



Leveraging Data & Analytics in Hydro Power Operations

Learnings, Use-Cases and future Opportunities

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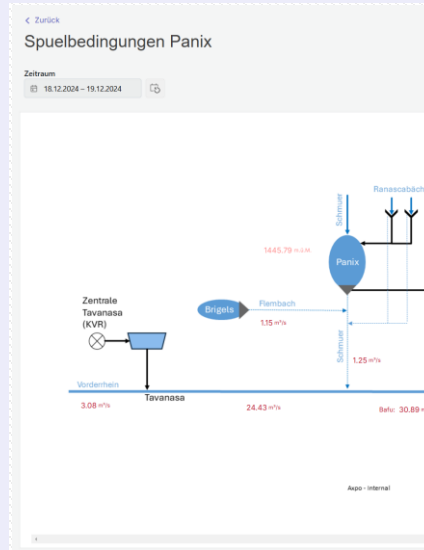
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Digitalisation at Axpo Hydro



Robotics

Later today



Analytics

Focus of this talk



Workforce

Stop by and ask!



Infrastructure

Stop by and ask!

Our Journey: From collecting data to connecting systems

2020

First Plant Connected

56

Plants connected 2026

200 Mio

Data points daily

60+

Source systems across Axpō

Our Data Journeys & Lessons Learned

1. Collecting early pays off

Years of full-resolution history are usable today

2. Reliable data is an investment and a continuous effort

We kept investing in data engineering pipelines

3. To drive real value, you need to go beyond collecting and making data centrally available

Collaboration between data science, plant operations, engineering



How to drive real value from data

Data roles with a clear mandate, working side by side with operators

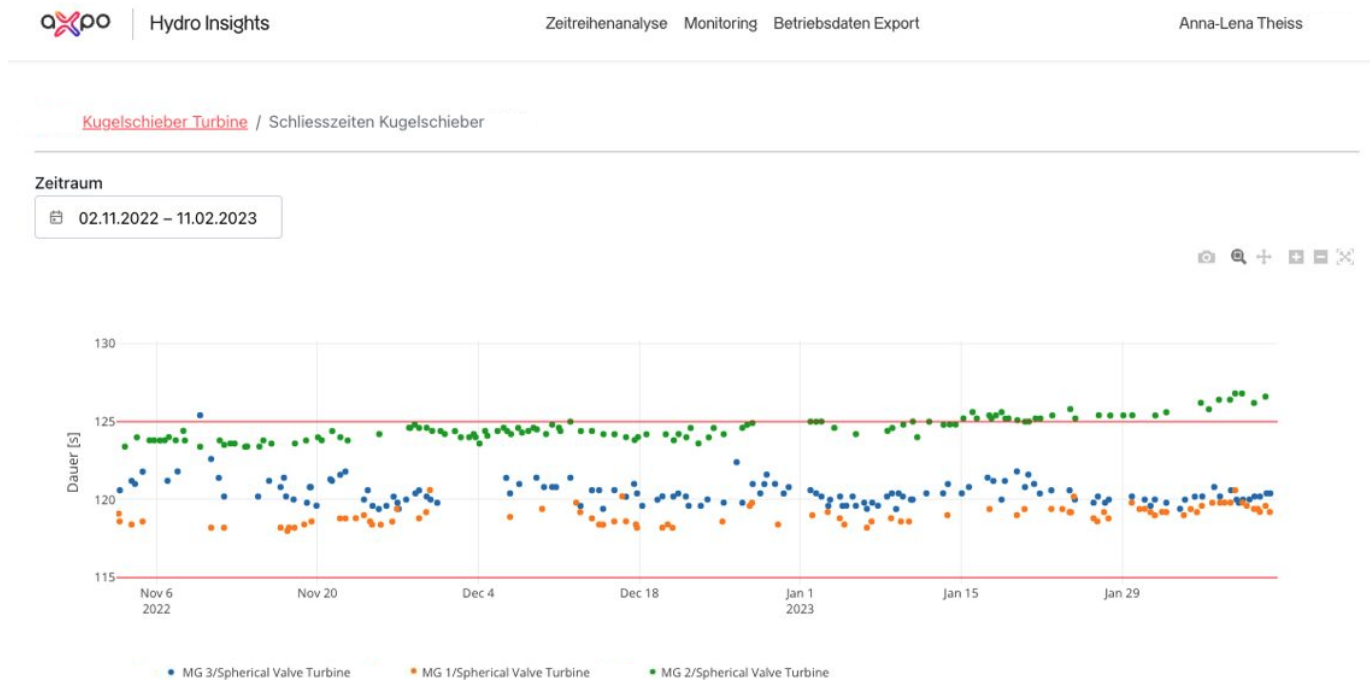
Our OMC Analytics team works in three streams

