

4-7 NOVEMBER 2024
ROTTERDAM, THE NETHERLANDS

 GET 2024

GEO THERMAL ENERGY

CONFERENCE

USE OF DATA TO IMPROVE PERFORMANCE OF GEO THERMAL INSTALLATIONS

Jonah Poort, Pejman Shoeibi Omrani; TNO, Geo4all

MOTIVATION

- Annual operation & maintenance (O&M) costs of geothermal systems can go up to 3-8% of total CAPEX costs
- Improved monitoring allows for pro-active planning of O&M
- Sector-wide data sharing can accelerate operational performance and efficiency
- As a result, we can save significant OPEX costs

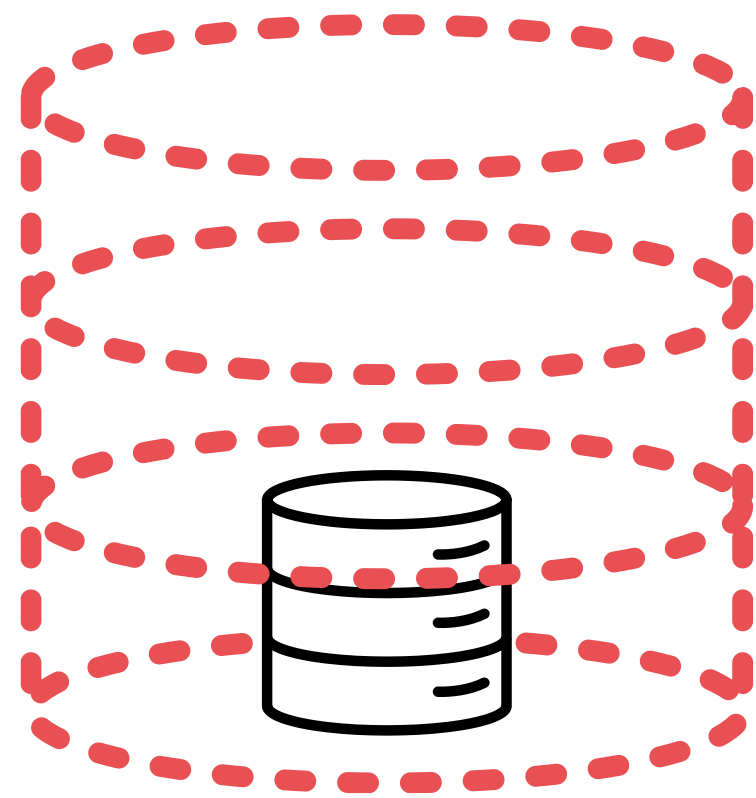


Data is key!

