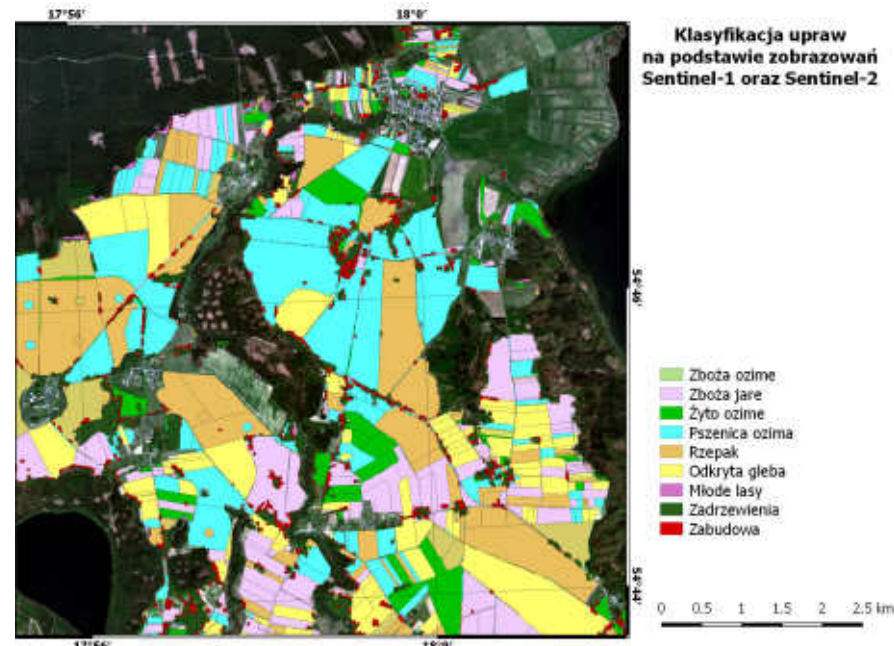
ADVANTAGES OF THE SOLUTION:

- Intuitive and simple reading of the amount of liquid inside the tank.
- Provides fire protection and predicts dangers.
- Remote and wireless operations enabling to cut down the implementation costs.
- Cloud-based scalable solution.
- Convenient and user-friendly liquid and steam sensors system available through a web browser.
- Reduction of dangerous, flammable and toxic liquids vapour emissions to the atmosphere.
- Analysis of data regarding the safety of the installations dedicated for toxic, dangerous and explosive liquids - reports and audits.
- Management of explosion-proof protection.

The solution is used by compaignies from any industrial, fuel (oil), tranportation and food sector and or any other industry that involves the storage of dangerous/explosive/toxic lliquids. The 2AK Tank Control measurment system operates in European countries, including Ireland, Spain or Macedonia, as well as in central and north Africa.

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SYNERGY SYSTEM

The development of satellite technology led to the increase of availability of good quality data enabling the preparation of analyses, in particular in agriculture or forestry. Publicly available data provided by NASA or ESA programmes, as well as commercial satellite or aeronautical data are within reach. It all helped the company BIOCONTROL to elaborate a innovative SyENERGY system.

BIOCONTROL, as an independent third party, is a leading provider of audit, verification and authentication services in the renewable energy sector, industry and trade. Its services constitute a reliable value added and limit the business risk for clients. The company offers the most modern tools based on the most recent technologies, including Sentinel or Planet Labs satellite data, as well as high-resolution aeronautical data. Within the SyENERGY system the company has implemented solutions resulting from the company's own research and the experience of other entities.

ADVANTAGES OF THE SOLUTION:

- Possibility to verify sustainability criteria for biomass fuels for energy purposes, in accordance with the RED II Directive.
- Possibility of a remote verification of the cropland, without the need to cover the costs of on-site visits.
- Capacity to determine in the evaluation of losses the exact location of a given crop, its type, condition, size of the cropland, surface of the decrements, biomass calorific value as well as the distance from protected areas and the identification and evaluation of the consequences of weather conditions (hail shower, storm), wildlife

damages etc. thanks to a constant access to high-quality satellite imagery from Sentinel and Planet Labs satellites and aeronautical data.

- Possibility of application for both annual and multi-annual crops at all stages of growth.
- Possibility to verify origins of the imported crops thanks to an unlimited operation area (worldwide range).
- Thanks to the access to present and historic data, the application both for constant monitoring of the existing crops as well as for crops that no longer exist, even the ones from the year 2000.
- Detection of pollutants in waters or grasslands, the evaluation of the range and consequences of fires, detection of the cases of burning off the grasslands thanks to the access to satellite and aeronautical data.
- In forestry - early detection of tree diseases, monitoring the state of the tree stand in the forests and the municipal greenery.
- Imagery resolution of up to a few millimeters thanks to the use of aeronautical data, which enables precise analysis of single plants or even their leaves in order to evaluate, among others, the purity of the crops.
- Information support services enabling to adapt the system to the needs of the partners through dedicated applications or API interface.