Production optimisation	More MWh
Knowledge base	More MWh, lower cost
Maintenance optimisation	Lower cost



Example 1 Data Self-service platform

Hydro Insights[®]



Data Engineering Pipelines

Ingestion, Plausibility Checks

Modules & Live dashboards

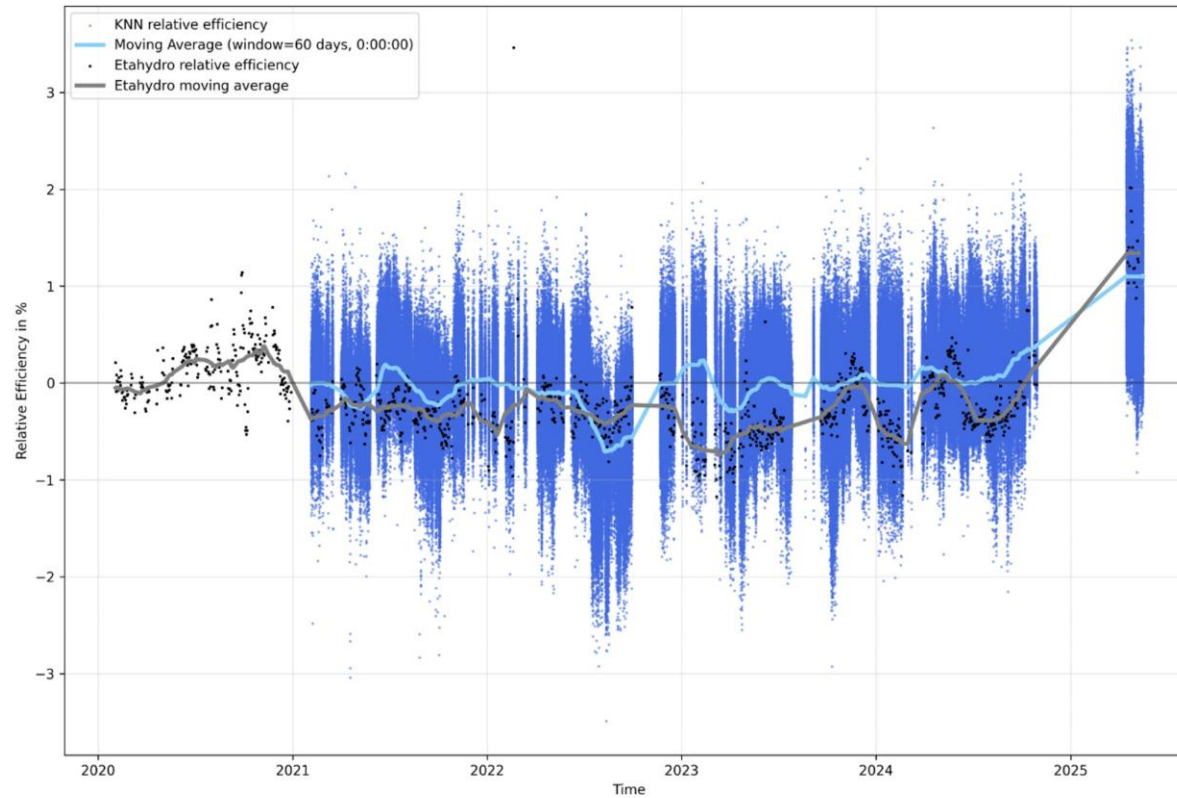
Trends, plots, specific modules

Partner Modules

Etahydro

