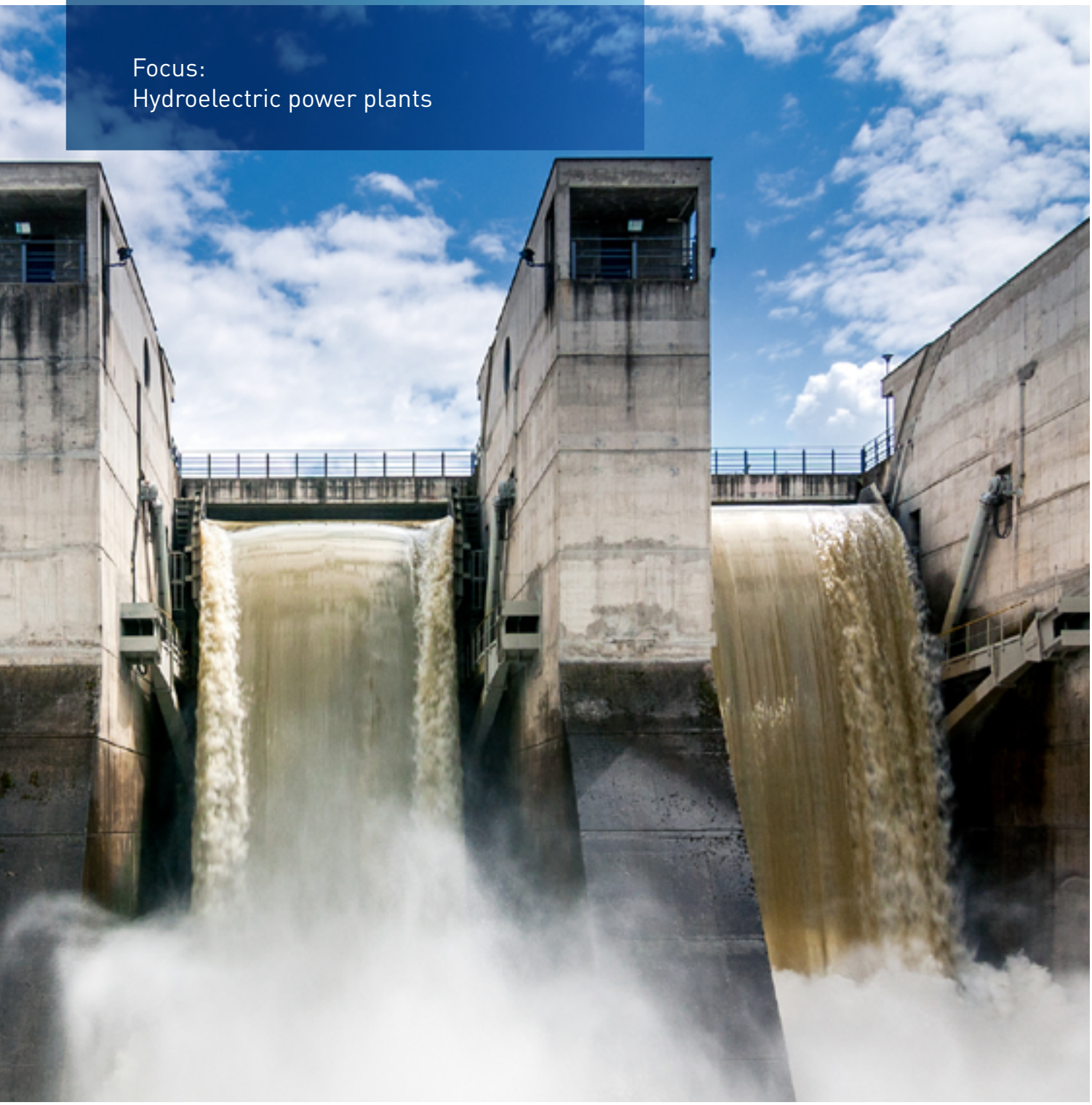
