

HYDROFORUM 2025 – in the valleys of Poprad and Dunajec rivers

The desire to organize the next edition of HYDROFORUM Polish Hydropower Conference near the Rożnów Dam had been brewing for a long time. The site attracted with the famous, one of the largest Polish hydropower plants and the over 40 years old plans to erect a pumped-storage power plant (PSP) using the Rożnów Reservoir as its lower water pond. The charming nature and the legendary history of the Dunajec River Valley were also of significance.

The conference was scheduled for October 7–8, 2025, at the "Perła Południa" (Pearl of the South) hotel in Rytró — a well-known resort on the Poprad River, located in Beskid Sądecki mountain range, ca. 20 km south of the Nowy Sącz city. The event was preceded by the National Assembly of the Polish Hydropower Association (TEW), convened for October 6. Its resolutions included granting the honorary TEW member title to Mr Zygmunt Paruch, President of Tauron Energoserwis Sp. z o.o., a multiyear operator of Rożnów and Czchów hydropower plants. President Z. Paruch took over the responsibility for organising a study visit to the Rożnów Hydropower Plant and a boat cruise on Rożnów Lake, scheduled for October 9.

With Organiser's eye

The main organizer of the event was the Polish Hydropower Association, supported by the Institute of Fluid-Flow Machinery of the Polish Academy of Sciences (IMP PAN) and the Polish Small Hydropower Development Association (TRMEW). Local co-organizers included Tauron Ekoenergia and Tauron Energoserwis Sp. z o.o., while Tauron Polska Energia SA served as the main sponsor and one of the conference patrons. Other patrons included the Polish Ministry of Infrastructure, the State Water Holding Polish Waters (PGW WP), and the Cracow University of Technology (CUT).

Traditionally, media patronage was provided by the "Energetyka Wodna" and "żek HYDRO" magazines. The publishing partners were the IMP PAN Publishing House and the Institute of Power Engineering, Gdańsk Division. The organizational success was possible thanks to



Fig. 1. HYDROFORUM 2025 delegates in front of the „Pearl of the South” hotel

the support provided by numerous sponsors. In addition to Tauron Polska Energia SA, platinum and premium sponsors included PGE Energia Odnawialna SA, BELSE Sp. z o.o., and Emerson Process Management Sp. z o.o. Other sponsors were ENERGOPROJEKT-Warszawa SA, IOZE Hydro, Hekla Energy, Mavel a.s., PFTechnology, T-G DNALOP Sp. z o.o. T.I.S. Polska, and INORA Sp. z o.o. The Honorary Committee included representatives of the main organizers — Professor Marcin Lackowski (IMP PAN), President Ewa Malicka (TRMEW), and President Wiesław Zieliński (TAURON Ekoenergia) — as well as Ms Magdalena Żmuda (Deputy President of PGW WP), Mr Mariusz Mazur (Director of the Institute of Power Engineering), Professor Maciej Sułowicz (Dean of the Faculty of Electrical and Computer Engineering at the Cracow University of Technology, WIEiK PK), and Mr Vadim Rassovsky (President of the Ukrainian Hydropower Association and Deputy Director of Ukrhydroenergo — the operator of all public hydropower plants in Ukraine). The conference was attended by 124 people, including 16 delegates from abroad. Thirty-three papers were presented and two panel debates were held: on the role of hydropower, especially pumped-storage, in the power system regulation and on maintaining hydraulic civil engineering infrastructure in the face of climate change and energy transformation.

Inauguration

On behalf of the organizers, conference participants were welcomed by the presidents of Polish hydropower association boards: Ewa Malicka (TRMEW) and the author of this paper (TEW). Next, Professor M. Sułowicz spoke, briefly addressing

the 80th anniversary of establishing the Cracow University of Technology and the 50th anniversary of the Faculty of Electrical and Computer Engineering at the Cracow University of Technology. The conference was traditionally opened by Professor Marcin Lackowski, Director of the IMP PAN institute. Tauron Capital Group was represented by Mr Zygmunt Paruch, President of Tauron Energoserwis company. His address included basic facts about the dam and the Rożnów Hydropower Plant. The impressive speed and quality of this investment's implementation in pre-war Poland was emphasized together with high competence of the Polish engineering staff which were appreciated even by the German occupation authorities. Eventually, the construction was left in Polish hands until launching the first hydroelectric units in 1942. An important part of his presentation was Polish TV documentary entitled "The Power of Dunajec river".