CURRENT CHALLENGES

In geothermal data

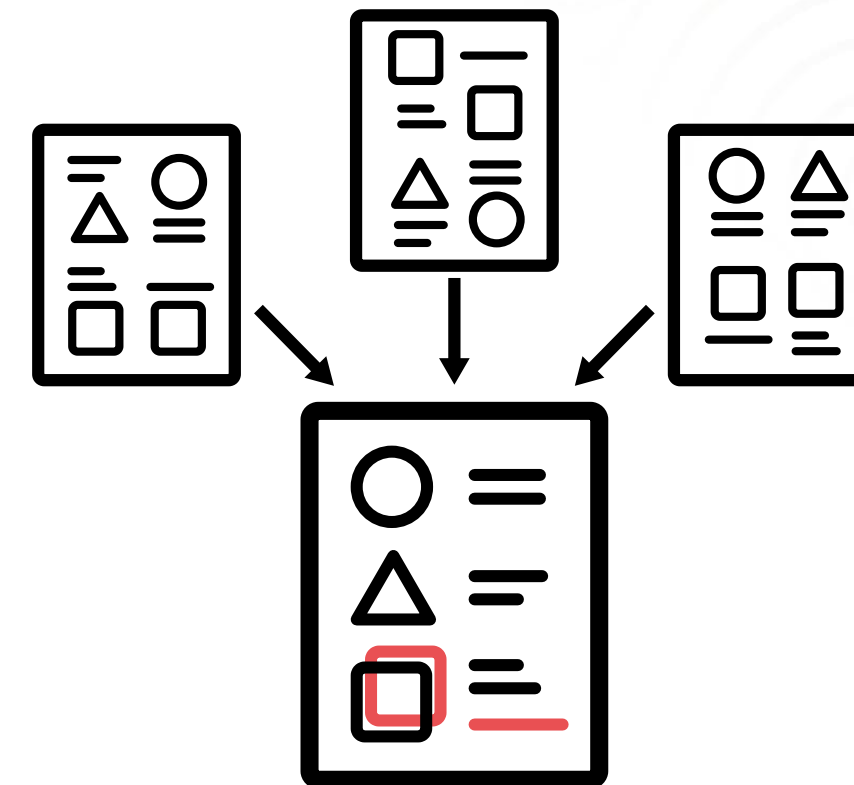
Underutilization



Effort & Expertise



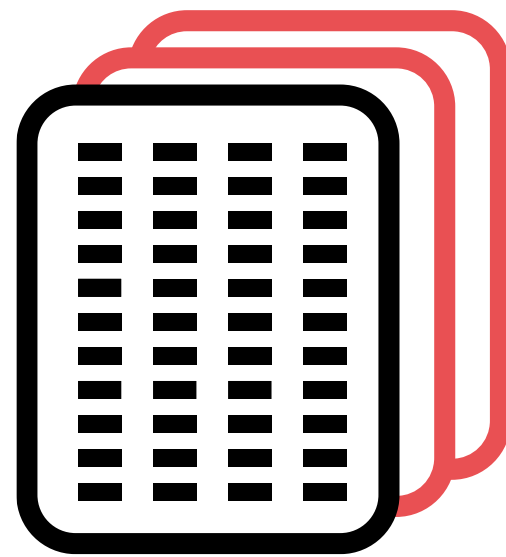
Standardization



APPROACH

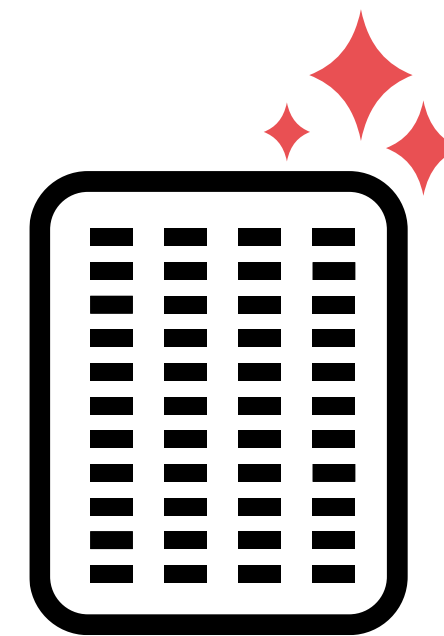
Existing data

- Standardize and calculate KPI's
- Monitor and improve plant operation
- Share data to identify multi-operator challenges



New data

- Identify additional data acquisition options
- Assess novel monitoring principles
- Demonstrate added value of additional data acquisition



Existing data

EXISTING DATA

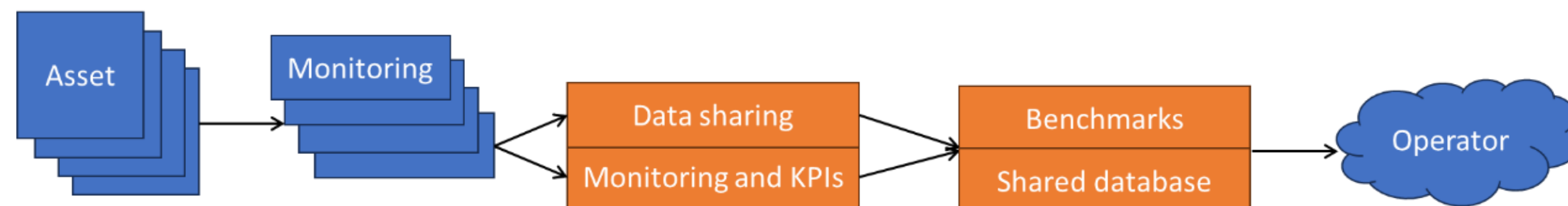
Overview of activities

1. Defining and selecting KPI's

- Interview operators and share questionnaires for KPI's insights
- Use inputs to create standardized templates
- Collect data using templates, process, and analyze
- Calculate KPI's in three categories: O&M and reliability, performance, environmental (with special focus on NORM cases)

2. Data sharing

- Case study selection
 - Data collection
 - Analysis of operational data for failure analysis
 - Development of online database and benchmark
- Focus on pumping equipment (ESP, injection) and heat exchangers



UNLOCKING DATA

Through digital twins

"A virtual representation that serves as the real-time digital counterpart of a physical object or process"
- NASA

