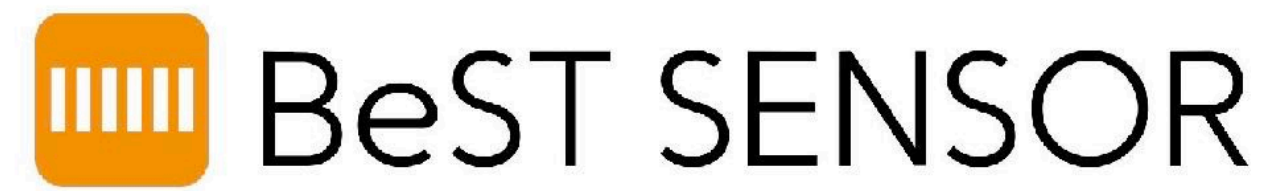OOSC in Kanpur 24.08.24

# Building a wireless wastewater monitoring system using Zephyr RTOS nodes

Oliver Völckers, BeST Berliner Sensortechnik GmbH

# Monitoring Wastewater Tanks

Toilets and on-board bistros discharge waste water into tanks

Tanks must be emptied regularly

Pumps are connected via hoses

Disposal process approx. 1-3min

Uneven flow of waste water
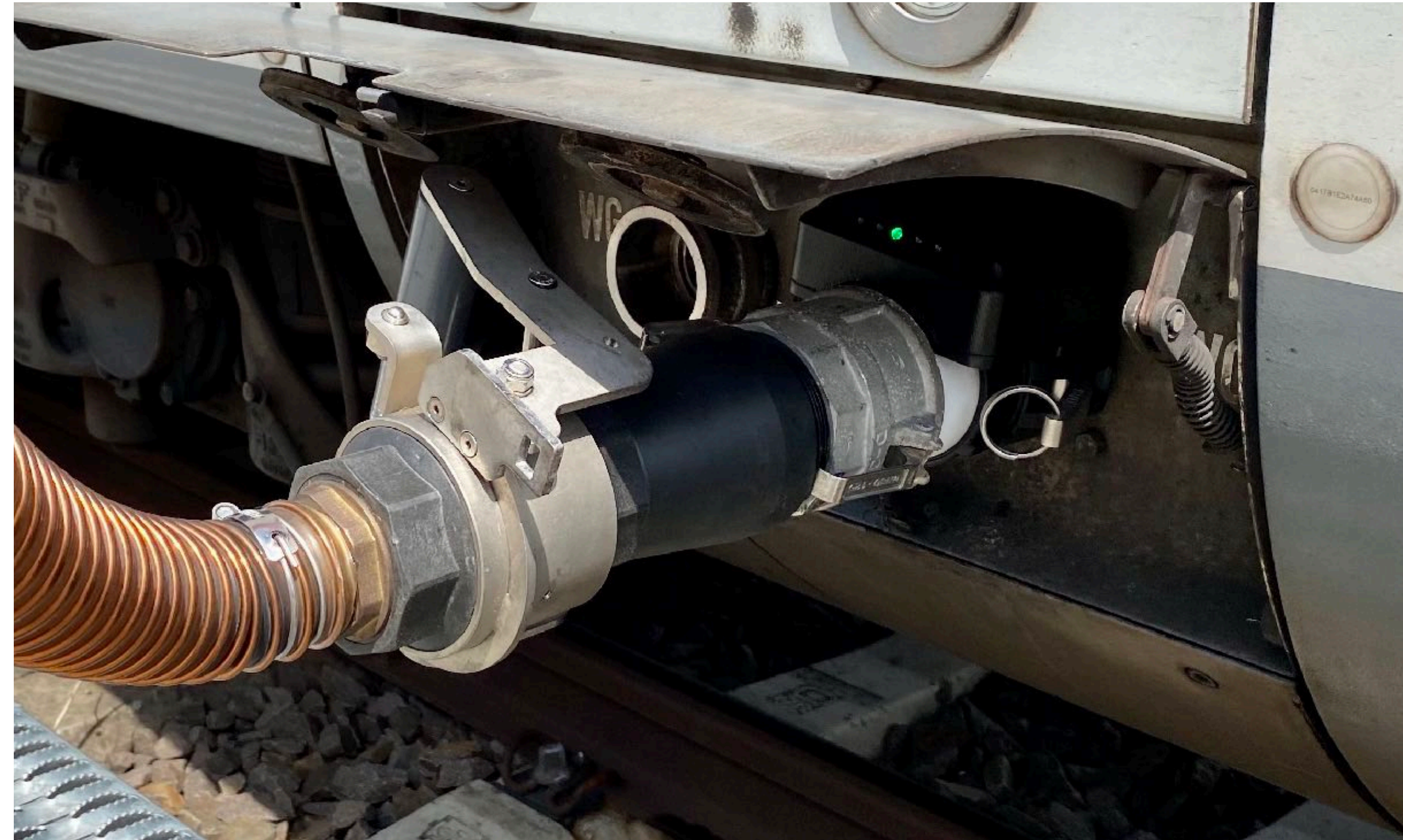
# Existing System