Pumped storage hydropower

The decisive factor in selecting the conference venue was revival of some investment plans in Polish hydropower sector having taken place several years ago. Due to this reason, high significance attributed to the pumped storage could be hardly considered a surprise during HYDROFORUM conference. Eventually, pumped storage was the topic of the first session, chaired by Mr Janusz Łobacz, chief specialist on diagnostics and control in Żarnowiec PSP. The session was an introduction to the panel debate "Hydropower for regulation and safety of Polish electrical power system under transformation conditions".

The session commenced with a presentation delivered by Hans O. Nyland from the



Fig. 2. HYDROFORUM lecture hall during the conference inauguration. In the foreground: M. Sułowicz (WIEiK PK Professor and dean) and M. Lackowski (IMP PAN Professor and director)

Norconsult consulting office. The speaker discussed the role of PSHs in today's power system and the increasingly broad range of technological possibilities to be considered when designing such facilities. The conference delegates were particularly interested in the comparison of functional and economic characteristics of energy storage in pumped storage reservoirs and lithium-ion battery storage systems.

Ewelina Bogacka and Michał Kubecki both from the Instytut OZE delivered another presentation on the PSH development trends. The speakers referred to the results of the International Forum on Pumped Storage Hydropower, which took place on September 9–10, 2025, at the UNESCO headquarters in Paris. The need to accelerate expansion of the regulatory potential of power grids was emphasized, as the current growth has not kept pace with the increasing share of intermittent energy sources. It was noted that China, which already has battery storage facilities with total capacity of 100 GW, remains the undisputed leader in pumped storage development. The European Union's approach to hydropower contrasts with its climate neutrality ambitions, but there is a growing understanding of the need to develop PSHs. The energy system models used by the European Commission assume doubling the capacity of European pumped storage power plants within the next 25 years.

The presentation by Dr. Yuri Bykov focused on selecting the runner blade lean at the spiral chamber side of radial-axial pump turbines. Such a lean has been used for a longer time in Francis-type turbines and pump turbines delivered by leading manufacturers. Numerical and experimental studies conducted in the Institute of Power Machines and Systems of the

National Academy of Sciences of Ukraine confirmed, among others, that a negative lean (in the direction opposite to that of turbine peripheral velocity, when viewed from the suction side) produces a number of positive effects on pump turbine operation. The presentation by Professor Yuri Landau, DSc, and Mr Viktor Ryzhyi, MSc (Eng.) was based on a design study by the Kharkiv-based Ukrhydroproject Private Joint Stock Company. The contribution confirmed consistent policy of Ukraine towards the pumped storage sector as the main tool for regulating the power system, in which nuclear power plays a significant role and the share of wind sources will increase in the future. Not only the use of large dam reservoirs as lower reservoirs for the PSHs under construction, but also construction of pumped-storage power plants at low- and medium-head dams, including using reversible tubular hydroelectric units is under consideration now.

The situation in Poland is different. After achieving a leading position in Eastern Europe, the PSHs development was limited to completing erection of the Niedzica Hydroelectric Power Plant and rehabilitating the already existing facilities. The green light, which was switched on several years ago in order to resume the pumped storage development, is fading again now.



Fig. 3. Panel debate „Hydropower for regulation and safety of Polish electrical power system under transformation conditions”. From the left: E. Bogacka (Instytut OZE), M. Kubecki (Instytut OZE), H. O. Nyland (Norconsult Norge), M. Lis („Energetyka Wodna”), J. Steller (IMP PAN/TEW), M. Mazur (Institute of Power Engineering), S. Samek (Energoprojekt Warszawa), A. Czarnecki (ZEW Niedzica), J. Łobacz (Żarnowiec PSP)

The government position on this matter remains ambiguous, with investment in electrochemical batteries clearly favoured. Current economic conditions and lack of strategic political place potential investors in a very difficult situation, even if preparatory work has already begun. This is also the reason why the topic of planned Rożnów II PSP erection did not come up during this year conference. Among numerous barriers for Polish PSH investors is the lengthy and complex procedure of obtaining approvals and permits, even when resuming previously abandoned projects. The procedural aspects of preparations for resuming development of Młoty PSP were the subject of a presentation by Ms Agata Obrębska from Energoprojekt Warszawa SA design office. Her presentation concluded the first session of the conference.