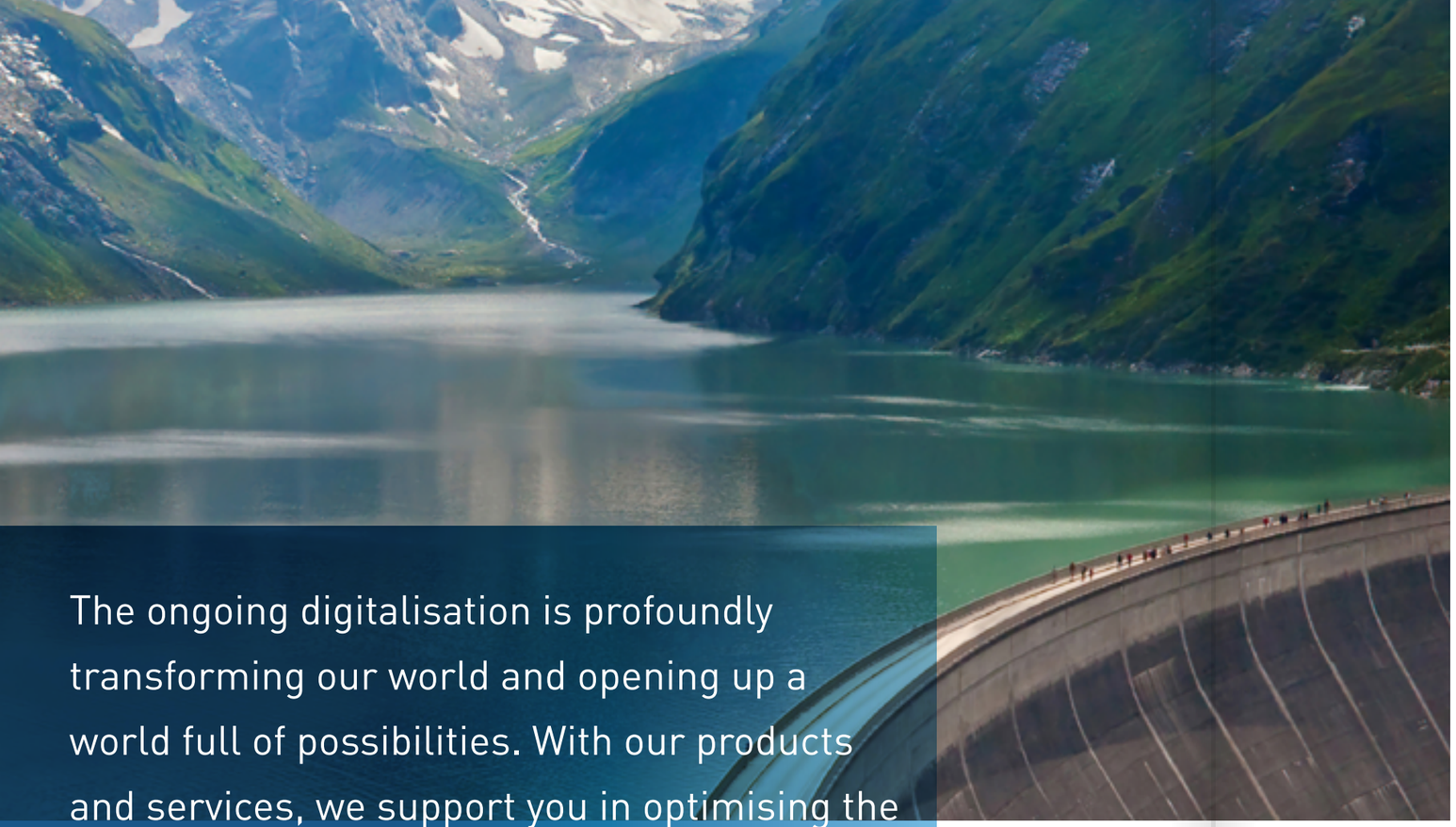
Measurement and monitoring systems