Physical system



Static and real-time data

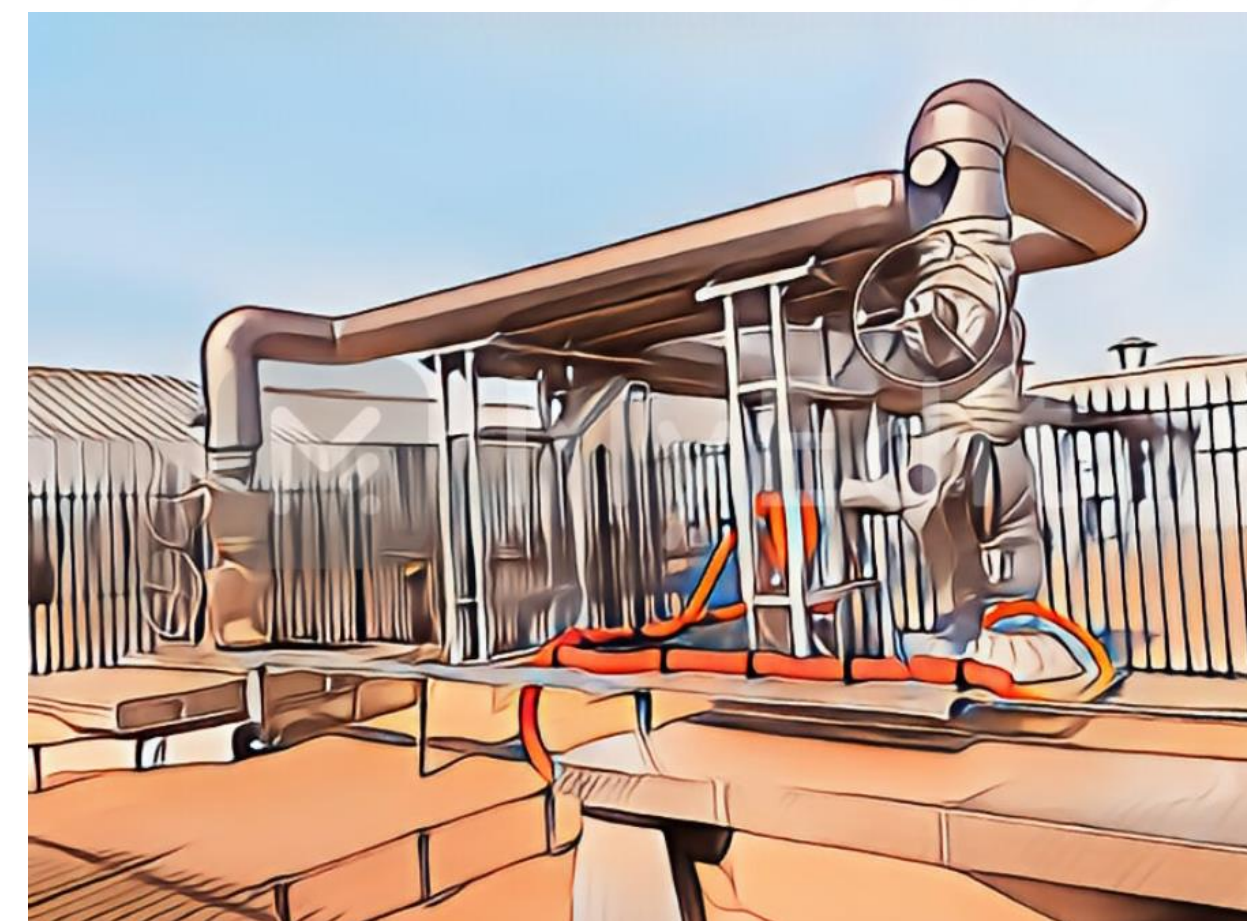


Digital twin



Information, actions,
feedback

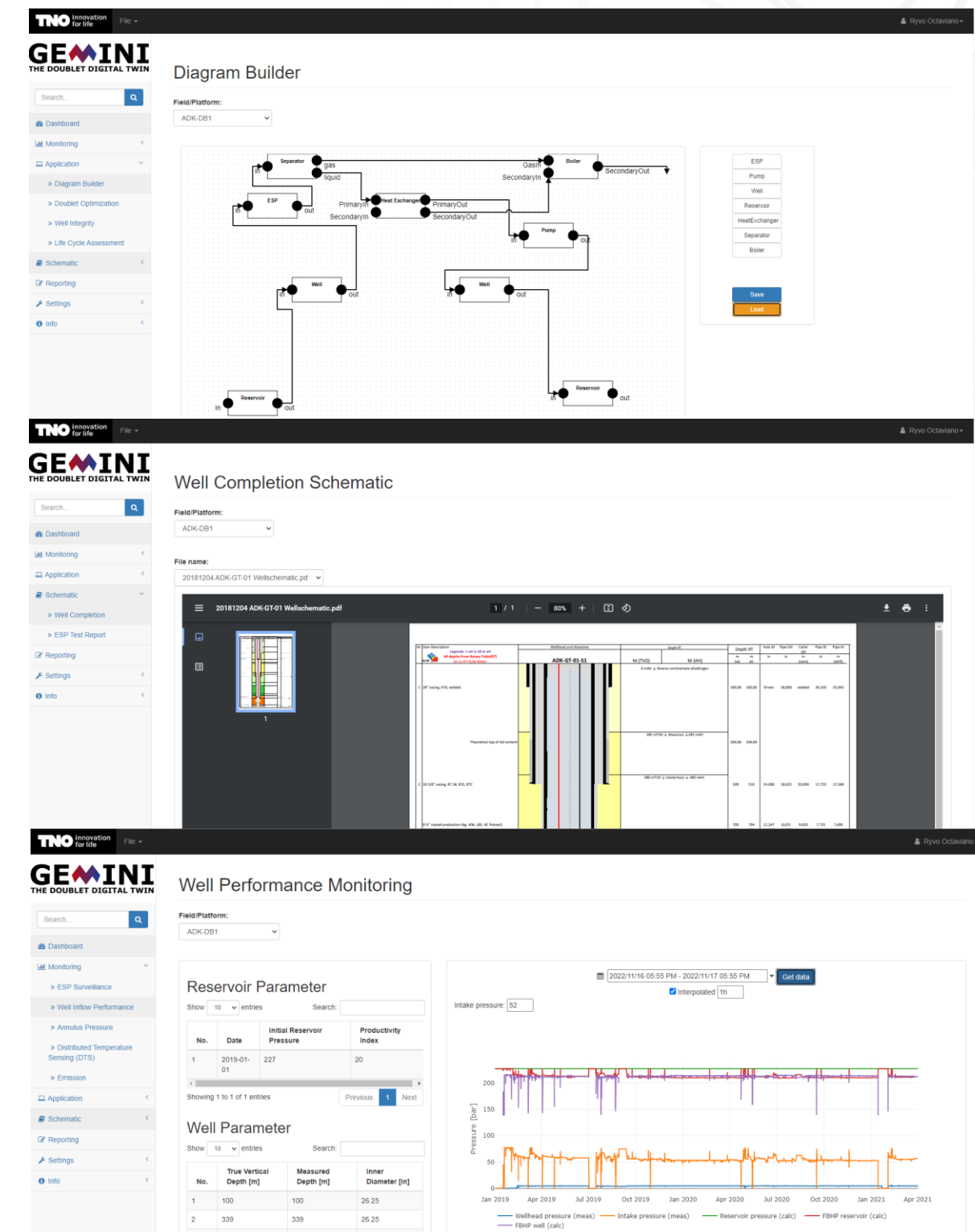
Digital system



GEMINI

A digital twin for geothermal assets

- A web-based framework for real-time monitoring, forecasting, and optimization
- Acts as an assistant to operators of geothermal and ATEs systems
- Provides a centralized location to access all continuously updated data to help:
 - Performance, integrity and environmental footprint monitoring
 - Tracking of critical processes (scaling, erosion, corrosion)
 - Manage production and operation processes
- To be released as open-source