The panel debate in Session II was moderated by Mr Michał Lis, Managing editor of „Energetyka Wodna,” quarterly along with the author of this text. On one side of the panel table sat the speakers from the previous session — E. Bogacka, M. Kubecki, and H. O. Nyland, and on the other side — M. Mazur (Director of the Institute of Power Engineering, Warsaw), S. Samek (Deputy President of Energoprojekt Warszawa), A. Czarnecki (ZEW Niedzica), and J. Łobacz (Żarnowiec PSP) (fig. 3).

The HYDROFORUM organizers' long-standing difficulties in contacting state authorities and the Polish Power Grids (PSE) to exchange views on the contribution of hydropower to grid regulation and security, along with the sector marginalization on numerous other occasions, prompted a key question: how do the transmission system operator (TSO) and state authorities perceive the importance of system ancillary services provided by the Polish hydropower sector and their future in the

country. Lacking representatives from the question addressees, the discussion was attended by representatives of hydropower sector. Based on their own experience, they indicated that while the Polish TSO is interested in ancillary services, access to companies and offices is often easier through personal contacts than through formal meeting proposals. They expressed their willingness to leverage existing contacts with state-owned companies to facilitate a debate with PSE representatives in the coming years. The question about the competitiveness of PSPPs versus battery energy storage also had a specific substantive subtext. Despite a lengthy discussion, a clear assessment could not be reached. The consensus can be formulated as follows: modern battery energy storage facilities are becoming increasingly similar in functionality to pumped-storage power plants, and the current legal and economic conditions and state policy create additional risks for PSPP investments. In many cases, the choice of battery storage is also rational. On the other hand, abandoning the development of PSPPs on a nationwide scale carries serious, difficult-to-reverse strategic risks for the power system, as well as other undesirable consequences.

Other issues raised during the debate included:

- experience from operation of the Norwegian power system which is based mainly on hydropower, but featured with growing share of wind energy;
- assessment of the current legal and economic conditions for operation of ESP in Poland, including the non-use of the Niedzica Hydroelectric Power Plant units in pumping operation and the lack of regulations regarding fees for ancillary services;
- opportunities to increase regulatory potential through rehabilitation and uprating of existing hydropower plants and erection of new ones;
- Polish competences to implement PSH projects after a 40-year break in investments;
- experience from other European countries

In conclusion, Mr Michał Lis of "Energetyka Wodna" quarterly emphasized the need to integrate the industry in informative and lobbying activities at the national level and to make efforts to reach decision-makers

while inviting them to cooperate with the editorial team of "Energetyka Wodna".

Digitalisation and market analyses

The session was chaired by Mr Arkadiusz Czarnecki, Chief Development and Investment Specialist at ZEW Niedzica. The opening contribution was of commercial character — Wojciech Taras and Grzegorz Szcześniak presented Emerson business profile, which focuses on the development and supply of advanced automation systems, including monitoring and control systems, measurement devices, and valves. In the next presentation, Daniel Chowański presented an innovative technique for increasing the durability of control elements and runner blades in Kaplan turbines by digitally limiting the number or amplitude of fatigue stress cycles that affect these components during operation in the automatic generation control (AGC) regime. The presentation by Dr. Artur Machalski from the Wrocław University of Science and Technology, focused on research and Development work on digitalization of the Wały Śląskie HP on the Oder River. The work was conducted within the D-Hydroflex project (Horizon European programme). The installed measuring devices together with dedicated software and access to measurement data of the Institute of Meteorology and Water Management will enable the ongoing control of relative efficiency as well as individual and collective optimization of the operation of hydroelectric units, generation forecasting, dynamic state assessment and identification of anomalies.

Small Hydropower

The session was chaired by Professor Janusz Plutecki, a retired master of many engineering adepts of Wrocław University of Technology. The session consisted of six conference presentations, four of which focused on rehabilitation of small hydropower (SHP) installations. The technical, economic, and legal aspects of repowering — the complete replacement of key electromechanical equipment in a power plant — were explained by Łukasz Kalina (IOZE hydro) and Ewa Malicka (TRMEW). The goal of the discussed repowering projects was both to increase capacity and electrical energy production, and to improve generation flexibility of the entire installation. Thanks to government support, repowering has become

