ERACONS.

Engineering Reliability

Data-driven predictive maintenance for utility networks

Eracons » Company profile

Expertise

reliability analysis

risk assessment

machine learning

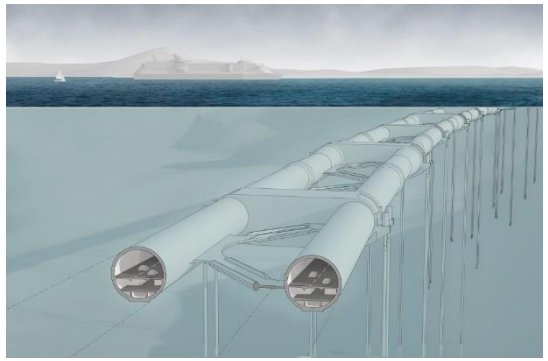
predictive modeling

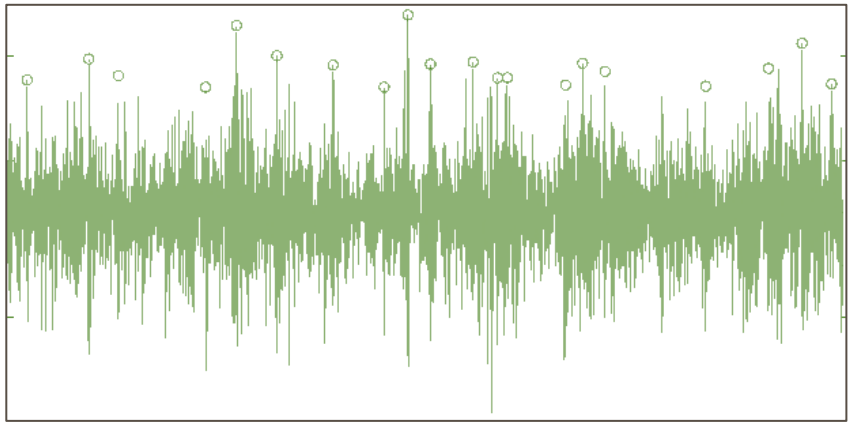
uncertainty quantification

optimization under uncertainty

data analysis

probabilistic decision-making





Eracons GmbH » Management team

Prof. Dr. Daniel Straub

Senior Consultant & Founder

Professor for risk and reliability analysis, Technische Universität München
20+ years of expertise in risk and reliability analysis

Dr. Iason Papaioannou

Senior Consultant & Founder

Lecturer/researcher at TUM; 10+ years expertise in uncertainty quantification, reliability analysis and machine learning for engineering applications

