HYDROPOWER | WATER MANAGEMENT | ENVIRONMENTAL PROTECTION | INLAND NAVIGATION | ENERGY RECOVERY

ENERGETYKA WODNA

3/2024 (51)
FREE COPY
ISSN 2299-0674

Flooding in the Kłodzko Valley – causes of catastrophic events in the region

p. 46

Water turbine refurbishment – behind the scenes

p. 14

Hydropower plants for floods

p. 36

The outlook for hydropower 2024 – IHA report

p. 38

TRMEW

Our offer

organisation:
- study tours
- conferences
- workshops

marketing:
- graphic design
- social media management
- website design and management

ENERGETYKA WODNA

Contact us:
mob.: +48 518 304 194
e-mail: biuro@energetyka-wodna.pl

www.energetykawodna.info

Pumped storage power plants in Europe

Study tour – 2025 edition
Switzerland/France • United Kingdom • Portugal*

Recruitment of attendees is in progress!

*Possible directions of the study tour, organization depends on gathering sufficient number of participants.

From the Editorial office

The flood that struck Central Europe, including Poland in September, left a painful mark on the affected regions, bringing not only destruction but also casualties. This challenging lesson for everyone, once again exposed the numerous shortcomings in our country's preparedness to face extreme weather events.

These events should serve as a call to action for everyone, within the scope of their own capabilities, both in their professional and personal lives, in order to minimise the potential effects of future excessive rainfall as much as possible. There is no doubt that such events will come. It is crucial to be prepared. I realise that this is a time-consuming and costly task, but it is worth asking ourselves whether we, as a nation, can afford to continue bearing the high costs of repeating the same mistakes.

First and foremost, higher priority must be given to water management, which has been neglected for decades, along with the adoption of a long-term investment plan, which will, equally importantly, be scrupulously implemented, particularly above political divisions. The actions taken should deliver the greatest benefits to society, while respecting the natural environment as much as possible, in accordance with the specific characteristics of each location. By listening to various perspectives and sometimes even merging the extreme views of two schools of water management ("hydrotechnical" and "renaturalisation"), a picture of a reasonable compromise begins to emerge. This approach considers renaturalisation efforts within rivers in the upper parts of the catchment areas, as well as increasing retention in undeveloped regions, particularly forests and agricultural lands. Such retention can primarily be enhanced through non-technical measures. In urbanised areas in the middle course of the river, the construction of polders or water reservoirs, both dry and wet, will be advisable, serving multiple functions (including the generation of electricity, which could help secure the budget for maintaining flood protection infrastructure). Meanwhile, the protection of settlements in the lower parts of the catchment or lowland areas should be ensured by flood embankments or natural floodplains, incorporated into local spatial development plans.

However, it is impossible to overlook other equally important matters, such as increasing investment in the maintenance of existing hydrotechnical structures, revising their technical parameters in light of observed changes in river flow characteristics, and issues related to the development and implementation of water management guidelines.

On the other hand, it is the responsibility of those outside the hydrotechnical sector to manage land use in river valleys wisely, particularly by refraining from building on floodplains or areas that have ever been considered such. This also includes practising rational forestry and agriculture that do not reduce the natural retention capacity of the catchments, and placing greater priority on preparing and updating crisis management and communication scenarios. Individual preparation for floods is also crucial, both in terms of protecting personal property and understanding the procedures to follow in the event of a flood.

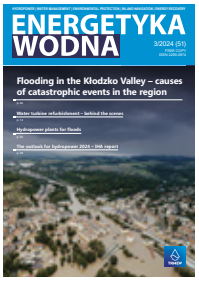
In such situations, the media also play a significant and responsible role, influencing the decisions of many people. It is extremely important that the media use proper technical terminology in their reports, accurately describing events according to established nomenclature, and thus avoiding misleading the audience, as unfortunately happened during recent incidents.

I hope my words will serve as a source of reflection and inspiration for everyone to take action in their own capacity, contributing a small part to the demanding task of creating a safe space for us all to live and grow.

Michał Kubecki
Editor-in-Chief

ENERGETYKA WODNA

International quarterly
NO 3/2024 (51) – estimated readership: 2 500 unique recipients
www.energetyka-wodna.pl



NEWS

3 Energy storage from renewables remains a challenge for Poland

4 TRMEW news

4 Calendar

5 Two more hydro units planned for Niedzica

5 SHPs in Ruda Maleniecka to modernisation

5 Additional PLN 2 billion in the "Energy for villages"

6 News from the Polish Committee for Large Dams

7 Industry catalog

8 Grants for small retention in cities

10 The LIFE Programme – Polish Waters encompasses fourteen projects

11 Renovation of Kozielno reservoir on the Nysa Kłodzka River postponed

11 Contract for modernisation of Czersko Polskie power plant

12 From the World

PRACTICE

14 Water turbine refurbishment – behind the scenes

21 Women's perspective in hydropower

22 T.I.S. fittings for waterpower applications

26 RENEWAT: leading renewable energy projects in existing water mills

28 Inter-university camp of student science clubs Dychów 2024

30 Reconditioning and modernisation of water turbine rotors

32 Composite – movable rubber dams

LAW

34 Real estate tax savings in the hydropower industry

PROJECTS

36 Hydropower plants for floods

KNOWLEDGE

38 The outlook for hydropower 2024 – IHA report

42 Energy storage facilities – market and legislative considerations for the commercial power sector

ECOLOGY

46 Flooding in the Kłodzko Valley: causes of catastrophic events in the region

49 On the way to sustainable energy

Photo on cover:
Flooding in Kłodzko, Sep. 14th, 2024
Source: Oliwier Kwiatkowski, OK Studio

Publisher:
Polish Association for Small Hydropower Development (TRMEW)
ul. Królowej Jadwigi 1
86-300 Grudziądz
phone: +48 (56) 46 49 644
e-mail: biuro@trmew.pl
www.trmew.pl

TRMEW

Orders for institutional subscription adopts Kolporter Sp. z o.o. Sp.k. Information available at the hotline number 0 801 40 40 44 or on the website www.dp.kolporter.com.pl

It was published: 18.11.2024

Media partners

CIRE.PL Centrum Informacji o Rynku Energii · GRAMWZIELONE.PL · Water Power & Dam Construction · Nowoczesne Budownictwo Inżynieryjne · The International Journal on Hydropower & Dams · wysokie napiecie.pl · zek

Energy storage from renewables remains a challenge for Poland

The Polish government has announced its work on new regulations aimed at facilitating the development of onshore wind farms. The proposed changes include abolishing the 10H rule, setting minimum distances from protected areas, and streamlining investment planning. While these steps may accelerate wind energy development, significant concerns remain regarding the issue of energy storage from renewable sources (RES).

On the one hand, the new regulations could lead to lower electricity bills due to cheaper renewable energy. On the other hand, if the government does not address the issue of energy storage, Polish citizens may face unstable energy supplies, such as power outages or price fluctuations. Additionally, planned investments could impact the value of properties located near wind turbines.

The Federation of Polish Entrepreneurs (FPP) warns that without appropriate energy storage solutions, the rapid growth of RES may lead to inefficiencies in its use. The challenge of storing surplus energy is becoming increasingly urgent, both in Poland and across Europe.

As the new regulations contribute to a dynamic increase in the number of wind installations, the question of where we will store the produced energy remains unanswered. The proposed regulations lack solutions to support the development of energy storage infrastructure for renewables, despite proven technologies such as pumped-storage power plants, which have been reliable for over 100 years and could complement the government's plans.

It is worth noting that in the context of the Blue Deal, which includes a budget close to €400 billion for significant investments in water infrastructure, efficient energy storage will be crucial for achieving European climate goals. Hydropower is the leading source of renewable energy in global electricity production, contributing over 70% of renewable energy capacity.

One promising solution are modern pumped-storage power plants (PSP), capable of operating even in challenging geographic conditions by using reservoirs filled with fluids that are 2.5 times denser than water. This technology allows for efficient energy storage, even in low-lying areas, significantly expanding the potential for PSPs in Poland.

Planned investments in Poland include the construction of new pumped-storage power plants with a total capacity of 2.5 GW, which will strengthen the national energy system. Notable projects such as Tolkmicko, Młoty and Rożnów II pumped-storage power plants form the core of new investments in this area. Despite the massive scale of these initiatives, it is also important to note that modern technology enables the construction of smaller PSPs that perform well in local conditions.

Tomasz Wojtczak, Managing director of Amiblu in Poland, notes: "Poland has suitable locations for building pumped-storage power plants, especially in mountainous regions like Sudety Mountains and Carpathians. We should also consider utilizing the height differences in closed coal mines. Post-mining pits can not only serve as reservoirs for PSPs but also aid in land reclamation and create new jobs".

The government's April 2023 legislation, which simplifies investment procedures for pumped-storage power plants, has faced criticism. While it aims to expedite such projects, it also poses the risk of social and environmental conflicts, as it simplifies expropriations and grants public purpose status to these investments. Without appropriate regulations on energy storage, these investments may not materialize.

In the UK and Ireland, as many as 165 PSP projects are currently underway. The Scottish government recently approved the construction of an underground pumped-storage plant with a capacity of 600 MW and a value of £500 million. Poland should follow this path to effectively compete in the energy market and secure the future of our energy system.

Across Europe, intense discussions are taking place on effective methods for energy storage, particularly in the context of EU regulations regarding renewable energy under the updated Renewable Energy Directive (RED). The new regulations, which came into force in November 2023, aim to increase the share of RES in total energy consumption to at least 42.5% by 2030, with the goal of reaching 45%. Under these regulations, member states will need to set national targets and promote the development of infrastructure for renewable energy production and storage.

> *Without appropriate energy storage solutions, the rapid growth of RES may lead to inefficiencies in its use.*

This is a critical moment for Poland to focus on modern energy storage technologies, which can ensure supply stability and energy efficiency. The Federation urges the government to take a comprehensive approach to energy challenges. Without clear regulations on renewable energy storage, Poland may face difficulties in achieving its climate and energy goals, lagging behind other countries that are already implementing advanced solutions in this field. These issues was discussed on September 24 at the Blue Deal Congress at the Sheraton Hotel in Warsaw.

During the Congress, key decision-makers from Europe, business representatives and NGOs practitioners also leaned into the most effective methods of action and solutions for water management.

Marek Kowalski
Chairman
Federation of Polish Entrepreneurs

TRMEW news

In mid-September a catastrophic flooding affected south-western Poland, causing enormous devastation. At first, we watched with a sense of helplessness as the element consumed people's lives and possessions. The floods inundated homes, streets and infrastructure, and the scale of the damage was enormous.

Members of the Polish Association for Small Hydropower Development (TRMEW) rushed to the aid of those affected, showing solidarity and commitment. Their selfless help in clearing up the areas, their financial support for the rental of dehumidifiers and even their simple words of encouragement really made a difference. Their commitment has reassured us all that we form a very close-knit group capable of overcoming even the most difficult situations together.

Today, even though the threat of flooding is over, our association is monitoring the situation, gathering information about losses and the needs of small hydropower plants owners. In response to the flooding, TRMEW made a request to the State Water Holding Polish Waters to exempt affected power plants owners from charges. We were pleased to learn that the institution granted this request. TRMEW has also taken action at government level. The Board has requested a meeting with the Ministry of Climate and Environment to present the scale of the damage and the needs of the hydropower industry. This meeting is expected to develop solutions to support hydropower restoration and protect against future disasters. We look forward to setting the date.

At the beginning of September, the General Assembly of TRMEW members was held in Grudziądz, during which current organisational matters were discussed. The members were unanimous in stating that their joint efforts are yielding tangible results and that solidarity is the foundation of their work.

One of the new successes of our association is the application submitted to the Foundation for the Development of the Education System (FRSE) within the framework of the competition "Establishment and support for the operation of 120 sectoral skills centres (BCUs) implementing the concept of centres of professional excellence (CoVEs)". We are delighted to announce that the TRMEW project has been shortlisted for funding. This means the creation of an industry skills centre for the hydropower, where professionals can gain knowledge and develop practical skills. The new TRMEW project is another step in the promotion of renewables and the development of the hydropower industry. The centre of professional excellence in hydropower will become a place to share experience and learn modern skills. We will soon provide more details on plans for the opening and operation of the facility.

Those of you who would like to support those affected by the floods are invited to support the collection we are organising for this purpose. Details can be found at **www.trmew.pl.** Many thanks for any support!

Monika Grzybek
Office manager
TRMEW

Calendar

18–20.11.2024 Graz, Austria	**HYDRO 2024** Organiser – Aqua~Media International Ltd.	www.hydropower-dams.com/hydro-2024
19–21.11.2024 Lublin, Poland	**ENERGETICS Trade Fair** Organiser – Targi Lublin	www.energetics.targi.lublin.pl/en/
3–4.12.2024 Ankara, Türkiye	**Dams & HydroPower Türkiye Summit** Organiser – HESİAD	www.damshydropowersturkiye.com
4–5.12.2024 Sarajevo, Bosnia and Herzegovina	**6th Annual International Summit and Exhibition Balkan's Power** Organiser – Vostock Capital	www.balkanspowersummit.com
11–13.12.2024 Shanghai, China	**Aquatech China** Organiser – RAI Amsterdam	www.aquatechtrade.com/shanghai

Two more hydro units planned for Niedzica

A new installation, with a capacity of nearly 7 MW, will be installed at the Niedzica hydropower plant (HP), enabling the use of the currently undeveloped hydropower potential of Lake Czorsztyn. It will be one of the largest installations of its kind constructed in Poland in recent years.

The new installation will be located within the existing dam and the turbines will be built in the free spaces of the existing Niedzica HP. Both supply of water to the hydro units and the discharge will be managed through newly designed pipelines, which will be connected to the existing bottom outlets. The existing hydroelectric potential of the Czorsztyn reservoir will be available for peaking by the existing Niedzica HP as well as for continuous operation by two new hydro units equipped with vertical Francis turbines, manufactured by VOITH Hydro. These turbines will operate within a head range between 28–48 metres, with each unit having a flow rate of 9 m³/s. The remaining balancing flow, between 6–8 m³/s, up to the average annual flow, will be processed by the existing Niedzica PSP during peak hours. The generating equipment, with an installed capacity of 3,322 kW per unit, will work with synchronous generators supplied by the Czech company TES Vsetín. The installation is expected to produce no less than 40,000 MWh annually. Each of the new generators will be capable of operating independently (island mode) or in parallel with the 15 kV power grid, either supplying the dedicated network of ZEW Niedzica SA or the TAURON Dystrybucja grid. The continuous operation of the newly designed hydropower units and full automation will facilitate the balancing of local consumers connected to the ZEW Niedzica SA grid on a 24-hour basis, with power and energy adjusted to current demand. Any surplus energy produced will be fed into the power grid. Furthermore, the capacity to continuously regulate both active and reactive power output from the hydro units (in real time) allows for optimal energy loss reduction and local voltage control, which is highly beneficial, especially in the light of the growing production of electricity from prosumer photovoltaic (PV) installations. The entity responsible for the investment, designated as the general contractor, is Enerko Energy from Kielce (Poland). The general contractor for the investment is Enerko Energy, headquartered in Kielce (Poland). The contract, concluded at the end of July, encompasses the development of comprehensive, multidisciplinary executive documentation, the acquisition and maintenance of all requisite agreements, opinions and administrative decisions necessary for the construction, acceptance and operation of Niedzica II SHP. The scope of work also includes the execution and management of turnkey construction and assembly operations, the delivery and assembly of complete power plant equipment, along with the commissioning and operational tests, as well as the development of operational instructions and conducting final staff training. The concept of the project had been evolving for many years and the final planning permission was granted in 2020. After time-consuming tendering procedures, we are finally moving on to putting our idea into practice.

Józef Wójcik
Chief investment and development officer
ZEW Niedzica SA

SHPs in Ruda Maleniecka to modernisation

On 13 August, a contract was formalised for the modernisation of small hydropower plants in the municipality of Ruda Maleniecka (Świętokrzyskie Voivodeship). As part of this investment, the technological equipment will be replaced and the existing infrastructure will be adapted to the new standards.

"The three SHPs on the Czarna Konecka River were constructed in the first half of the 1990s, however they have not undergone any form of repair for approximately three decades. As a consequence of the modernisation, the energy obtained from the power plants will be used primarily for public lighting and to power municipal public buildings, including the primary school, kindergarten, municipal library and the fire station of the voluntary fire brigade in Ruda Maleniecka. In addition, it will meet the current energy needs of the municipality. The total cost of the task is estimated at PLN 8,580,000, with PLN 7,980,000 to be financed from the Government's Fund Polish Deal: The Strategic Investment Programme. The entity responsible for the implementation of the investment is Enerko Energy Sp. z o.o.

Paulina Góral
tkn24.pl

Additional PLN 2 billion in the "Energy for villages"

The recently constituted management board of the National Fund for Environmental Protection and Water Management (NFOŚiGW) has resolved to augment the budgetary allocation for the 'Energy for Villages' priority programme.

In view of the considerable interest in green energy investments in rural areas, the new management board of the NFOŚiGW has put forward a proposal to increase the funds available for the "Energy for Villages" programme from PLN 1 billion to PLN 3 billion. The programme offers financial assistance for the installation of photovoltaic systems, wind turbines, biogas plants, hydropower plants and energy storage facilities. Those engaged in agricultural activities or energy cooperatives situated in rural areas may be awarded grants of up to 65% of the eligible costs, up to a maximum of PLN 20 million, and loans of up to 100% of the eligible costs, up to a maximum of PLN 25 million. The proposed amendments will be submitted to the Minister for Climate and Environment for consultation.

Press office
NFOŚiGW

News from the Polish Committee for Large Dams

POLCOLD has established strategic cooperation with the Albanian counterpart of the national committee of large dams — ALBCOLD, which may bring significant benefits for hydroengineering in both countries. This cooperation is aimed at intensifying the exchange of technical information, organizing joint seminars and mutual support of activities on the international forum. The first steps in this direction were taken during a meeting held at the invitation of the ALBCOLD President from July 16 to 18 in Tirana.

As a part of the visit of the Polish delegation to Albania, the chairman of POLCOLD delivered a lecture on dams in Poland and discussed plans related to the organization of the EURCOLD seminar, which will be held in Poland in 2026. The meeting took place at the Ministry of Infrastructure of Albania and gathered key representatives of the Albanian hydrotechnical sector. In his presentation, Śliwiński emphasized the importance of large dams for water management and energy, which is a common denominator for both countries. After the presentation, there was a discussion with ALBCOLD members, when current problems related to the operation and safety of dams in Poland and Albania were debated. Experiences regarding monitoring, analysis of measurement data and their interpretation in the context of dam safety assessment were exchanged. In particular, the focus was laid on advanced techniques for monitoring the technical condition of dams, which is an important aspect of their safe operation.

The visit program also included a technical trip to two large dams — Vau Dejës and Qyrsaq. These damming structures are elements of the Drin River cascade, which is responsible for the production

Five proposals to improve flood safety in Poland

The events of recent days have brutally confirmed the critical importance of ensuring the safety and proper maintenance of dam structures to protect human life and property. While it's true that the rainfall that hit southwestern Poland reached record levels, these are precisely the types of challenges that water management and hydrotechnics must face in a changing climate. Is it even feasible to tackle these challenges? Yes. The principles of dam structure design are based on selecting construction parameters that correspond to a certain probability of occurrence, depending on the required safety level downstream of the structure. This must be consistently implemented along the entire river, because what good is it if the flow remains within reinforced embankments in one section but spills over the crests of levees in another, flooding towns and villages?

There are many problems we need to solve, and it's impossible to address them all in this article. However, it is important to highlight those issues that require the most urgent decisions.

- Firstly, water management guidelines should be made more flexible, even though they are part of a water law decision—a document that takes ages to issue!
- Secondly, we must be able to change the classification of structures (currently, this is not possible, as the class determined during the design phase cannot be altered). This would allow us to enhance the technical and safety parameters of hydrotechnical structures through reconstructions and upgrades.
- Thirdly, let's build reservoirs wherever it makes sense. The money spent on these investments will quickly pay off compared to the costs we incur in dealing with the effects of floods and droughts.
- Fourthly, let's build based on the principles of sustainable development, taking into account all aspects of the interaction between humans and nature. Let's focus on retention (including flood retention) without prioritising imagined benefits for plant communities that nature has equipped with mechanisms to adapt to changing water and climatic conditions. This should be done without repeating slogans about concreted or straightened rivers, or barriers disrupting the continuity of river life. These arguments lose their meaning in the face of the recent catastrophe. Retention serves to increase water resources and enhance resilience to extreme events, combating both floods and droughts, and reducing the vulnerability of ecosystems. Solutions used in the construction of retention projects that maintain the continuity of watercourses (such as mandatory fish passes), or the materials and approaches used on riverbanks and reservoirs that are closer to nature, truly demonstrate the potential for sustainable retention actions. The guides and catalogues of solutions and best practices for retention developed in recent years at the national and EU levels, as well as the requirements and environmental impact assessment systems for technical activities, without which construction projects cannot be implemented, are the foundations of water management. Extremely valuable in these efforts are the bulletins of ICOLD, recommended and implemented by POLCOLD, which provide guidelines for the design and maintenance of hydrotechnical structures. These are prepared and proposed by the world's leading specialists.
- And fifthly, a good national water management system cannot be built in a single parliamentary term or planning cycle. It must be a long-term plan, transcending political divisions, as it is meant to serve the people of Poland now and for future generations.

Both natural and artificial, small and large, retention systems are worth creating, having, building, and maintaining in proper condition. Both forms of retention have their numerous positive functions — this is indisputable. Efforts to increase retention are a response to climate change and are a desirable direction in adaptation.

Source: POLCOLD

Fig. A commemorative photo of the meeting with ALBCOLD members

of approximately 80% of Albania's power demand. These dams, like many others in the region, play an important role in the country's energy stability.

Albania has almost 400 large dams (according to ICOLD's definition), 40 of which are located in the capital of the country — Tirana — and its surroundings. Most of them were built to supply water to agriculture, which reflects the specificity of hydroengineering in Albania. These systems are crucial for both the agricultural and energy sectors of the country. The technical visits allowed the POLCOLD delegation members to understand the challenges Albania faces in maintaining and modernizing these structures. Both sides found the meeting very fruitful, emphasizing the importance of further relations strengthening. The next stage will be the return visit of the ALBCOLD delegation to Warsaw, scheduled for the end of 2024. As part of this visit, a micro-seminar will be held at the Warsaw University of Technology, which will bring together damming experts from Poland and Albania.

The culminating point of the meeting will be the ceremonial signing the letter of intent on cooperation between POLCOLD and ALBCOLD, which will formally tighten the relations between the two organizations. This document aims to support further exchange of information and experience, joint activities for dam safety and promotion of modern solutions in the management of damming structures.

Piotr Śliwiński
Chairman
Polish Committee of Large Dams POLCOLD

Grants for small retention in cities

The National Fund for Environmental Protection and Water Management (NFOŚiGW) will provide further financial assistance for water investments in eight cities. From the European Funds for Infrastructure, Climate and the Environment (FEnIKS) 2021–2027 programme, funding for investments in these cities will amount to PLN 190 million.

In the 2030 perspective, more than PLN 7 billion will be allocated for small and large retention from the FEnIKS programme. Investments by local authorities will enable effective rainwater management and increase protection against the effects of extreme precipitation, including flooding, which will benefit city dwellers, said Robert Gajda, Deputy President of the Management Board of NFOŚiGW.

Wrocław will receive more than PLN 23 million in funding to create a sustainable rainwater management system. The city is planning solutions based on green infrastructure and nature. The work is planned in six locations on an area of more than one hectare. Among the goals of the project are to increase the retention capacity of publicly accessible urban spaces, create conditions for the development of biodiversity and improve living conditions for residents by mitigating the urban heat island effect. Small retention facilities with a capacity of approximately 1,050 m³ will be built. The creation of rain gardens and planting of plants will facilitate the filtering and retention of rainwater. The upgraded green squares will provide a place of rest in the urban space. The investment will provide better protection from extreme rainfall for more than 100,000 residents. The project is expected to be completed in autumn 2026, with a total investment of more than PLN 37 million.

In Bielsko-Biała, the investment will cover an area of nearly 7 ha of the city. The modernisation of the city's green-blue infrastructure will improve retention capacity and reduce heat island effect. This will be achieved by rehabilitating reservoirs and developing retention basins, removing impermeable surfaces and increasing biodiversity in the city's squares, parks and plazas. Three green stops will also be created. The project will cost nearly PLN 25 million, of which PLN 19 million will be provided by EU funding. The works are scheduled to be completed by the end of 2026.