Trains in the depot

Analog wastewater monitoring

No digital overview of faults

Reporting via forms

Failure possible from:

- Train schedule

- Personnel

- Valves

- Pump

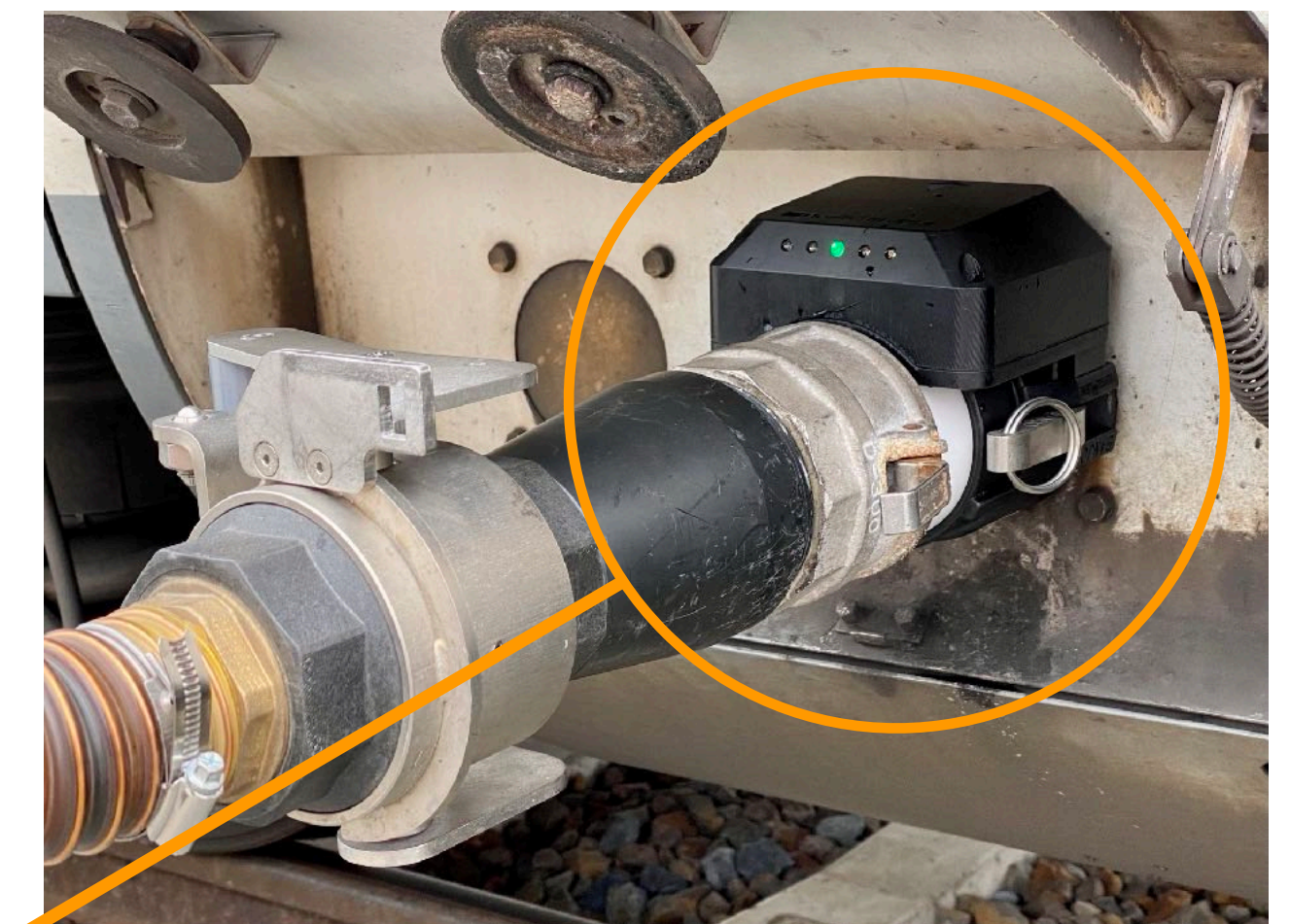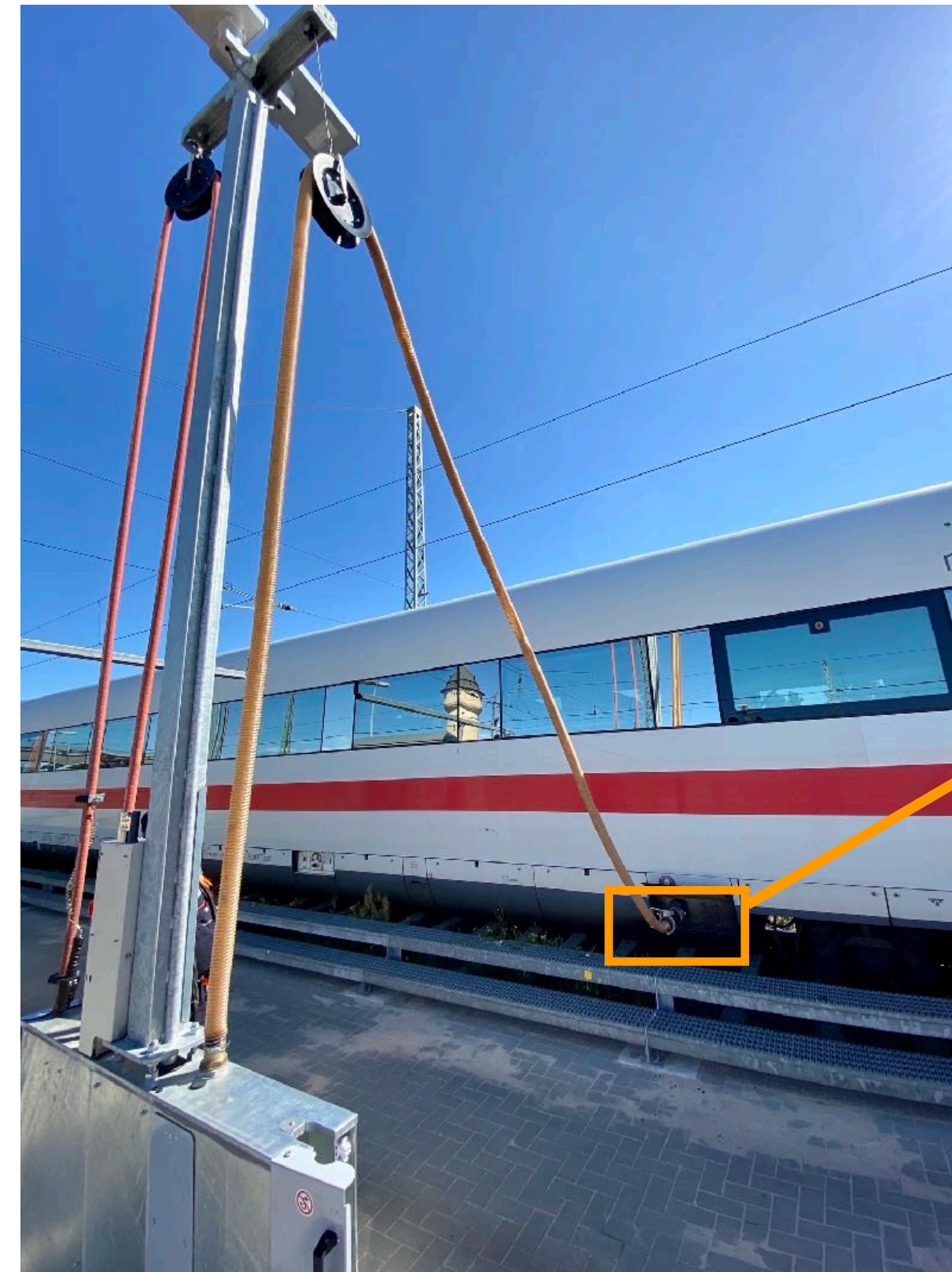# BeST Module analyses Pumping Process