Focus:
Hydroelectric power plants



Innovative solutions
for valuable resources



The ongoing digitalisation is profoundly transforming our world and opening up a world full of possibilities. With our products and services, we support you in optimising the efficiency of your hydropower plant and increasing the safety of your infrastructure. Our flow measurement systems have already proven themselves worldwide over several years of operation. You too can benefit from our experience in design, planning, and turnkey installation.

Dr.-Ing. Jürgen Skripalle, SVP
Sergio Thaddey, Product Management

GWF

OUR COMPANY

Working for precious resources – since 1899

01

1899

With a view to the Pilatus, Johannes Elster founds the GWF to support the Swiss gas industry with innovative technology.

1910

GWF expands its product range and adapts to new market conditions with an innovative spirit.

1920

The introduction of first water meters paves the way for an international future.

1930

In the global economic crisis, new business opportunities are opened up with creativity.

1940

GWF strengthens its position in the water market through cooperations.

1950

GWF develops advanced water meters and establishes itself as a quality leader.

1960

The production in Lucerne is modernized.

1970

GWF receives its first mentions for environmentally friendly and sustainable production.

1980

GWF increases its production volume and invests in internationalization.

1990

The era of digitalization begins - with the GWF Encoder and remote meter reading.

2000

GWF sets new technical standards with its radio meters.

2010

The high-resolution 8-roll GWF Encoder counter is being developed.

2014

GWF successfully executes a generational transition. Elena and Florian Strasser start running the company in 6th generation.

2016

GWF starts the development of ultrasonic technologies and acquires patents and basis technology.

2018

GWF partners with Dr. Jürgen Skripalle and builds on decades of ultrasonic measurement experience.

2020

GWF builds out its market presence in the US, UK, and Eastern Europe.

2024

GWF expands its activities in Austria and Germany with own Service and Sales offices.

TODAY

GWF broadens its portfolio to include water quality and integrated solutions

HISTORY

« Innovation, partnerships and customer orientation have been our focus for generations. »

Florian Strasser, CEO & Chairman

Our roots go back to 1848 when Johannes Elster founded Elster AG in Berlin. After the company grew rapidly through bold investments, his son Johannes Siegmar Elster initiated the internationalization of the business.

GWF AG was the first foreign subsidiary of the Elster Group and was founded in 1899 in Lucerne. The company started out by manufacturing gas meters, gas lamps and street lamps, setting new standards for energy supply in Switzerland. Water meters were added to the product portfolio shortly thereafter. GWF continued to grow as an independent company and maintained close ties with the Elster Group over the decades. GWF is still a family-owned company today.

02

OVERVIEW

Our services are driven by passion

Areas of application

About us

We are experts in reliable data acquisition, communication, and processing for consumption billing and process control. Our customers have access to a wide range of technologies and products, as well as personal contacts for questions regarding system integration. We also act as general contractors for our customers and support them from product selection to installation and commissioning of the measuring devices.

Hydropower

Flow measurement for determining efficiency and monitoring leakage in penstocks.

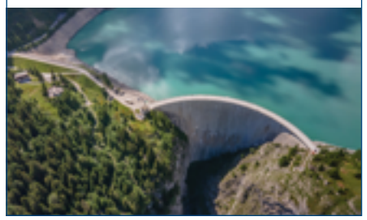
PRESSURIZED PIPES

Technologies/solutions

- Feedthrough sensors
- Internal mount
- Clamp-On

Products

- Ductus DN400-DN10000



Hydrology

Flow measurement in rivers and waterways for high and low water forecasting and for monitoring the ecological minimum flow.

RIVERS, CHANNELS

Technologies/solutions

- Single path system
- Crossed path system
- Multi-path system

Products

- Kanalis <100m width
- Fluvius >100m width

Wastewater

Measurement of inflow and outflow at wastewater treatment plants, sewer networks, and groundwater infiltration.

PARTIALLY AND FILLED PIPES, OPEN CHANNELS

Technologies/solutions

- Wetted sensors
- Non contact sensors

Products

- Q-Eye PSC
- Q-Eye Radar

Irrigation

Flow measurement in large irrigation systems, for monitoring water withdrawal and billing.

CHANNELS

Technologies/solutions

- Single path system
- Crossed path system
- Multi-path system

Products

- Kanalis <100m width

Water supply

Process control (SCADA), independent of bends, valves, or pumps in the flow.

PRESSURIZED PIPES

Technologies/solutions

- Feedthrough sensors
- Clamp-On
- Flange (SONICO®)

Products

- Ductus DN400-DN10000
- SONICO® EDGE DN50-DN300
- SONICO® NANO DN15-DN40

Water solutions

Measurement and monitoring systems for hydroelectric power plants

As water becomes increasingly scarce, it is essential to monitor water usage, especially in applications like hydroelectric power plants. Monitoring the penstock is a critical part of managing these plants, as it ensures efficient and safe operation by measuring the flow rate in the pipes that carry water from the source to the turbines or pumps. This is crucial for maximizing energy production and protecting the infrastructure. The importance of hydroelectric power plants has grown in recent years, with the construction of pumped storage power plants that can store electricity generated by the sun or wind and provide energy during peak loads.