The rainwater management project in Gorzów includes the construction of two retention and infiltration tanks, a retention tank with a capacity of 35,834 m³, and the installation of stormwater drainage infrastructure in the area of Warszawska Street. Additionally, one of the tanks will serve as a rain garden, and its surroundings will be designated for recreational use. The project is scheduled for completion by the end of 2026. For the implementation of this undertaking, valued at PLN 14 million, the city will receive over PLN 11 million from the NFOŚiGW through the FEnIKS programme.

Zielonogórskie Wodociągi i Kanalizacja Sp. z o.o. will receive nearly PLN 2 million for a project that includes the construction of small retention facilities and a section of stormwater drainage network. The new infrastructure will enable the efficient use of rainwater — utilising infiltration systems to irrigate green areas in the city. The investment also includes the construction of a new recreational park. The project is scheduled for completion by the end of 2025, with the total cost of the undertaking exceeding PLN 3 million.

In Gdańsk, new retention tanks and pumping stations will be constructed. The new infrastructure will improve the collection and drainage of rainwater, reducing the risk of local flooding. The capacity of the new and modernised small retention facilities will amount to 137,270 m³. The works will cover nearly 8 hectares in the areas of the Oliwski Stream, Strzyża Stream, and Kowalski Stream. For the implementation of this project, valued at over PLN 123 million, the city will receive nearly PLN 93 million from the FEnIKS programme. The project is scheduled for completion in 2029.

The improvement of retention capacity and the creation of green space in the city are the main objectives of the revitalization project for the Silnica Valley in Kielce. A total of over PLN 31 million has been allocated for the task, with PLN 24 million covered by funding from the FEnIKS programme. Dry retention basins will be constructed in the Silnica area to collect rainwater. Restoring the ecological functions of the Silnica floodplain will involve, among other things, the reinstatement of grassy riverbanks, the preservation of meadows, and the planting of vegetation with water purification capabilities. Additionally, wooden walkways, terraces, and relaxation areas for residents will be created. The project is set to be completed in 2028.

In Grudziądz, a new stormwater drainage network will enhance water distribution during heavy rainfall and reduce the risk of flooding. The investment includes the construction of two retention basins along with rainwater pumping stations and pre-treatment facilities. The expansion of the stormwater drainage network will relieve the existing collectors and allow for the diversion of some rainwater to the Vistula River. Roads and residential areas will be protected from heavy rains and snowmelt. The total capacity of the new small retention facilities will be 7,774 m³. The completion of this investment, valued at over PLN 23 million, is planned for the end of 2026.

Furthermore, funding will be allocated to Sopot. The municipal authorities have devised a programme of works comprising the construction of new retention tanks and the modernisation of the stormwater drainage system in the areas of Lower Sopot and Świemirowo. The new facilities will facilitate the utilisation of rainwater for the irrigation of green spaces. Furthermore, the city square will undergo modernisation. The project, with an estimated value of over PLN 4 million, is scheduled for completion in the spring of 2028.

In accordance with Action 1.2 of the FEnIKS programme, the Poznań-based company Aquanet has been allocated funding of PLN 9 million for the initial phase of the project "Rainwater Management in Poznań". It is anticipated that a further six contracts for the funding of projects in cities with populations exceeding 100,000 citizens will be concluded during the course of this year.

Press office
NFOŚiGW

enex

Targi Kielce
exhibition & congress centre

Good energy for your business

Poland's largest Trade Fair of Renewable Sources of Energy

18-19.02.2025

Targi Kielce

enex.pl

The LIFE Programme – Polish Waters encompasses fourteen projects

The LIFE program is the only program managed at the European Commission level and entirely dedicated to environmental, nature and climate protection and energy transition issues. State Water Holding Polish Waters will apply for funding to implement 14 projects under the LIFE programme. The proposed actions focus on improving water quality, restoring the ecological continuity of rivers, enhancing biodiversity and increasing water retention.

The State Water Holding Polish Waters (PGW WP) is actively working to protect water environments in Poland by initiating new renaturation projects under the LIFE financial instrument. Currently, project preparations are underway, which will serve as the basis for applying for funding from the European Union. Proposals are planned for fourteen projects, with ten applications expected to be submitted in this year's call for funding. A significant support in achieving this goal is the close cooperation between PGW WP, the National Fund for Environmental Protection and Water Management (NFOŚiGW), and non-governmental organizations. In August 2024, a joint working group was established with the task of intensifying efforts to prepare and finance environmental projects under the LIFE programme. The experience of experts from PWG WP, who have already participated in similar initiatives, will also be invaluable.

The new LIFE projects will be implemented across Poland in collaboration with a range of stakeholders. The table summarizes the descriptions of the projects being developed. The LIFE projects implemented with the involvement of PGW WP are characterized by their comprehensiveness and the engagement of multiple stakeholders. This aligns with the principles of watershed management, which considers the watershed not just as a single river or lake, but as an entire hydrological system. Systematic actions throughout the watershed allow for improvements in its ecological status, which in turn affects the condition of specific river sections, lakes, and reservoirs.

Source: PGW WP

Project title	Project objective
LIFE ecological corridors	preserving biodiversity and increasing resilience to climate change by reducing the fragmentation of ecological corridors and creating connections between protected areas in Poland
LIFE Drawa encore	improving water quality and environmental conditions in the Drawa River catchment by achieving key conservation objectives
LIFE Odra	supporting the restoration of the Oder River ecosystem in the canalized section (between the Krapkowice and Januszkowice barrages) by reducing the concentrations of chlorides, sulfates, nitrates, and phosphates, as well as increasing the population of fish species through the construction/modernization of fish passes and/or creating optimal conditions for the growth of soft coastal/water plants
LIFE Wisła	restoration of the morphological continuity of the (Little) Vistula River from the Vistula Czarne reservoir to the Goczałkowice reservoir to improve flood safety and enhance biodiversity
LIFE green iDream	increase and protect the stability and biodiversity of dykes contributing to a reduction in flood risk and maintenance costs of flood protection infrastructure by applying natural methods of sustainable vegetation management using sheep
LIFE Skawinka	the introduction of comprehensive and distributed solutions for water management as an example of adaptation to climate change, with the aim of increasing biodiversity and retention in the entire Skawinka river catchment area; among other things, it is planned to reduce the impact of rainfall through the retention of 33,412 m³ of rainwater, improve the habitat and biological quality of 8 species in selected areas of the catchment and increase knowledge of water management among at least 12,000 inhabitants
LIFE spawn	renaturalisation of selected rivers and river valleys in the southern region of the Świętokrzyskie Mountains, Greece and Spain through restoration of natural habitats and protection and reintroduction of endangered mollusc, fish and amphibian species of high biocenotic importance; actions will be carried out to restore the natural course of rivers in the Nida basin by building fish passes, restoring oxbow lakes and eutrophic reservoirs and planting trees in the shoreline; thanks to habitat restoration, the population of rare and endangered freshwater mussels will be increased. The restoration of habitats will increase, among other things, the population of rare and endangered freshwater mussels
LIFE natural regeneration of the Bug valley	slowing down water run-off, leading to maintaining or increasing the high diversity and functionality of the natural environment in the Bug River catchment area by increasing the potential for water storage and retention, with a view to its use for agricultural purposes, taking into account the achievement of the environmental objectives of the catchment area
LIFE Sandomierz basin	restoration of biological continuity of watercourses, restoration of natural valley retention and improvement of hydromorphological and habitat conditions of transformed river sections
LIFE 4 rivers	improving the ecological state of the waters in the Parsęta River catchment area, including renaturalisation measures to slow down the outflow of water from the catchment area and to restore continuity between the Parsęta River and its oxbow lakes and improve the ecological state of the waters in the Parsęta catchment area
LIFE for seaside	strengthening the protection and enhancement of valuable natural habitats of migratory birds and wetland birds, including the improvement of fish migration corridors associated with Lake Liwia Łuża and Lake Resko Przymorskie, as well as their catchment areas
LIFE Międzyodrze	strengthening the protection of the habitats and protected species of the Międzyodrze (an area in Poland located in the Lower Odra valley between two branches of the Oder River: West Oder and East Oder), through the optimisation of water conditions and active protection of its natural ecosystems, taking into account the sustainable development of the area
LIFE space for retention	increasing water retention in wetlands by improving the efficiency of the management of natural processes and hydraulic facilities; this is to be achieved by optimising the management of water resources through the use of satellite data
LIFE Bóbr Blue Basin	achieving greater biodiversity of species historically present in the Bóbr River valley (atlantic salmon and river lamprey), restoring proper groundwater levels in the Lower Beaver Valley Natura 2000 habitat area, and building artificial spawning grounds for bi-environmental fish and new passes

Tbl. Planned projects by PGW WP under the LIFE programme

LIFE projects are actions aligned with the concept of Nature-Based Solutions (NBS). Utilizing ecosystem services is increasingly a component of rational water management. Sustainable development connects the ability of water users to access water while emphasizing the protection of aquatic ecosystems. This enables the achievement of the objectives of the Water Framework Directive, to which Poland has committed as a member state of the EU.

Press office
PGW WP

Renovation of Kozielno reservoir on the Nysa Kłodzka River postponed

State Water Holding Polish Waters (PGW WP) has postponed construction works on the Kozielno reservoir on the Nysa Kłodzka River in the Opolskie Voivodeship. The works, which are designed to provide flood protection for the inhabitants of the Lower Silesia and Opole regions, as well as water retention and energy production, were originally due to start in autumn of this year.

Source: Damian Daszkowski

Fig. Damaged overflow between Topola and Kozielno reservoirs (16.09.2024 r.)

According to the schedule, the works were set to begin at the start of October. The renovation was to include the repair of the erosion on the left side dam of the Kozielno reservoir along a 150-meter section, which was deemed necessary by the Centre for Technical Control of Dams (CTKZ) in Katowice.

The contractor for the construction works, selected through a tender process, is the company Zmechanizowane Roboty Ziemne Andrzej Korczyński, which is expected to complete the task within 45 days. The scope of necessary works in the reservoir basin will involve a temporary lowering of the water level in the reservoir. After the appropriate repairs are completed, the reservoir will be gradually refilled with water to reach the normal level of impoundment. However, the progress of this phase will depend on the current hydrological and meteorological situation, as well as weather conditions and precipitation levels throughout the Nysa Kłodzka catchment area, which supplies the Kozielno reservoir. Water management for the Kozielno reservoir will be overseen by the Flood Protection Operations Centre of the Regional Water Management Authority in Wrocław.

However, the effects of the flood that occurred in mid-September in this area have caused a delay in the renovation. Following the flood event, every construction facility, including dams and flood protection embankments, is required by Article 62 of the Construction Law Act of 7 July 1994 to undergo an inspection by staff from the CTKZ of the IMGW PIB. It's representatives have already begun their research work, but at this stage, they are unable to provide a definitive opinion. During the inspection period by the CTKZ, the water level in the Kozielno reservoir must remain at the normal impoundment level (NPP), which is 222.50 meters above sea level. To carry out the necessary works for the project, the impoundment level would need to be lowered to 220.50 meters above sea level, which is currently not possible. The execution of the task is postponed until approval is obtained from the CTKZ.

Press office
PWG WP
RZGW Wrocław

Contract for modernisation of Czersko Polskie power plant

On 10 July, Andrzej Ryński, Director of Regional Water Management Authority (RZGW) in Gdańsk, signed a contract for the modernisation of Czersko Polskie small hydropower plant (SHP) in Bydgoszcz. The contractor, Enerko Energy, will carry out the task under the "design and build" formula.

The project includes the replacement of the existing technological equipment of the SHP with a new vertical hydro unit. This unit will be equipped with automatic control and the capability to adjust its operation according to the water conditions prevailing at any given time, ensuring the preservation of the hydrological parameters essential for the existing ecosystem. The turbine automation will enable control over the amount of water flowing through the hydro unit, ensuring the quickest possible response to changing hydrological conditions. The installed capacity of the modernized power plant will be between 125 and 150 kW. The work is scheduled to be completed by September 10th 2026, with a project budget set at PLN 5.6 million.

It is worth mentioning that the first SHP at Czersko Polskie weir was built about 120 years ago (1903–1906) using the damming of the Brda River. The power plant generated the energy needed to illuminate the technical building for the operation of the weir and locks.

Poland's economy continues to increase its demand for electricity and hydropower plants can sustainably and environmentally-friendly meet this growth. In 2022, hydropower plants in Poland produced just under 2% of the country's electricity. Although this is a small figure, hydropower plants contribute to the supply of clean energy and enhance the country's energy independence.

Press office
PGW WP
RZGW Gdańsk

From the World

03.07.2024 New guide launched to boost investment in pumped storage hydropower

A new guide aimed at reducing investment risks in pumped storage hydropower (PSH) projects was released. The guide, titled "Enabling New Pumped Storage Hydropower: A guidance note for decision makers to de-risk investments in pumped storage hydropower", offers recommendations to help key decision-makers navigate the development and financing of PSH projects. The guidance note, developed by a working group chaired by Bechtel Corporation and supported by the International Hydropower Association (IHA), aims to enhance project development and delivery by providing tools for effective risk management and financial strategies. Key principles outlined in the guide include:

- private sector delivery, public sector enablement: success in liberalized electricity markets depends on government recognition of the need for storage, support mechanisms, and long-term revenue visibility,
- investment in project development: early investment and focus from an experienced delivery team increase the chances of project success,
- good project management equals good risk management: coordinated teams are essential for mitigating interface risks,
- optimal delivery and commercial models: effective risk allocation is vital, with risks minimized by those best placed to manage them and residual risks shared by those able to bear them.

15.07.2024 Edison and Webuild partner on pumped storage projects in Italy

Edison and Webuild have signed an agreement to develop pumped storage hydropower projects in southern Italy. The goal is to develop at least 500 MW of pumped storage hydropower by 2030, boosting Italy's energy autonomy and economic development. The partnership will focus on two pumped storage projects in Pescopagano, Basilicata, and Villarosa, Sicily. These initiatives are part of Edison's strategy to increase its installed green capacity from 2 GW to 5 GW by 2030. The projects will store excess renewable energy, ensuring the stability of the electrical grid and reducing waste. The projects will create new and improve existing reservoirs, making them safer and increasing their capacity. They are pending approval from the Italian Environment and Energy Security Ministry and regional authorities, with plans to participate in upcoming tenders organized by Terna for new storage capacity.

22.07.2024 SSE and Gilkes Energy announce Loch Fearna pumped storage hydropower project

SSE and Gilkes Energy have revealed plans for a pumped storage hydropower scheme at Loch Fearna in Scotland's Great Glen. This project will be developed through a 50:50 joint venture between SSE Renewables and a consortium led by Gilkes Energy. Located about 25 km west of Invergarry, the project will be adjacent to SSE Renewables' existing Loch Quoich reservoir. The Fearna pumped storage project will involve the construction of tunnels and a new power station linking the Loch Quoich reservoir to an upper reservoir at Loch Fearna. The Fearna project aims to achieve a generating capacity of up to 1.8 GW, producing around 37 GWh of stored energy capacity. The Fearna site, with its mountainous location and ideal geology, is particularly suitable for a pumped hydro storage project. The site's features make it cost-competitive and capable of blending into the landscape while supporting the region's hydropower heritage.

26.07.2024 Tunnel construction starts for Forbach pumped storage project

German energy company EnBW hosted a ceremonial tunnel groundbreaking event, signifying the official commencement of tunnel and mining work at the Forbach pumped storage project in Germany. The event, held at the Rudolf-Fettweis Plant, was attended by representatives from state and local governments, as well as the executing companies. This ambitious project aims to convert and expand the Rudolf-Fettweis-Werk in Forbach, located in the Northern Black Forest, into a pumped storage power plant. This transformation necessitates the removal of many thousands of cubic meters of granite from the mountain to accommodate the modern facilities and enhance the capacity of the extensive water and energy storage facility. This hydropower plant will be equipped with 50 MW pump turbine along with three Francis turbines (13, 7, and 3 MW), with the commissioning set for the summer of 2027.

30.07.2024 UK Government urged to invest in pumped storage hydropower

The British Hydropower Association (BHA) and Scottish Renewables are urging the UK Government to implement a 'cap and floor' mechanism to accelerate investment in long-duration electricity storage (LDES), including pumped storage hydropower (PSH). They have addressed a joint letter to Ed Miliband, Secretary of State for Energy Security and Net Zero, Ian Murray, Secretary of State for Scotland, and Jo Stevens, Secretary of State for Wales. The letter, co-signed by major pumped storage hydropower developers, highlights the UK's pipeline of more than 9 GW of capacity, including several ready-to-start projects. The proposed 'cap and floor' mechanism aims to balance commercial incentives with risk mitigation, providing revenue certainty for investors while capping excessive returns.

From the World

31.07.2024 Scottish Water completes UK's first mid-process hydropower project

A new hydropower project at Hamilton Waste Water Treatment Works in South Lanarkshire has been completed by Scottish Water, marking the first of its kind in the UK. The project, developed by Scottish Water Horizons, a commercial subsidiary of Scottish Water, features a 48 kW hydro turbine that is expected to generate 0.42 GWh of green electricity annually. This innovation will offset around 13% of the facility's annual electricity demand. The installation is the first prefabricated hydro scheme in the UK to be integrated 'mid-process' at a wastewater treatment plant, using wastewater to power a hydroelectric generator within the pipeline. The turbine is projected to cut carbon emissions by about 64 tonnes annually.

12.08.2024 DGPC and Tata Power Partner to Build 600 MW Khorlochhu Hydropower Project

Druk Green Power Corporation (DGPC) and Tata Power have formed a strategic partnership to develop the 600 MW Khorlochhu Hydropower Project in Bhutan. The project, previously known as the Kholongchhu Hydropower Project, will require an investment of around Nu 70 billion, with DGPC holding a 60% stake and Tata Power a 40% stake. The project is to be developed in the Trashiyangtse Dzongkhag district in Eastern Bhutan on the Kholongchhu river. The construction is expected to take five years. All necessary statutory approvals have been obtained, and construction is set to begin immediately. The project is part of Bhutan's broader goal of achieving 20 GW of hydropower generation capacity by 2040 and will contribute to meeting both Bhutan's winter electricity needs and India's growing power demand in the summer.

16.08.2024 China completes world's largest pumped storage hydropower plant

China has completed the Fengning Pumped Storage Power Station in Hebei province, now the largest facility of its kind globally. The plant, which has a total installed capacity of 3.6 GW, is operated by the State Grid Corporation of China (SGCC). The final turbine unit was activated on August 11, 2024, marking the end of construction that began in June 2013. The project was built in two phases, each phase adding six 300 MW reversible pump-turbine units. China continues to lead in hydropower development, having added 6.7 GW of new capacity in 2023, including over 6.2 GW of pumped storage. With Fengning now online, China aims to expand its pumped storage capacity to 80 GW by 2027 and reach a total hydropower capacity of 120 GW by 2030.

05.09.2024 Fortum in upgrading Untra hydropower plant

Fortum is undertaking a modernization project for the Untra hydropower plant, located in Tierp municipality, Sweden, which has been operational for over a century. The project involves replacing three of the plant's five generators, increasing its output from 42 to 48 MW and boosting expected annual production from 270 to 300 GWh. The modernization at Untra hydropower plant will replace the current horizontal shaft and generator setup with vertically designed equipment. Additionally, a new machine room with a glass superstructure will be built, connecting the existing intake house and the old machine room. The project is ongoing, with the final commissioning scheduled for the end of 2030.

10.09.2024 ORNL-led project aims to revolutionize hydropower manufacturing with 3D printing

The Oak Ridge National Laboratory (ORNL), in partnership with the Tennessee Valley Authority (TVA) and other organizations, is launching a new initiative to produce large metal parts for hydropower using 3D printing. This project has received $15 million in funding from the Department of Energy (DOE) over three years. The focus of the project is to manufacture hydropower turbine runners using additive manufacturing techniques. This approach combines 3D printing with conventional machining, allowing parts to be produced domestically and significantly reducing the time and cost associated with traditional manufacturing methods. Currently, the large metal components used in hydropower turbines are mostly produced overseas, leading to lengthy delays when parts need replacement.

12.09.2024 NHPC and Maharashtra Govt sign MoU for pumped storage development

The Department of Water Resources, Government of Maharashtra, and NHPC Limited have signed a Memorandum of Understanding (MoU) to develop pumped storage projects with a total capacity of 7,350 MW in Maharashtra, India. The MoU, signed in Mumbai, aims to advance the state's energy infrastructure in line with the Maharashtra government's policy on the development of pumped storage projects. The MoU outlines the responsibilities of NHPC in conducting surveys, investigations, and the preparation of Detailed Project Reports (DPRs) for these projects. It also covers the execution of the projects in compliance with the relevant policies of the Central and State Governments.

Water turbine refurbishment – behind the scenes

It is a source of great satisfaction for hydropower technology enthusiasts to see refurbished hydropower turbines and to realise how their service life is extended by many years, thanks to well-thought-out refurbishment measures and, of course, how the productivity and operational safety of the generation system is improved. This time, we will be presenting refurbished turbines in daily operation at two major utility power plants. The results are impressive indeed. Read on for an account of the repair processes.

Fig. 1. The runner of the overhauled turbine, juxtaposed with an IOZE hydro runner (IOZE rivus microturbine)

As an introduction, it is worth giving a brief overview of the organisational side of an overhaul project. Regardless the size or complexity of the system to be refurbished, the operating procedures remain the same, ensuring satisfactory project outcomes, including financial ones. For more information on this issue, see the boxed statement.

Jakub Górecki, Head of Precision machining department, IOZE hydro

Turbine overhauls are often highly complex projects, hence the involvement of specialists from various disciplines in their planning and execution. Organisational and working meetings, attended by mechanical engineers, designers, precision machining specialists, technologists, quality controllers and regeneration and assembly personnel, are aimed not only at scheduling activities, but also, or rather primarily, at determining how — with what means (to avoid unnecessary costs) and human resources — to restore the machine to a condition that is close to its original state of repair. All this while ensuring high quality workmanship, of course.

We often rely on incomplete documentation of the equipment provided by the customer, which requires its precise examination, and decisions on further action are taken successively after completing a given stage, measurements or tests, as well as based on accumulated experience in overhauling and constructing water turbine components. At working meetings, we often brainstorm the best solutions to problems that arise in the course of the work. Indeed, we care about the turbines we overhaul as much as the ones we manufacture ourselves and give them the technological diligence they require.

Our philosophy of a responsible approach to contracted overhaul work includes routine measures that we always take — even if they are not listed in the job description. This includes such things as 3D scanning to verify the correctness of component geometry, surface cleaning and assessment of key parameters affecting turbine operation. We always verify the condition of the whole and not just the selected components the order provides for. Considering that the turbine runner will have been already dismantled by that point, we must make every effort to restore it to the maximum possible efficiency and bring the turbine closer to its original technical condition.

Often, it is only at the stage of measurements and destructive testing that we discover previously unforeseen anomalies and faults, which we report to the client and determine together, if they are critical and in need of urgent intervention or if the system can continue to operate smoothly despite their presence. Of course, we are always happy to provide the ordering with expert recommendations, which makes it easier to decide.

Turbine overhaul involves multiple tasks that can run in parallel, concurrently and, in special cases, be outsourced. The work has to be planned in a well-considered manner to align with one of our key goals — meeting the completion deadline. We are aware that every day a power station is out of action represents a real loss in power production, and as such, translates into financial losses. At the same time, thanks to our experience, intuition and technical expertise developed over the years, we can make the repair time as short as possible. Recent projects also show that a creative approach to problem-solving allows our engineers to generate savings for customers while achieving the intended results and maintaining quality. One might say that a refurbishment requires a strategy, not only from a technical and technological standpoint, but also from a business one. What is worth mentioning as a testament to the correctness of our approach, is that we have

recently taken over the responsibility for day-to-day online monitoring of a power plant and the rapid response to any machinery malfunctions, commissioned by a satisfied refurbishment client. Our role also includes regular maintenance to optimise the hydrounit's performance and ensure its continued trouble-free operation. In an emergency, we can immediately dispatch a maintenance team to rectify faults and restore normal plant operation, minimising downtime and loss of energy generation. It is extremely gratifying to have been trusted by a client for whom we first refurbished a turbine and who later entrusted us with the care of their facility and committed to long-term cooperation with IOZE hydro.

Now, let us see how the above organisational processes translate into real-life repair activities based on examples of recent refurbishment works.