Adapter on hose connection

Identification of the tanks via NFC tags

Faults are automatically detected and reported immediately

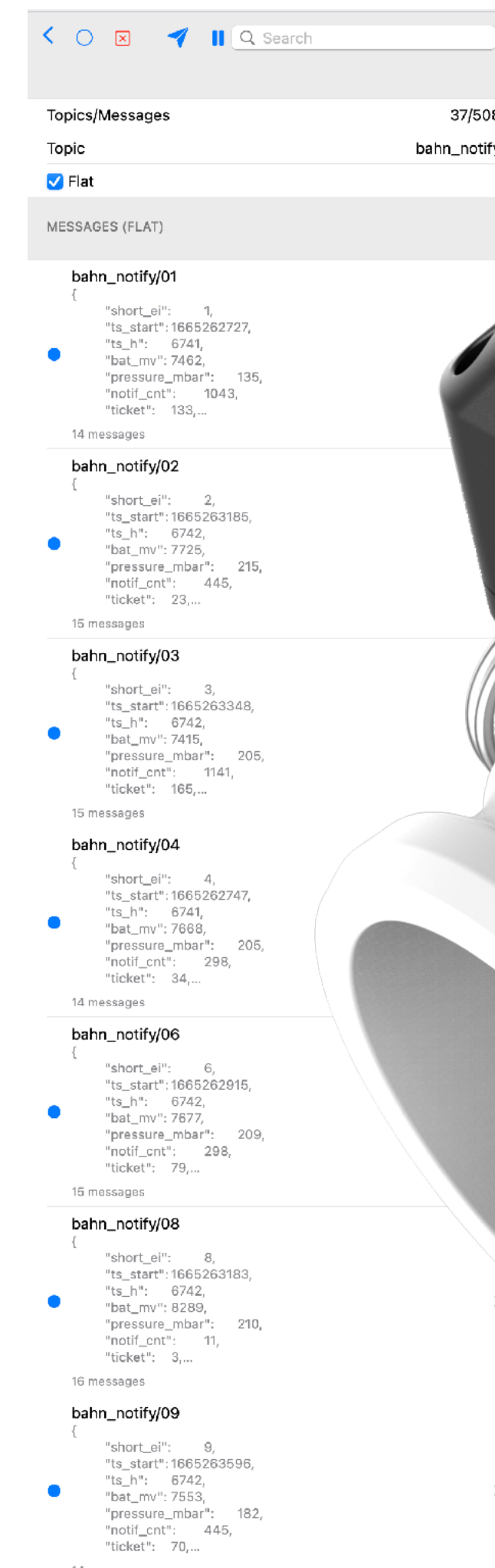Battery operation, mobile network, connection to railroad IT

Development period 2020-23

# Adapter using Zephyr RTOS

Requirements:

- no new approval for trains or pumps

- Electrical safety

- without power supply and data connection

- Secure data transmission

- Must not disrupt work processes

- Automatic system for monitoring and logging

- No operating elements

# Why use Zephyr for Wastewater Monitoring

- Technical parameters

  - Multitasking of peripherals

  - Real-time operation

  - Energy saving

- Economic reasons

  - Long-term serviceability

  - 100% control over source code

  - increased safety



## Products Running Zephyr Today

Proglove — Ruuvi Tag — PHYTEC Distancer — Keeb.io BDN9 — Hati-ACE — Oticon More

Adhoc Smart Waste — GNARBOX 2.0 SSD — Anicare Reindeer Tracker — Safety Pod — BLiXT solid state circuit breaker — Moto Watch 100