Flow measurement

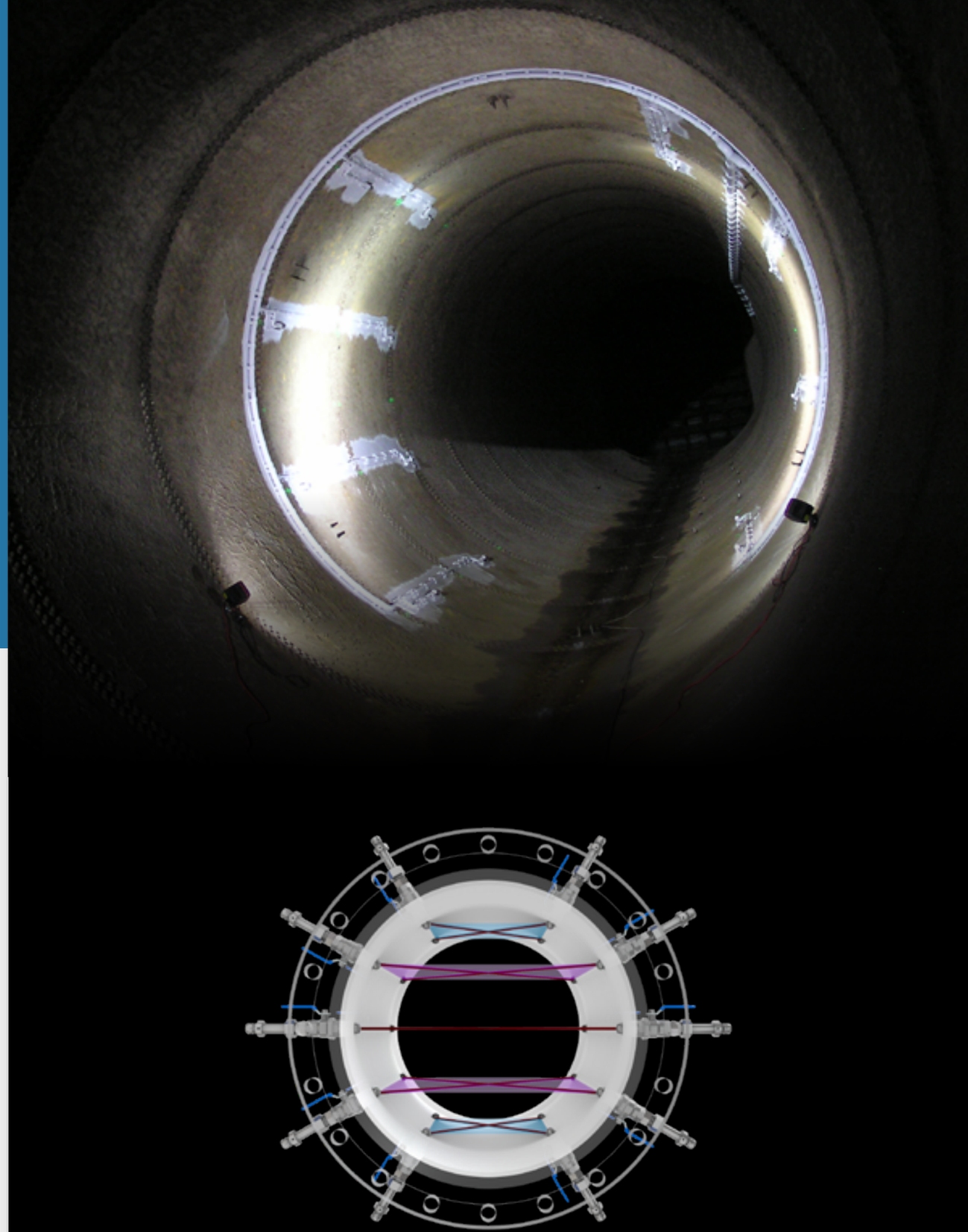
Flow measurement pursues four main objectives: measuring the efficiency of the turbine or pump turbine, monitoring efficiency, monitoring for pipe bursts, and monitoring for leakages. Over the years, GWF has built a trusted relationship with leading turbine and pump manufacturers. These manufacturers value the expert advice and turnkey installation of our systems. GWF has installed numerous systems worldwide and leverages this expertise to successfully implement your project, tailored to on-site conditions and the required measurement accuracy.