Example 1 – Kaplan turbine runner overhaul

The first case in question involved the overhaul of the runner, hub cover and control system of a Hungarian-made

Turbine type	**Kaplan turbine**
Installed capacity	**1.55 MW**
Runner diameter	**3,696 mm**
Maximum discharge	**53.5 m³/s**
RPM	**88.3 RPM**
Head	**3.5 m**
Year of manufacture	**1963**
Manufacturer	**Ganz Mavag**
Generator	**DolMel 2,000 kVA, synchronous**

Tbl. 1. Key parameters of the overhauled turbine – example 1

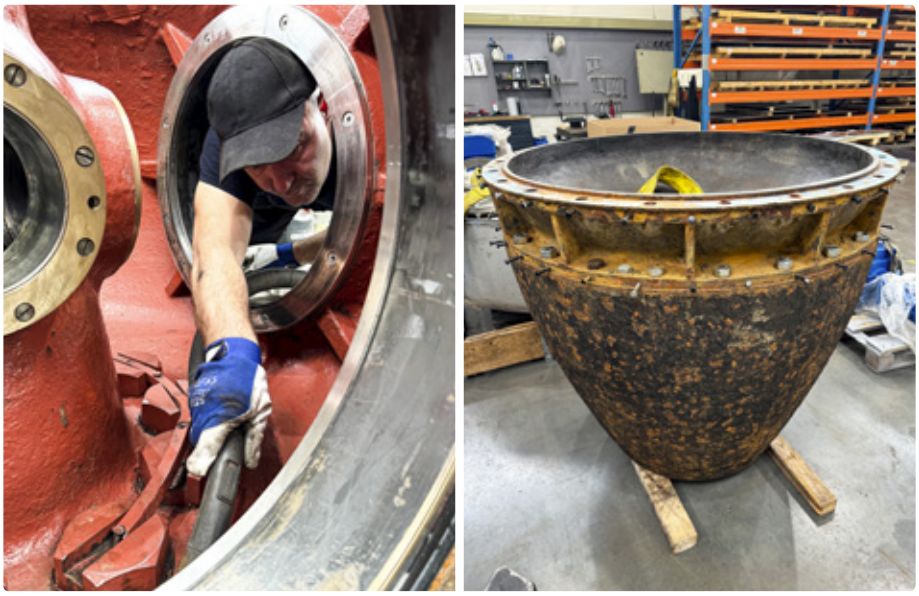


Fig. 2. Manual cleaning of the inside of the runner hub — hub cover prior to overhaul

Fig. 3. Close-up of the hub surface before and after blast cleaning

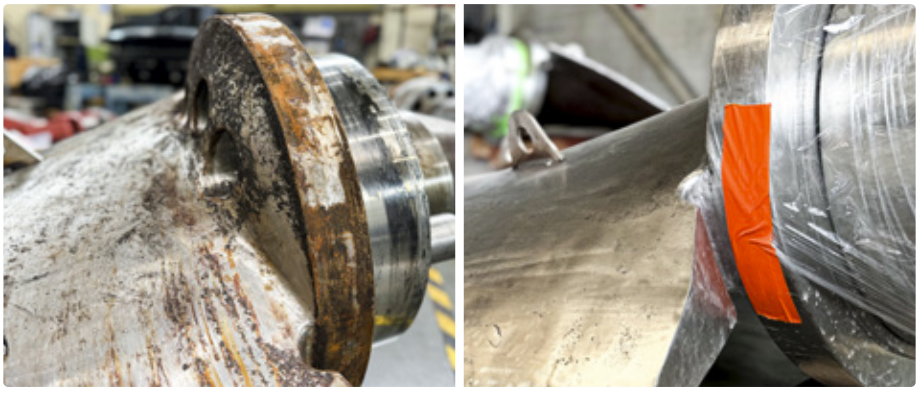


Fig. 4. Runner blades before and after cleaning

Fig. 5. Runner hub: after disassembly, after cleaning and after coating with epoxy paint

Kaplan turbine, which was over 60 years old, though well-preserved. The size of the machine was a challenge: the hub alone weighs nearly 3.5 tonnes, and the span of the entire runner is approximately 3.7 metres. The first case in question involved the overhaul of the runner, hub cover and control system of a Hungarian-made Kaplan turbine, which was over 60 years old, though well-preserved. The size of the machine was a challenge: the hub alone weighs nearly 3.5 tonnes, and the span of the entire runner is approximately 3.7 metres.

Already at the beginning of the runner disassembly, a fracture was found in the ring that prevents the main bolts from unscrewing and falling out. It was decided that the ring must be remanufactured. Subsequently, an inspection of the remaining components was carried out. No damage was identified in either the cross-piece, the cams or the pushing rods and their condition was assessed as very good. They bore no signs of wear or mechanical damage, so they were reused during reassembly. The interior of the hub was carefully cleaned by hand.

The next stage was abrasive blasting (shot blasting) of the hub and it's cover, which were properly secured to prevent the abrasive from uncontrollably entering the hub interior and damaging the fitting surfaces of the shaft and the hub's cover, as well as the main bolts. Cleaning was carried out until a surface preparation grade of Sa 2½ was achieved, and the components were then secured against corrosion and osmosis by pneumatic spraying. The epoxy paint system used in this case was Epinox 77. As the turbine parts in question are permanently immersed in water during operation, we used a coating with a thickness of at least 450 µm and consisting of three layers — the first one in grey and the next two in black. It is important to maintain adequate drying intervals between the application of successive layers to achieve the desired coating properties.

The refurbishment also included the replacement of the runner blade plain

Fig. 6. The refurbished machine leaves the IOZE hydro site

Jan Skołuba, Mechanical design engineer, IOZE hydro

On a day-to-day basis, we produce technologies mainly for small hydropower plants, but we successfully translate the accumulated experience into large-scale solutions for commercial power generation. We are thoroughly familiar with the kinematics of hydropower turbines, including Kaplan turbines, which allows us to service machines from other manufacturers with great confidence.

For a turbine of such considerable dimensions, the one in question here positively surprised us with its excellent blade angular alignment (the recorded alignment error was negligible), as shown by the initial 3D scan. Of course, after the overhaul, we recreated this correct blade alignment, as confirmed by the final scan. The entire runner was scanned; this included examining the blade tips for wear (no wear was found).

The scanner creates a point cloud from which a polygon model (triangle mesh) is developed, which is then analysed and processed in dedicated software, in this case, PolyWorks Inspector and Siemens NX. To scan the entire machine

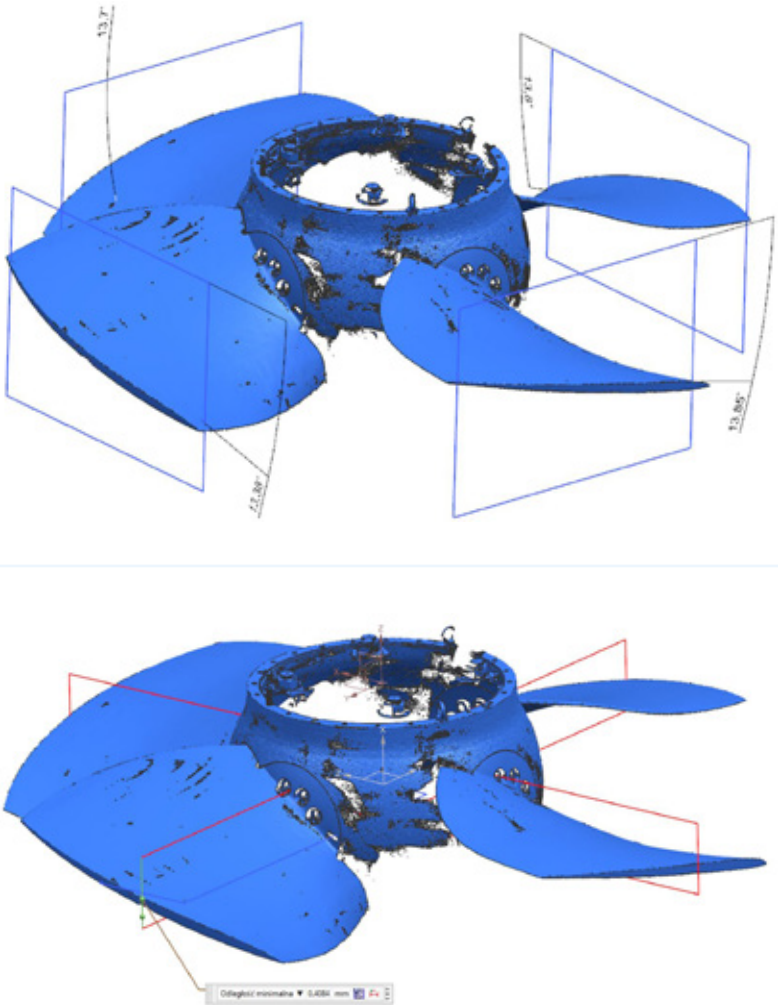


Fig. 7. The process of measuring the blade angular position (left) and measuring the blades relative to the nominal runner diameter after final assembly

and obtain its complete, consistent 3D model, it was necessary to reposition it several times, as the working range of our FARO laser is 1.5 m. This also necessitated the so-called reference positioning. The latter is done on a computer screen during the processing of the point cloud and is based on scans that share the same reference points.

As for replacing the runner blade face seal, we had documentation from previous overhaul work and a disassembled and cleaned hub on which we could take measurements. We noted a discrepancy between our measurements and what the documentation indicated. The difficulty was that the groove in which the seal was supposed to settle was actually smaller in diameter than the documentation indicated. Only during the investigation phase did this inaccuracy become apparent. And what came to the rescue was laser scanning technology. To ensure that a seal with the correct cross-section was ordered, we scanned the dismantled component. Measurements could not be taken with standard tools like a calliper due to the complex shape. With the resulting geometry, we were confident that the new seal had been selected correctly.

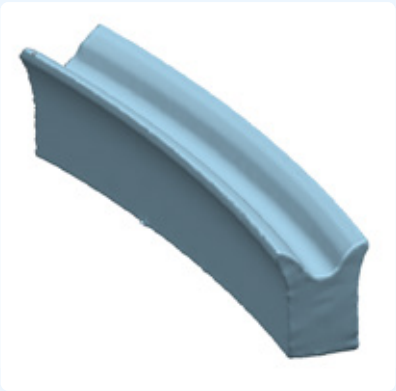


Fig. 8. Cross-section of the blade face seal obtained by scanning

bearings. New bearings made of deva. bm® were installed, and the key diameters were measured. The measurements indicated that the blade stubs and bearing bushings were within the correct operating tolerances, in accordance with the manufacturer's guidelines. The blades themselves were cleaned, and any larger cavities on their surfaces were filled by hardfacing and hand-sanding to a proper outline. Finally, all four blades were pressure washed, cleaned and polished by hand. In the course of this relatively uncomplicated overhaul, one of the few issues requiring additional investigation was choosing the main seals for the guide vanes. The doubts in this regard were quickly resolved thanks to laser scanning. For more on how this technology is used during overhauls, see the box below.

Finally, the old seals were replaced with new ones, made of SKF Ecorubber-1, which were identical to those originally installed, i.e. type K06-R. Prior to seal installation, the duct was cleaned and secured against corrosion. Once all the repair work was completed, the runner was reassembled. The entire operation took 2 months and will probably be repeated in another 10 years. The example analysed demonstrates that such overhaul frequency keeps the generating unit in good shape.

Example 2 — Kaplan turbine wicket gate mechanism overhaul

Turbine type	**Kaplan turbine**
Installed capacity	**12.88 MW**
Runner diameter	**3,000 mm**
Maximum discharge	**60 m³/s**
RPM	**214 RPM**
Head	**28.5 m**
Year of manufacture	**1938**
Manufacturer	**Escher Wyss**
Generator	**BBC 15.6 MVA, synchronous**

Tbl. 2. Key parameters of the overhauled turbine – example 2

Mateusz Merwart,
Technologist/Quality controller,
IOZE hydro

We used a FARO Vantage S laser tracker for measurements taken inside the power station. We employ this device when measuring the geometry of large objects. Unlike a measuring arm with a scanning tip, this gives us points, and not a point cloud, to work with. Based on the measured points, we reconstruct object geometry. In this particular power plant, we used the tracker to measure the pitch diameter of the guide vanes, which was important for determining the seating face.

The interacting surfaces with guide vanes in the unassembled part of the system were also measured and verified with the tracker. Further, to correctly determine the new guide vane seating faces, it was necessary to create their model. To this end, vanes 8, 12 and 20 were scanned, and their geometry superimposed. No significant deviations were found as regards the repeatability of the vane shapes. An averaged geometric model of the vane was thus created. This model was then matched to the on-site measurements (the models were collated based on the previously determined pitch diameter). This made it possible to determine two new contact face edges for each of the 20 vanes, which were then produced by CNC machining on an OKUMA VTM2000YB machine, according to the manufacturing documentation. The shape of the contact surfaces after an overhaul of the guide vane surfaces is crucial, as their correct fit when the inlet is closed, determines whether the turbine is watertight. If the inlet is watertight, its closure completely cuts off the flow of water into the runner and immobilises the turbine.

Notably, considering the lack of source technical documentation from the manufacturer (let us recall that this is a pre-World War II turbine), the guide vane tip

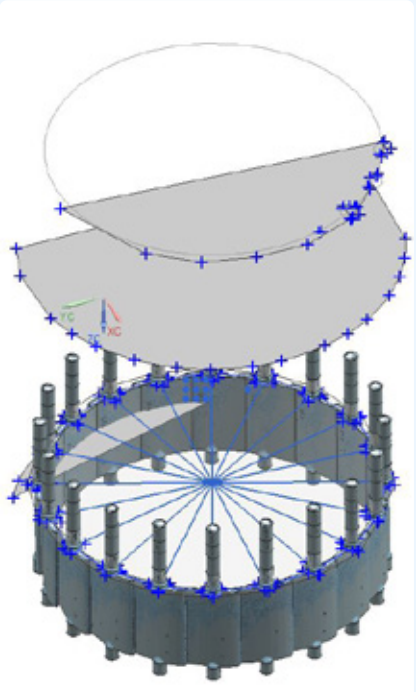


Fig. 9. Wicket gate mechanism geometry obtained from scanning results

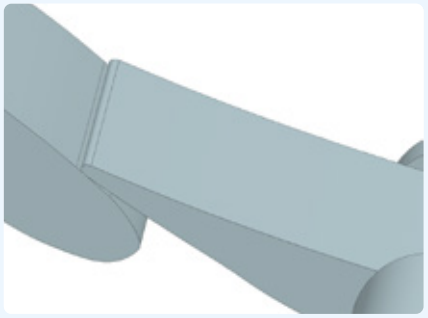


Fig. 10. Guide vane seating faces – model

geometry could only be reconstructed using 3D scanning. Only in the case of the vane stubs we have the technical documentation provided by the client, as this had been prepared by a contractor for the previous turbine overhaul. The vane geometry technical design we developed was then used to machine each vane.

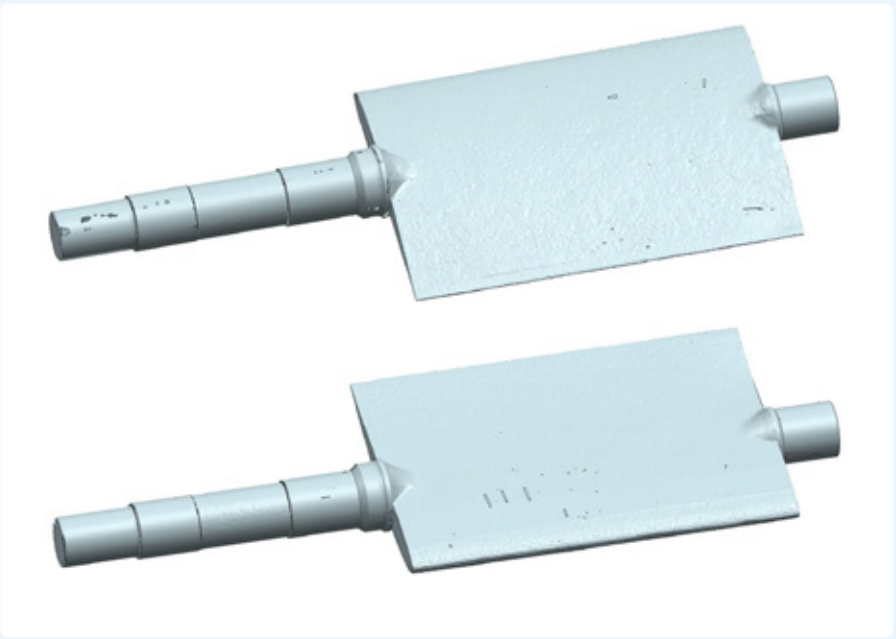


Fig. 11. Guide vane model obtained by laser scanning

Far more complicated than the first example, this project involved the overhaul of the wicket gate mechanism of an 86-year-old Kaplan turbine from a major power station operating in southern Poland. This vintage system needed considerable work to maintain the required technical quality and operational efficiency. Before going into the details of the repair shop activities, it is worth having a closer look at the work of the technologists at the installation site — the power plant — as the results of this work affected the actions taken at later stages.

Fig. 12. Measuring the anti-corrosion coating during the coating application process

First, the geometry of the turbine components needed to be examined to map the spacing of the 20 inlet guide vanes, which was then used to precisely determine the contact face edges of the guide vanes to be repaired (see the box for more on this). As a result of the measurement, the pitch diameter of the inlet guide vanes in the turbine was determined to be 3,729 mm. It was also necessary to measure the diameter of the stubs mounted in the inlet guide ring, which interacts with the inlet fasteners. A detailed inspection showed that 10 of the stubs required replacement. The design and manufacture of the new components and their installation to replace the worn-out ones was handled by the refurbishment contractor.

The stubs installed in the guide vane's levers were also measured and assessed for wear. Five stubs were found to deviate from the nominal values specified in the manufacturing documentation, so new ones were made and fitted in place of the worn ones. The levers were disassembled into their component parts, cleaned and secured against damage during the subsequent reconditioning processes. All dismantled items were abrasive-blasted to Sa 2½ grade and received an anti-corrosion coating. After painting, reassembly was carried out and the operability of the inlet guide vane angle adjustment mechanism was checked. The existing wedges interfacing with the inlet's levers had deteriorated, so new ones were made to replace them (their design was based on the measurements of the old elements).

Some additional inlet components we analysed and also had to be replaced or remanufactured based on design documentation, due to their significant wear and tear. These were the inlet fasteners and the inlet top and bottom bearings. Wear and tear exceeding the nominal deviations, as well as extensive mechanical damage, led to the replacement of all sliding sleeves in the fasteners, sliding sleeves in the upper bearings and sliding sleeves in the lower bearings of the guide vane mechanism (100 different sleeves in total). All fasteners and bearings requiring replacement were properly secured after disassembly, blasted to Sa 2½ grade and then secured with an anti-corrosion coating. Moreover, all bronze seal housings were dismantled during the reconditioning. These were cleaned, and their mounting screws were replaced with new ones. All seals were replaced as well. Significant wear was detected in 5 slip rings during the work, which were replaced with new manufactured to match the old ones.

Finally, let us look at how the inlet guide vane surfaces were regenerated. Much like in the case of other components, the first stage was abrasive blasting (shot blasting) to a grade of Sa 2½. This process revealed numerous cavities on the vane surfaces, deep pores and surfaces with a peeled-off

Fig. 13. Bearing sleeves before and after reconditioning

composite layer, probably applied during previous overhauls. The detected cavities and pores were filled using BELZONA 1111 (Super Metal), a two-component composite material. Filling the deep pores and cavities ensured that the space between the vane and the paint coating was no longer exposed to oxygen, effectively preventing the accelerated formation of corrosion spots. As for the inlet vane stubs, the outer diameters of the bearing stubs were measured against the nominal dimensions. The vast majority of the measured vane stubs showed wear and were outside the range of permissible deviations included in the manufacturing documentation. Cracked sleeves were found on eleven vanes; these had to be replaced to enable continued operation. All damaged and cracked sleeves were remanufactured and subsequently fitted to the vane stubs. The remaining sleeves were reconditioned by surface preparation and cold metal spraying with Fe13Cr to prevent deformation of the vane geometry, and their coating was sealed after spraying. After replacing the sleeves with new ones and applying a coating to the reconditioned stubs, the whole assembly underwent a finishing treatment. The contact surfaces of each vane were regenerated by using CNC technology. The seating faces were determined by on-site measurements of the guide vane ring (refer to the box). Further, each vane/stub interface was subjected to non-destructive penetrant testing (PT), which confirmed that the components had been regenerated properly.

What are the results of overhaul work?

The descriptions of the work carried out, which are occasionally highly detailed, reveal the complexity of water turbine renovation, as well as illustrate how simple measures, e.g. in the case of large components, can often bring a noticeable improvement and have a positive effect on the technical condition. Proceeding from the general to the detailed (and vice versa), step by step, element by ele-

Fig. 14. The corroded stub/guide vane interface and the remanufactured workpiece

Fig. 15. Inlet guide vanes before and after overhaul

ment, the overhaul process makes it possible to restore a decades-old machine to its former glory. Numerous carefully reconditioned or remanufactured components are reassembled into a coherent, functional whole, so that it can continue to generate electricity efficiently and reliably. A refurbishment is, so to speak, building a turbine anew, and it is the precision, workmanship quality and the materials/assemblies/technology used that determines how close to the original state of repair it will be at the end of the process.

Due to the exposure to water, which generates corrosion and cavitation, as well as the natural wear and tear on components, overhauls are an unavoidable and recurring stage in the life of any hydropower plant. When carried out professionally, at the right time, well-planned and completed within the time frame set, they guarantee stable, uninterrupted operation of the power plant. A number of further benefits associated with overhaul projects were comprehensively described in the first article of this series ("Energetyka Wodna" 2/2024). At this point, it is worth emphasising the role of experience, knowledge, proper organisation and technical intuition of the execution team in the ultimate success of the project.

Guided by the motto "turn water into profits", IOZE hydro ensures on a daily basis that hydropower systems enable the highest possible benefits to be derived from the available natural potential of water. This is regardless of whether our team services a newly manufactured IOZE hydro turbine or a vintage foreign or domestically manufactured one. We assume that whenever it is technically possible and economically viable, every effort should be made to make electricity generation more efficient. Our experience in the production of water turbines gives us an additional perspective, allowing us to meet even the highest technical requirements and ensure the reliability and durability of overhauled systems — both macro- and microscale ones.

As a result of the experience gained in the field discussed here and in ensuring the continuous operation of hydropower plants, the scope of services provided by IOZE hydro has expanded to include the day-to-day supervision of power plant operation. Our primary ambition is to be a reliable technical partner for hydropower plant owners in the implementation of targeted projects, in ensuring continued operations, as well as in further development.

Wioleta Smolarczyk
Jarosław Wysocki
Łukasz Kalina

IOZE hydro

Graphics and photos are from the **IOZE hydro** archive.

Women's perspective in hydropower

Apparently women in hydropower do exist! But where? When we take a look around at the attendees at specialised gatherings, conferences and trade fairs, we see and hear mostly men. Women are a rather rare sight at such events and are so far a marginal group in the hydropower industry. In other words, a woman will attract attention, if she appears in this environment.

Source: Wasserkraft.Frauen.Netzwerk.

Fig. The group meeting during Renexpo Interhydro 2023

No deep research is needed to find out the reasons for this under-representation. Traditional gender roles, the difficulty of balancing family life with a career, the discrimination women face compared to men, or the lack of female role models are just a few of the many contributing factors. Nevertheless, there are now many women working in this sector, in roles related to design, project management, operations and maintenance, as well as legal services.

They are doing an excellent job, but paradoxically, they still often have to prove that they can match the performance of men. However, socio-cultural changes are not going unnoticed in the hydropower industry, which tends to be somewhat resistant to change. The outdated division between traditionally male and female roles is gradually shifting, and more women are entering technical fields. But it is still not enough. We can all actively contribute to making the industry more female-friendly.

The courage to take action

Half of the world's population is women. Many issues, including those related to skilled workers, solve themselves when this half of humanity is given the opportunity to fully participate. To address the underrepresentation of women, their visibility must be significantly increased. However, this doesn't mean (just) that more women need to enter the industry, but most importantly, those already working in it need the courage to join the conversation, share their opinions, and take on various roles equally with men. Women in this sector don't want to cause a stir — they simply want to be treated equally and receive the same opportunities as their male colleagues. A female perspective in this field can undoubtedly bring many benefits: diversity of viewpoints naturally broadens the range of possibilities rather than limiting them. This call is directed to men, but above all to women!

At this point, heartfelt thanks are due to all the men who have supported us, taken us seriously, and given us the encouragement to actively participate in discussions and make our presence known. We are grateful to those who trusted us, without whom we might still be working from the safety of the background. However, those who have something to say and want to help shape the future do not need the paralyzing comfort of operating from behind the scenes.

The future

Hydropower faces a significant challenge: continuing to make a substantial contribution to the energy transition towards 100% renewable energy, while also responsibly addressing aquatic ecology concerns. Strong opposition from various quarters highlights the ongoing and increasingly urgent need for informed education and closer collaboration among all stakeholders in the hydropower industry. To meet the demands of the current energy policy transformation, the full engagement of the sector is essential, regardless of gender.

