Optimization algorithms for long-term operation of energy hubs
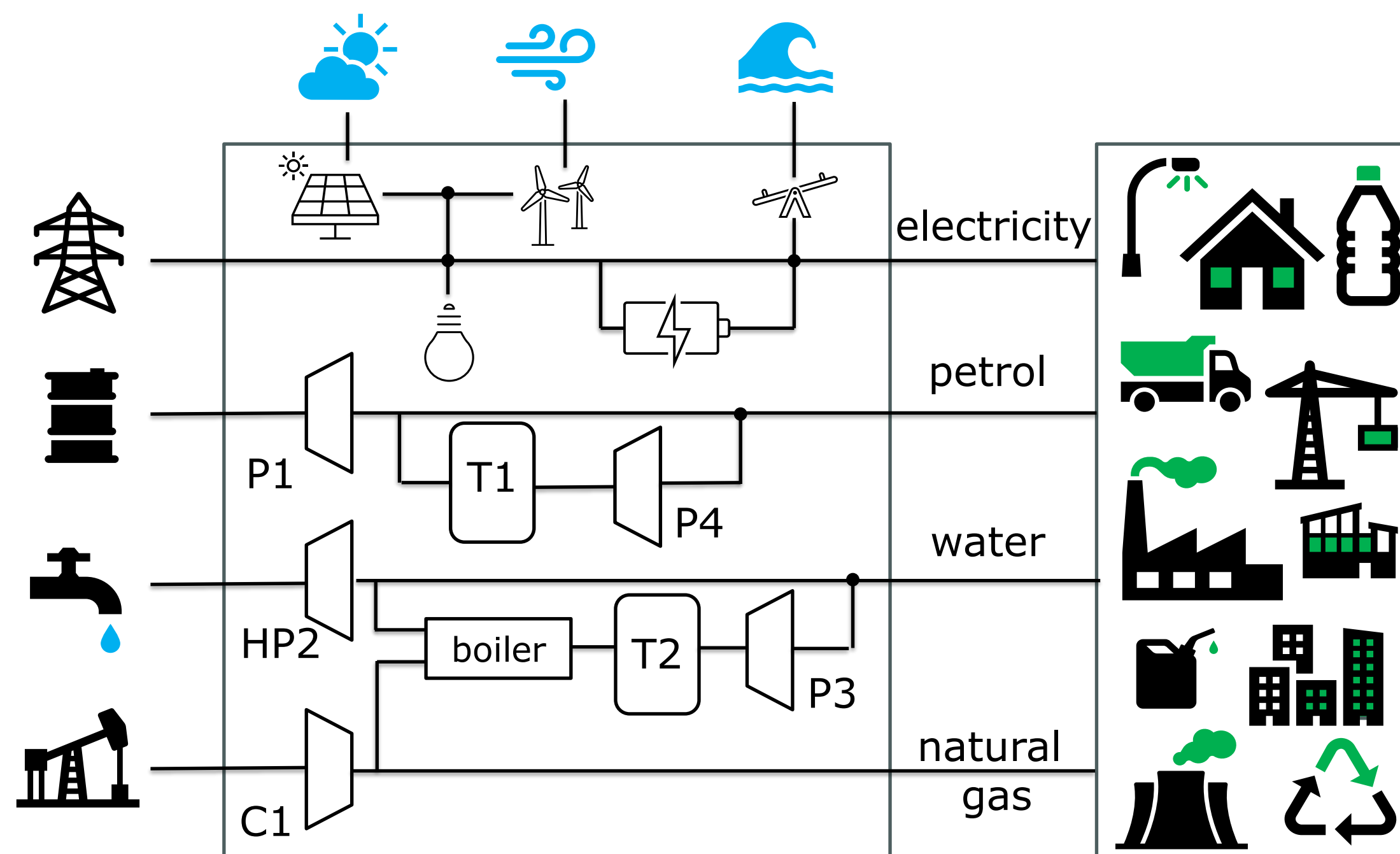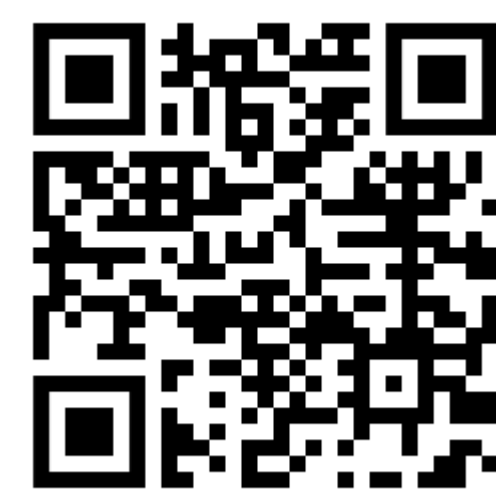
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Fig. 1. Energy hub – processing energy carriers to satisfy demand