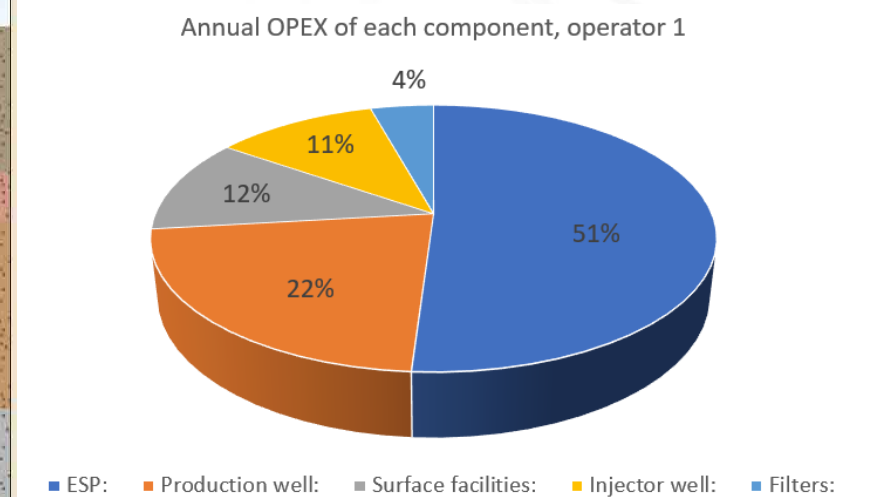
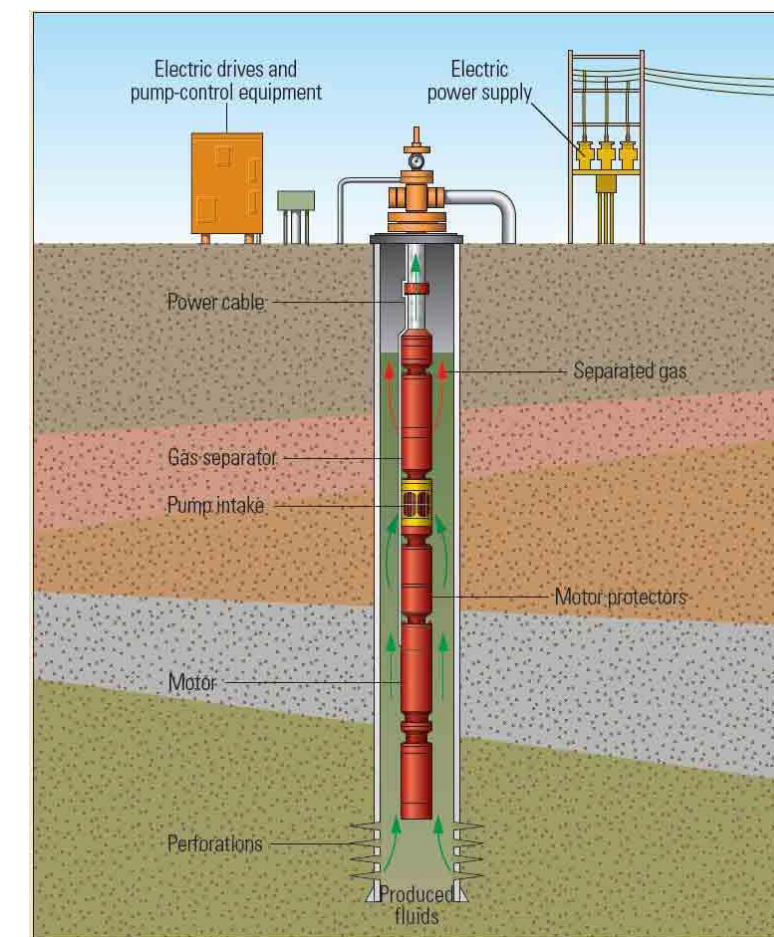
PREDICTIVE MAINTENANCE OF ESP'S

An example of leveraging existing data

- Current geothermal ESP's have several shortcomings:

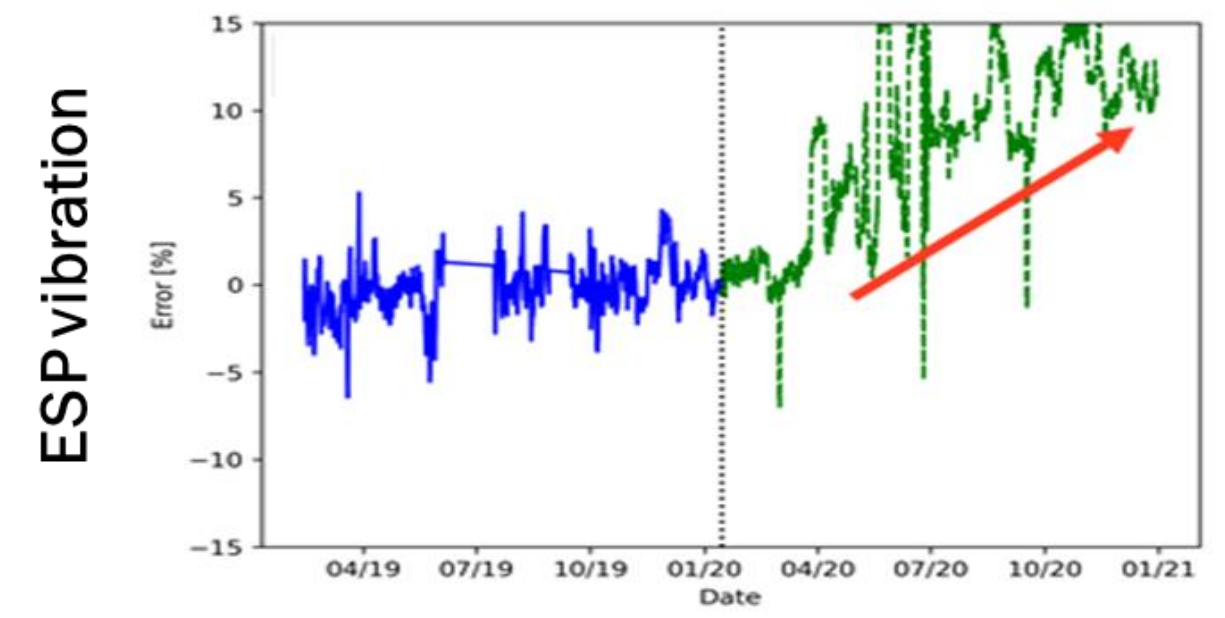
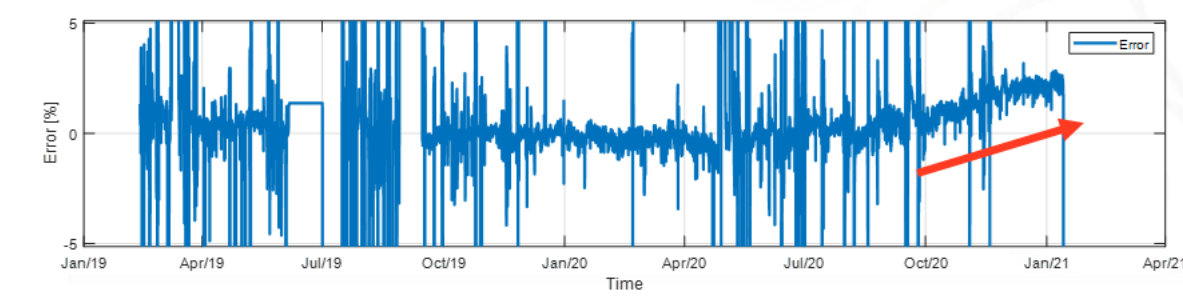
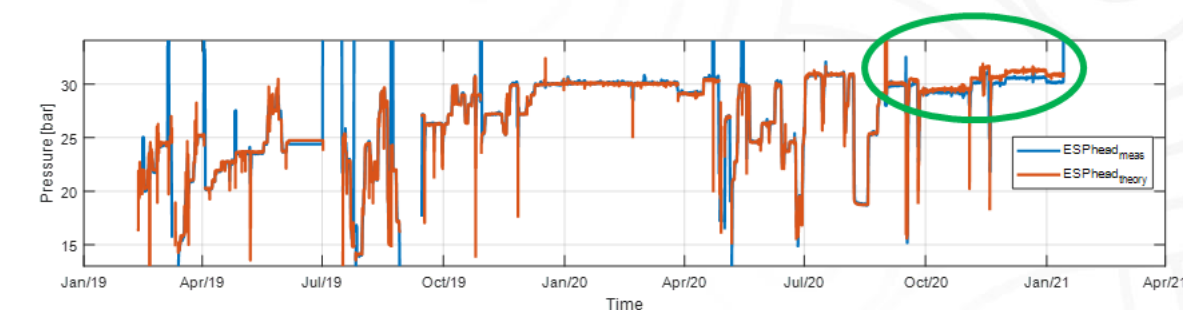
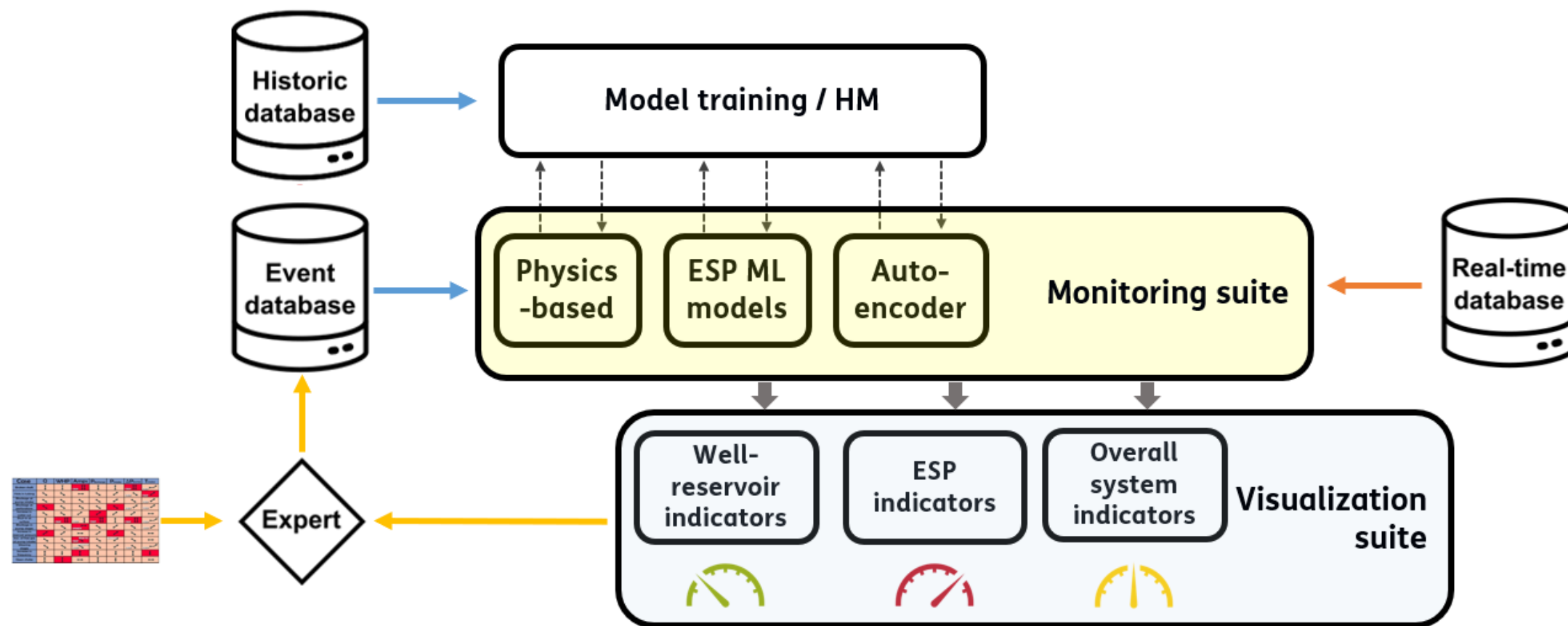
- Relatively short lifetimes (~ 1-2 years)
- Frequent failures due to sub-optimal design for geothermal applications
- Lack of proactive monitoring of system performance during operation
- High costs associated with ESP inspection and replacement