Network

Since September 2022, the members of the Wasserkraft.Frauen.Netzwerk group have been meeting in various formats, both online and in-person at industry events. In this short period of less than two years, we have successfully created an environment that fosters respectful dialogue, where everyone feels comfortable voicing their concerns, where mutual trust prevails, and where collaboration is approached in a pragmatic manner. We have already accomplished a great deal: we held a panel discussion at Renexpo 2023 focused on the future of hydropower, published several articles in industry magazines, conducted webinars on electricity sales, and officially launched our website and LinkedIn channel. Maintaining a network for knowledge exchange and enhancing collaboration across three countries — Germany, Austria, and Italy (South Tyrol) — can be time-consuming, but the advantages of such initiatives certainly outweigh the challenges.

During our next online meeting, which will take place on July 1, 2025, we will share our experiences regarding association structures in Germany, Austria, and South Tyrol. We would be delighted if women from Switzerland could join us to share their perspectives on associations in Switzerland — or simply to listen. Our network is generally open to all women who work in the hydropower industry or feel connected to it. We look forward to the opportunity to meet you!

Brigitte Reitter
Wasserkraft.Frauen.Netzwerk.

T.I.S. fittings for waterpower applications

T.I.S. Group, an integral part of which is T.I.S. Polska operating in Poland, is a supplier of fittings solutions for many applications. Its offer includes both general-purpose and specialized fittings, dedicated to specific areas of application, which include waterpower.

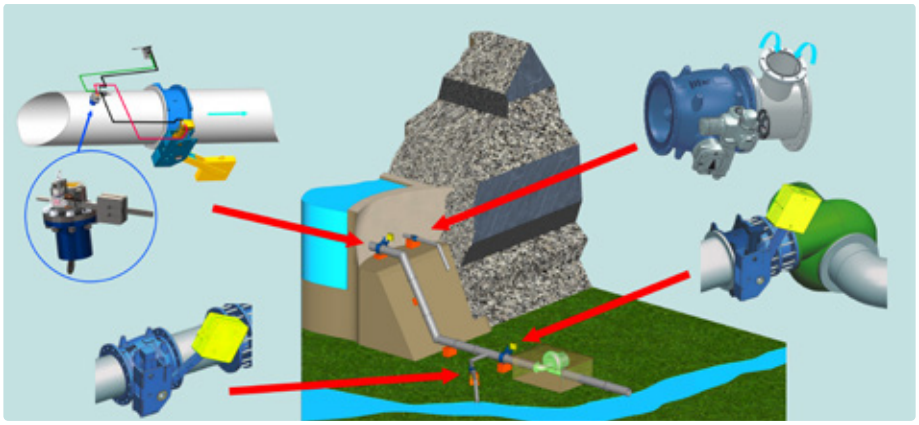


Fig. 1. Examples of applications of T.I.S. fittings in waterpower

The presence of entities of T.I.S. Group on the market of waterpower and hydrotechnical facilities dates back to 1996. The current product offer for this market segment includes fittings for the following solutions:

- shutting off the water supply to the turbines;
- emergency closures in the event of excessive flow rates;
- flow control on turbine protection bypasses;
- by-pass flow control for filling and pressure equalization;
- bottom drains;
- water intakes (valves);
- renovation closures on pipelines;
- other, according to the customer's needs.

Butterfly valves

The type of shut-off fittings most often provided by T.I.S. intended for shutting off the water at the turbine supply are throttles, in the hydro-energy nomenclature called butterfly valves. For this T.I.S. Group offers double eccentric butterfly valves with ductile iron or steel bodies.

The production program of double eccentric throttles, which are the basis for a completely equipped butterfly valve, in the case of ductile iron as the body material, includes the following diameter range: DN 200 ÷ 2400, and steel DN200 ÷ 3000 (PN6, PN10). At the same time, throttles

Fig. 2. DN2200 PN6 double eccentric butterfly valve with integrated mounting insert

are offered for higher nominal pressures (PN16 ÷ 40). The solution recommended by T.I.S., which is gaining more and more recognition, especially in the case of larger nominal diameters, is a throttle body with an adjustable connection flange, i.e. a combination of a valve with an assembly insert into one integrated whole. An example of a throttle constructed in this way is shown in figure 2. This is an interesting proposition not only from the point of view of costs, but also in technical terms, especially in cases of significant restrictions on the length of the building.

Butterfly valves (throttles) for shutting off the water supply to the turbine are usually supplied as fittings together with a hydraulic cylinder and counterweight. The cylinder has a dual function: a brake that provides control over the position of the disk when closing, and an actuator responsible for opening and maintaining the disk in the right position. The counterweight (weight on the arm) is the element providing the torque, suitable for triggering the automatic closing of the valve, without the need for external energy supply, which is crucial for reliable operation. The oil pressure for the actuator can come from the facility's oil system as well as from a local oil supply. A properly selected oil supply can be included in the scope of supply together with a valve. The selection of the optimal version of the valve is carried out by the Technical Department of T.I.S. Polska, individually for a given project, based on complete data related to the water supply to the turbine, power supply to the actuator, taking into account all construction conditions, as well as various customer's wishes, including time range of disk position changes, position signaling, etc. Even the shape of the counterweight weights can be adjusted to the operating conditions, an example of which can be seen in figure 3.

Fig. 3. The counterweight weights of DN2200 PN6 butterfly valves of individually selected shapes

T.I.S. butterfly valves can also be used as shutting off fittings for other functions such as:

- safety shut-off in case of excessive flow rate;
- as renovation closures;
- pressure equalization by-pass;
- other, depending on the needs of the facility.

An example of a safety closure assembly in the event of excessive flow rate is shown in figure 4. The safety assembly consists of a complete butterfly valve (throttle) with a cylinder and counterweight, and a device responsible for detecting excessive flow rate, which is a fin speed sensor, also manufactured by T.I.S. The swing angle of the fin located near the pipeline axis depends on the flow rate. Exceeding the permissible speed causes the fin to be swung by the angle at which the sensor counterweight position changes and the limit switch that signals the hydraulics of the butterfly valve

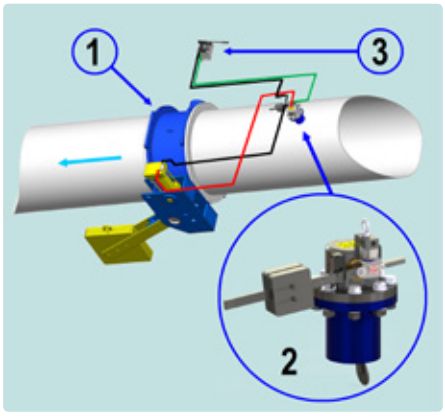


Fig. 4. Butterfly valve assembly with over speed sensor. 1. Butterfly valve (throttle) with a hydraulic cylinder and counterweight. 2. Over speed sensor. 3. Oil pump to open the valve

Fig. 5. An example of throttle installation activated by an over speed sensor

to close is activated. The closing of the butterfly valve controlled by the hydraulic cylinder begins. Re-opening the valve is only possible after the user's intervention. An example of the completed installation of such an assembly is shown in Fig. 5.

Needle valves

A separate, very interesting item in the T.I.S. fittings offer are needle valves (Italian: valvola a fuso) also used in the waterpower industry, also called plunger valves. It should be clarified here that, despite the multiple names used (which is the result of the absence of a fixed contractual nomenclature), it is the same, in terms of design and function as well as applications, type of fittings, and the above-mentioned terms are used so far simultaneously, depending on the nomenclature adopted by the manufacturer. In the following part of the article we will use the term "needle valve", derived from the direct translation of the Italian name valvola a fuso, used by T.I.S. Group. T.I.S. needle valve production program covers the range of diameters up to DN2000 for PN10 and PN16, or DN1000 for PN25, which places the manufacturer among the most significant in Europe.

Needle valves, due to their specific design, have a lot of operational advantages,

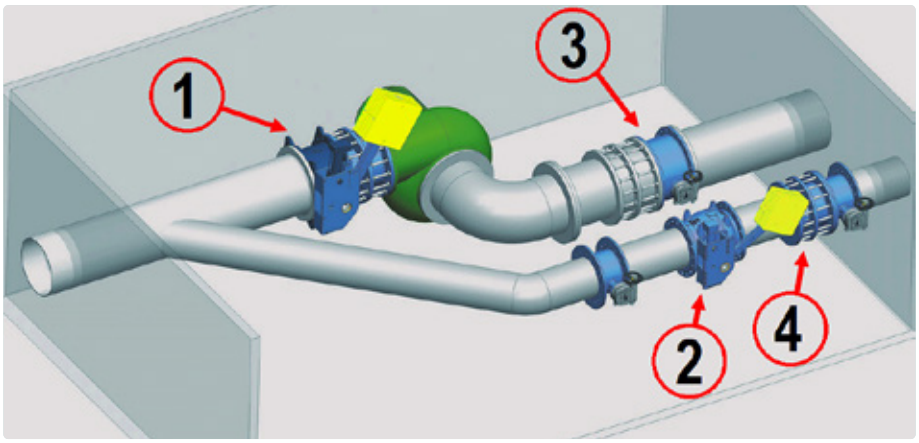


Fig. 6. An example of turbine pipeline and bleed bypass fixture with T.I.S. fittings: 1. Butterfly valve (throttle) with a hydraulic cylinder and counterweight, 2. Needle valve with hydraulic cylinder and counterweight, 3. Hut-off throttle (renovation closure), 4. Mounting insert

thanks to which they find various applications, both in shutting off flow and regulation. Among many features characterizing this type of fittings, from the point of view of their usefulness in waterpower, above all we should mention the possibility of using them where the use of other fittings would mean working in cavitation conditions. This is determined by the characteristic structure of the valve body, due to which the medium flow rate at the valve outlet is higher than at its inlet, so the zone of possible cavitation is located just outside the valve body. This does not mean, however, that the section of the pipeline immediately after the valve is left under the influence of possible cavitation, because, in the event of such risk, the valve is equipped with appropriate anti-cavitation protection. Depending on the specific operating conditions and installation of the valve, it can be a properly selected gap ring, mounted directly on the valve piston, or an aeration device installed directly behind the valve. The use of a specific type of needle valve fixture results from an analysis of hydraulic conditions and is an integral part of the selection of the entire solution presented to the customer.

The aeration device, with an external shape resembling a flanged tee, causes the suction of atmospheric air and its inflow to the cavitation formation zone. The air supply reduces the pressure drop in the zone behind the valve, thanks to which it is possible to maintain the flow in cavitation-free conditions. An additional element of this simple device is the air supply pipe, the vertical section of which is also subject to selection to prevent water from flowing out under low flow conditions. The operating principle of the device is illustrated in figure. 7.

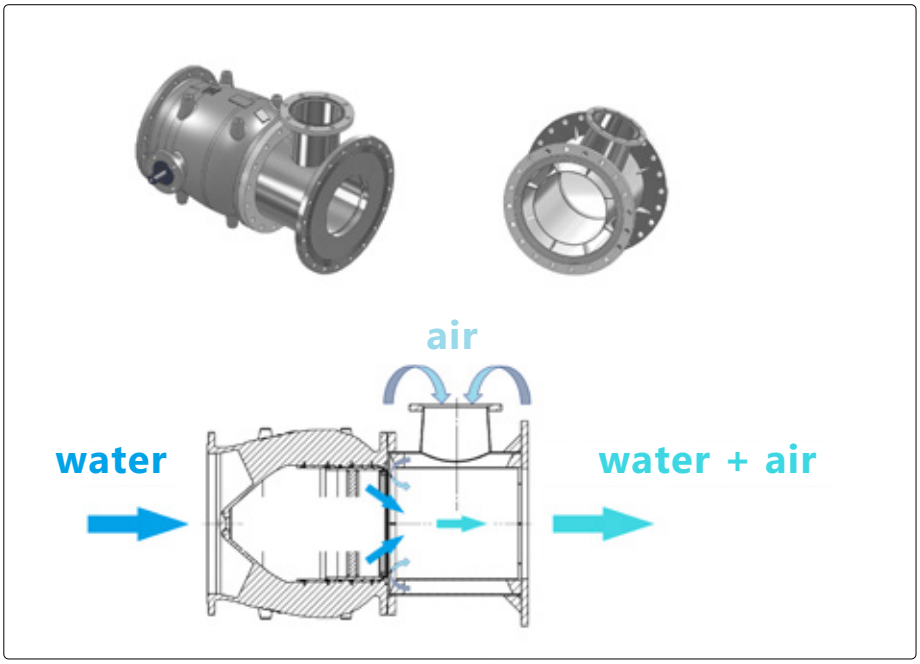


Fig. 7. Operating principle of the aeration device

The structure of the needle valve, in addition to cavitation prevention options unavailable for other types of fittings, has one more advantage, important from the point of view of water power applications: circular stream cross-section, with the stream narrowing in the zone immediately behind the valve, with a small opening of the valve assuming a conical shape. Due to this shape of the stream flowing out of the valve, a large dispersion of the kinetic energy of water particles is obtained. This property is extremely useful when using a needle valve, both as a fitting opening the flow in the turbine protection bypass, and on the bottom drain, because under the conditions of a large pressure difference (bleeding into the zone in which there is a pressure close to atmospheric pressure) it provides the possibility of very safe ejection, even at high inlet pressure and fast opening. The shape of the water stream flowing from the valve is illustrated in figure 8, presenting an example of a valve installed on a bottom drain, operating in the conditions of slow discharge.

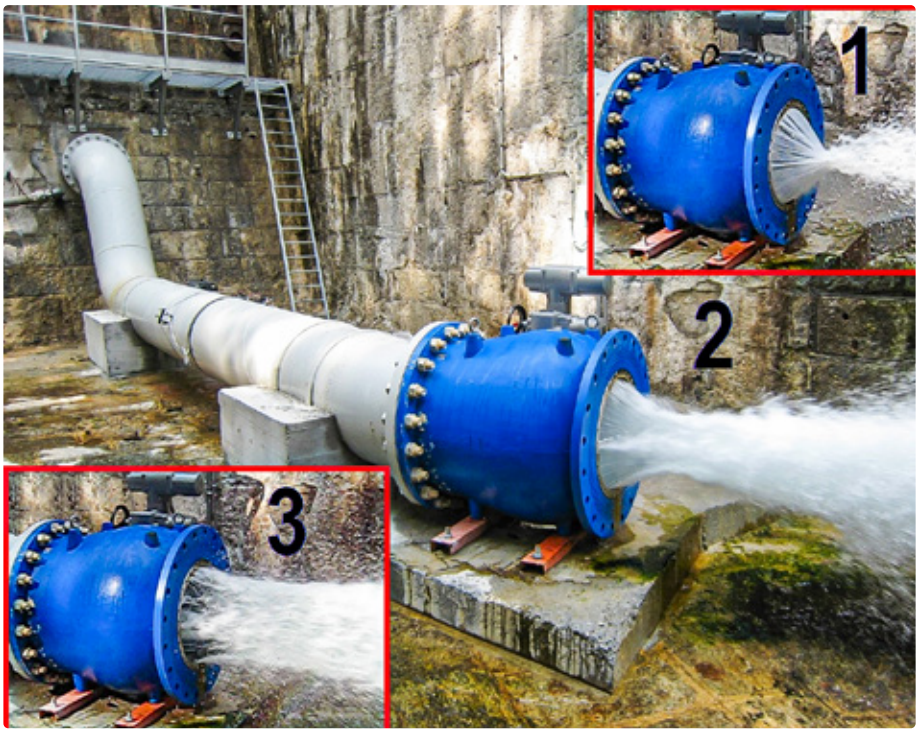


Fig. 8. An Example of the needle valve installation as a bottom drain fitting operating under conditions of free discharge: 1. Stream at a slight opening, 2. Stream at an intermediate opening, 3. Stream at a significant opening

The most common applications of needle valves in waterpower include:

- flow control on bypasses taking water drainage for the time of closing or limiting the flow through the turbine;
- flow control in pressure equalization by-pass;
- controlling the flow of water from bottom bleeds.

Generally, for needle valves mounted on bypasses taking water drainage for the time of closing or limiting the flow through the turbine, a drive in the form of a hydraulic cylinder and counterweight is provided, but it works in the opposite way than in the case of a butterfly valve, i.e. the counterweight falling ensures valve opening, while the hydraulic cylinder forces its closing.

Fig. 9. An example of the implementation of a hydropower plant using T.I.S. fittings:
1. Double eccentric throttle with hydraulic cylinder and counterweight, together with mounting insert,
2. Needle valve with hydraulic cylinder and counterweight, together with an aeration device

Other types of fittings

Additional items from the T.I.S. Group's offer include ball valves, used in waterpower, that have an analogous function as butterfly valves installed before the turbine spiral inlet, but for pressures above the PN25 limit. In the offer of T.I.S. Group there are also general-purpose fittings, useful for renovation closures or other auxiliary functions.

For needs such as renovation closures, the main offer of T.I.S. Group includes double eccentric dampers with worm gears, enabling manual operation or by means of an electric actuator, as well as a hydraulic 2-way operation. The offer in this area is supplemented with centric throttles, wedge gate valves and knife gate valves (including those of individually selected structure). Each of these types of fittings can be controlled manually or by an electric or hydraulic actuator. It is worth paying special attention to centric throttles and knife gate valves, due to the short length of the fitting, which can help solve the problem of limited space available on the pipeline. T.I.S. Group provides centric throttles and knife gate valves up to DN1600 inclusive, while wedge gate valves up to DN1000 inclusive.

Fig. 10. DN600 PN25 needle valves with different types of slotted cylinders

Fig. 11. Preparation for shipment of the DN1600 PN10 needle valve

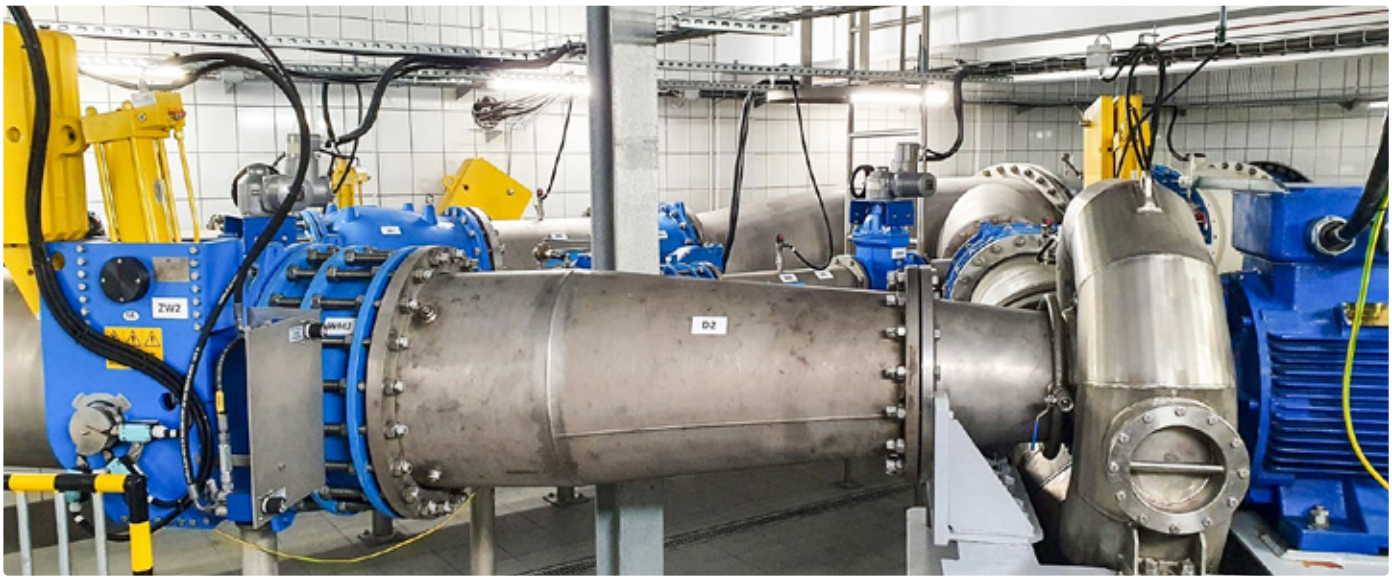


Fig. 12. T.I.S. fittings installed in a small hydropower plant at the Pomorzany Water Production Plant (ZWiK Szczecin)

Fig. 13. Pressure reduction and energy production station of the FR-TN series including control valve

Energy recovery

Recently, with the growing interest in the recovery of energy dissipated in various places of water supply infrastructure or industrial installations, more and more projects and developments are emerging with the aim of obtaining electricity from such recovery. T.I.S. Group is also increasing its involvement in this field by helping to select and then supply suitable valves, such as those described above, as well as automatic membrane control valves, which are useful primarily as a valve to help regulate pressures and protect against water hammer. A special example of such an implementation is the small hydropower plant installed in 2019 at the Pomorzany Water Production Plant, owned by ZWiK Szczecin (figure 12). Apart from its participation in external energy recovery projects, T.I.S. Group created research and development team working on the implementation of its own product offer in this field, i.e. a pressure reduction and power generation station, adressed mainly to waterworks companies (figure 13). Several experimental installations are currently in operation in Italy.

Technical consulting, contact

Long-term presence of T.I.S. Group on the market related to waterpower and hydrotechnical construction would not be possible without providing competent consulting and technical support, from the design phase to implementation, in order to meet the expectations of the customer and the final user. T.I.S. Polska as a representative of T.I.S. Group in Poland and Eastern European markets, provides such support through the Technical Department at the company's headquarters.

Adam Chlapek
Technical director

T.I.S. Polska Sp. z o.o.
a.chlapek@tispolska.pl
+48 506 168 243

Graphics and photos are from the archives of **T.I.S. Polska Sp. z o.o.**

RENEWAT: leading renewable energy projects in existing water mills

RENEWAT stands for "renewable energy in European water mills" and it addresses the cultural and territorial challenges of repowering water mills as modern tools for producing renewable energy.

Fig. 1. RENEWAT project participants during the kick off meeting

European rivers are rich with historical hydraulic structures, but over the years many of them have fallen out of use or have not been properly maintained. Recent European research, carried out under the project RESTOR Hydro, has uncovered approximately 65,000 potential sites for small-scale hydropower production, including 27,000 water mills. Over time many local mill owners have shown interest in renovating their sites for micro hydropower production, but they often face significant administrative obstacles. To address these challenges, the RENEWAT project has been launched under the Interreg Europe programme, within the Greener Europe specific objective. Led by the Syndicate Energy Haute-Vienne (SEHV), the project brings together 9 partners from 8 European countries: France, Italy, Croatia, Slovenia, Lithuania, Poland, Albania and Ukraine.

What will RENEWAT project change?

RENEWAT aims to share knowledges and experiences in renewable energy projects regarding existing watermills and potentially implementing pilot actions. Over the course of the project, which started on 1.04.2024 and will end on 30.06.2028, partners will explore topics such as technical skills, administrative processes, and financial models. The aim is to focus on the renovation of a historical heritage that combines several potentials in the energy, environment, heritage, economic, social, and cultural fields.

Indeed, watermills offer a valuable local source of renewable energy and represent an important part of our historical heritage that can stimulate the local economy by encouraging economic development in rural areas and create new jobs. RENEWAT partners will cooperate to upskill local and regional actors of their territories about water mills repowering, so that this renewable energy is identified and supported in their policies amongst the energy mix. Finally, the partners will work to improve 6 specific policy instruments related to different scales, approaches, and locations, all serving a complementary approach and vision for the repowering of existing water mills, allowing to use already existing installations.

Kick-off meeting

From the 11th to the 13th of June, RENEWAT partners participated in the project kick-off meeting, which was hosted by the project's Lead Partner SEHV in Limoges (France). This first encounter gave the partners the opportunity to build stronger working relations, delve into project goals, communication and management, as well as visit two reconverted mill sites: Beaufort Mill and Got Mill. The visits allowed the partners to study various aspects of the mills uses, which are detailed below.

Beaufort Mill – environmental sustainability

Beaufort Mill is a hydropower plant owned and operated by the town council of Saint-Leonard-de-Noblat and it is situated within a 19th-century building on the banks of the Vienne River. Saint-Leonard-de-Noblat is located at the east of Limoges, in the Haute-Vienne department and the hydropower plant houses three turbines: one dating back to 1910 (which is no longer in service) and two operational ones, dated from 1946 and 1961. The owners aimed to ensure its environmental and energy sustainability with the ecological continuity tackled by the fish pass and sensors in place that are used to monitor the available water resources without impacting the ecological flow downstream, according to the governmental regulations. In 2023 the town council agreed to renovate the hydropower plant with the objective of doubling the energy production. The planned renovation will only improve the generation without impacting the downstream flow. Currently the power plant is managed by one employee within the municipality and produced electricity is sold under a contract type 'H07' at a fixed price. These contracts are regulated under national energy law and the management of the site is based on the flow available: when the flow rate increases

Fig. 2. Beaufort Mill – water intake for hydro units – view from the high-level reservoir

Fig. 3. Beaufort Mill – from left: currently operating hydro unit and historic gearbox

then the turbine raises its production and vice versa.