Challenges:
- **Energy intensive** operation
- Strict **safety requirements**
- **Limited information** available

Idea: use an **optimization** algorithm as a **controller** to reach the **optimum** and **satisfy constraints**

Objective: Minimise power consumption in a compressor station

$$\sum_{i=1}^{K} W_i\left(m_i, \eta(m_i, \Delta_i)\right)$$

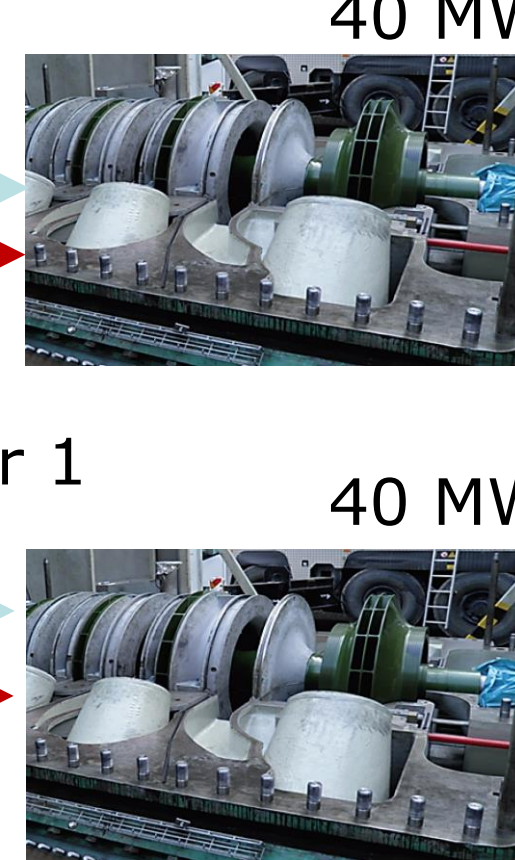while satisfying the demand

$$\sum_{i=1}^{K} m_i = M$$

and staying in the operating range

$$m_i^{\min} \leq m_i \leq m_i^{\max}$$
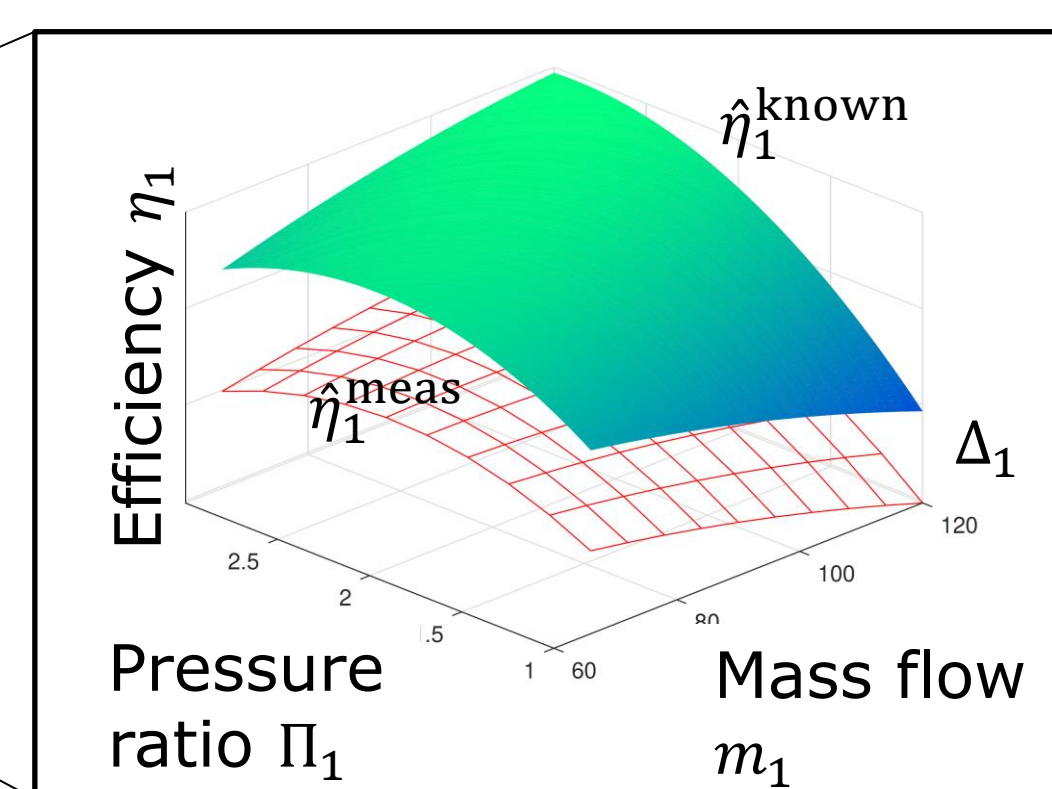
Fig. 2. Compressor station with model mismatch Δ_i
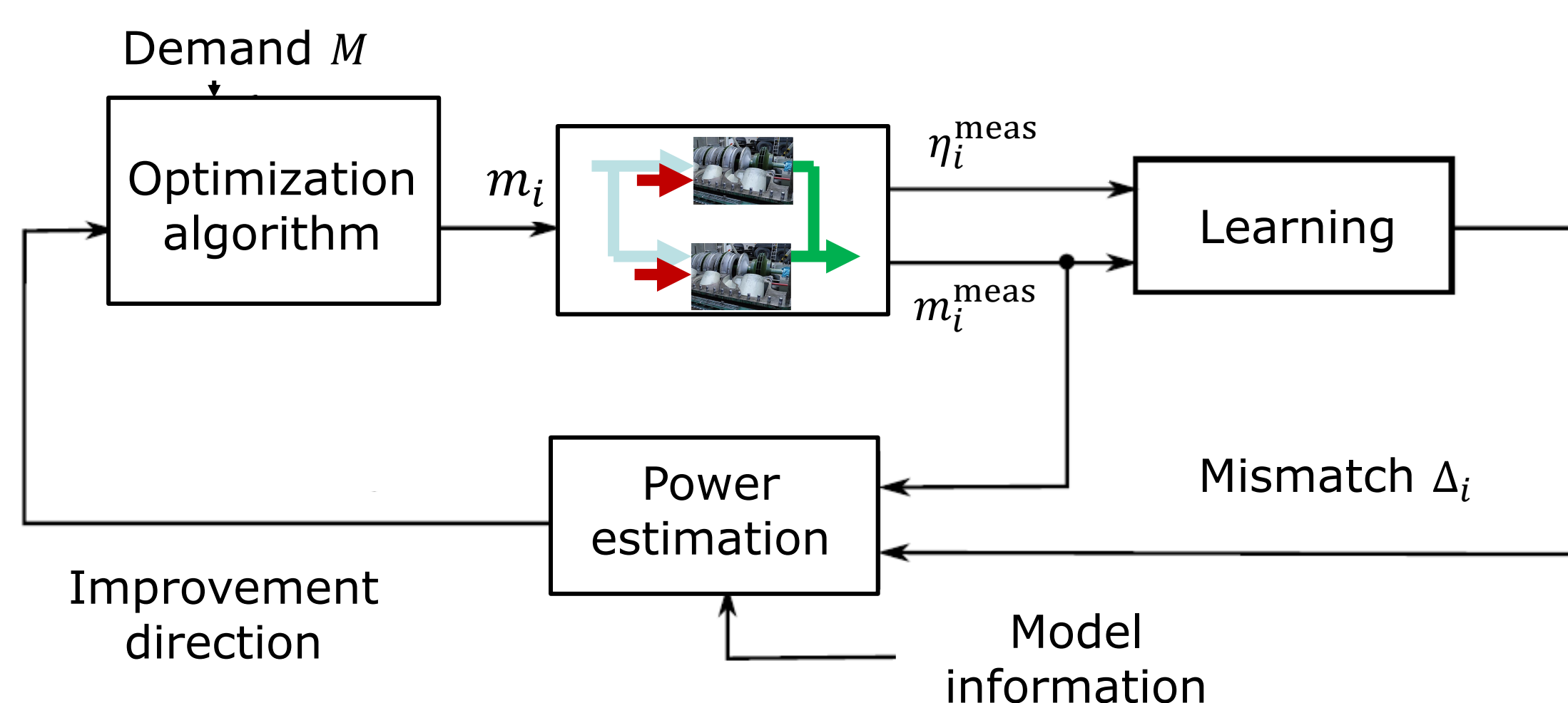
Fig. 3. OFO with learning for systems with model mismatch