Example 2 - kNN-based relative efficiency monitoring

Each unit compared to its own past



Relative efficiency over time: the revision shows as a clear step up

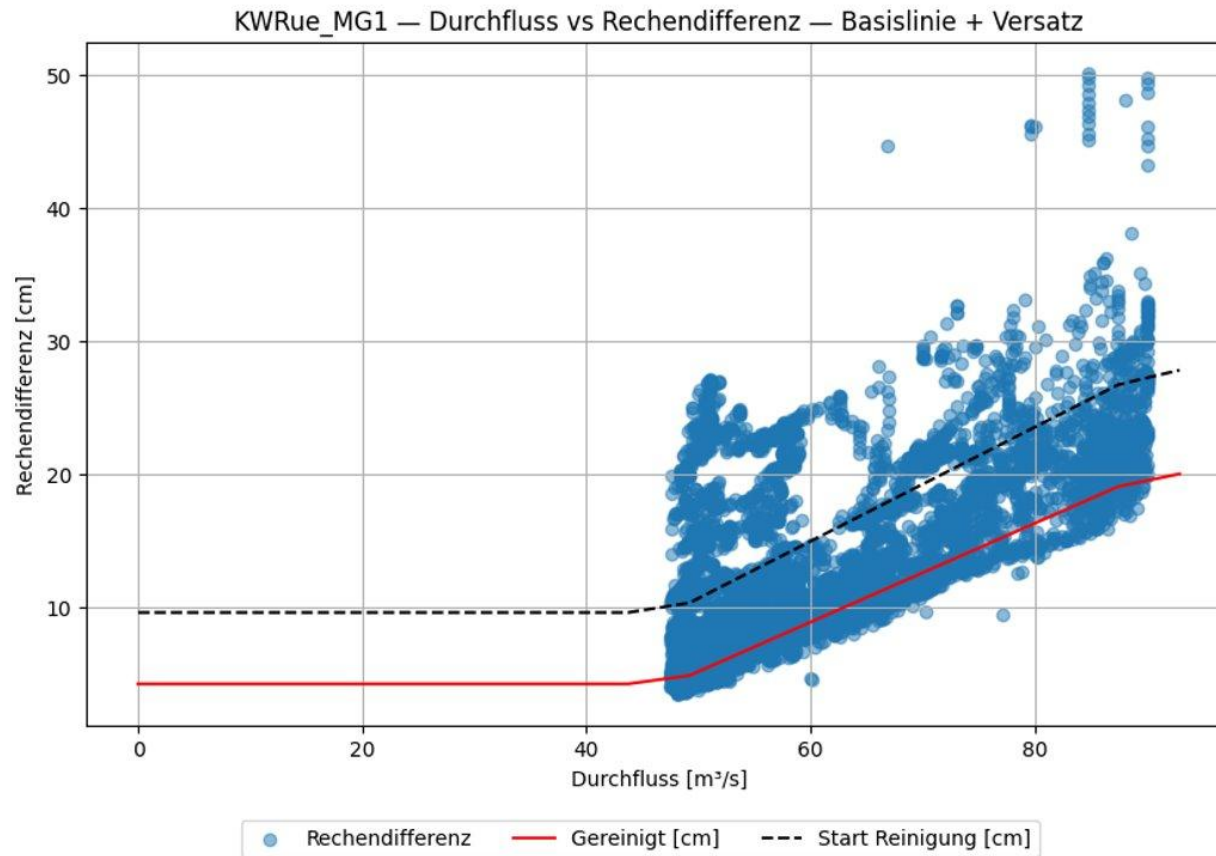
k-nearest-neighbours method

Identify comparable operating points

Track relative efficiency trends over time