Dr. Wolfgang Betz

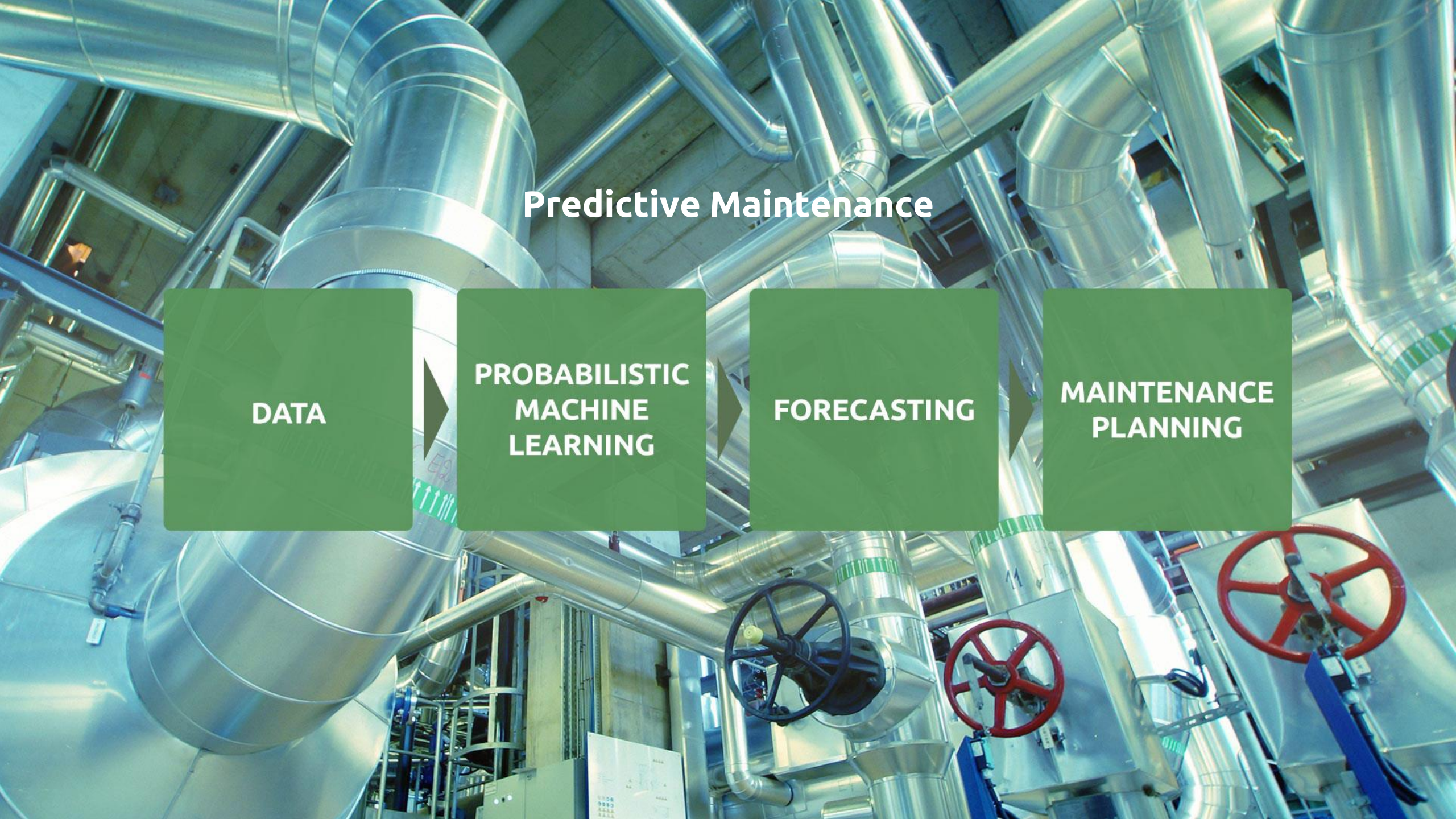
Senior Risk & Reliability Engineer

expertise in probabilistic modeling, Bayesian inference, reliability analysis and tailor-made software solutions

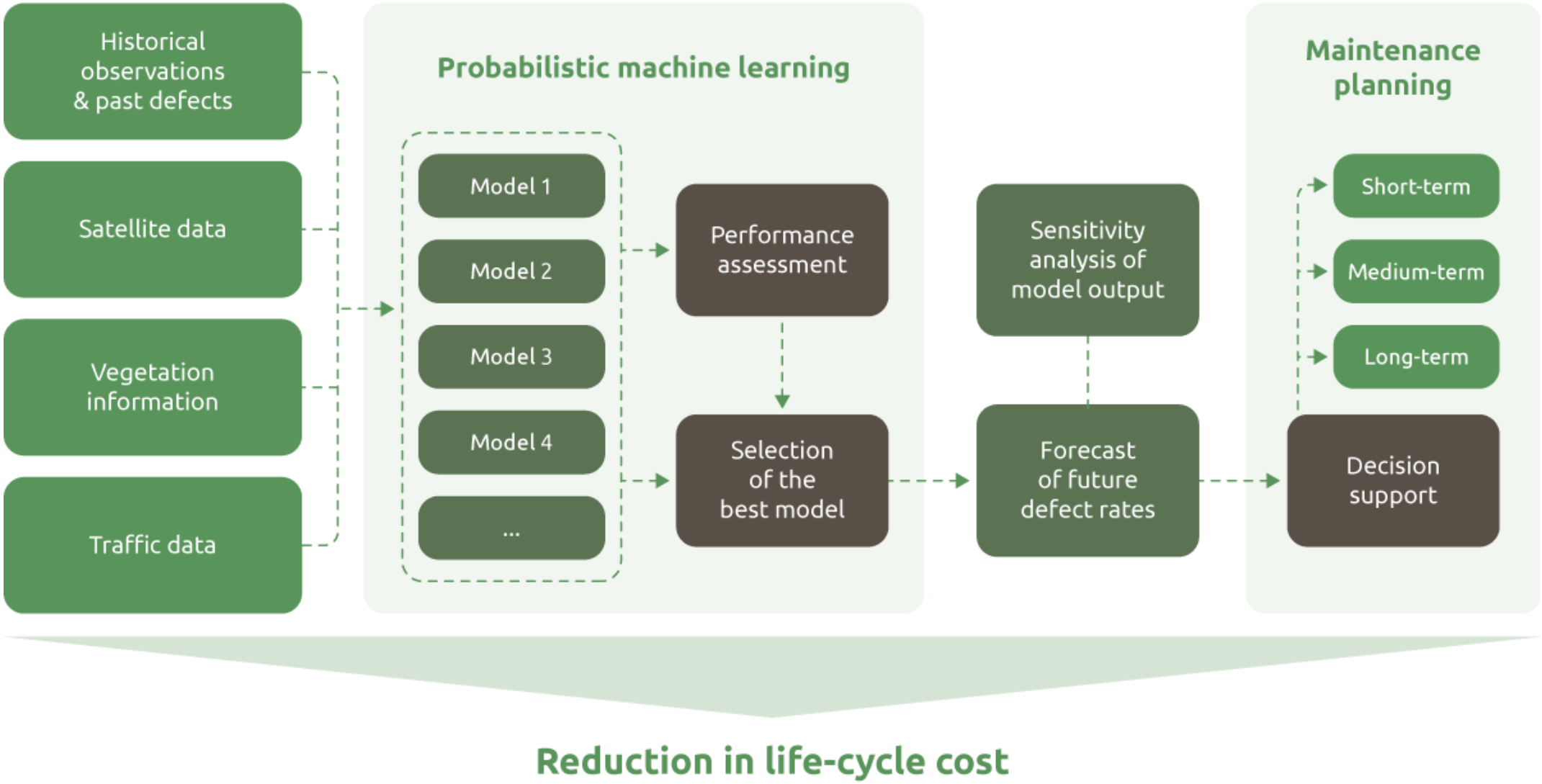
Maintenance planning » optimization of life-cycle cost