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VENTURIS HORECA – KUMIN.SYS. SYSTEM MONITORING THE QUANTITIES, STRUCTURE AND VALUE OF OVERPRODUCTION IN HORECA SECTOR

The KuMin.Sys system is used to monitor and analyse data from the HoReCa sector. It helps to plan more precisely the amounts of prepared food to be more coherent with the needs of the clients and guests. As a result, the food waste and the environmental footprint are reduced. Rational use of resources: raw materials, human work, water, energy, etc. leads to the improvement of financial performance of the companies in the sector.

Venturis HoReCa is the first professional group in Poland, which provides a digital transformation of a traditional sector such as HoReCa (hotels, restaurants, catering companies, educational institutions). The KuMin.Sys. system elaborated by the company offers a comfortable and intuitive interface to weigh the products and perform managerial analyses. It also enables to constantly monitor the scale of food waste by registering and categorising its weight and by monitoring online the results. A special scale guarantees accuracy, adequate measuring range and communicates with the programme's interface. Waste (leftovers from guests' plates, outdated food, waste left after the cooking process, food left in buffets and others) is put directly on the scale or into a special container and registered by the programme in accordance with the client's needs. The measurements take only a few seconds. The result is registered in a single central database and is instantly visible in the manager's interface.

ADVANTAGES OF THE SOLUTION:

- Easy to use, intuitive and automated system.
- Provides information on what and how much food has in reality been eaten by the guests (which is crucial for better planning of the amount and structure of the production).
- Provides instant feedback information on the total quantities, structure and value of the food waste on a given day.
- Enables also to monitor kitchen work.

In times of changing climate, increasing dry periods, increasing water shortages, increasing costs of waste storage and management as well as growing prices of raw materials each kilogramme of food ending in a bin is a waste, which needs to be curtailed. Thanks to the solutions provided by Venturis HoReCa a 340-room hotel in a centre of a big city is able to save yearly up to 1,5 million zlotys by reducing the overproduction and food waste.

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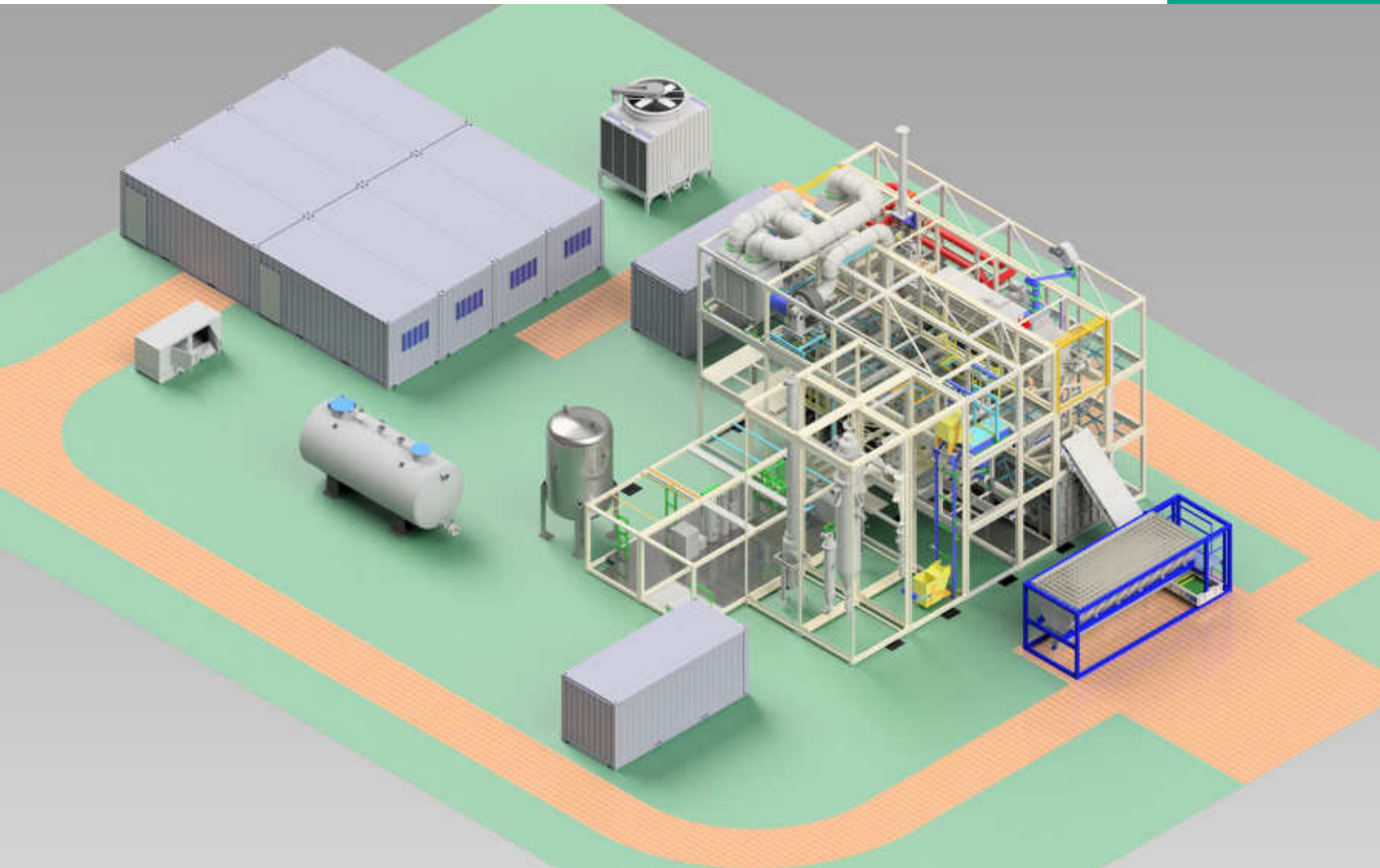
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ZEWE® TECHNOLOGY – ZERO- EMISSION WASTE ELIMINATION