- In addition, lack of proper monitoring and human errors often lead to sub-optimum operation



PREDICTIVE MAINTENANCE OF ESP'S

An example of leveraging data



Early signs of degradation visible 6 month prior to eventual failure

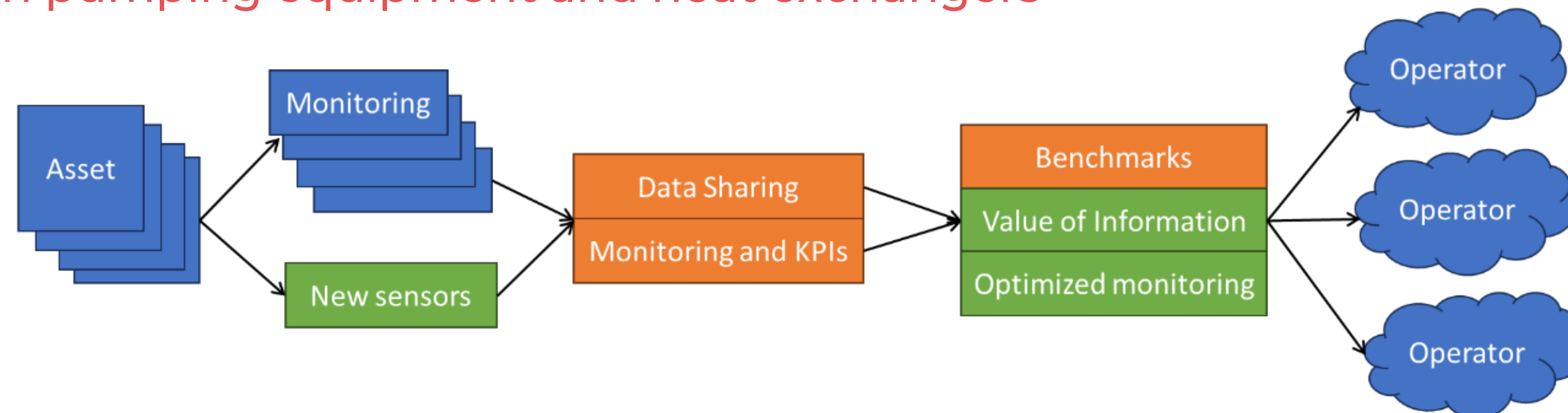


New data

NEW DATA

Overview of activities

1. New monitoring strategies and sensors
 - Inventory of monitoring options
 - Develop method for evaluation of added value of new data acquisition techniques
 - Conduct desktop study on added value vs. cost
 2. Field case validation
 - Select case studies
 - Evaluate case studies
 - Selection and placement of sensors
 - Field experiments and data processing
 - Value of Information assessment
- Again focus on pumping equipment and heat exchangers