Making **full use of all** available network-specific **data**/information **is the key** to a more efficient maintenance planning. In combination with engineering models and expertise, machine learning allows to develop **predictive maintenance planning**, which can lead to a substantial increase in maintenance efficiency. To make full use of the potential, the predictive models must be integrated with our client's maintenance planning processes.

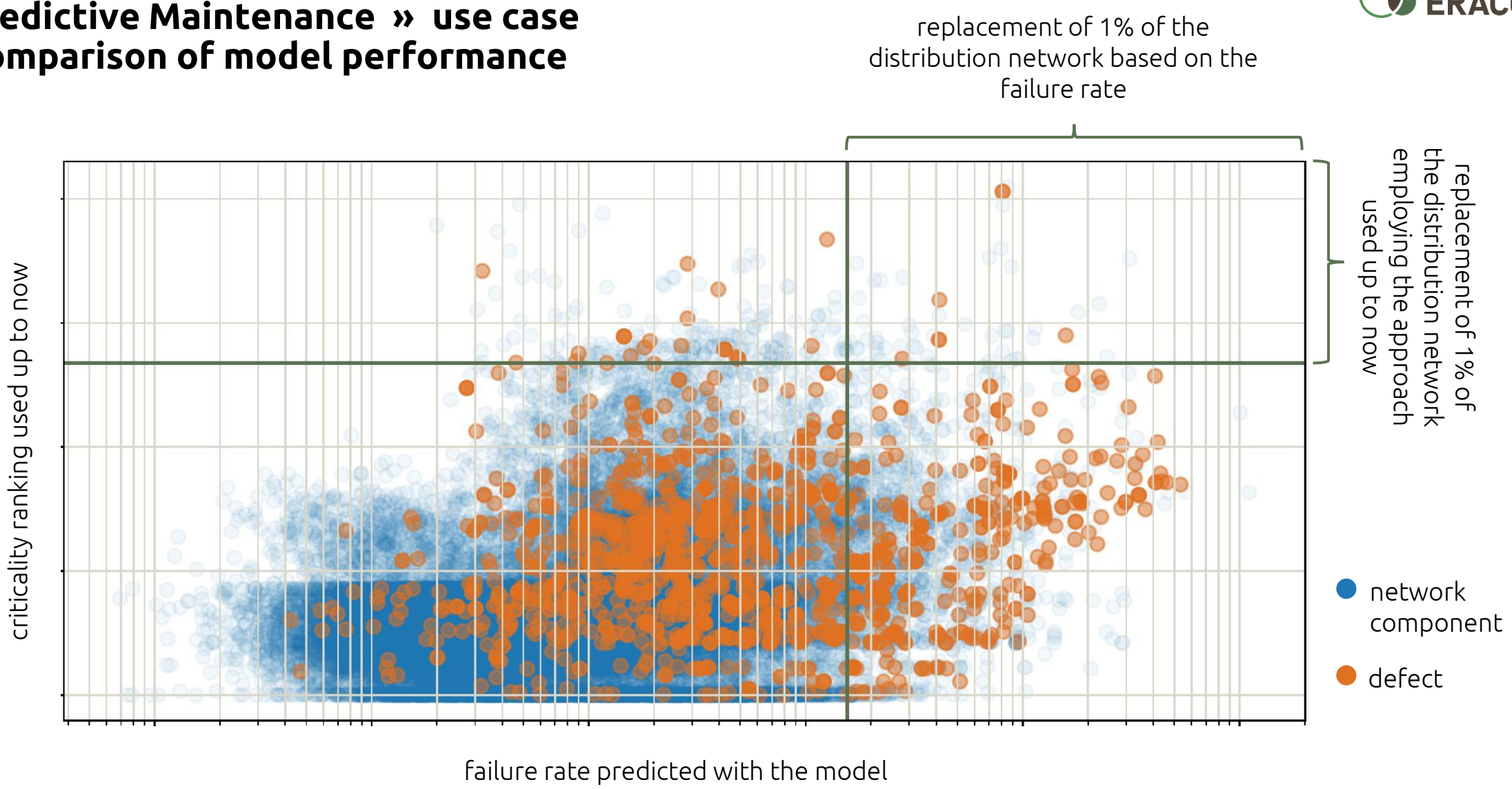
Our models enabled our clients to achieve a tenfold increase in the detection rate of defects