Efficiency Testing

There are several methods of ultrasonic flow measurement, but not all have proven capable of achieving the measurement accuracy of < ±1.5% required in performance or acceptance tests in the field. Only methods based on the physical principle of transit time difference and that capture the entire flow profile using multiple acoustic paths meet this requirement. The Ductus system is the right choice in this regard.

Efficiency Monitoring

The continuous monitoring of the efficiency of each individual turbine or pump, or the overall efficiency of a hydropower plant when multiple machine units are installed, requires the measurement of additional parameters. These include the water level in the upper reservoir, the pressure before the turbine or pump, the pressure in the draft tube, the water level in the lower reservoir, and the electrical output. GWF offers a system for efficiency monitoring that continuously records all parameters, calculates the efficiency, and transmits the results to a downstream process control system. Although installation and commissioning involve a higher initial investment, the continuous verification of efficient use of the valuable resource water is invaluable. Increasingly, regulations and laws governing water usage demand that the performance of turbines and pumps be improved or optimised.



Winter-Kennedy-Method

At some hydropower plants, the installation of a permanently installed flow measurement system may not be feasible. As an alternative, the Winter-Kennedy method can be used, which determines the relative flow using pressure measurements at two locations. To calibrate the proportionality factors of the Winter-Kennedy method, field measurements can be carried out using a temporarily deployed flow measurement system with non-contact sensors. GWF also offers a solution for this with the Ductus system.

Pipe Burst Detection

A partial or complete rupture of the pressure pipe leads to an increase in flow velocity or flow rate in the penstock. The flow velocity or flow rate then exceeds the maximum expected or permissible values. A sudden burst of the pressure pipeline, a valve, or a gate can result in flooding and destruction of the hydropower plant. It is therefore essential to continuously and reliably monitor the flow velocity or flow rate in order to detect a sudden pipe rupture at an early stage and initiate necessary measures such as shutting down the plant.

Leak Detection

Leaks do not always occur suddenly and massively; rather, gradual leaks over an extended period can lead to severe damage. This is especially critical in areas with geological risks, where the integrity of a pressure pipeline or tunnel may be compromised. To monitor this gradual process, flow measurement systems can be installed at the beginning and end of the pipelines to detect even the smallest differences. By defining a threshold value and monitoring its exceedance over time, an alarm can be sent to the process control system or directly as an SMS to the responsible operating personnel.

Measurement solution

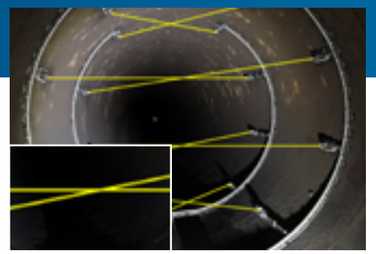
Ductus

Ductus is a system based on the transit time difference principle. It can measure flow in large pipes with diameters of up to 10 metres. The key advantage is that multiple acoustic paths measure the flow velocity at different positions across the cross-section, providing information on whether the velocity profile is disturbed or undisturbed. It is ideally suited for highly accurate and continuous flow measurement in penstocks of hydropower plants. With the ability to use various sensor types, all applications can be covered.

Feedthrough

Feedthrough sensors are preferably used in pipelines when the pipe is accessible from the outside. If the pipe wall is sufficiently thick, the sensors are screwed in directly; if the wall thickness is low, they are installed via an additional welded nipple.

Internal



If the pipe is only accessible from the inside, the sensors can be installed from the inside against the pipe wall.
All cables are then additionally routed in conduits to protect them against the flow velocity.

Clamp-On

Non-intrusive sensors are strapped onto the outside of the pipe and measure through the pipe wall. The sensors can be installed and maintained with minimal effort and without interrupting the process.