Example 3 - Production Optimisation: Trash-rack cleaning schedule

Clean the trash rack when it pays off



Before

One fixed starting threshold

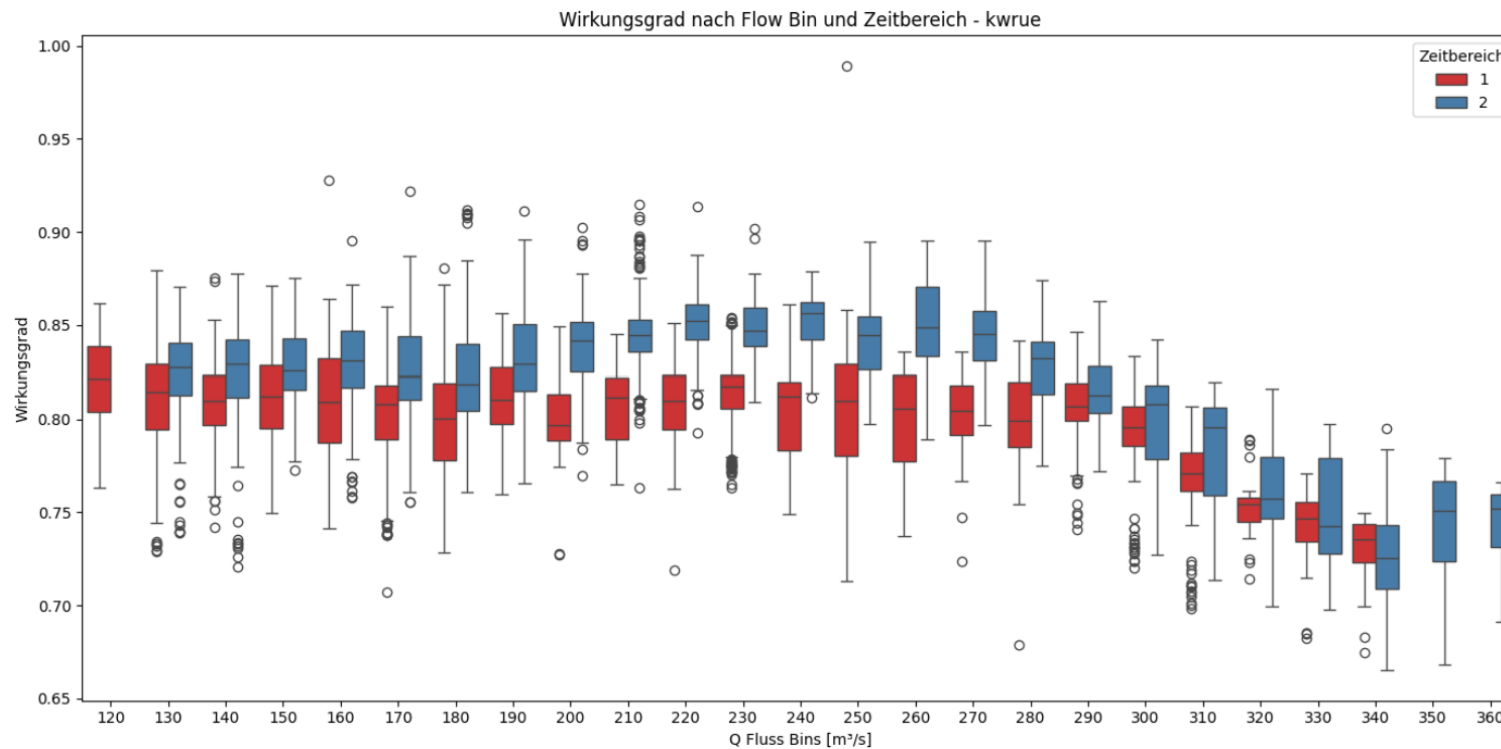
Now

Optimal start point for specific flow rate

Result

Production optimised rack cleaning

Example 4 - Production Optimisation: Verification of Influence of maintenance actions on efficiency