Predictive Maintenance
DATA
PROBABILISTIC MACHINE LEARNING
FORECASTING
MAINTENANCE PLANNING

Predictive Maintenance » exemplary use case



Predictive Maintenance » use case
Comparison of model performance



ERACONS.

The process of setting up an efficient maintenance planning poses challenges that require an approach tailored to the problem at hand.

We offer holistic solutions to coherently integrate probabilistic models in decision making for maintenance planning.

Challenges

of applying predictive maintenance to utility networks

Challenge #1

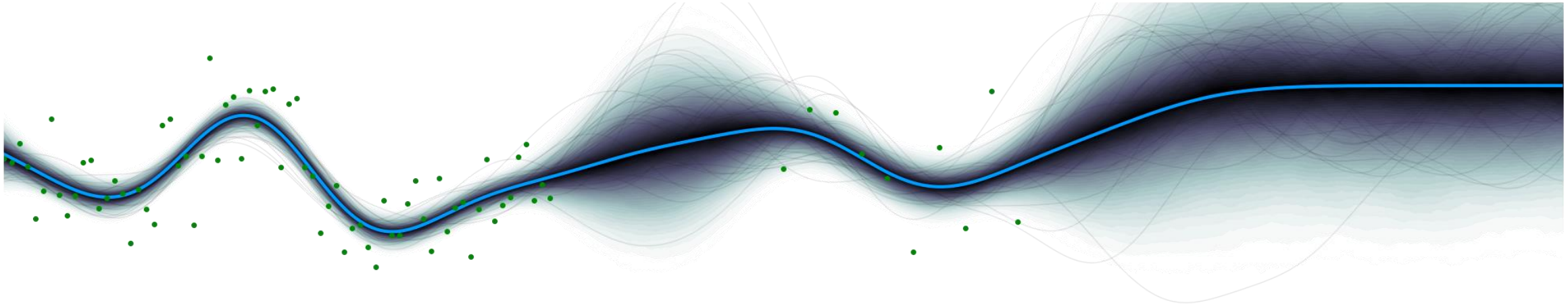
Data-driven models **cannot extrapolate**.

- → They can only generate valid predictions within regions sufficiently populated with training data points.
- → Historical data on safety-critical events is typically sparse. Nevertheless, often our models need to be able to identify safety-critical scenarios.

Our Solution

By combining machine learning techniques with process-based models we enhance the performance and robustness of predictive models.

We have extensive experience with modeling and assessing deteriorating engineering assets and systems.



Challenge #2

Most available data sets contain **incomplete**, **sparse**, **noisy** or **indirect** data.

- → Missing or censored data can reduce the representativeness of a data set.
- → Indirect data is available information that cannot directly be linked to the problem at hand.