Lildog & Lilcat pet tracker — Rigado IoT Gateway — Livestock Tracker — Laird Connectivity sensors & gateways — BeST pump monitoring — Vestas Wind Turbines

zephyrproject.org/products-running-zephyr

https://www.zephyrproject.org/products-running-zephyr/

# Signal Evaluation

Sensor in adapter monitors wastewater flow

Automatic evaluation in the module

Transmission of results by radio

Server software generates reports from the messages

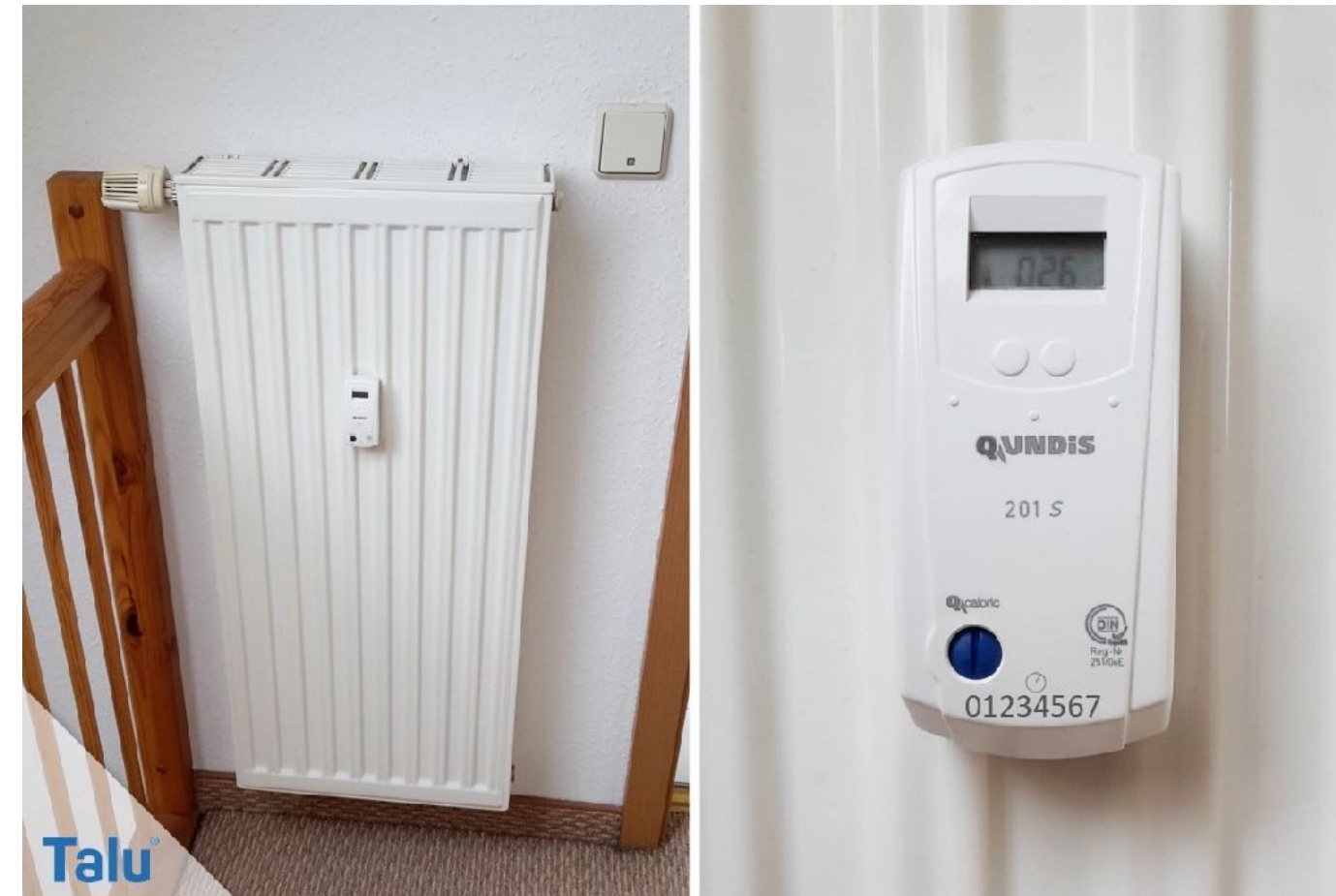Reports are sent to the railroad on a daily basis
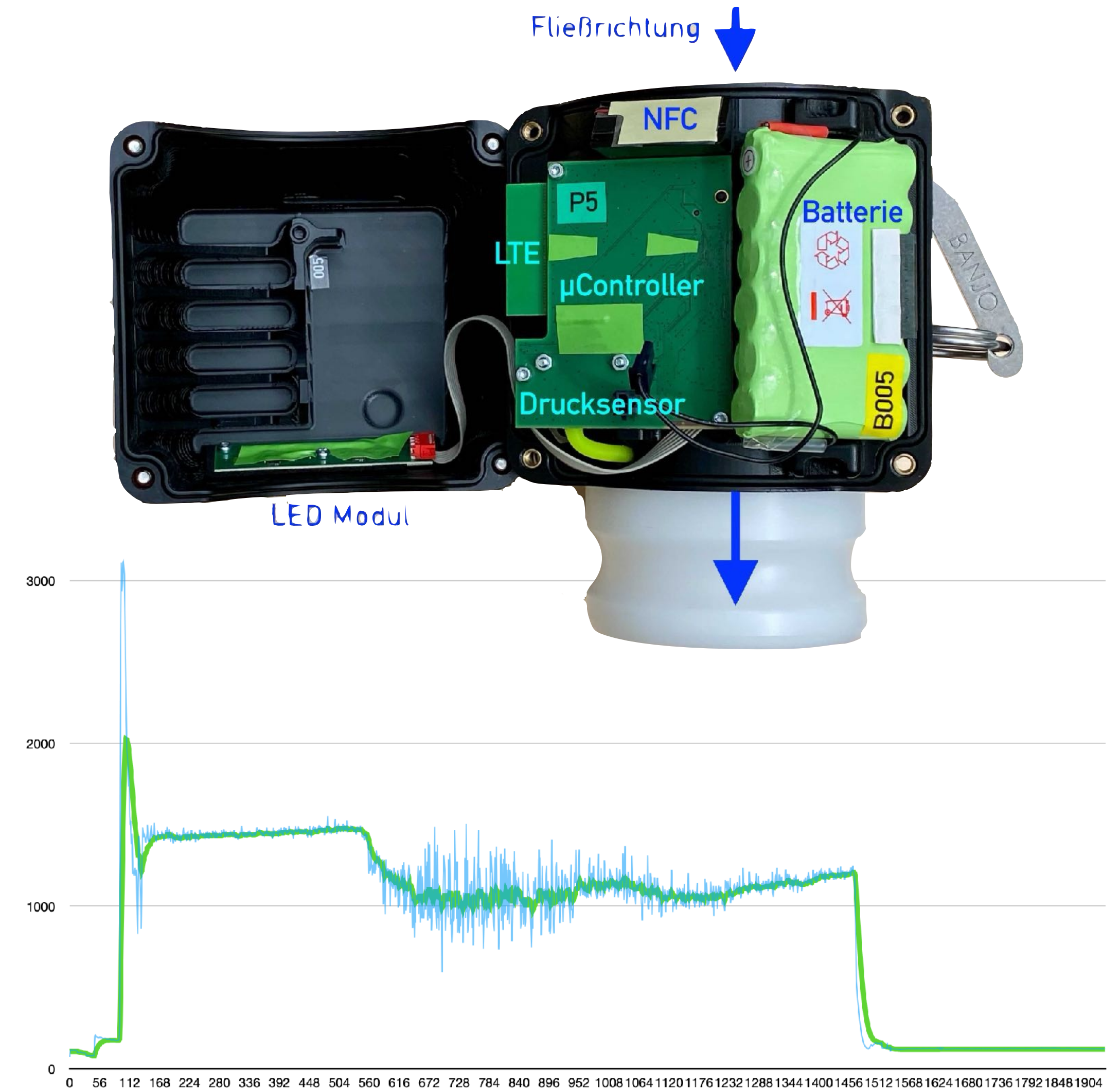
# Analogy heating monitoring