ZEWE® is a technology elaborated by the company WTT, which consists in the processing of waste materials (organic and non-organic) from wastewater treatment plants, municipal waste and hazardous waste - it is distinguished by a fully zero-emission and waste-free process with a very high energy efficiency. The line is composed of substations: waste drying and torrefaction, low-temperature gasification, process gas treatment to a level of cleanliness higher than natural gas, water treatment substation and electric and thermal energy generation substation in an engine or fuel cell.

The devices are assembled in a form of a container, which is detached from the ground. The technological line solves the problem of waste treatment with high availability rate, operation flexibility and low exploitation costs. The technology does not require additional fuel, which helps to fully solve the problem of waste storage and disposal. Moreover, the heat which is a by-product of the thermal disposal of waste is used in the process of drying and torrefaction of the input, increasing at the same time the heating value.

ZEWE® technological lines when designed and produced by WTT are each time technologically adapted to the location and the type of disposed waste taking into account the needs of a particular client. Their efficiency ranges from 0.5 to 20 tons of moist input per hour.

ADVANTAGES OF THE SOLUTION:

- No need to provide heat for drying and torrefaction.
- The technological line is 100% electrically self-sufficient with a given calorific value of the input.
- The technological line generates thermal and electric energy using pure gas - thus the environmental decision is not required.
- Lack of technological waste or pollutant emissions to the atmosphere.
- The technological line provides a complex solution for the waste disposal, it is universal and adapted to all types of waste.

ZEWE® constitutes a solution for facilities which produce wastes hampering the development of Circular Economy by preventing the creation of waste, its secondary use or recycling. A project adopted by the Sejm in September 2019 entitled "Road map of transformation towards circular economy" indicates the directions in which the legal regulations will be tightened with respect to the efficiency of the current municipal waste collection and management until 2021. The technology offered by WTT may be helpful in implementing that policy.

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CHARGING STATION EV CHARGER SERIE FX /ALTERNATIVE FUELS STATION EKOEN

The company Ekoenergetyka-Polska has been building electromobility - both on a national as well as international level - for over 10 years. Well-known and acknowledged on the bus market, the company has also important merits in the field of electric vehicles charging infrastructure. It actively participates in the global process of transition to a zero-emission transport, which cannot be done without a proper infrastructure. The company claims that the only path towards a comfortable usage of electric cars is through a quick high-power charging.

With their knowledge and rich experience Ekoenergetyka-Polska is launching innovative solutions with a main goal in mind - the comfort of the electric cars owners. The company proposes a new approach to the charging services of zero-emission vehicles - alternative fuels station EKOEN. A single station has at least five quick DC charging posts, Ecocafeteria with catering facilities as well as special, separated premises for drivers, available 24 hours per day, 7 days per week. The payment process is very easy - a payment card. The company also offers a charging station EV Charger Serie FX, which is characterised by the highest quality of manufacture and reliability.

ADVANTAGES OF THE SOLUTION:

- The station is equipped with all commonly used plugs, which enables to charge every electric car, including plug-in hybrids.
- Simultaneous charging capacity of three vehicles.
- Three output power options: : 50 kW, 100 kW and 150kW.
- The highest version is equipped with a HPC plug with a cable that is cooled down with liquid, which enables it to keep the temperature on a secure level during the high-power charging.
- Intuitive and easy user's interface.

All of these advantages make that product perfectly adapted to the needs of the most demanding clients. It has been proven also by the presence of the company Ekoenergetyka-Polska among the infrastructure suppliers for the biggest Polish multi-energy group PKN Orlen.

The company will soon launch a new compact device, available for all electric car owners, which will enable quick charging in private households. At the same time, the company conducts works on an ultra quick charging station with a power capacity of up to 350 kW - which is way more than the current technical capacities of electric cars. Such policy helps to properly represent the Polish technical thought on international markets and promotes clean and modern transport.

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The costs of the present material were covered from the resources of the National Fund for Environmental Protection and Water Management. The Ministry of Climate and Environment is exclusively liable for the content of the present leaflet.

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