DUCTUS SYSTEM DETAILS

Measurement technology
Ultrasonic time of flight

Area of application
Penstocks from DN400 up to DN10000

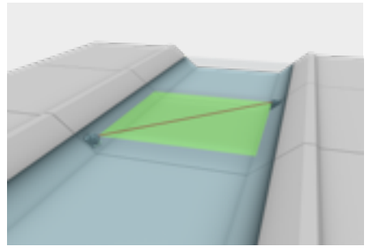
Number of acoustic paths
1 to 10

Accuracy flow
<+/- 1% depending on flow conditions and the number of measurement paths

Kanalis

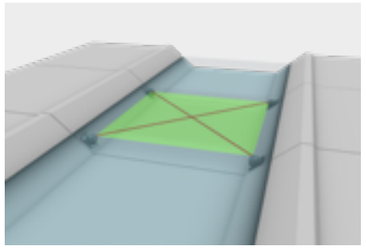
Kanalis is a transit-time ultrasonic system designed for permanent flow measurement in open channels. It is resistant to backwater effects that occur during water level regulation in impoundments, making it ideally suited for use in hydropower plants where water is diverted from a river upstream via a dam and flows through an open channel to the power station. Kanalis continuously and accurately measures the flow in an open channel to document the officially approved water abstraction from a river or the minimum ecological flow in the watercourse.

Single Path System



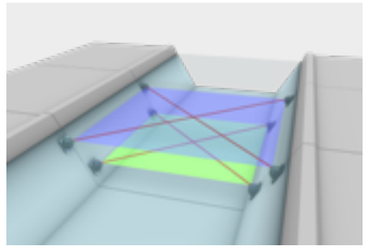
In its simplest form, the measuring device can be equipped with just one pair of sensors. However, this requires that the flow runs parallel to the bank, the velocity profile is stable, and a hydrometric calibration is carried out after commissioning.

Cross Path System



If there is a bend or an asymmetrical change in the channel cross-section, the flow no longer runs parallel to the banks. In such cases, a second pair of sensors must be installed at the same elevation. This crosswise arrangement makes the measurement more or less independent of crossflows.

Multi Plane System



Even more accurate flow measurement can be achieved by installing multiple planes, especially at measuring points with strong and frequent fluctuations in water level and where the vertical velocity distribution significantly deviates from the theoretical profile.