Heating controller

Thermostat

Consumption meter per heating period

Real-time system with radio transmission

Economic efficiency:

better for larger systems

for new buildings today always



Bildquellen
https://esa-tec.com/gebaeudeautomation-smarthome.html

https://www.talu.de/heizung-richtig-ablesen/
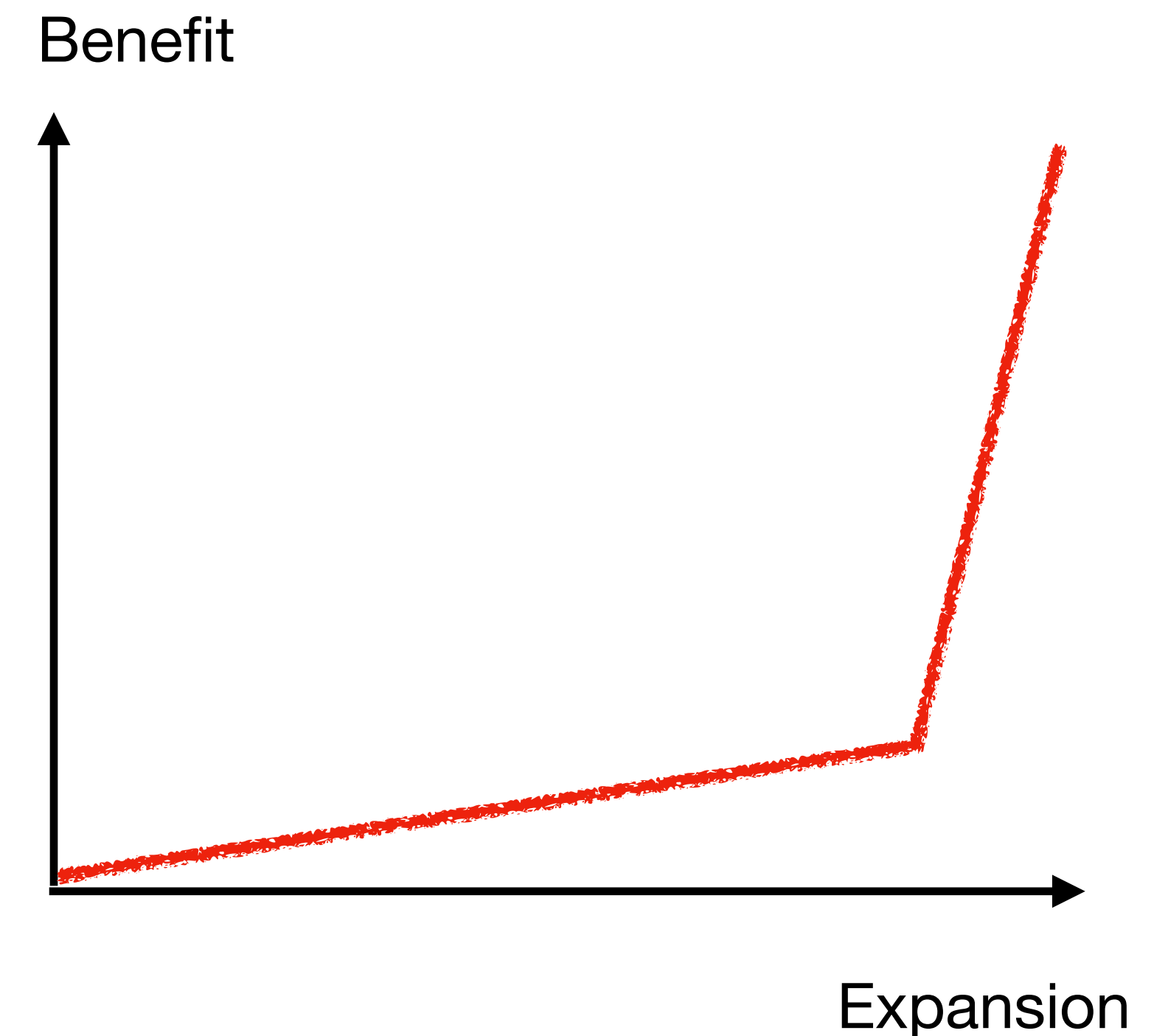
# Goal: complete monitoring system

Overview of disposals at all times

Recognize anomalies in tanks, location, pump

NFC is replaced by RFID

Expansion: one location after another

Economical thanks to optimized disposal planning, saved energy, fewer breakdowns

# Current Status

Result now (Summer 2024): Pre-series of 36 modules in continuous operation for two years

Over 50,000 disposals analyzed, clear detection, immediate reporting of faults

But: pre-series only allows random sampling

Missing disposals go unnoticed

NFC tag requires extra handling

Full transparency requires full roll-out