Compare

Efficiency per flow range,
before vs. after

Reference

Compare against historic
production performance

Result

Verify effectiveness of

Example 5 - Maintenance Optimisation: Auxiliary Systems Monitoring

Catching leaks through pump behaviour

Hydraulischer Regler

Pumpe	MG1	MG2	MG3	MG4
Kühlerpumpe Regelöl	●	●	●	●
Laufregelölpumpe 1	●	●	●	●
Laufregelölpumpe 2	●	●	●	●
Leitregelölpumpe 1	●	●	●	●
Leitregelölpumpe 2	●	●	●	●

Entwässerung

Pumpe	Zustand
Kammerentleerung_Pumpe	●
Kellerentwässerung_Pumpe 1	●
Kellerentwässerung_Pumpe 2	●
Turbinenentwässerung_Pumpe 1	●
Turbinenentwässerung_Pumpe 2	●

Hochwasserentlastung

Pumpe	Zustand
HWE1 Ölpumpe 1	●
HWE1 Ölpumpe 2	●
HWE2 Ölpumpe 1	●
HWE2 Ölpumpe 2	●

Count

Daily switching cycles per pump

Compare

With similar pumps and their history

Act

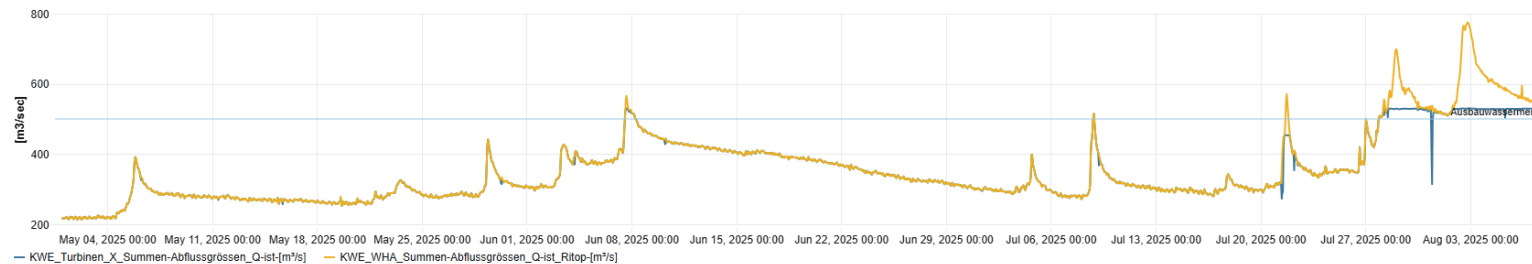
Traffic light and alert, checked by the OMC

Example 6 - Knowledge base

Control cycle tracker for blades and wicket gates

From an outage to a data solution

Sum of cycle_count	date													
mg	2025 W18	2025 W19	2025 W20	2025 W21	2025 W22	2025 W23	2025 W24	2025 W25	2025 W26	2025 W27	2025 W28	2025 W29	2025 W30	2025 W31
KWE_MG1		16	10	16	21	16	11	8	8	13	16	14	72	13
KWE_MG2	9	14	10	12	10	20	14	13	12	14	18	16	20	20
KWE_MG3				1	15	16	13	16	10	11	17	19	16	8
KWE_MG4	9	16	9	15	19	17	11	17	8	7	8	14	16	13
KWE_MG5	8	12	10	15	22	15	20	13	11	15	24	13	15	7
KWE_MG6	7	15	12	15	19	15	22	13	0	8	12	4	8	10
KWE_MG7		11		3	21	27	16	13	13	28	30	14	48	20



Event

Broken guide pieces in a Kaplan runner

Gap

OEM limit < 48 cycles/week, not tracked

Solution

Cycle counter, live in Hydro Insights

What's next

Connecting operations, maintenance and asset management

OT & IoT into maintenance

Condition data feeding the maintenance system



Operations meets finance

SAP cost data next to operational data



Scale what works

Roll out data products across our fleet and beyond