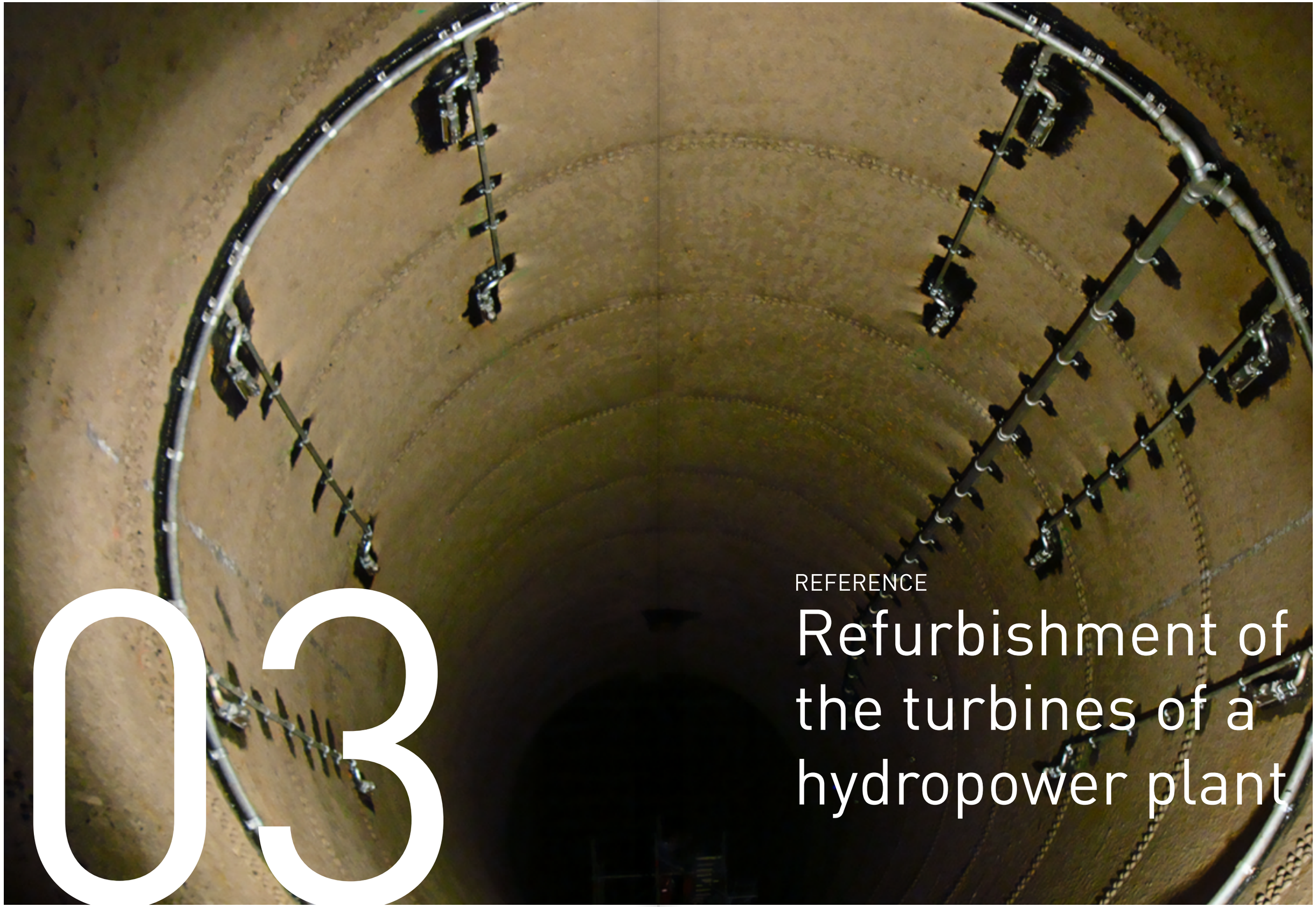
KANALIS SYSTEM DETAILS

Measurement technology
Ultrasonic time of flight

Area of application
Open channels up to 70 m width

Number of acoustic paths
1 to 10

Accuracy flow
± 2% depending on flow conditions and the number of measurement paths



03

REFERENCE

Refurbishment of the turbines of a hydropower plant

Installation of ultrasonic flow measurement systems to verify increased production following the replacement of machine units.

PROJECT OVERVIEW

Hydropower is considered one of the most important and promising renewable energy sources. Older existing plants are being refurbished to increase efficiency while also meeting the highest standards of sustainability and minimal environmental impact. To verify the improvement in efficiency, six acoustic flow measurement systems were delivered as turnkey solutions.

TECHNICAL EXECUTION

A flow measurement system of the Ductus type was installed in each of the six penstocks. Each system uses **eight acoustic paths** to ensure the required measurement accuracy of **< ±1%** and complies with international standards **IEC 60041 and ASME PTC 18**. Given the complex flow conditions, the **OWICS integration** method was implemented. This method calculates weighting factors based on the actual installed position of the sensors and offers advantages over other methods in disturbed velocity profiles. As a result, measurement accuracy could be significantly improved even with limited straight pipe lengths.

The sensors were mounted from the inside against the pipe wall using a support structure. All cables were laid in protective conduits from the sensor to the exit point of the penstock to prevent long-term damage from the high flow velocity. A subsequent corrosion protection coating ensures the long-term stability of the installation. The pipe diameter and the position of each sensor were **digitally measured** in high resolution, and the recorded lengths, angles, and elevations were stored in the system for precise flow calculation.

The systems were integrated into the power plant operator's **LAN network** and **transmit measurement data in real time to the process control system**. With integration into the local network, operating personnel can directly access each system, visualise the signals of each acoustic path via the integrated oscilloscope, and access comprehensive system diagnostics. GWF also has remote access, enabling immediate support for the operating staff in the event of a fault.

The successful implementation of this project highlights the importance of flow measurement in hydropower plants. In addition to verifying the increase in efficiency, digital data is now available 24/7, enabling continuous online performance monitoring.