The power station's turbines production provides around 10% needs of the 1,500 customers of the energy company, which since 2017 has adopted the status of a local industrial and commercial public service.

Fig. 4. The round-form machine used to grinding the raw material

Got Mill – socio-economic sustainability

Got Mill is located on the outskirts of Saint-Leonard-de-Noblat. This site is an ancient papermill from the 15th century, which has been renovated into a museum, which includes a printing shop and paper production. Here, following the footsteps of their 15th-century predecessors, the papermakers can produce different kind of papers, such as pure cotton, linen, and hemp paper. The machinery has been renovated and is back in operation to produce large sheets of fiberboard, the thickness of which they adapt to demand. The produced paper is used by artists for their creations, as well as by the printing workshop for a variety of jobs such as book covers, business cards, announcements, etc.

Drawing inspiration from historic techniques, the mill's papermakers are also committed to constantly inventing new and original papers. The year 2020 saw the launch of recycled papers in bright or pastel colours, vegetable-based papers such as leeks, asparagus, artichokes and onions, as well as papers made from a variety of plants including ferns, mint, and sage. Not forgetting the unmissable crumpled papers known as "Papier smock" and "Papier Cobe", made using a unique and original process on the mill's 1872 round-form machine.

This July the mill's ancient wooden wheel has been replaced by a modern metal wheel, and now the mill owner is seeking to introduce and connect the electricity production with the historical aspects, which are at the heart of the site.

These two mill sites represent good examples of sustainability, which are contributing to the local economy and energy production. As the project progresses, it is clear how the collaboration and shared expertise among the RENEWAT partners will be crucial to achieve the project's goals, following the path to build a more sustainable future.

For more information on the RENEWAT project and Interreg Europe programme, please visit: **www.interregeurope.eu/renewat.**

Fig. 5. The ancient wooden wheel recently replaced by a modern metal wheel

Interreg Europe Co-funded by the European Union RENEWAT

Project team
RENEWAT

Photos are from the project's archive.

Inter-university camp of student science clubs Dychów 2024

The third edition of the Inter-university camp of student science clubs Dychów 2024 took place between August thirty-first and September sixth. The project is carried out by student science clubs from the Warsaw University of Technology (SSC IskIErka, SSC Hydroinformatics, SSC Water Engineering, SSC Energy engineers) and the University of Environmental and Life Sciences in Wrocław (SKN Hydrologists and Hydrotechnicians).

Fig. 1. Inter-university camp participants in front of PSP Dychów

In times of dynamic technological development, systematically growing challenges related to environmental protection and ensuring climate neutrality in the European economy, creating and expanding opportunities to acquire and improve knowledge and skills in this area, especially for future engineers and scientists, is gaining importance like never before. Independent activity of young candidates for future leaders of technological development — especially in real conditions, is a unique platform for shaping the professional profile of students and plays a key role in shaping future staff for the energy sector — especially in the area of renewable energy. It gives participants the opportunity to explore specialist issues, exchange experiences with peers and meet experts and outstanding practitioners. In addition, such initiatives support the development of teamwork skills, critical thinking, innovative approach to solving technical problems and drawing satisfaction from independent creative activity.

This year's edition of the camp included, among others, a full-day educational trip along the most interesting facilities of the Dychów hydro-system (barrages: Krzywaniec, Dychów and Raduszec), development of plans and performance of specialist measurements and research in the field of energy, hydrology, geotechnics and environmental monitoring. As part of this year's edition of the camp, nearby small hydropower plants were also visited, which are interesting, instructive and still active monuments of hydropower (SHP Żarki Wielkie, Zielisko and Gubin). On the last day, a presentation was organized, summarizing the research and measurements carried out, the experiences gathered, during which a discussion was also held on the possibility of continuing this form of activity in the near and long term.

Organizers and partners

As in previous editions, the camp was organized by the scientific clubs associating students of various specializations of the Warsaw University of Technology (WUT) and the University of Environmental and Life Sciences in Wrocław (UPWr). In addition, for the first time, guest biologists representing the University of Gdańsk (UG) participated, dealing with water quality research in the area of the entire energy node.

Participants

The camp was attended by students and guardians representing WUT, UPWr and UG, who together created an extremely wide range of interests and competences related to both engineering and energy. Among them were future energy engineers, specialists in engineering and environmental protection, as well as mechatronics and electrical engineering. Thanks to this, the camp gained a unique, interdisciplinary character on a national scale. This facilitated a broad exchange of knowledge and experience, as well as cooperation and mutual understanding on many levels of a technological and scientific research nature.

Participants were expected to have not only solid theoretical foundations, but also readiness to actively participate in projects and a predisposition to teamwork. Students were not only to take an active part in classes, but also to actively and creatively participate in defining assumptions, requirements and implementation of tasks within research projects in the area of pumped-storage power plant Dychów. Their role in the project included both analysis of technical data, simulations and development of engineering solutions, as well as presentation of results during the summary at the end of the camp. This required them to have a careful, logical and often innovative approach to technical problems, critical thinking skills and close cooperation with peers and mentors.

Projects and research carried out

A number of important and interesting studies were carried out as part of the camp. A bathymetric inventory of the upper and lower reservoirs of the pumped-storage power plant Dychów was carried out, along with a measurement of the thickness of the bottom sediment layer. Measurements were made of the spatial distribution of basic water quality parameters, including pH, PEW (specific electrolytic conductivity), TDS (Total Dissolved Solids), CF (mineralization) and dissolved oxygen content. Some of the above-mentioned studies and measurements were carried out using an unmanned floating drone, built as part of the preparatory work by student teams working under the guidance of their substantive supervisors.

Student teams, under the supervision of scientists from universities, performed measurements of the spatial distribution of the saturation zone in the body of the frontal dam, in the immediate vicinity of the artificial reservoir and the derivation

channel on the section led in the embankment, which are part of the hydro-node. For this purpose, the method of electrical resistivity tomography supported by direct, point piezometric measurements and test holes was used. The obtained results were used both to assess the technical condition of the facilities and their impact on the groundwater environment in the immediate vicinity. Additionally, measurement systems were built to study vibrations and temperature of the operating pumped-storage power plant Dychów hydro unit and for the SHP Raduszec.

Results and conclusions

Practical activity, containing a scientific and research element, especially in contact with real objects inaccessible within academic walls, assisted by specialists — practitioners who know the secrets related to the unique features of the examined object, brings a number of benefits to both parties. It is a channel for the flow of information about the possibilities of new technologies to the practitioner community, creating an opportunity for experimental verification of their usefulness, offering in return information about the expectations of the practitioner community, possible defects and necessary modifications of the presented solutions. On the other hand, the conducted research and experiments, contributing new — previously unavailable information, allow for a more complete, precise and reliable interpretation and assessment of both the technical condition of the object and its impact on adjacent areas, environment or climate. They often also constitute the basis for verifying appropriate forecasts in the subject area or even — formulating them.

Fig. 2. Unmanned floating drone's sensors programming, tests including measurement systems calibration

Future prospects

The Inter university camp of student science clubsDychów 2024 is still only the beginning of a long-term initiative aimed at supporting the development of young talents in the field of broadly understood energy, including hydropower. The organizers are planning subsequent editions, counting on the possibility of systematically expanding the program with new issues, especially in the area of innovative technologies and challenges related to the ongoing process of energy transformation. It is also planned to involve technical universities from Poland more broadly and to allow international student groups to participate, which will further enrich the exchange of knowledge and experiences.
Further cooperation between universities and PGE Energia Odnawialna SA, as well as acquiring other companies to cooperate, will play a key role in the development of future editions of the camp. Companies from the renewable energy sector and modern technologies can not only support the organization of the event, but also participate in the creation of educational programs that better meet the current needs of the industry. Thanks to such partnerships, students will have the opportunity to have direct contact with market leaders and access the latest technologies used in water energy.

Acknowledgements

The idea and goals of the camp were met with an exceptionally warm reception and support from our host — PGE Energia Odnawialna SA and in particular the Management of pumped-storage power plant Dychów — Mr. Jarosław Borodynko. We would like to sincerely thank you for the help provided to us at every stage of planning and carrying out the research. At all times we could count on detailed and competent consultations, access to the equipment, buildings and installations of the pumped-storage power plant Dychów and any other assistance necessary for the safe and careful implementation of the work plan. We would also like to sincerely thank Mr. Mariusz Dudziuk and Ms. Julia Trymucha — employees of the PGE Energia Odnawialna SA headquarters.

We would also like to express our sincere gratitude to the Pradma Dariusz Naruszewicz company for purchasing and providing materials for the construction of an unmanned floating drone, along with components necessary for the construction of measurement systems. This year's edition of the camp also received funding from the funds of the "Excellence Initiative — Research University" program implemented at the WUT. The camp was among the ideas distinguished in the competition for initiatives supporting the development of scientific groups at the WUT.

Conclusion

The camp in Dychów proved to be a valuable experience for both the participants and the energy industry. Students had a unique opportunity to gain practical knowledge in the field of hydropower, work with advanced technologies and learn about the operation of a pumped-storage power plant in real conditions. Inter-university cooperation and a multidisciplinary approach facilitated the exchange of knowledge and experiences, which resulted in new ideas and potential technical solutions. For the energy industry, such initiatives constitute an excellent and invaluable platform that perfectly enables building the competences of future staff and a training ground for improving methods of introducing innovations.

The camp, for the third time, proved to be an excellent example confirming the value of skillfully combining theory with practice and experience by creating a space in which young enthusiasts can build and develop their skills. We encourage both students and representatives of the energy industry to get involved as widely as possible in future editions of this and similar events. Such initiatives not only support the development of an environment of future specialists, but also significantly contribute to the intensification of technological progress with full awareness of respecting the expectations in terms of sustainable development of Polish hydropower.

Tadeusz Daszczyński, BEng, PhD
Szymon Stoczko, BEng, MSc
Jacek Stasierski, BEng, PhD
Łukasz Kaczmarek, BEng, PhD
Janusz Buchoski, BEng, PhD
Krzysztof Badyda, BEng, PhD, DSc, ProfTit
Warsaw University of Technology

Maciej Gruszczyński, BEng, PhD
Radosław Stodolak, BEng, PhD
University of Environmental and Life Sciences in Wrocław

Photos are from the author's archive.

Reconditioning and modernisation of water turbine rotors

Exposure of water turbines to the weather and mechanical wear and tear cause surface irregularities to build up and thus reduce efficiency. Belzona composite materials recondition the damaged steel surface by extremely reducing the roughness coefficient and preserve it, protecting it from further damage.

The energy of the actual fluid in the flow is systematically dissipated, increasing the energy losses arising in hydraulic systems. Losses in the flow can arise locally or be linear. Linear losses are caused by molecular interaction forces between fluid molecules and wall surface molecules (impeller, steering wheel, pipeline, etc.) and between fluid molecules throughout the fluid volume (mass). Local losses, as the name suggests, arise at specific points, areas of the flow, such as the leading edge of a vane, an orifice, a valve, or are caused by an abrupt change in the shape of the duct. Clearly, flow losses are a significant contributor to the operating costs of hydraulic machinery.

Surface roughness

In water turbines, from a technical point of view, every material (steel, alloy steels, special alloys) from which the rotor and the guide vane are made has a rough surface. The surface roughness depends on the degree of manufacturing accuracy of the component, but even if one reduces the roughness and other irregularities at great expense, the surface roughness still increases with service life due to corrosion and mechanical wear, including cavitation erosion (photo 1). By determining the average height of the irregularities at various points on the duct surface as the roughness value, a certain value is obtained, which is referred to as absolute roughness in flow loss calculations (in the literature it is usually referred to by the symbol k and is expressed in mm). In new ducts, the value of this coefficient can vary between 0.02 and 0.1 mm, while for ducts after many years of operation, these values can reach up to 3 mm (corrosion, cavitation pits, caking, etc.). In practice, the more important value is the so-called relative roughness ε, i.e. value related to the cross-sectional area of the duct. The more turbulent the flow, the more important the duct roughness is. This regularity is expressed in the linear resistance coefficient λ and includes the type of fluid movement (Reynolds number) and the ductl surface roughness. As a guideline (to simplify calculations), the value of the energy loss in the flow over the length L can be calculated by assuming a duct with a circular cross-section of diameter D and applying the Darcy-Weisbach equation:

$$h_{str} = \lambda \frac{Lv^2}{D^2 g} \quad (1)$$

where:
h_{str} – energy loss value [m];
λ – linear resistance coefficient;
L – length [m];
v – average flow velocity [m/s];
D – diameter of circular cross-section [m];
g – acceleration due to gravity [m/s²].

For an arbitrary cross-section, the hydraulic radius R_h is most often used as the linear dimension characterising the cross-section according to the definition:

$$R_h = \frac{F}{O_{zw}} \quad (2)$$

where:
R_h – hydraulic radius [m];
F – cross-sectional area of the duct [m²];
O_{zw} – length of wetter perimeter [m].

Taking into account (2), equation (1) takes a more general form for a circular section *(R_h=D/4)*:

$$h_{str} = \lambda \frac{Lv^2}{4R_h 2g} \quad (3)$$

The calculation of the value of the linear resistance coefficient λ for any non-circular R_h enables the Colebrook-White equation to be used with a fairly high degree of accuracy:

$$\frac{1}{\lambda} = -2\lg\left(\frac{2.51}{Re\sqrt{\lambda}} + \frac{k}{3.71 \times 4R_h}\right) \quad (4)$$

where:
R_h – hydraulic radius (wetted) [m];
Re – Reynolds number;
k – roughness height [m].

Based on calculations, it can be shown that an increase of a few tens of percent in the deformation of the duct compared to a perfectly circular one results in an increase in the λ-value of a few percent. In view of the above, there will also be an increase in hstr line losses.

Reduction in surface roughness

Therefore, in order to reduce energy losses in the flow through the ducts of a hydraulic machine, taking into account the directly proportional influence of the λ factor, it is necessary, above all, to reduce the roughness of their internal surfaces and to ensure that this surface

Fig. 1. Surface area of Kaplan turbine vanes after years of operation (the Oder River)

Fig. 2. Water turbine inlet with Belzona® 1341 coating

Fig. 3. Reprofiling of rotor surfaces – filling of pits and irregularities with Belzona®1111 composite

Fig. 5. Application of Belzona® 1341 coating

Fig. 6. Water turbine rotor with Belzona ® 1341 coating

shows resistance to corrosion and erosion processes including cavitation erosion. A proven method is to coat the metal surfaces of the inlet duct, steering apparatus ducts and rotor with Belzona® 1341 composite coating (photo 2). The polymer layer of Belzona® 1341 is not only very smooth (roughness coefficient k=0.0078 mm), but is above all hydrophobic and practically unaffected by the corrosive processes to which steel surfaces are exposed (general corrosion, pitting, crevice, intergranular, biological corrosion, etc.).

The service life of Belzona® 1341 coatings under operating conditions in water turbines is estimated at 10–15 years. Taking into account the physicochemical properties of the surface of the composite coating and its effect on improving flow efficiency (reduction of hydraulic losses), it can be said that the coating of the channels of a water turbine is a kind of efficiency upgrade of the machine, as the effect of these measures will always be to reduce the expenditure of energy required to overcome the (mainly linear) resistance in the flow. Obviously, the coating reduces surface roughness, but it is also important that the surface is even, i.e. without indentations, offsets, cavities, perforations, etc., which appear especially in parts already in service and sometimes even in new castings or welded structures. When using polymer composite surface reconditioning methods, the levelling of any irregularities with paste composites such as Belzona® 1111 and Belzona® 1311 (ceramic R-metal) is applied prior to the application of the final coating of Belzona® 1341 (photo 3).

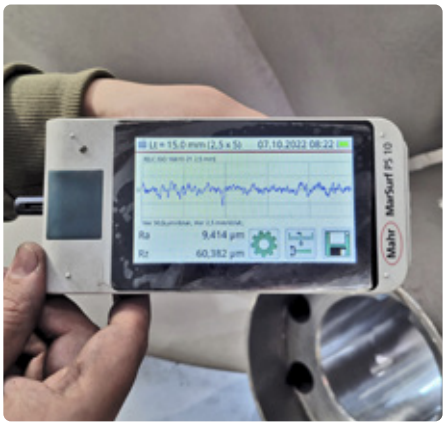


Fig. 4. Surface roughness profile – measurement

Steel reconditioning using composites

At a time when steel is very expensive and waiting times for new parts have increased dramatically, and given the more than 80% higher energy intensity of the process of making new parts compared to remanufacturing them, reconditioning with composites is not only becoming readily available, inexpensive, but is also a low-carbon method. The most applications confirming the above performance apply to centrifugal pumps of various designs and capacities, which were upgraded with Belzona® coatings between 1992 and 2022. Higher efficiency and durability confirmed by operation for at least 10 years applies to a huge number of pumps used in waterworks, power stations, chemical plants, nitrogen plants, refineries, mines and many other enterprises in Polish industry. Given the many similarities that exist in the operation of different types of hydraulic machinery, it seems natural to apply reconditioning using composites to the overhaul and modernisation of water turbines analogous to the methodology previously used in the repair and modernisation of pumps. Increasing the energy efficiency of the turbine and the longevity of its components, especially in terms of the impact of corrosion and cavitation erosion on its scope, were the reasons behind the decision to upgrade the Francis turbine rotor at Enerko Energy, a professional hydraulic machinery repair company. The rotor, with a diameter of ø1,720 and a hub diameter of ø1,027 and at a height of 950 mm, underwent a reconditioning and subsequent coating upgrade. Prior to application of the composites, the rotor surface was blasted to an optimum roughness of average 60–75 µm (photo 4). It guarantees good wetting of the surface with the polymer, a prerequisite for good adhesion. Corrosion pits, cavitation pits and macroscopic surface irregularities were filled and levelled with a paste composite, I.e. Belzona® 1111. Application of the Belzona® 1341 base coating to the rotor surfaces is carried out using a rigid brush (less frequently by spraying) and in a two-layer system (photo 5).

One day after completion of the coating, the rotor is ready for assembly and operation (photo 6). For the application in question, the rotor speed is 108 rpm at a flow rate of 10.5 m³/s in a turbine with a rated output of 288 kW. The hydropower plant, where the upgraded rotor was installed, has been in operation since 1930.

Roman Masek
Technical director
Belse Sp. z o.o.

Photos come from the archive of **Belse Sp. z o.o.**

Fig. 1. Movable weir gate (Ostrów SHP, the Dunajec River, 2024)

Composite – movable rubber dams

Among many materials previously used in water civil engineering, current technological progress is focused on the use of composite materials based on synthetic resins, polyesters, and elastomers. The combination of the physical and mechanical properties of these materials provides unprecedented material strength. Moreover, thanks to modern production technologies and the use of recycled raw materials, they are considered environmentally friendly.

AQUA-Tech has specialised in production of composite weir gates for over 15 years. Since the company's inception, we have systematically introduced a range of innovative solutions for hydraulic engineering. Our flagship product is the elastomeric inflatable weir gates, used as an equipment for water intakes of small hydropower plants. Weir membrane is a polyester-polyamide composite joint with amorphic polymers (elastomers).

Advantages of rubber weir

During periods of drought, the movable weir reduces the flow of water, creating a flume reservoir to aid retention. During periods of increased flow, the movable weir automatically (by gravity) lowers the weir gate, maintaining a safe level of damming in the riverbed. In addition, the composite materials have resistance to freezing from the ice floe, what makes this solution very safe during winter exploitation. Thanks to the possibility to endure multiple reactive deformations — elastomer membranes are a very durable element of water dams in contrast to the steel materials (steel gates and flaps) used so far. The composite materials do not corrode in the water environment, and thanks to this, they can be exploited numerous times without typical conservation with greases and lacquers. Maintenance processes for steel components, due to the chemical materials used, are seen as environmentally unfavorable. Filling the weir shell with river water or air is safe for the aquatic environment. Any failure of the rubber weir does not result in environmental damage and contamination.

Cascade weirs

Another interesting and innovative solution is the cascade weir. In many weir installations, additional damming is possible during periods of low flows. For existing weir installations, exchanging the entire rubber dam is a high cost. With the

Fig. 2. Cascade weir (SHP Leszno Dolne, the Bóbr River 2018)

Fig. 3. Pneumatic movable weir with PE-HD flaps (Brzeg, the Oder River, 2022)

development of a new cascade damming technology, AQUA-Tech manufactures cascade rubber dams which can be used as a supplementation of the already existing composite weirs. A pneumatic weir gates installed on top of the main rubber dams increasing thus the available damming height by some 50 cm.

Flap weirs

Another innovative solution is the introduced flap weir controlled with an elastic membrane. This solution is designed for low dammings in the range up to 150 cm. These can be new installations or modernized permanent barriers. The first installation of this type was made for Oława hydropower plant at the Oder. In 2014, a broad-crested weir was upgraded with a flap gate structure controlled by a hydraulically filled weir membrane. Thanks to support from EU funds under project RPMP.01.02.03-12-0017/21, AQUA-Tech implemented technology for the construction of high-density polyethylene (PE-HD) weir flaps. Such an installation was made in 2022 as part of the modernisation of the Brzeg weir on the Oder.

Autonomous weir installations

Weir facilities can operate autonomously at locations away from power sources. A typical autonomic system is equipped with an elastomeric weir membrane powered either hydraulically or pneumatically. The energy to operate the system is obtained from a renewable source (PV, wind) and powers a water pump or air pumping unit and a control system that maintains the set damming level of the river or retention/corridor reservoir. This system can transmit data (including images) via the GSM network to the management unit.

Fig. 4. Autonomous weir (Kamienna Góra, the Zadrna River, 2022)

Modular hydropower plants

In response to market demands, AQUA-Tech, with the support of EU funding under project POIR.01.02.00-00-0251/16, has developed a technology for constructing modular hydrotechnical structures for ultra-low head installations. The developed technology showcases the latest technical solutions, including direct coupling of a water turbine with a variable-speed permanent magnet synchronous generator (PMSG), featuring an island-mode operation option as well as the capability to power dedicated networks and maintain critical resources (e.g., water supply systems, hospitals, etc.). This innovative modular construction technology ensures that structures are cost-effective to build and highly efficient.

Our knowledge, experience, and commitment to continuous improvement are available to all investors. We are pleased to support investors and work on custom projects from concept to completion. We look forward to collaborating with you!

Andrzej Polniak
AQUA-Tech Sp. z o. o.

www.aqua-tech.info.pl
biuro@aqua-tech.info.pl
+48 (32) 441 77 17
+48 884 302 109

Photos come from archive of **AQUA-Tech.**

Source: www.pixabay.com, FlyFin Inc.

Real estate tax savings in the hydropower industry

While real estate tax (RET) may initially appear to be a relatively straightforward levy, practical experience demonstrates that taxpayers frequently overpay this tax. Notably, through thorough reviews of RET obligations, it is often possible to reduce the annual tax liability by as much as 20%. For this reason, conducting a review of RET settlements may present a significant opportunity for financial savings in business operations.

RET is governed by the Act on Local Taxes and Duties, which, in addition to regulating real estate tax, also encompasses taxes on means of transport, market duty, local duty, spa duty, dog ownership duty, and advertising duty. The revenue from RET is allocated to the municipality where the taxable land, buildings, or structures are located.

Although RET is regulated by several statutory provisions, these regulations are often unclear, and their interpretation is heavily shaped by evolving and highly casuistic jurisprudence from administrative courts. In practice, accurate RET accounting requires not only a solid understanding of tax law but also knowledge of other legal domains (e.g., construction law, civil law, water law, energy law) as well as technical expertise.

Wealth taxation – practical application

RET is imposed on properties owned by taxpayers, including land, buildings, and structures. In the case of land, the tax base is its area as recorded in the land and building register. For buildings, the tax base is the usable area, with the Act on Local Taxes and Duties providing an autonomous definition of usable area that differs from the definition found in construction law. For structures, the tax base is the value of the structure, and it is important to note that structures are taxed only when they are connected to business activities. Generally, the value used as the tax base is the value adopted for tax depreciation purposes. It is crucial to highlight that RET is disconnected from the financial condition of the business. Consequently, financially struggling or unprofitable enterprises are liable to pay RET at rates comparable to profitable businesses of similar size and characteristics. In essence, the mere ownership of RET-liable property triggers the tax obligation.

Municipalities in dual roles – 2,477 local RET systems in Poland

As mentioned previously, the municipalities where taxable real estate is located are the beneficiaries of RET revenue. However, municipalities also perform a second role: the executive authorities of the municipality (such as village heads, mayors, or city presidents) are the competent authorities for assessing and collecting RET, while the municipal councils possess legislative powers to determine tax rates.