recently a financially attractive option for modernizing older SHPs in Poland. Similar issues were addressed in the presentation by Dr. Maciej Kaniecki, Eng., from T-G DNALOP Sp. o.o. — a subsidiary of Thordon Bearings Inc., specializing in the supply of seals and slide bearings. Rehabilitation of the decommissioned Strużyska Small Hydropower Plant on the Głomia River (Wielkopolska Voivodship) enabled to demonstrate the new technical solutions of the company under operational conditions. The Strużyska power plant is equipped with three small hydroelectric units with a total capacity of 50 kW, including a tubular turbine one with triple regulation mechanism. Of particular interest was the presentation by Mr Jacek Świdorski who, together with his Chinese partner, Mr Yi Jie Liu of Forward Hydro Power Equipment Co., presented the numerical tool MODOA (Multi-Objective Design Optimization Algorithm). This tool allowed for successful optimization of a Kaplan turbine runner blade in China after failed rehabilitation attempt by another team. The repeated rehabilitation goal has been achieved without the need for model testing. The next presentation focused on the long-term research and development work on hydraulic energy recovery in the heating installations of the Municipal Heat Power Company (Miejskie Przedsiębiorstwo Energetyki Ciepłej) in Kraków, which utilizes pumps in turbine mode of operation. These projects, typically with a capacity of several kilowatts, make economic sense thanks to the on-site use of the harvested energy. Dr. Mariusz Piękoś, Eng., reported on the progress of the work. The session was concluded with a presentation by Mr Michał Lis on a Branch Skills Center (BCU) in the hydropower industry. The program to build a network of 120 BCUs was initiated by the Ministry of National Education in 2021, partly in response to the effects of vocational school closures. In the latest edition of the competition, the Agricultural School Complex in Marszew (Greater Poland Voivodship) was selected as the leader, with the support of TRMEW, TEW, and the Warsaw University of Technology. The first classes are planned for spring 2026. The day ended with a conference reception at the which was an opportunity to meet long-missed friends and colleagues, as well as to establish new contacts.

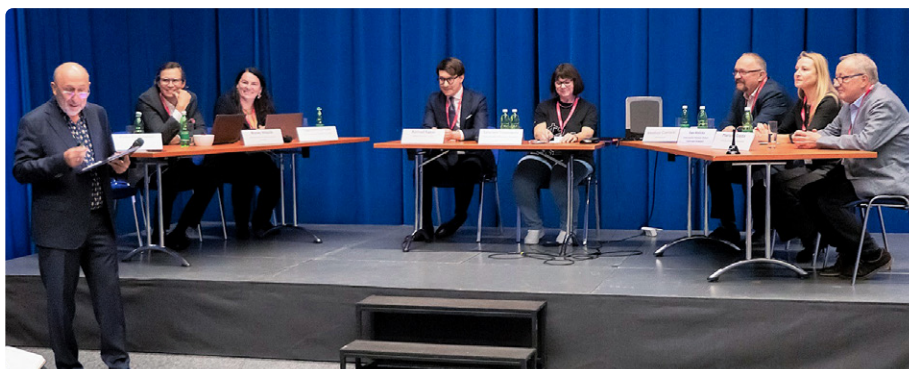


Fig. 4. From the left: B.K. Puchowski (private engineering practice/TRMEW), B. Wójcik (lawyer/developer), M. Żmuda (PGW WP), K. Kąkol (Tauron Group), K. Trojanowska (TEW), A. Czarnecki (ZEW Niedzica), E. Malicka (TRMEW), M. Gajda (private engineering practice)

Hydropower and water management

The second day of the conference began with a session devoted to hydraulic infrastructure, thematically linked to the next plenary debate. The session was chaired by Michał Krzyszkowski from ZEW Niedzica SA. The session started with a commercial contribution by Mr Sebastian Iwaniec (Hekla Energy) which was moved from the previous day due to organizational reasons. The contribution dealt with strategies for maximizing revenues in the electricity market.

The main part of the session started with a contribution delivered by Professor Zygmunt Kowalski from the Institute of Mineral Resources and Energy Economy of the Polish Academy of Sciences. The paper was prepared in collaboration with co-authors from the Cracow University of Technology. The speaker discussed creating economic conditions for intensifying the restoration of retention in reservoirs by processing excavated sediments into construction aggregates for use in road and water construction. The next paper was presented by Andrzej Polniak, owner of the AQUA-Tech company — a Polish manufacturer and supplier of inflatable weirs. The paper concerned techniques for increasing retention in riverbeds by means of such installations. The next group of topics was opened by a presentation of Ms Katarzyna Trojanowska who highlighted the systematically deteriorating technical condition of water barrages in Poland. She emphasized that owners or users of these structures often fail to implement the post-inspection recommendations. Such a practice increases the risk in the face of increasing extreme weather events.