Our Solution

We consistently integrate sparse data into our probabilistic modeling strategy to take full account of all information available.

Our process-based models optimally exploit the information contained in indirect data and clearly communicate the uncertainty associated with a prediction.

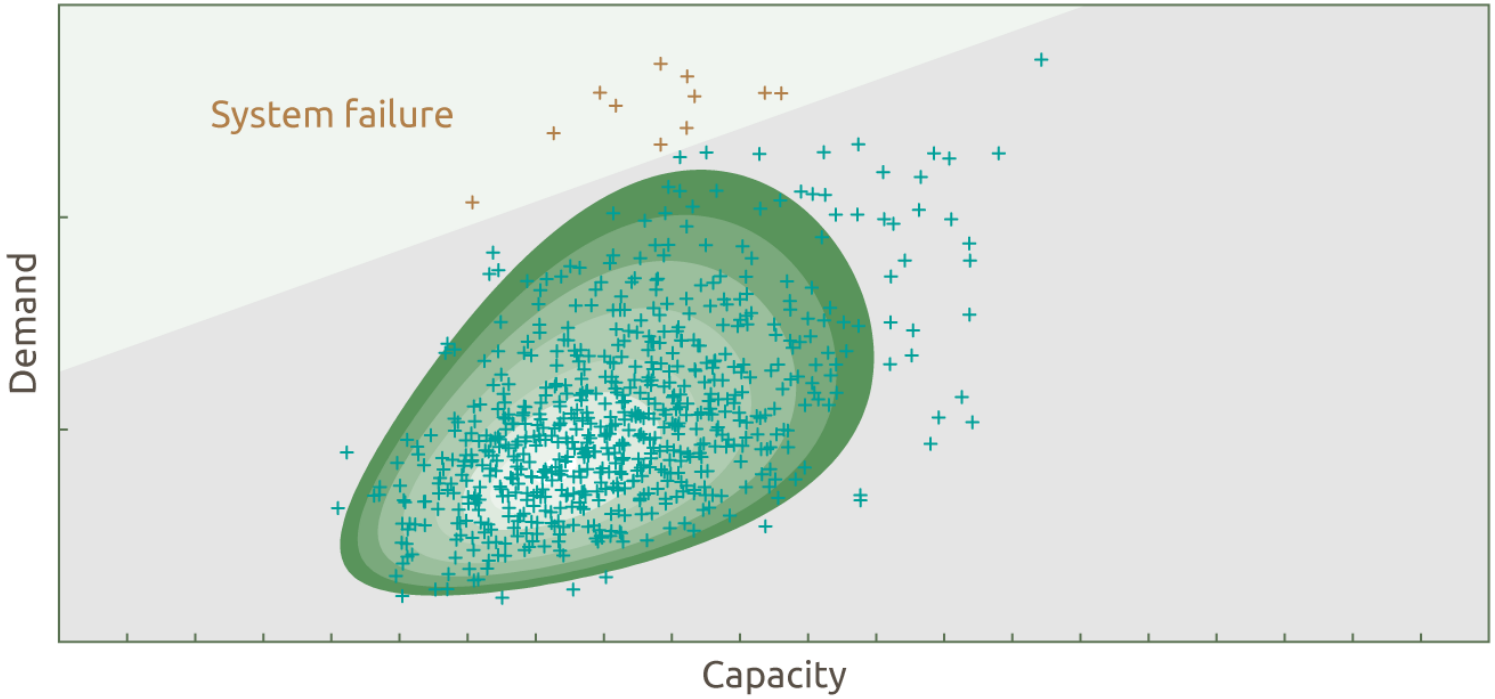
Challenge #3

For safety-critical assets and systems, one needs to demonstrate that the required level of **safety** is **maintained at any time**.

Our Solution

We have a long history of performing probabilistic safety and risk assessment of technical systems.

Model-based verification of safety enables an effective verification of a system's safety, relative to current practice.



Challenge #4

Integrating a data-driven model in **the decision process** and exploiting it to make optimal decisions **is not straightforward**.

- → Legal and technical regulations as well as budget constraints are imposed on the decision process.
- → The decision process is also affected by pending public works of other disciplines.
- → Work scheduling and resource planning must be considered.

Our Solution

We are experts on probabilistic decision making and support our clients in making optimal decisions under uncertainty that adhere to the imposed constraints.

We help our clients to identify and clearly communicate improved decision processes and foster the acceptance of data-driven predictive decision making.