As of 1 January 2024, Poland had 2,477 municipalities. Given that each municipality can establish different RET rates and exemptions, and since the heads of municipalities, mayors, or city presidents operate independently in their capacity as tax authorities, there are effectively 2,477 RET systems in Poland. It is not uncommon for contradictory tax decisions to be issued by different municipalities under identical factual and legal circumstances. Moreover, there is no central tax authority to harmonize interpretations of RET legislation.

It is also important to note that municipalities tend to adopt a pro-fiscal interpretation of RET regulations. This occurs because the executive authorities of municipalities, who are responsible for tax assessment and collection, also serve as the competent authority for issuing individual interpretations of RET law. This dual role has been subject to criticism from taxpayers and has led to various controversies. The fact that the same authority that determines RET assessments also benefits from the revenue and directs taxpayers on the correct interpretation of tax rules creates a conflict of interest. As a result, decisions may be biased, and claims for overpaid tax by entrepreneurs may be intentionally denied to avoid reducing municipal revenue. Although such practices occur in reality, they are economically irrational, as a taxpayer who successfully appeals such decisions in a higher instance, such as the local government appeals court or an administrative court, may secure a refund of the overpaid tax, along with interest. This delayed payment can often result in a financial advantage for the taxpayer.

Tax saving opportunities specific to the hydropower industry

Each industry possesses its own unique attributes that create potential avenues for tax savings. These savings typically arise from the nature of the assets held, the type of business conducted, and the specific location of the taxable subject matter.

The first step in seeking RET savings is to verify whether a particular property should indeed be subject to RET. The Act on Local Taxes and Duties provides for several exemptions, and municipalities may also introduce additional local exemptions.

Another area for potential savings involves reviewing the classification of properties as either buildings or structures. Often, taxpayers mistakenly classify properties as structures when, in fact, they should be classified as buildings under the tax law. In addition, certain installations, which are integral parts of buildings, are incorrectly taxed separately as structures, resulting in overpayments.

In the hydropower industry, overpayments frequently occur due to the misidentification of the RET taxpayer. In the case of facilities located on land not owned by the taxpayer, the taxpayer may not always be responsible for RET, despite having constructed the facility. Verifying the proper taxpayer for RET requires a thorough understanding of both tax and civil law.

Another area of potential savings involves reviewing the reported value of structures for tax purposes. While the taxable base is generally the value used for tax depreciation purposes, there may be capitalized expenses included in this value that do not qualify as part of the structure's cost under the Local Taxes and Duties Act. This distinction allows the taxpayer to switch to using the market value as the taxable base, a more favorable solution, without requiring adjustments to the initial value or income tax settlements.

It is also advisable to measure the usable area of buildings according to the tax law's definitions. Experience shows that the usable area defined under building law is often larger than the area calculated under tax law.

Recovering overpaid tax

To recover overpaid RET, the first step is to review the existing tax settlements. During the review, the taxable objects and their bases (area or value) should be thoroughly examined. If the review indicates that overpayments have been made, the taxpayer must file amended tax returns and submit an overpayment claim to the appropriate tax authority. It is worth noting that, under the provisions of the Tax Ordinance, it is possible to recover overpaid tax for periods that are not time-barred, i.e., up to five years retroactively (currently, as far back as 2019).

Experience indicates that a review of RET settlements, followed by the recovery of overpayments, can typically reduce annual RET liabilities by up to 20%. Given the possibility of recovering overpaid RET for the past five years, the total amount recovered can be equivalent to a full year's RET liability. Therefore, conducting a review of RET settlements may offer a significant opportunity to improve business efficiency.

Filip Kaplita
Legal advisor
GJW Gramza i Wspólnicy
Kancelaria Radców Prawnych sp. p.

Hydropower plants for floods

Flood protection is an important topic and in view of the flood that hit Poland in September 2024, a very lively topic as well. In the coming years, we need to answer the question: is it worth investing in more hydraulic structures to reduce the effects of flooding?

As with many complex issues, the answer is not that easy. In addition to social aspects, a major argument for opponents is the excessive cost of such investments.

Kamieniec Ząbkowicki reservoir

An example of a facility that not only fulfils flood control functions, but also facilitates energy storage and production is Kamieniec Ząbkowicki reservoir on the Nyska Kłodzka River. This investment had already been planned as early as the 1970s, and after the 1997 flood, consideration of its construction was revived. To date, the reservoir has not been built, but it is included in the current planning document, which is the Flood Risk Management Plan for the Oder River Basin Area (PZRP), adopted by the Decree of the Minister of Infrastructure dated October 26, 2022 on the adoption of the Flood Risk Management Plan for the Oder River Basin Area — action no. R_SO_S_024 (Journal of Laws 2022.2714). Kamieniec Ząbkowicki reservoir is planned at km 102 + 200 of the Nysa Kłodzka, situated above the Topola reservoir and integrated into the cascade of existing Topola — Kozielno — Otmuchów — Nysa reservoirs. Four reservoirs with a total flood capacity of about 172 million m³ [2] played a major role during this year's floods. Each is equipped with a hydropower plant operating in a flow regime and the cascade's total annual production is about 30 GWh of emission-free electricity.

According to information on Hydroportal, the planned Kamieniec Ząbkowicki reservoir will be constructed with an earthen dam with a maximum height of 18.7 meters. A total capacity of the reservoir will be up to 100 million m³ and a run-of-river hydropower plant will provide an annual production of about 5 GWh.

PSP reservoirs and flood control functions

The primary function of a pumped storage plant (PSP) is to store energy. This is done in the process of converting electrical energy into potential energy of water by pumping (charging the storage), and then working out the stored energy using the power plant's hydroelectric generators (discharging the storage). In most cases, the lower reservoir of such system is fed by a river flowing through it, which water is used in the lower and upper reservoirs — so it can be considered as retention.

For these reservoirs to fulfill their flood function, analogous to traditional storage reservoirs, a certain portion of both reservoirs should be emptied in the situation of forecasted floods and during the passage of the flood wave, the reserves of both the lower and upper reservoirs should be gradually filled. In such case, energy storage will serve as both water storage and flood capacity in addition to energy capacity.

Naturally, this would require the implementation of appropriate regulations governing the management of such reservoirs, encompassing both energy storage and flood control.

In Poland, the total usable capacity of the upper reservoirs in PSPs (PSP Poręb-

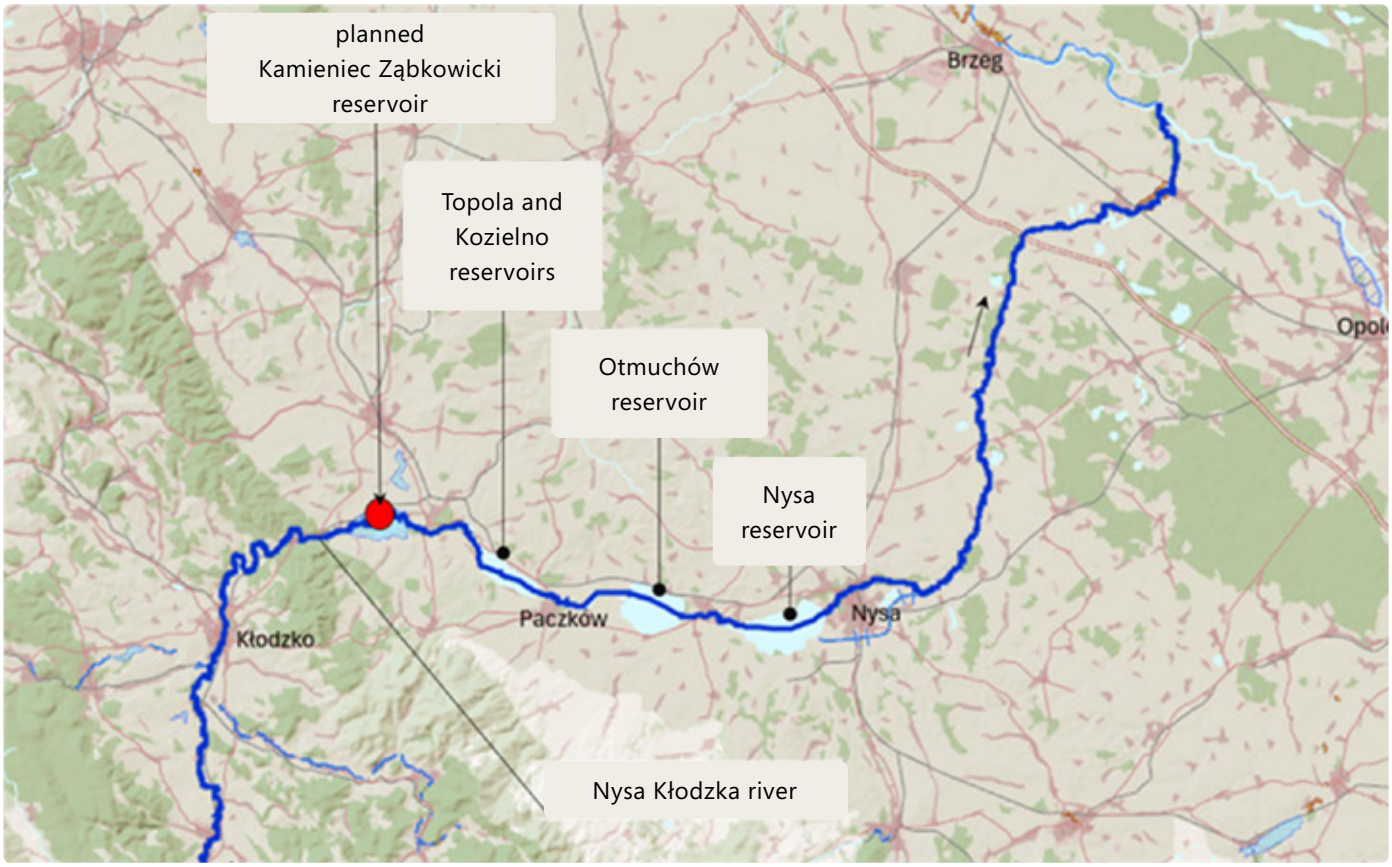


Fig. 1. Planned location of the Kamieniec Ząbkowicki reservoir

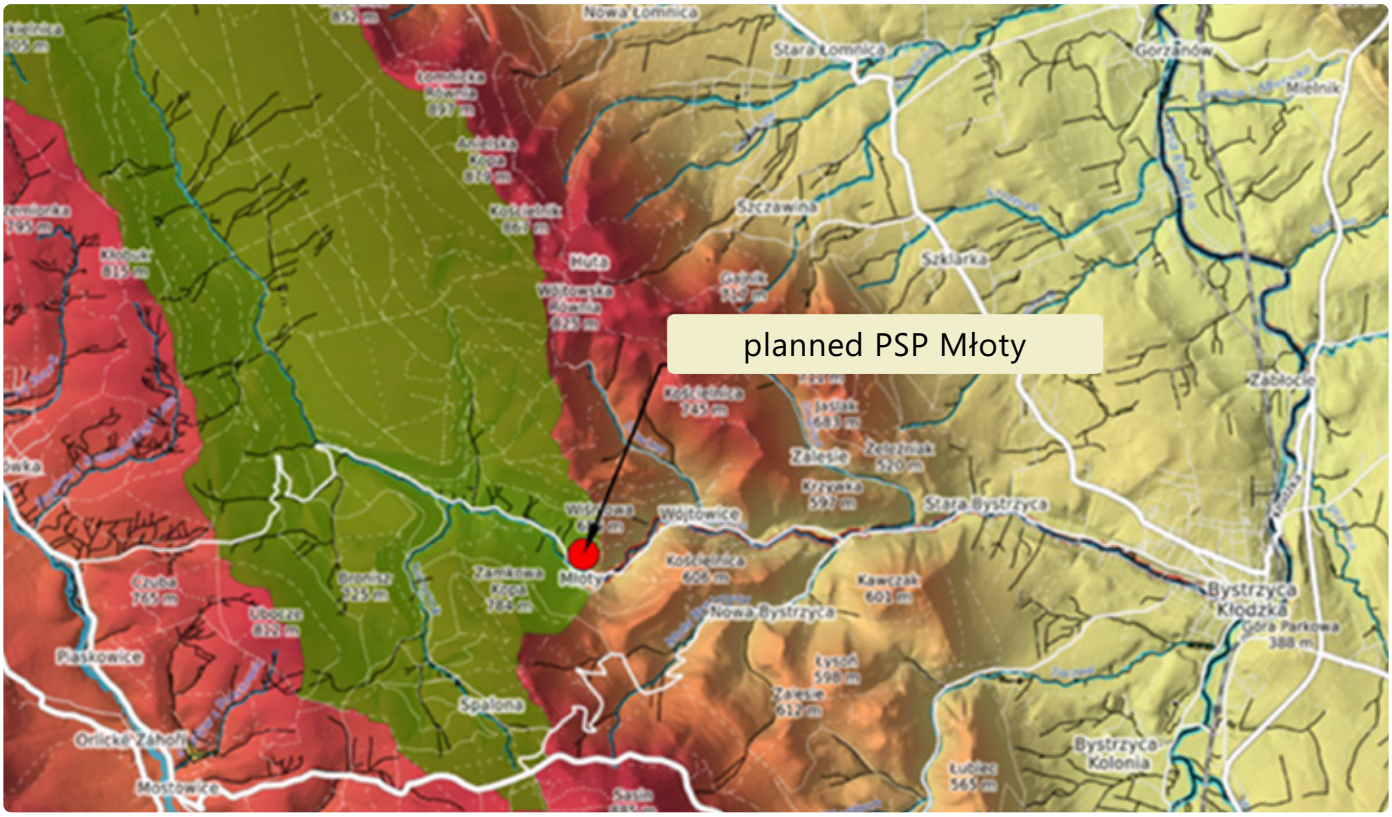


Fig. 2. Bystrzyca River catchment area in the cross-section of the planned PSP Młoty

ka-Żar, PSP Żarnowiec, PSP Dychów and PSP Żydowo) is relatively small compared to flood protection needs, totaling approximately 22.4 million m³.The key factor determining the usefulness of PSPs in flood protection is their location. For this reason, when deciding on the location of new PSPs, the retention capacity of the reservoirs should also be considered.

PSP Młoty example for retention

An interesting example illustrating the flood control function of the PSP is the planned PSP Młoty, which will use the water of the Bystrzyca River. The catchment area of the river above the cross-section of the power plant is 41 km² and by its mountainous nature the water runoff is relatively fast.

After a rainfall of 400 mm, similar to the one observed in September this year, about 4.1 million m³ of water would flow from the 40.9 km² catchment area into the power plant's cross-section. (wsp. 0.25 x 41 km² x 0.4 m = 4.1 million m³). The usable capacity of the upper reservoir of PSP Młoty is expected to be 6 million m³. According to the above calculations, using the flood control capacity of the upper reservoir of PSP Młoty, it will be possible to stop the entire volume of the surge wave flowing down from the mountainous part of the Bystrzyca River basin, contributing to the flood protection of the localities below.

Summary

Although these projects would not fully solve the flood protection issues in southwestern Poland, every cubic meter of water retained in mountainous area can significantly influence the safety of communities located downstream where flood waves tend to accumulate. In addition, combining energy and flood control functions can effectively reduce the amount of investment in retention measures.

For this reason, it is worth considering every opportunity to hold back water and water reservoirs that work with run-of-river hydropower plants, as well as pumped storage plants, can do their part in protecting against flooding.

Kamil Jabłoński
kjablonski@energoprojekt.pl
Agata Lethel
alethel@energoprojekt.pl
Zbigniew Pawlak
zpawlak@energoprojekt.pl
Energoprojekt – Warszawa SA

Graphics are from the archive of **Energoprojekt-Warszawa SA.**

The article was originally published on WysokieNapiecie.pl portal, titled "Floods should give a boost to the construction of hydropower plants".

References:

1. Archival design studies of the Młoty Pumped Storage Power Plant, Energoprojekt Warsaw
2. Modeling water economy on retention tanks on the example of the Nysa Kłodzka cascade, Institute of Meteorology and Water Management National Research Institute, Warsaw 2017
3. Flood Protection Project in the Oder and Vistula River Basins, www.gov.pl
4. Ordinance of the Minister of Infrastructure of October 26, 2022, on the adoption of the Flood Risk Management Plan for the Oder River Basin Area (Dz.U.2022.2714)
5. "They discussed the construction of the Kamieniec Ząbkowicki reservoir on the Nysa Klodzka River. It is to be built by 2030" 26.04.2024 – zabkowice.express-miejski.pl
6. Project Młoty (gkpge.pl); accessed 19.09.2024.
7. Hydroportal – ISOK; accessed 19.09.2024
8. Stop the Flood – Flood Protection; accessed 19.09.2024.
9. powodz.gov.pl ; accessed 19.09.2024
10. "Memorial on hydrotechnical investments planned in Kłodzko land destroying social, natural and cultural environment", Kłodzko Land Forum – residents, NGOs, scientists, May 12, 2019
11. Scalgo Live Program

The outlook for hydropower 2024 – IHA report

Global hydropower fleet grows to 1,412 GW in 2023 but five-year rolling average shows downward trend. To meet decarbonization goals and increase the flexibility of energy systems, urgent upgrades to hydropower plants and investments in pumped storage hydropower are necessary.

A growth rate of just over 26 GW per year from now to 2030 is needed to meet net zero targets.

- Hydropower is the largest single source of renewable energy, with pumped storage hydropower providing more than 90% of all stored energy in the world.
- It is estimated that around double the amount of hydropower that is currently installed is needed for net zero scenarios by 2050.
- To double hydropower capacity by 2050, a cumulative investment of approximately US $3.7 tn is required, or about US $130 bn annually. This equates to more than double the current level of funding.
- IHA's assessment of the "big 100" pipeline of projects under development indicates that this acceleration is within reach for the early years of the next decade, but more action is needed over the longer term.
- Hydropower is among the best ways to mitigate for droughts. IHA estimates that through the water storage function of its reservoirs, the hydropower industry prevents over US $130 bn in annual GDP losses from drought incidents.

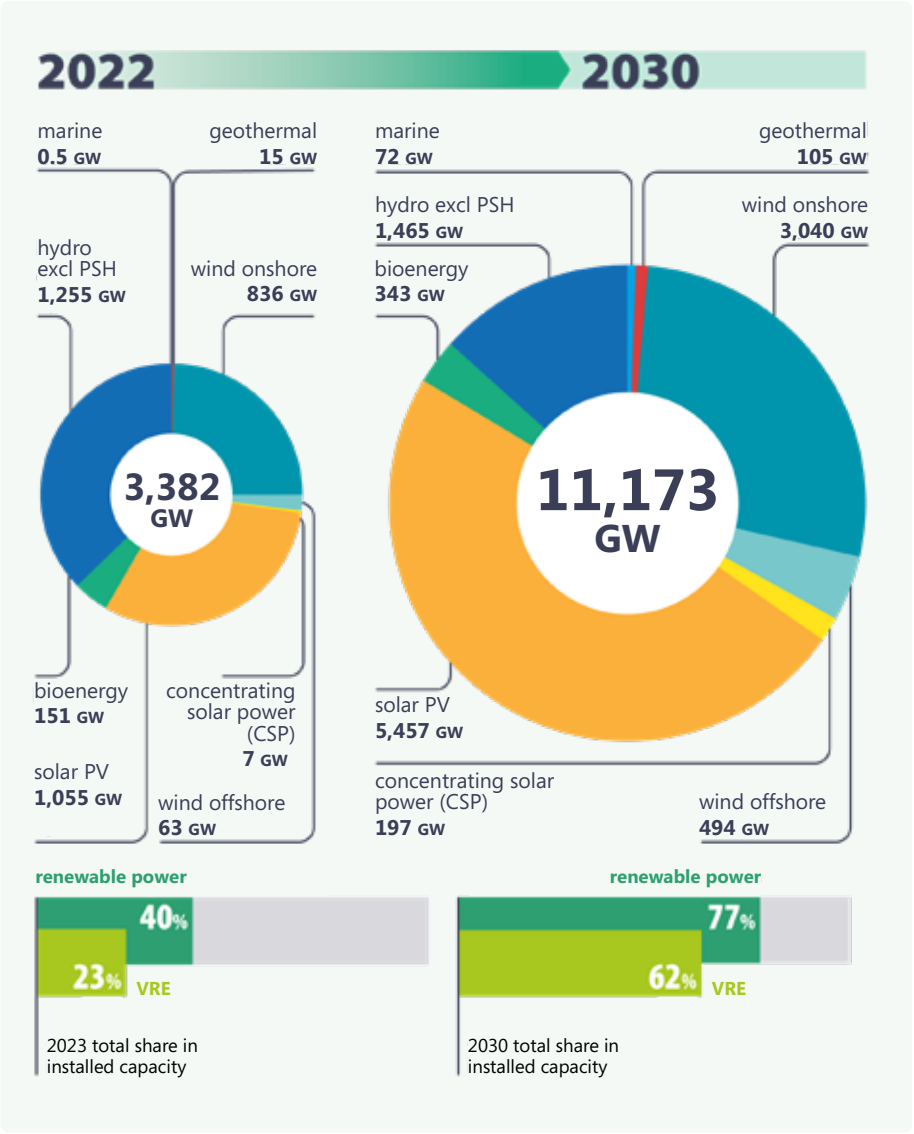


Fig. 1. Global installed renewable electricity generation capacity in the 1,5°C scenario (2022 and 2030)[2]

A global perspective

The latest World Hydropower Outlook, published by the International Hydropower Association (IHA), shows that in 2023, hydropower capacity grew by 13.5 GW to 1,412 GW, of which pumped storage hydropower (PSH) grew by 6.5 GW to 182 GW. Overall, there is an average downward trend for hydropower which risks energy systems missing global targets for decarbonisation by 2050.

With increasing global interest in hydropower, action is needed from governments to convert interest into new projects. Hydropower capacity needs to increase by 25 GW per year until 2030 to meet the 'tripling up' objective agreed at COP28[1]. After that, if net zero is to be achieved, delivery needs to more than double and this rate needs to be sustained until 2050.

IHA's assessment of the "big 100" pipeline of projects under development indicates that this acceleration is within reach for the early years of the next decade, but more action is needed to raise this rate of delivery. Ultimately, the world needs more hydropower projects, done better and delivered faster.

Eddie Rich, CEO IHA:

"Hydropower is the backbone to a reliable energy and water system. As well as providing electricity, it provides storage, flexibility, reliability to support solar/wind, access to clean water, irrigation, and drought and flood control".

"Whether we like it or not, more droughts and floods due to climate change will mean an increased need to invest in water infrastructure such as dams and reservoirs. Where possible these should be powered".

"This Outlook shows how investments are lagging and development has slowed down in the past decade. On the positive side, there is a healthier pipeline and pumped storage hydropower is experiencing a renaissance. Its potential to shore up the energy grid is increasingly recognised".

What does this mean for Europe?

- Following some of the worst droughts experienced across Europe in 2022, hydropower generation rebounded in

[1] United Nations Climate Change Conference, which took place in Dubai (United Arab Emirates) in November 2023.

[2] The special report on global warming of 1.5°C, published on October 8, 2018, by the Intergovernmental Panel on Climate Change (IPCC).

2023 to 637 TWh, close to the 2020/21 average.
- 70% of hydropower projects are over 30 years old. Modernisation and innovation investments can increase capacity.
- Total installed hydropower capacity reached 259 GW across Europe in 2023.

Ongoing changes in the European (and global) climate highlight an urgent need for the clean, green and affordable innovations in grid flexibility and security which are offered by hydropower. Significant opportunities in Europe exist to maximise the use of existing hydropower infrastructure by modernising it and hybridising it with other renewables and batteries.

As Europe phases out dispatchable gas and coal plants, the challenge lies in replacing this capacity with 'clean, firm' technologies. Complex regulatory frameworks and a lack of long-term incentives have steered development towards solar PV, wind, and short-duration storage options rather than the dispatchable resources that will be increasingly necessary. The flexibility offered by the entire hydropower fleet is vital to secure sectoral progress and conventional and PSH development are crucial for grid control. They secure power supply and avoid VRE curtailment, but this requires robust regulatory support.

While current electricity markets maximise competition to provide services at the lowest cost, they fall short in providing the long-term pricing essential for financing large infrastructure projects. This limitation hampers the adoption of the most cost-effective energy solutions for society in the long run. Europe's existing hydropower fleet is ageing rapidly, with over 70% of plants at least 30 years old. Exploitation licenses nearing expiration introduce uncertainty regarding license renewal and asset control, hindering investments in modernisation projects. This uncertainty acts against tapping into Europe's flexibility potential and holds back long-term strategic planning for plant owners. Addressing these challenges

Global hydropower in numbers

- China, Brazil, US, Canada and Russia were the top five countries for installed hydropower capacity in 2023.
- Almost half of new installed capacity in 2023 was in China.
- Europe is focused on the modernisation of existing hydropower and pumped storage hydropower development as part of its target of 42.5% renewable energy by 2030.
- In Africa, hydropower already provides 40% of sub-Saharan Africa's power but 90% of the continent's potential has yet to be tapped.
- In South America, hydropower contributes 45% of South America's electricity supply and over 13 GW of projects are in the pipeline.
- In Central America, hydropower accounts for over 30% of electricity.
- In the US, there is huge potential for modernisation with roughly half of the non-federal fleet up for relicensing by 2035.

