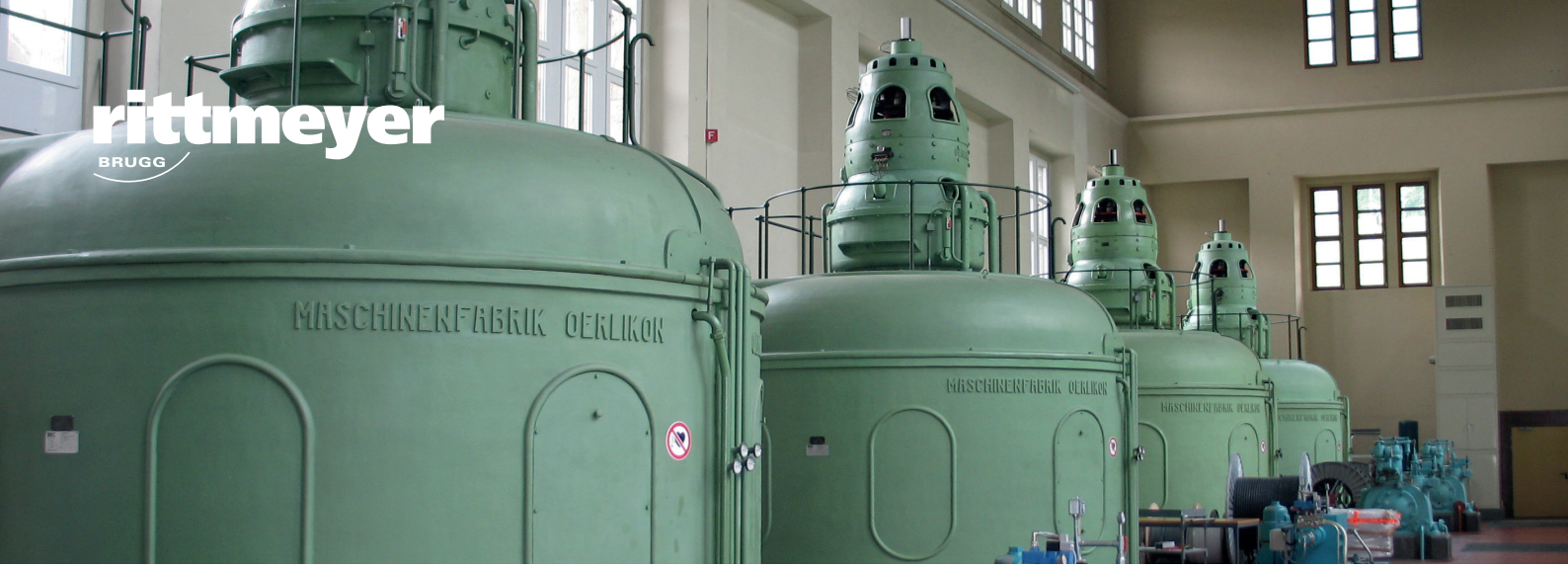


Turbine Efficiency Monitoring

With RISONIC modular flow measurement

Additional Values

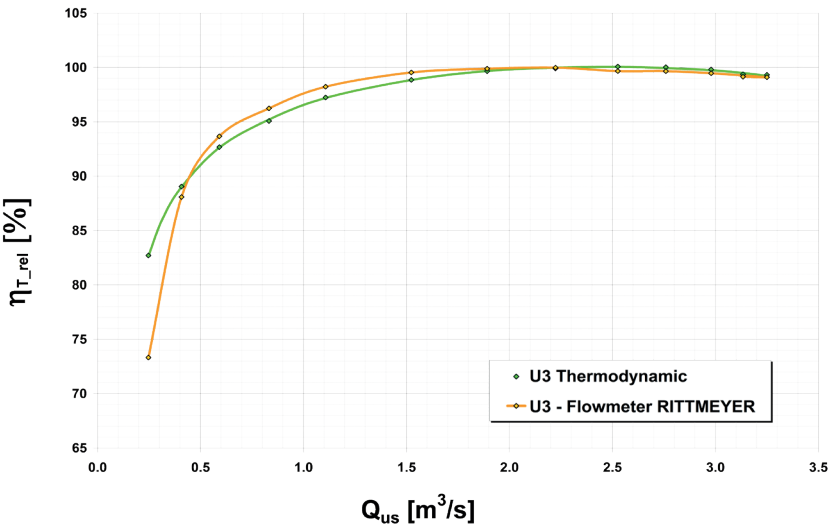
- Penstock Leak Detection System
- Sediment Monitoring

Benefits

- Extremely cost-effective
- Online and trend monitoring
- Very easy to implement due to predefined intelligent applications
- Use existing flow and pressure measurements for the evaluation

Description

The RISONIC modular system includes an intelligent application with predefined processing rules designed for simplified turbine efficiency evaluations.
Research studies[1] have shown that Rittmeyer 8-paths ultrasonic flowmeters used for efficiency monitoring, can achieve results comparable to thermodynamic methods.



[1]Refer e.g. to «TURBINE EFFICIENCY MEASURED BY THERMODYNAMIC METHOD AGAINST USING ULTRASONIC FLOWMETER» by Petr SEVICIK/OSC, Brno, Czech Republic.

Turbine Efficiency Monitoring

With RISONIC modular flow measurement

This type of efficiency monitoring is particularly suitable for the determination of temporal changes in turbine efficiencies.

Input variables

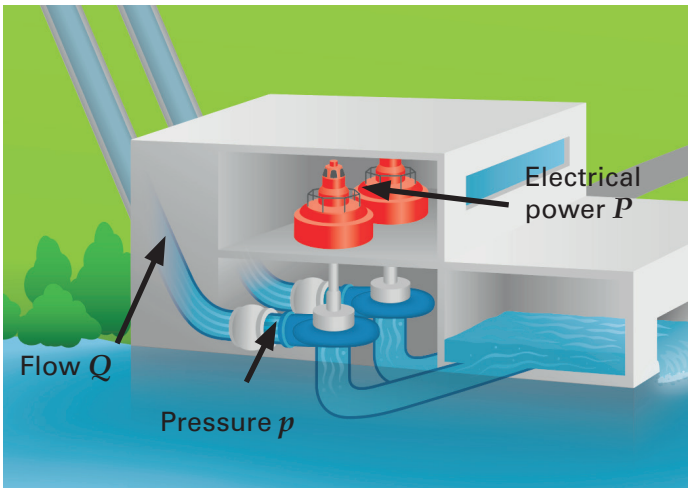
The following input variables are needed for the evaluation and are continuously evaluated:

Electrical power output P from generator (i.e. from energy/power measurement) → $P_{electric}$

Flow Q through penstock and turbine (i.e. from flow measurement)

Net head i.e. pressure p at turbine housing/entry (i.e. from pressure measurement)

→ $P_{hydraulic}$



Calculation

The efficiency is calculated as follows:

$$\eta = \frac{P_{electric}}{P_{hydraulic}}$$

Implementation

- Integrated in RISONIC modular flow measurement system
- Standalone i.e. as complementory/ redundancy to existing control systems

Limitations

Several aspects are not considered such as:

- Generator losses
- Thermodynamic measurement/influences of temperature rise
- Pumping operation
- Interdependency with multi-turbine set-ups

Note: not all requirements from IEC-60041 and ASME PT-18 are covered with these simplified turbine efficiency evaluations.

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