The next two presentations were of commercial character again. In the first one Mr W. Kosoń (INORA Sp. z o.o.) presented tech-

nologies for strengthening slopes and bottoms of open canals using synthetic formworks. In the second one Mr R. Masek (Belse) discussed methods for repairing and protecting concrete elements of hydraulic structures by means of composite materials. The session concluded with a presentation by Prof. Leszek Opyrchal of the Military University of Technology, on forecasting threats to buildings in floodplains.

The panel debate, "Energy and water management in response to the challenges of the climate crisis and other threats" was brilliantly moderated by B. Kuba Puchowski, multiyear President of the TRMEW Management Board, currently running his own engineering business. The discussion was attended by: Ms Magdalena Żmuda (deputy president of PGW WP), Mr Mariusz Gajda (former undersecretary of state in the Ministry of Environment, currently — individual engineering activity), Ewa Malicka (president of the TRMEW Board), Ms Katarzyna Trojanowska (secretary of the TEW Board, currently — individual engineering activity), Mr Arkadiusz Czarnecki ZEW Niedzica, Mr Konrad Kąkol (legal counsel, Tauron Ekoenergia Sp. z o.o.), Mr Błażej Wójcik (legal counsel, private developer) (fig. 4).

The debate enabled participants to exchange experiences and views on the threats resulting from the climate crisis, the state of civil engineering infrastructure in Poland and the role of hydropower in ensuring security of the power system.

The outcome point for the debate was the moderator's doubt as to whether we are truly dealing with climate change, given that so little is being done to counteract its effects. One of the immediate causes is lack of financial resources for both

investment and maintenance in water management. State funding is many times lower than the actual needs, while the burden placed on hydropower plants utilizing multi-purpose civil engineering infrastructure is often disproportionately high as compared to the benefits achieved. Representatives of the hydropower sector highlighted numerous misunderstandings in daily contacts with the State Water Holding Polish Waters (PGW WP). Faced with rising costs of civil engineering infrastructure maintenance, exacerbated by extreme weather events, small hydropower plants are increasingly losing their profitability, and in extreme cases, their further operation is no more continued. Consequently, the entire dam maintenance cost falls on the State Treasury. In accordance with the spirit of the Water Law, the "user pays" principle should ensure proportionate burdens laid on all infrastructure users. In practice, the principle has become a caricature of itself: fees are high, the main beneficiaries — municipalities benefiting from flood protection and water availability during drought season — are exempted from these fees. Instead, they collect taxes for the flood protection infrastructure presence at their territory. Critical opinion on the implementation of relevant regulations was presented also by Mr Mariusz Gajda, the main initiator and author of the current Water Law.

The debate moderator also touched on the long-awaited legislative changes, pointing out the need to define the conditions for hydropower plants operation, especially small hydropower plants (SHPs), in the coming years. He emphasized that the continuing uncertainty hinders development of reliable feasibility studies, halts investments, and delays overhauls and rehabilitations. He described colourfully the entire administrative process as a "multi-headed hydra," emphasizing the complexity and intricacy of the current regulatory system in water management.

Design and operation

Session VII, on design of water turbine flow systems, was chaired by Dr. M. Kaniecki (T-G DNALOP / IMP PAN). The session started with Dr. Zbigniew Krzemianowski's presentation on the inverse method application to the design of runner blades and guide vanes of a high-speed Kaplan-type tubular turbine. Optimization of the entire flow sys-

tem was performed based on calculations for 192 cases. Performance and cavitation tests of the model were conducted at the IMP PAN laboratory. In the next lecture, Mr J. Świderski presented the use of his own virtual laboratory for upgrading of water turbine flow systems. The starting point were the results of CFD analyses of the entire system, which were used then to tune and optimize the numerical model using the multi-objective MODOA algorithm.

The closing presentation of the session was delivered by Ms Anna Chernobrova (Wrocław University of Science and Technology) who demonstrated that the properties of pumps operating in turbine motion (PaT) can be significantly improved by modifying the geometry of the spiral chamber, especially in the case of double-flow centrifugal pumps.