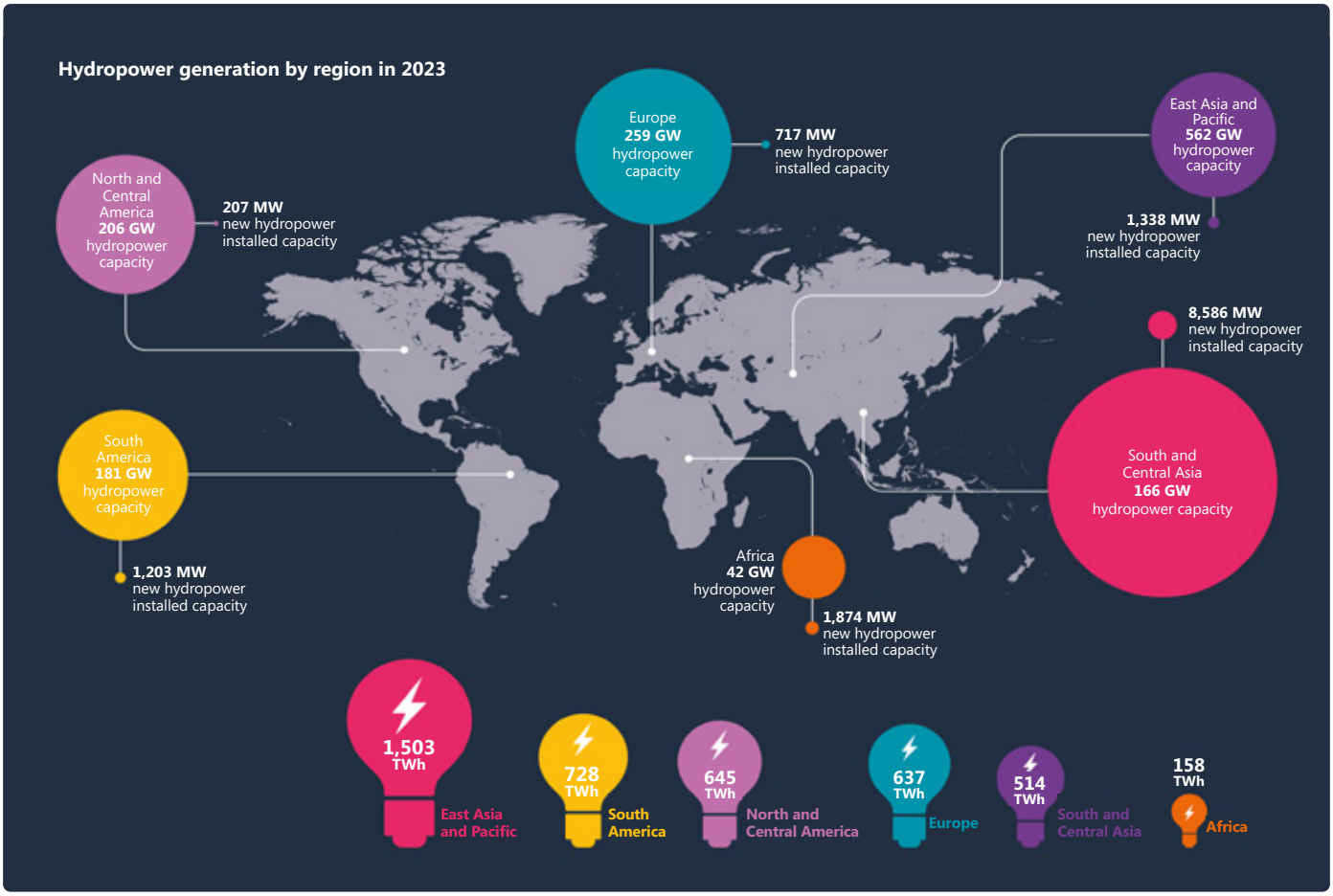


Fig. 2. Hydropower capacity by region in 2023

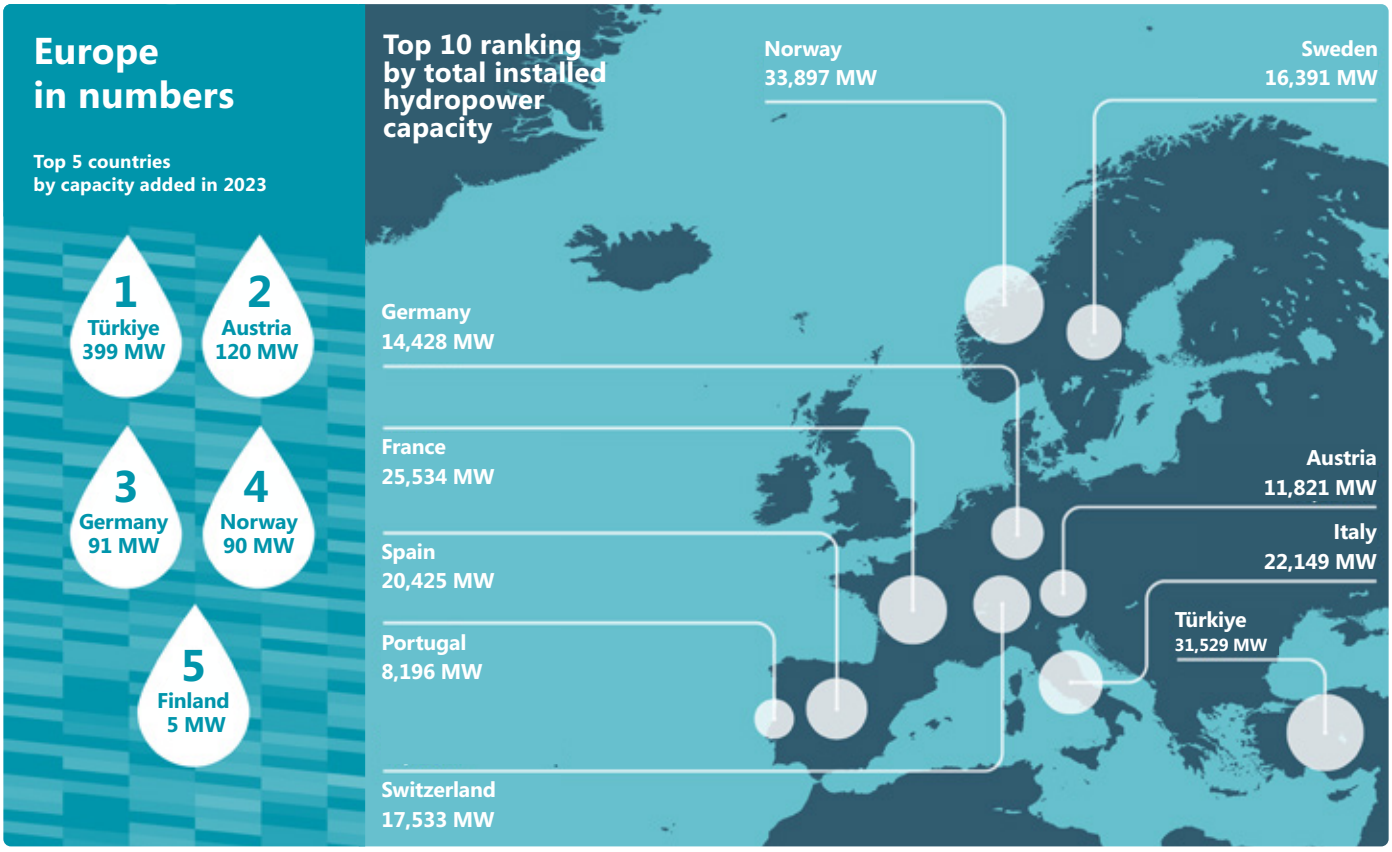


Fig. 3. Europe in numbers

is imperative for Europe to navigate its energy transition and ensure a sustainable and resilient energy future.

But there is hope. In January 2024, the European Commission and European Council reached a provisional agreement to reform the electricity market design. This initiative aims to create a buffer between short-term markets and consumers' electricity bills by incentivising longer-term energy contracts. It encourages the use of long-term instruments like power purchase agreements and capacity remuneration mechanisms, although two-way contracts for difference will not be available for reservoir hydropower and PSH.

Under this regulation, EU member states are required to review their needs for grid flexibility and establish objectives to decrease their dependence on fossil fuels. To manage potential gaps, they will also have the opportunity to introduce new support schemes, especially for demand response and storage.

Innovation through collaboration

We need to recognise and value hydro flexibility as an essential service to the power system to achieve a successful energy transition. As power systems are progressively losing the flexibility provided by non-renewable conventional energy sources, recognising, and valuing the growing necessity for flexibility services is crucial to

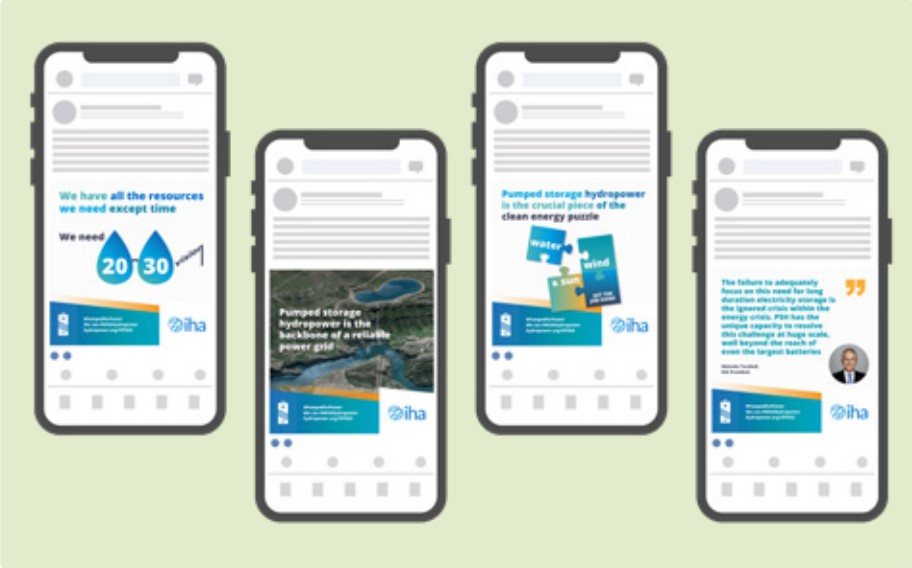


Fig. 4. PSH campaign assets

ensure grid stability and security of supply over the next decades.

Governments need to remove regulatory barriers for unrestricted implementation and operation of hydro flexibility technologies. To unlock the full potential of existing hydro assets and introduce new technologies, it is essential to eliminate regulatory barriers that limit the adoption of flexibility upgrades or that create discrepancy in the procurement process of flexibility services.

Innovation will thrive if we can better facilitate cross-border collaboration for the efficient exchange of flexibility services. Encouraging international collaboration among countries is essential for the efficient exchange of hydro flexibility services and expertise. By fostering cross-border connections, countries can share resources and expertise, optimising the utilisation of hydro flexibility on a broader scale.

Streamlining licensing renewals for optimised hydropower operations and simplifying the licensing process and accelerating permitting procedures are also vital for the operational stability of hydropower projects.

The future is pumped storage

Most of the hydropower development within Europe in the next decade will be focused on pumped storage, helping balance the increased use of wind and solar power, and manage the challenges of increasing droughts and floods across the region.

Countries to watch

Countries to watch include the United Kingdom with a development pipeline of 7 GW capacity and 136 GWh storage under development, Spain with a development pipeline of 2.5 GW capacity and 740 GWh storage in permitting/construction, Austria with a development pipeline of 2.7 GW, predominantly PSH, Switzerland with 16 new storage hydropower projects in early stages and Türkiye with 2.3 GW hydropower under development and 460 MW under construction.

Get involved in the campaign #PumpedforPower

The International Hydropower Association (IHA) is creating a momentum of activity to promote pumped storage hydropower, the rechargeable water batteries of the energy sector.

A year-long campaign for pumped storage hydropower launched in July with an industry-first guide to de-risk investments in pumped storage hydropower. The campaign will culminate at the International Forum on Pumped Storage Hydropower 2.0 in Paris in 2025 with key events, milestones and activities designed to pump it up throughout the year.

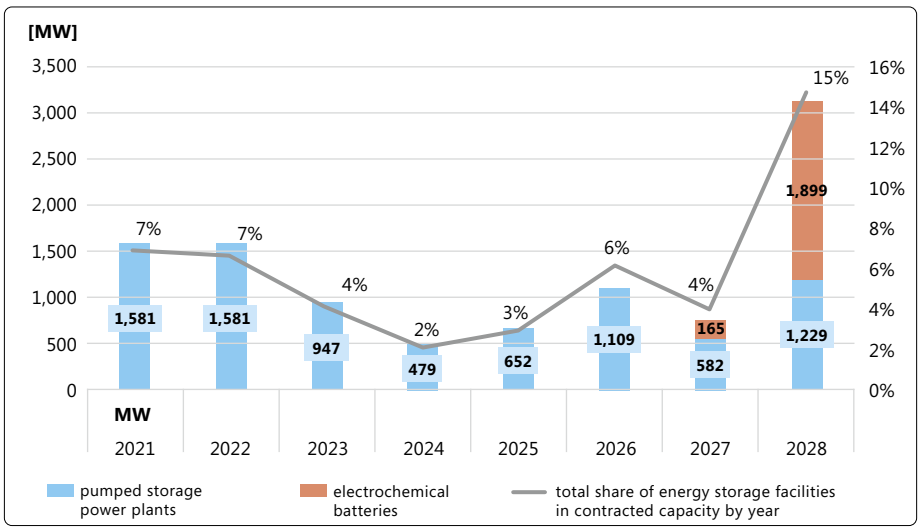
More information about upcoming you can find here: **https://www.hydropower.org/events/ifpsh2**

Gemma Regniez
Head of communications and advocacy
IHA

Graphics are from the archive of **IHA.**

Energy storage facilities – market and legislative considerations for the commercial power sector

It probably never crossed the minds of the designers and builders of the pumped storage power plants that were built in Poland in the second half of the 20th century, how different their fates would be. For decades to come, it was more a story of forgotten colossuses, written mainly by politics. However, changes in the electricity sector in recent years have led to a renaissance of these large-scale energy storage facilities, as well as a growing interest in alternative technologies. In the following article, a closer look is taken at the current market and legislative environment for energy storage.



Source: Energy Regulatory Office, Electricity storage, 2024

Fig. 1. Capacity contracted by energy storage facilities in the main auctions for 2021–2028

Pumped storage plants (PSPs), considered to be one of the first effective energy storage technologies, began operating in Poland on a larger scale in the 1970s. One example is Żarnowiec pumped storage plant, commissioned in 1983, which still plays a key role in stabilising the national electricity system (NES). The increasing significance of renewable energy sources (RES) is closely linked to the development of energy storage technologies. Increasing the share of RES in the energy mix requires the development of infrastructure to manage surplus energy effectively. In Poland, the share of RES is expected to increase to around 40% by 2030, providing a key impetus for further investment in energy storage facilities.

Energy Regulatory Office as a key market regulator

The President of the Energy Regulatory Office (URE) plays an important role in the process of shaping the legal and regulatory framework for energy storage facilities. Opening up a range of legislative modifications and quite an important intervention, was the introduction of the 2021 regulatory change to categorise pumped storage power plants based on their electricity storage function. As a result, four PSPs (Żarnowiec, Porąbka-Żar, Solina and Dychów) of the six plants operating in the country were licensed for energy storage in 2022, and the fifth, Żydowo pumped storage plant, in 2023. This is only the beginning of larger changes aimed at making fuller use of the RES potential in the Polish energy system and thus fulfilling Poland's energy transition commitments, including the EU climate policy goals of climate neutrality by 2050. Another step was the imposition of an obligation on all electricity system operators, irrespective of the fact that they actually have energy storage facilities connected to the network, to maintain a register of with a total installed capacity of more than 50 kW installations.[1]

The continuation of the changes is the imposition of rather clear and restrictive requirements on electricity network operators (DNOs and TNOs) in 2023. Namely, they may neither own, build, operate nor manage an energy storage facility unless it is recognised as a fully integrated part of the network by a decision of the President of the Energy Regulatory Office, thus allowing TNOs and DNOs to use storage facilities only to improve the stability of the distribution network. The list of premises based on which the decision is issued, is set out in the Act on amending the Act on Special Solutions for Certain Heat Sources in connection with the situation on the fuel market and certain other acts[2].

It is worth mentioning that from the introduction of the amendment until 10 May 2024, the Energy Regulatory Office has received 41 applications to qualify an energy storage facility as a fully integrated network element, from a total of six operators, of which five have been granted, one has been refused and the others are still pending.[3]

On the other hand, to recap 2023, the Energy Regulatory Office did not receive any new applications for electricity storage licences, however, three licence promises were granted to operate electricity storage facilities using lithium iron phosphate (LiFePO4) cells or lithium-ion cells with an installed electrical capacity in the range of 113.587 MW to 300 MW.[4]

Capacity market and energy storage

The icing on the cake is the amendment to the balancing conditions approved by the President of the Energy Regulatory Office.[5] It represents the second phase of the balancing market reform, which, as a further element, will significantly affect the development of energy storage facilities through their contribution to better integration of RES in the system and the reduction of non-market generation reductions. The change will also improve

[1] Art. 43g sec. 3 of the Energy Law Act (Dz. U./Journal of Laws/ of 2024, item 266).

[2] Pursuant to Art. 9d1 para. 1 of the Energy Law Act, which was introduced by the amendment of the Energy Law Act in 2023 through Art. 3(2) of the Act of 8 February 2023 on amending the Act on Special Solutions for Certain Heat Sources in connection with the situation on the fuel market and certain other acts (Dz. U. /Journal of Laws/ of 2023, item 295).

[3] Electricity storage – Report of the President of the Energy Regulatory Office, 2024.

[4] Report on the activities of the President of the Energy Regulatory Office in 2023.

[5] The amendment to the Balancing Conditions came into effect on 14 June 2024.

Source: Own compilation based on records: PGE Energia Odnawialna SA, PGE Dystrybucja SA, TAURON Ekoenergia Sp. z o.o., TAURON Polska Energia SA, Energa Wytwarzanie SA, Orlen SA Odolanów Branch, Almides Sp. z o.o., Stoen Operator Sp. z o.o.

no.	name of the holder	installation name	technology	total installed capacity [kW]	capacity [kWh]	efficiency [%]	maximum charging power [kW]	maximum discharge power [kW]
industrial system operator								
1	PGE Energia Odnawialna SA	Żarnowiec hydro-power plant	pumped storage	710,600	3,800,000	78	800,000	776,000
2	PGE Energia Odnawialna SA	Żar hydropower plant	pumped storage	540,000	2,000,000	75	560,000	592,000
distribution network operator								
3	PGE Dystrybucja SA	energy storage facility in Rzepedź	battery-powered, lithium-ion	2,088	4,237	84	2,048	2,048
4	PGE Energia Odnawialna SA	Solina hydro-power plant	pumped storage	198,660	640,000	79	64,800	198,000
5	PGE Energia Odnawialna SA	energy storage Porąbka	lithium-ion battery with nmc cells	550	750	90	550	550
6	TAURON Ekoenergia Sp. z o.o.	Lubachów energy storage facility	battery-powered, lithium-ion	500	500	80	500	500
7	TAURON Inwestycje Sp. z o.o.	energy storage facility Bytom	electrochemical	200	250	92.5	150	150
8	TAURON Polska Energia SA	Jaworzno energy storage facility	electrochemical	150	150	88	150	150
9	Energa Wytwarzanie SA	Bystra hybrid energy storage facility	hybrid – battery storage	6,000	15,000	70	6,000	6,000
10	Orlen SA Oddział PGNIG w Odolanowie	Odolanów energy storage facility	battery-powered, lithium-ion	180	403	98	100	50
11	Almides Sp. z o.o.	Nowa Wieś energy storage facility	acid batteries	250	420	80	250	250
12	Stoen Operator Sp. z o.o.	energy storage facility	battery-powered, lithium-ion	70	62	82	70	70
			TOTAL:	**1,459,248**	**6,461,772**			

Tbl. 1. Register of energy storage facilities of TNOs and DNOt (updated 26.08.2024)

the real-time pricing of electricity by opening a new catalogue of services and reducing the settlement period for balancing energy and imbalance settlements to 15 minutes. To complement the above, let us take a further look at the correlation of energy storage systems in the capacity market. The report of the President of the Energy Regulatory Office, already quoted, indicates, based on power market auctions, that pumped storage will continue to play a dominant role in energy storage. From 2021 to 2028, a total of 9.5 GW of capacity will be contracted, of which 7.6 GW will be existing or upgraded pumped storage power plants, and the remaining 1.9 GW will be 33 new energy storage facilities using electrochemical battery technology, planned for 2027–2028.[6]

The detailed share of contracted capacity by year and capacity is shown in Fig. 1.

A rather important issue of capacity market (CM) settlement is the corrective availability factor. This is a mechanism that is used to adjust the remuneration of entities participating in the CM (including power plants and energy storage facilities) depending on their actual availability, i.e. their ability to deliver contracted capacity at certain times, especially at times of threats to the electricity system.

If an entity is not able to deliver its declared capacity in full or does not meet other availability requirements, it is assigned a corrective availability factor. This topic was subject to a heated debate in the mid-year, as an amendment to the capacity market proposed lowering the corrective availability factor (CAF) to 57.58% for battery energy storage. Finally, the regulation[7] revised the CAF to 61.30% — for electricity storage in the form of batteries, kinetic energy storage and supercapacitors. This compares with a factor of 96.09% for reservoir hydropower plants.

Programme to support network stabilisation by DNOs

In the context of the growing importance of energy storage facilities for the stability of the Polish electricity system, a number of initiatives have been introduced to support them and integrate with existing infrastructures. One of the projects aimed at distribution network oper-

[6] "As a result of the main capacity market auction for the 2028 supply year, power contracts were concluded by 33 energy storage facilities using electrochemical technology" – Electricity Storage – Report of the President of the Energy Regulatory Office, 2024.

[7] The Regulation of the Minister of Climate and Environment of 26 July 2024 on the parameters of the main auction for the 2029 supply year and the parameters of the additional auctions for the 2026 supply year, as well as the parameters of the pre-auctions for these auctions (Dz. U. /Journal of Laws/ 2024, item 1154)

ators (DNOs) is the programme "Support for the use of storage facilities and other devices for network stabilisation".[8] Its aim is to improve electricity quality parameters in the distribution network by promoting the integration of energy storage and other technologies that can support network stabilisation, which is particularly important in the context of the growing number of renewable energy sources.

Under this programme, distribution network operators will be able to receive financial support to implement innovative solutions that will improve the quality and reliability of energy supply. Through this programme, operators will gain the ability to better manage fluctuations in energy production, which will contribute to energy security and reduce the risk of blackouts. The integration of energy storage in the distribution system will not only improve the stability of the network but also increase the efficiency of the use of available resources. In the long term, such a programme has the potential to contribute to a more sustainable and flexible energy system that responds to the challenges of the energy transition and the growing share of RES.

The programme has been planned for the period 2023–2030, with contracting until 31.12.2026. The programme envisages support for, among other things, the construction of a storage system that is an integrated part of the distribution network (e.g. battery containers, inverters, mobile storage facilities, autotransformers, transformers, installation of battery modules, support systems) together with testing and acceptance of storage facilities.

Support for strategic projects

Special purpose acts are special laws aimed at simplifying and accelerating the implementation of strategic investments, including in the energy sector. They enable administrative procedures to be shortened and simplified, allowing the required decisions and approvals to be obtained more quickly. A key element is also the facilitation of the acquisition of real estate necessary for the construction of infrastructure, thanks to a simplified land acquisition procedure. In addition, they provide rules on environmental compensation, which is particularly important in the context of investments affecting protected areas. They also often introduce exemptions from certain provisions of the construction law, which facilitates the construction of key infrastructure, such as transmission lines. Investments carried out based on special purpose acts are prioritised at the state level and their implementation is carried out in close cooperation between various state authorities, which allows efficient and coordinated project implementation.

In the implementation of investments related to energy storage and capacity derivation in Poland, two documents should be pointed out:

- the special purpose act on transmission — the Act of 24 July 2015 on the preparation and implementation of strategic investments in transmission networks

and

- the special purpose act on pumped storage power plants — the Act of 7 July 2023 on the preparation and implementation of strategic investments in pumped storage power plants and associated infrastructure.