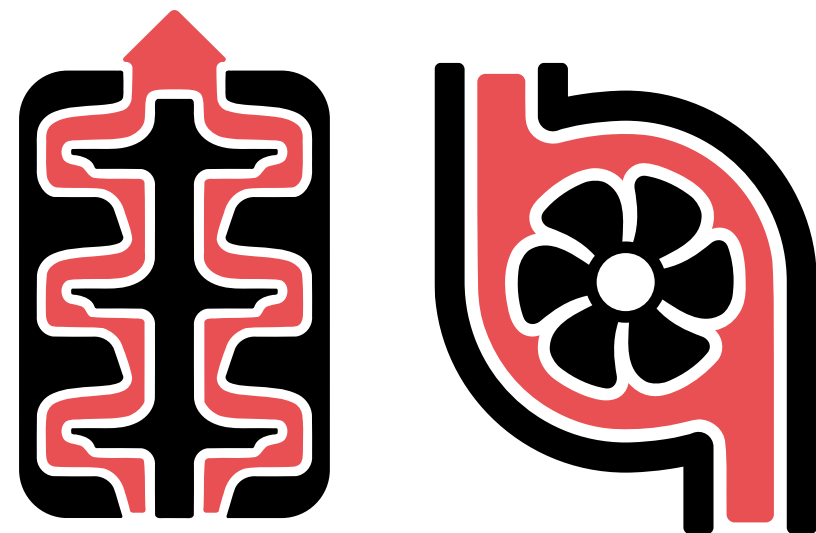


POTENTIAL CASES

For demonstrating the workflows

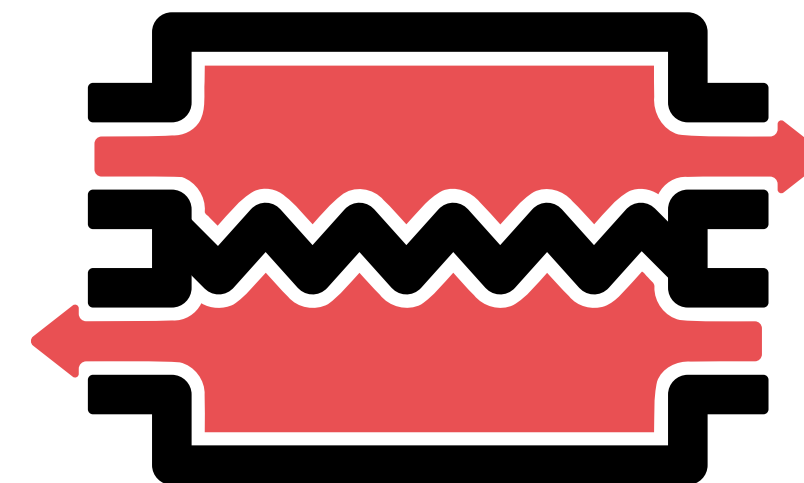
ESP & injection pumps

- Power/current quality monitoring
- Vibration monitoring of injection pumps



Heat exchangers

- Efficiency losses due to deposit build-up
- Heat exchanger degradation due to transients
- Integrity monitoring of heat exchanger seals

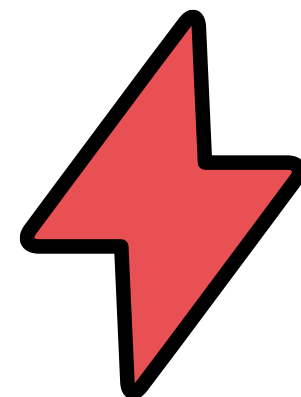


POTENTIAL CASES

ESP examples

Power quality monitoring

- Electrical issues are frequent causes of ESP failures
- Oftentimes these are caused by poor power input
- By adding data from the power grid side, can we improve identification of motor challenges and aid in root-cause analysis



Vibration monitoring

- Vibration is typically measured at a single location
- Is this enough?
- Can we better identify the location (e.g. motor, shaft, bearing, pump, etc.) of issues with more sensors
- If so, where should we put them?



SUMMARY

- Address challenges in geothermal operational data: underutilization, required expertise, and standardization
- Approach divided into two parts: existing data, and new data
- Develop additional methods for standardization and analysis of existing data
- Create workflows for evaluating added value of new data acquisition methods
- Test methods in the field and validate methodologies



THE PARTNERS WORKING TOGETHER IN GEO4ALL

Supported by TKI Nieuw Gas, topsector Energie



Mede mogelijk gemaakt door



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