Session VIII, dealing with generation systems in hydropower plants, was chaired by Professor M. Sułowicz, Dean of the Faculty of Electrical and Computer Engineering at the Cracow University of Technology. The opening paper was delivered by Dr. Juliusz Kirejczyk, an independent consultant, expert in selection of variable speed reversible hydraulic units. The speaker outlined main guidelines for selecting such units and pointed out the impact of speed control on their performance and cavitation properties. In the next contribution Professor Dariusz Borkowski (WIEiK PK) discussed variable speed units with propeller and Kaplan turbines for mini- and micro-hydropower plants, emphasizing the beneficial impact of speed control on their efficiency characteristics, particularly when combined with synchronous generators. Finally, Dr. Piotr Kisielewski (Kisielewski Sp. z o.o.) drew attention to the advantages of small permanent magnet (PM) synchronous generators which, when working with grid parameter converters, constitute a competitive alternative to asynchronous generators, mechanically coupled to the turbine.

The final session, "Selected Issues in Hydroelectric Power Plant Operation," was chaired by Professor Grzegorz Żywica (IMP PAN). The session was opened by the contribution of Dr. M. Kaniecki who presented the history and key products of Thordon Bearings Inc., the world leader in production of water-lubricated guide bearings,

lubrication-free bearings, and shaft seals. The speaker characterized also the outstanding personal input of the company multi-year president, George A. (Sandy) Thomson, into Thordon Bearings technological progress.

The next two presentations were of a commercial nature. Mr Jerzy Przydatek (PFTechnology), discussed the operating principle of FSDN self-cleaning filters used in generator as well as bearing and seal lubrication oil cooling systems while Mr Adam Chlapek (T.I.S. Polska Sp. z o.o.) presented a range of valves, including needle and diaphragm ones, as used in hydraulic energy recovery installations in waterworks and recommended in the studies conducted under the EU Life NEXUS project.

The last two papers concerned diagnostic and performance tests of hydroelectric power plants in operating conditions. Dr. Waldemar Janicki (IMP PAN) emphasized the need for careful selection of the measurement card and measurement range when monitoring vibrations to avoid erroneous conclusions, especially when it is needed to integrate the acceleration or velocity signal to determine the displacement amplitude. Mr Petr Ševčík (OSC, a.s., Brno) pointed out the usefulness of tracking the dynamic state of the Kaplan turbine, demonstrating that determining the optimum cam relationship requires consideration of such factors as cavitation and partial load vortices - a finding confirmed by the professional experience of the author of this text.

Conclusion

It was already past 6 p.m. when the HYDROFORUM 2025 conference came up to the end. The chairman of the Organizing Committee thanked Professor G. Żywica for chairing the final session and all participants for their perseverance. In a brief summary, he stated that the conference had achieved the goals set by the Organizing Committee and expressed confidence that the joint meetings and discussions would prove fruitful, providing impetus for further efforts to develop hydropower in Poland. Preliminary information regarding the next edition of the conference was also provided. Today it is already known that HYDROFORUM 2026 is to be held from October 21st to 23rd, 2026, in "Warszawa" Hotel in the town of Augustów, close to



Fig. 5. The study visit participants step down along the Rożnów HP fish ladder and the dam towards the powerhouse. The view from the road leading to the Rożnów Dam

the Polish/Lithuanian border. A study visit to the Kruonis PSP Plant in Lithuania is planned for the final day. The conference partners will be Ignitis Gamyba (power plant operator) and Voith Hydro, as well as the Lithuanian Hydropower Association.

The two-day conference debates in the "Pearl of the South" hotel were followed by a study visit to the Rożnów HP and a boat cruise on Rożnów Lake. At this place it is to be explained that erection of the Rożnów Dam and the Rożnów HP count to the largest investment projects in the Second Republic of Poland. The Rożnów project was a rapid and decisive response by the young Polish state to the catastrophic flood of 1934. Within seven years — including three years under German Nazi occupation — the dam was completed, the Dunajec River was dammed, and the first two hydroelectric units were commissioned. In 1943, the plant reached its full installed capacity of 50 MW.

The Rożnów HP is equipped with four hydroelectric units with Kaplan turbines from Escher Wyss. Until commissioning of Włocławek HP at Vistula river, it was the largest conventional hydroelectric power plant in Poland. The visit to Rożnów Power Plant and the farewell dinner at Łaziska Hotel in Czchów were the final highlights of HYDROFORUM 2025. Shortly after 2 p.m., after good wishes of seeing each other one year later, the last Conference delegates started their travel homewards.

Janusz Steller

Chairman of the Organizing Committee
Polish Hydropower Conferences