Facilities resulting from the aforementioned acts include, for example, the possibility of parallel processing of the location decision and the decision granting permit under the Water Law Act (which, for the construction of a pumped storage power plant, shortens the administrative stage by a few months) or the recognition of the construction of block lines, a substation, a power lead-out line or a power supply cable line for own needs as accompanying infrastructure, which also allows for the application of a simplified formal and administrative procedure.

However, in order for the provisions of a particular special purpose act to be applied to a particular investment, it must meet certain conditions. Thus, in the case of the Act on the preparation and implementation of strategic investments in transmission networks, the entity that can benefit from the act in question is the transmission system operator, i.e. Polskie Sieci Elektroenergetyczne, and the investments that are subject to the regime of this act are specified in the annex to this act. While the list of investments does not specify block lines, substations and MV or LV power lead-out lines, an investment concerning the construction of a line string together with a switchyard, deriving power from an energy storage facility, can be qualified under item 52 of the Annex, which reads: "Construction of connections and lines for the connection of connected entities to the electricity transmission system". However, the definition of a strategic investment in the transmission network, as well as the investor, should always be taken into account.

Conclusions

Legislative conditions for energy storage facilities are of key importance for the future of the commercial power sector in Poland. With the growing interest in modern storage technologies, the regulations introduced by the Energy Regulatory Office are becoming an important element that may define the future of the sector. However, as history shows, in the energy industry, adaptation to new regulations and technologies is a long-term process.

Energy storage facilities can be used by operators to manage the risk of blackouts, which can occur as a result of network congestion or sudden increases in energy demand. With energy storage, TNOs and DNOs can better manage fluctuations in renewable generation, which is key to the security of energy supply to end users. As technology evolves, there are bound to be new opportunities and challenges that will require innovative solutions and flexibility from operators and regulators. So, with changes to come, it is worth watching developments with an open mind, as the future of the power sector may bring surprising and exciting solutions.

Ewelina Bogacka
Project office manager

Michał Kubecki
President of the management board

[8] https://www.gov.pl/web/funduszmodernizacyjny/wsparcie-wykorzystania-magazynow-oraz-innych-urzadzen-na-cele-stabilizacji-sieci-program-dla-operatorow-sieci-dystrybucyjnych

DRIVING
THE ENERGY
TRANSITION

KEY 25

THE ENERGY TRANSITION EXPO

5 → 7
MARCH
2025

RIMINI
EXPO
CENTRE
ITALY

Get Your
Free Ticket

key-expo.com
#climatefriends

Organized by
ITALIAN EXHIBITION GROUP
Providing the future

In collaboration with
ITA
madeinitaly.gov.it

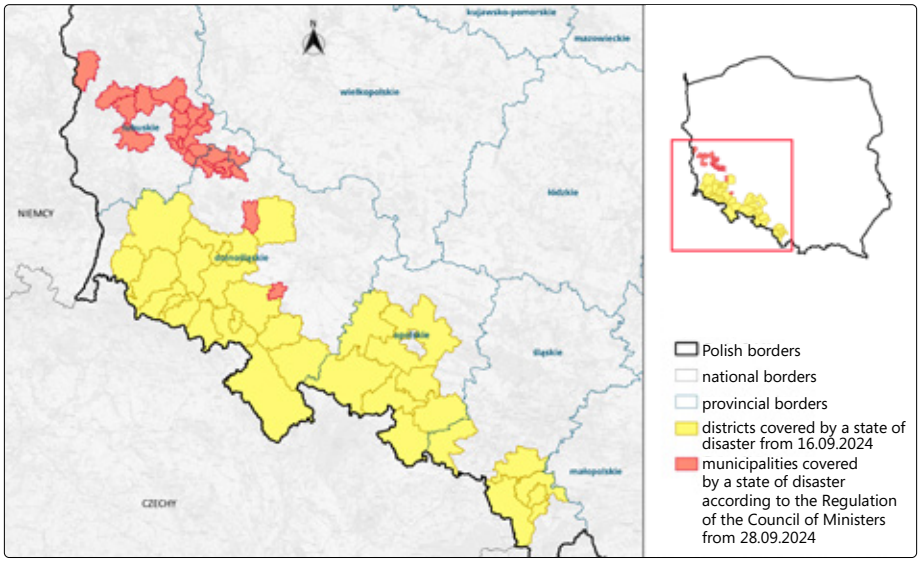
Simultaneously with
ITALIA SOLARE
Forum Tech

Fig. 1. The bridge of St. John of Nepomuk in Lądek-Zdrój destroyed by flooding

Source: Paweł Pachura, TV Sudecka

Flooding in the Kłodzko Valley: causes of catastrophic events in the region

The Kłodzko Valley, known for its picturesque landscape surrounded by the Sudetes mountains, has recently become a symbol of the dramatic struggle against forces of nature. The flooding that has affected this region is not a random occurrence. Numerous factors, both natural and resulting from human activities, have contributed to the current situation. Let us take a closer look at the conditions that have determined the flooding events.



Source: Own study based on the Chancellery of the Prime Minister

Fig. 1. Area under state of natural disaster, status on October 2, 2024

The Kłodzko Land is a region rich in history and remarkable natural beauty, located in the southwestern part of Poland, near the border with the Czech Republic. Surrounded by the Sudetes mountain ranges, this area features a diverse landscape, ranging from mountain peaks to valleys and basins, including the famous Kłodzko Valley. The Kłodzko Land is known for its numerous spas, historic towns, and stunning tourist areas that attract nature and history enthusiasts. However, due to its specific location and hydrological conditions, this region often becomes a stage for catastrophic weather events, such as floods, which have a devastating impact on local communities.

Geological and hydrological predispositions of the Kłodzko Valley

The Kłodzko Valley is situated in a tectonic graben, which significantly influences the hydrology of the area. This structure facilitates the accumulation of rainwater from the surrounding regions. The nearby rivers are mountainous, characterized by hard, rocky beds, which increases the speed of water flow and its erosive potential. The Nysa Kłodzka River, flowing through the central part of the valley, is fed by numerous tributaries from both the right and left sides. These tributaries, descending from the mountain slopes, contribute to the rapid rise in water levels in the river, which is a crucial factor determining the nature of flood events in this region. The swift influx of water into the riverbeds leads to the formation of intense flood waves, with accumulations observed mainly in the lower, estuarine sections of the rivers.

Impact of anthropogenic changes on flood risk

Changes in land use, such as deforestation, urbanization, and infrastructure development, have undoubtedly increased the vulnerability of the Kłodzko Valley to flooding. The construction of buildings in areas adjacent to rivers and alterations to the natural landscape reduce soil permeability and increase the speed of surface runoff. Notably, the relatively small streams that form the hydrographic network of the catchment area have been extensively regulated, with both transversal and longitudinal constructions. Such transformation of the landscape leads to a heightened risk of extreme hydrological events.

As analyses have shown in the context of the Odra River Basin Flood Protection Project[1], the flood risk in the Kłodzko Valley primarily arises from the insufficient capacity of river and stream channels, as well as transportation structures. The report also emphasizes the inadequate number of flood retention reservoirs, insufficient height and quantity of flood embankments, and the high degree of development in areas directly adjacent

[1] https://odrapcu.pl/inwestycje/kotlina-klodzka/

Source: Paweł Opaliński

Fig. 2. Dry reservoir in Roztoki Bystrzyckie during the peak flood wave

to watercourses. In many cases, the existing flood protection infrastructure is in poor technical condition.

On the other hand, it is important to emphasize that hydrotechnical structures will not provide full protection for the region's residents. The nature of the phenomena observed in the Kłodzko Valley indicates that it is essential to implement measures aimed at protecting and increasing natural retention, as well as restoring natural flow conditions. It is imperative to also limit development in flood-prone areas and manage land use rationally to prevent flood-related losses.

Recent events and their consequences

The first half of September brought a series of extreme weather events that contributed to a crisis in the region. Towns such as Kłodzko, Stronie Śląskie, and Bystrzyca Kłodzka experienced dramatic flooding. Water overflowed the embankments and dams, inundating streets and homes, which necessitated the evacuation of residents. The direct cause of the rises in water levels was extreme rainfall. The total precipitation recorded between September 9 and 15 in the Kłodzko Valley area exceeded 400 mm (on the Czech side), while the recorded values on the Polish side were only slightly lower.

As a result of the damage to the earthen dam (a structure built in 1908) on the small Morawka River, a sudden flood wave formed, inundating a significant part of Stronie Śląskie and destroying infrastructure and buildings. Water surged through the town with tremendous force, causing catastrophic destruction. Two bridges were swept away, effectively isolating the town from the outside world. Stronie Śląskie was left without electricity, gas and drinking water, complicating access for rescue services. Local residents, supported by the Water Rescue Service (WOPR), the military, and the fire brigade, worked on-site, battling the elements and trying to secure the areas that had survived the deluge.

In Kłodzko, the water level in the Nysa River reached an astonishing 798 cm during the night of September 15 to 16. This was over 550 cm above the alert level and nearly 150 cm higher than the record level observed in 1997. Numerous buildings were inundated, and parts of the town were left without electricity and drinking water, which became contaminated due to a water supply failure. In the city center, water depths ranged from 50 to even 150 cm. Although the situation began to stabilize, the material losses are enormous.

In Bystrzyca Kłodzka, serious damage also occurred when the swollen waters of the Nysa flooded part of the town, isolating the villages of Wilkanów and Pławnica from the outside world. The consequences of the flooding were dramatic—residents faced interruptions in electricity supply, and infrastructure losses increased with every passing hour.

Lądek-Zdrój, like Stronie Śląskie, suffered severely from the violent flood wave that swept through the town on Sunday, September 15. The water caused immense destruction — many homes were literally split in half, and nearly all the bridges, including the 16th-century St. John's Bridge, were swept away by the current.

Source: Paweł Pachura, TV Sudecka

Fig. 3. Damaged dam on the Morawka in Stronie Śląskie

Source: Jacek Halicki

Fig. 4. Kłodzko, Franciscan monastery complex

The town was covered by a thick layer of mud, wood debris, and remnants of buildings. The situation in Lądek-Zdrój is dire, with significant losses in both municipal infrastructure and private property.

Aging hydrotechnical infrastructure

In light of recent events, the risks associated with aging water infrastructure cannot be overlooked. This is emphasized by both global reports such as "Ageing Water Storage Infrastructure: An Emerging Global Risk"[2] and our national reports on the technical monitoring of dams, published by the Institute of Meteorology and Water Management (IMGW-PIB)[3].

As demonstrated by the aforementioned report, globally, the majority of the 58,700 large dams were built between 1930 and 1980 and were designed for a lifespan of 50 to 100 years. Signs of aging infrastructure include an increasing number of dam failures, rising repair and maintenance costs, greater sedimentation in reservoirs, and consequently, a loss of effectiveness and functionality. A dam may reach a respectable age of one hundred years and still function well, provided that its designers accounted for adequate capacity, ensured a robust structure, and that the facility has been regularly inspected and maintained.

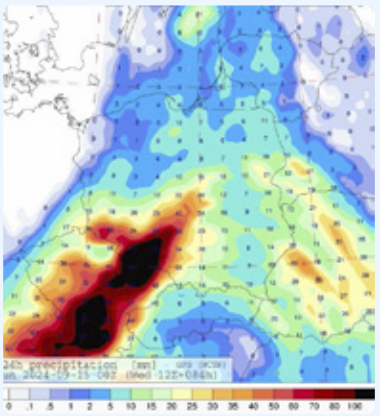
As emphasized by the Institute of Meteorology and Water Management (IMGW-PIB): "maintaining the appropriate condition of dam structures, especially the significant and often cumulative costs of necessary, simultaneous repairs of many of them, is currently a problem and a global challenge faced by even highly developed countries".

In Poland, in 2023, the technical condition of hydrotechnical structures classified as Class I and II was assessed as inadequate in 21% of cases, adequate in 53%, and only good in 26%. In the area of operation of the State Water Holding Polish Waters in Wrocław, these values were 32%, 40%, and 28%, respectively.

Recent events highlight the importance of monitoring and responding appropriately to hydrological and meteorological warnings, especially in the context of a changing climate, which can increase the frequency and intensity of such phenomena. Maintaining the proper condition of hydrotechnical infrastructure is crucial, but only in areas where it is necessary and fulfills its functions. Above all, the recent devastating flood should prompt reflection on the proper land use in river valleys, which is key to reducing or avoiding flood losses.

The Genova Low

The Genoa Low is a type of low-pressure system that forms in the area of the Gulf of Genoa, on the northern coast of the Mediterranean Sea. It occurs when cold air from northern Europe flows over the warm waters of the Mediterranean Sea, leading to the intense development of low pressure. This system causes particularly heavy precipitation in Italy, the Alps, the Balkans, and Central Europe, contributing to floods, avalanches, and other natural disasters. Its area of influence can also extend to Poland, the Czech Republic, and Slovakia. As a result of the impact of the Genoa Low, there are often sudden increases in water levels in rivers and streams, leading to flooding. Due to the terrain, regions such as the Alps, the Dolomites, and the Carpathians, as well as valleys (including the Kłodzko Valley), are particularly susceptible to floods caused by precipitation triggered by this low-pressure system.



Source: IMGW-PIB Meteo Poland

Fig. 2. The forecasted intensity of precipitation over Poland on September 14, 2024

[2] https://collections.unu.edu/view/UNU:7930
[3] https://www.imgw.pl/wydarzenia/stan-budowli-pietrzacych-w-polsce

Agnieszka Hobot
Editor in Chief
"Wodne Sprawy" magazine

On the way to sustainable energy

Hydropower, as one of the largest sources of renewable energy, faces many challenges that concern not only the efficiency of energy production but also the protection of ecosystems. As the world strives to minimize carbon emissions and achieve climate neutrality goals, it is essential to find sustainable solutions that allow for both energy generation and environmental protection.

One of the key challenges for hydropower is reducing its impact on the migration of fish and other aquatic organisms. In light of this, the hydropower industry must seek innovative technological solutions and effective strategies for collaboration with local communities to promote sustainable development. It is therefore crucial to understand how energy production can be harmoniously integrated with ecosystem protection, as well as how to implement changes in existing facilities to minimize their environmental impact. The establishment of associations that facilitate the exchange of expert knowledge and support the development and implementation of innovations is an important step towards a greener future for hydropower.

In the context of these complex issues, Gia Schneider, a board member of the International Hydropower Association (IHA), shares her insights on the future of the industry with the editors of "Energetyka Wodna" magazine. In the interview, we discuss solutions that could help achieve a balance between energy production and environmental protection.

Source: Gia Schneider's archive

Fig. 1. Gia and her brother Abe in high school, collecting insect samples in Colorado for a research project

Where did your fascination with hydropower come from? Not only from the engineering side but also its impact on the ecosystem. Is there a personal backstory to your beginnings in the industry?

My fascination with hydropower began at a young age, growing up in Texas, where my father was deeply concerned with climate change and energy efficiency after living through the 1970s energy crisis. I vividly remember being 8 years old, sitting at the dinner table as he sketched diagrams to show how carbon dioxide traps heat in the atmosphere. Those moments sparked my early interest in the connection between energy, water, and climate.

My brother Abe and I both earned engineering degrees from MIT, and while we took different career paths — me into finance and energy trading, and Abe into mechanical engineering — we were both driven by the idea of making hydropower more sustainable.

Were there specific moments or projects early in your career that shaped your views on how hydropower could be more sustainable?

One particularly formative experience was fishing together in Colorado as teenagers. We noticed how the branch of the river with beaver dams flourished, while the section where the dams had been removed by a cattle company struggled. It was a real eye-opener: those beaver dams weren't hurting the ecosystem — they were essential to creating it. This realization inspired our future approach to hydropower, focusing on systems that help, rather than harm, the environment.

In 2009, Abe and I co-founded Natel Energy with the goal of enabling more sustainable hydropower. We have developed turbine designs with the goal of allowing hydropower plants to continue to produce reliable, renewable power while enabling aquatic biodiversity to thrive. For me, hydropower represents a unique opportunity. It sits at the intersection of energy, water, and climate, making it a critical solution for a zero-carbon grid. But as we push for cleaner energy, we have to make sure we're protecting the ecosystems that depend on the same water sources. That's what drives my work every day.

While the need to generate energy from water is clear, the environment often faces challenges from this source. Is there a healthy compromise between generating hydropower and protecting ecosystems?

Yes, a healthy compromise between generating hydropower and protecting ecosystems is achievable. Hydropower, the world's largest renewable energy source, plays a key role in stabilizing the grid and achieving net-zero targets. However, traditional turbines can be harmful to aquatic ecosystems, particularly migratory fish species like salmon and eel, with one in five fish suffering injuries or fatalities when passing through. This environmental impact is a serious challenge as we expand renewable energy sources.

To address this, we are working on solutions, that can reduce their negative impact. An example a Natel's turbine designs which allow fish to pass safely through hydropower systems without reducing energy efficiency. Unlike traditional fish protection methods like fish screens or bypasses which can be prohib-

Source: Hydropower Sustainability Alliance

Fig. 2. Eastmain-1 Development – one of the hydropower projects recognized by the Hydropower Sustainability Alliance with a gold HSS award

itively expensive and can reduce power output, this solution can ensure over 98% survival rates across fish species. Innovations like this present a sustainable way to modernize hydropower plants and reduce their impact on ecosystems.

In addition to technological solutions, it's essential that hydropower projects are developed responsibly. The Hydropower Sustainability Standard, which aligns with World Bank and International Finance Corporation performance standards, ensures that projects meet global best practices for minimizing environmental impact. Engaging local communities and adopting these standards promotes transparency, balancing energy generation with ecosystem protection, and ensuring hydropower remains a sustainable solution for all.

The IHA has consistently supported the growth of hydropower. What recent innovations or developments have caught your attention, particularly those that maintain a balance between environmental values and energy generation?

The IHA helped catalyze the creation of a global certification approach to define best practices for sustainable hydropower development and operation, which became a formal, independent standard managed by the Hydropower Sustainability Alliance in 2021. Over 35 projects have used the standard to guide development and operations.

The IHA's efforts to promote sustainability represent a significant leap forward in balancing environmental protection with energy generation. When we modernize aging hydropower assets, we need to focus on doing so in a way that ensures that these facilities can remain operational for generations to come. That is, not just from a mechanical standpoint, but because hydropower plants that protect biodiversity are more likely to remain compliant with environmental, social, and governance criteria, reducing permitting and public opinion obstacles and making them eligible for green financing options like Climate Bonds[1].

What actions are planned by the association in the coming years to support sustainable development in the hydropower sector?

IHA is working to strengthen sustainable development in the hydropower sector through several key initiatives. Central to these efforts is the Hydropower Sustainability Standard, a certification framework developed and governed by a multi-stakeholder council and aligned with World Bank and IFC performance standards. The Standard is used globally to assess and improve the sustainability performance of hydropower projects. By partnering with the Hydropower Sustainability Alliance, IHA will continue to offer developers access to guidelines, tools, training, and sustainable hydropower assessors to support both new developments and the modernization of existing plants. This is especially important in countries with significant hydropower potential, ensuring that growth is aligned with global best practices.

How do you assess the IHA's activities in recent years? What benefits have they brought, and what challenges have you faced in raising awareness about sustainable energy generation?

I am proud to see IHA championing values within the hydropower industry that align with my own to protect ecosystems while advancing hydropower's benefits to communities. As an IHA board member I actively promote IHA's commitment to transforming the global hydropower fleet to be truly sustainable.

Part of IHA's work in this area is through the Global Renewables Alliance, an advocacy organization formed by leading renewable energy organizations to unite clean technologies for achieving net-zero by 2050. Together, they are working to amplify the call to triple renewable energy capacity to at least 11,000 GW by 2030, accelerating the global energy transition.

Gia Schneider
Board member
International Hydropower Association

Co-founder, CCO
Natel Energy

[1] Climate Bonds are fixed-income instruments designed to support climate or environmental projects – they are meant to finance or refinance investments, projects, expenditures or assets that help address climate and environmental issues. Governments and private companies use them to finance the transformation towards a more sustainable and low-carbon economy.

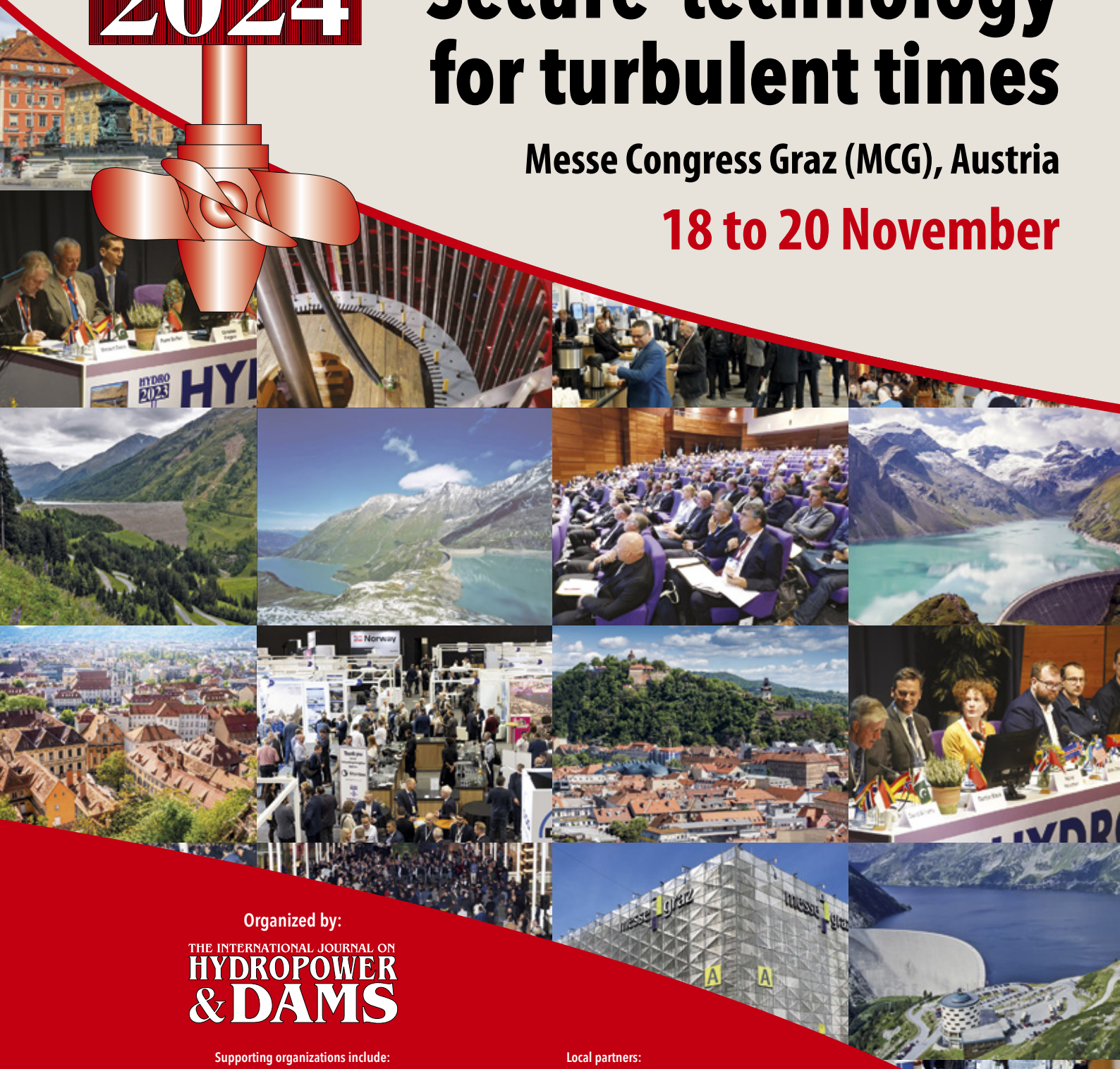
HYDRO 2024

International Conference and Exhibition

Secure technology for turbulent times

Messe Congress Graz (MCG), Austria

18 to 20 November



Organized by:

THE INTERNATIONAL JOURNAL ON HYDROPOWER & DAMS

Supporting organizations include:

Local partners:

PRESENT • EXHIBIT • ATTEND

Industry sponsors include:

For information visit:
www.hydropower-dams.com/hydro-2024/

IOZE hydro

turn water into profits

AUTOMATION OF HYDROTECHNICAL STRUCTURES

Take full advantage of the available potential

Hydropower plant owners are facing a number of challenges, such as rising operating costs, ageing assets, limited availability of experienced staff and the need to adapt structures to strict regulations and the energy market. Automation can turn these challenges into opportunities and generate real value for your business.

- Water turbines for low & high head
- Hydromechanical equipment
- Modernization & rehabilitation
- Spare parts
- Trash racks
- Consulting & design

Contact us

Łukasz Kalina
+48 512 008 805
lukasz.kalina@ioze.pl

www.hydro.ioze.pl