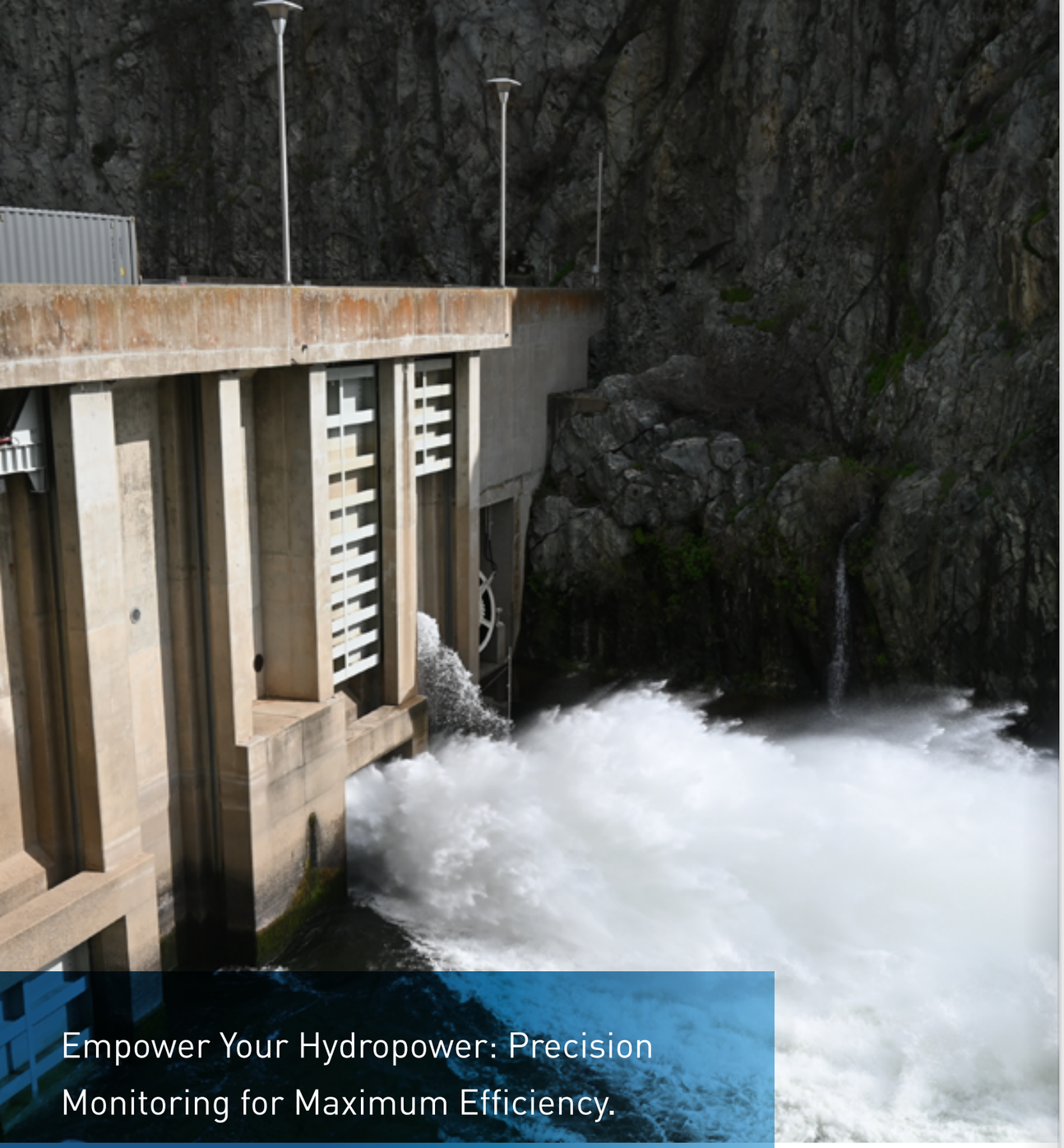
RESULT

- **Optimal Operating Point**
  Precise flow measurements maximise energy production while ensuring responsible use of the water resource.
- **Improved Monitoring**
  Digital data enables long-term trend analysis and enhances safety.
- **Reduced Downtime**
  Preventive maintenance measures help reduce operating and maintenance costs.
- **Regulatory Compliance**
  Proof of compliance with water authority permits (minimum flow requirements).

GWF

Contact

04



Empower Your Hydropower: Precision Monitoring for Maximum Efficiency.

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