Outcomes:
- **Optimization** algorithms can be used as **controllers**
- Combining **optimization** and **learning** overcomes model **mismatch**

Open questions:
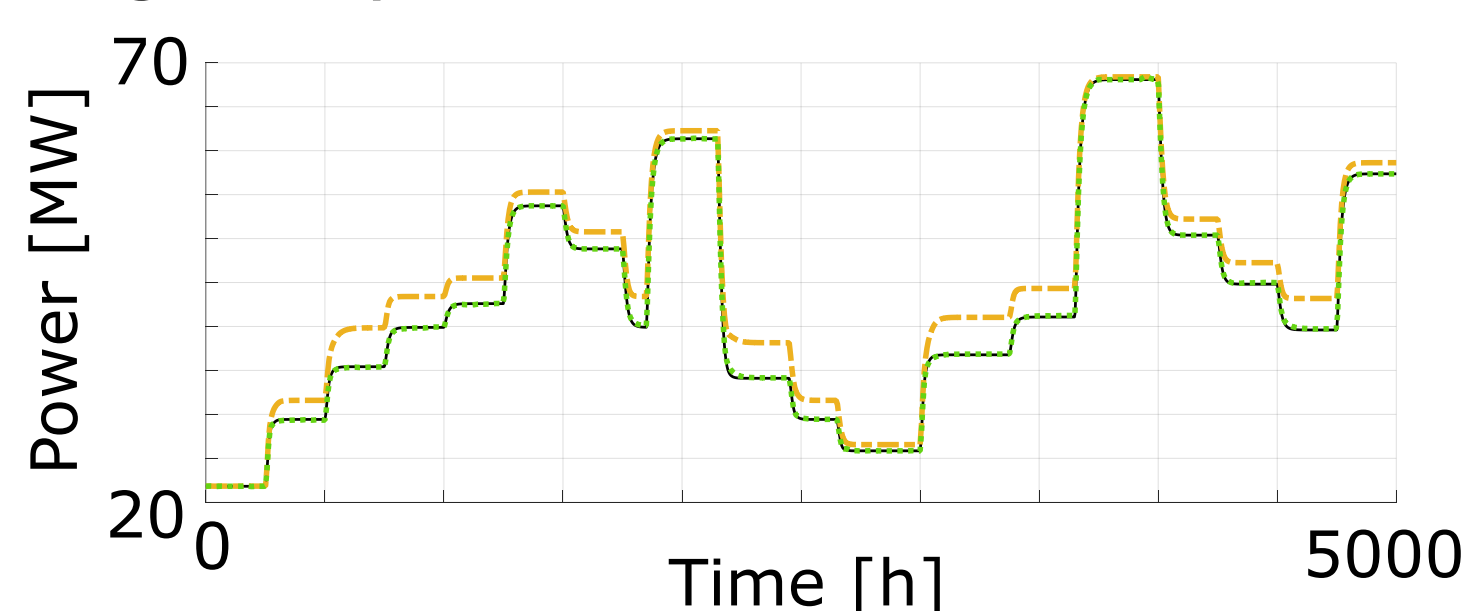- How to **implement** such controllers **in practice**?

Ongoing work → Adaptive tuning for long-term operation

Results:
Reduction of power consumption up to **0.8%**

Fig. 4. Power consumption

Zagorowska, M. et al., Online Feedback Optimization of Compressor Stations with Model Adaptation using Gaussian Process Regression, *Journal of Process Control*, 2022