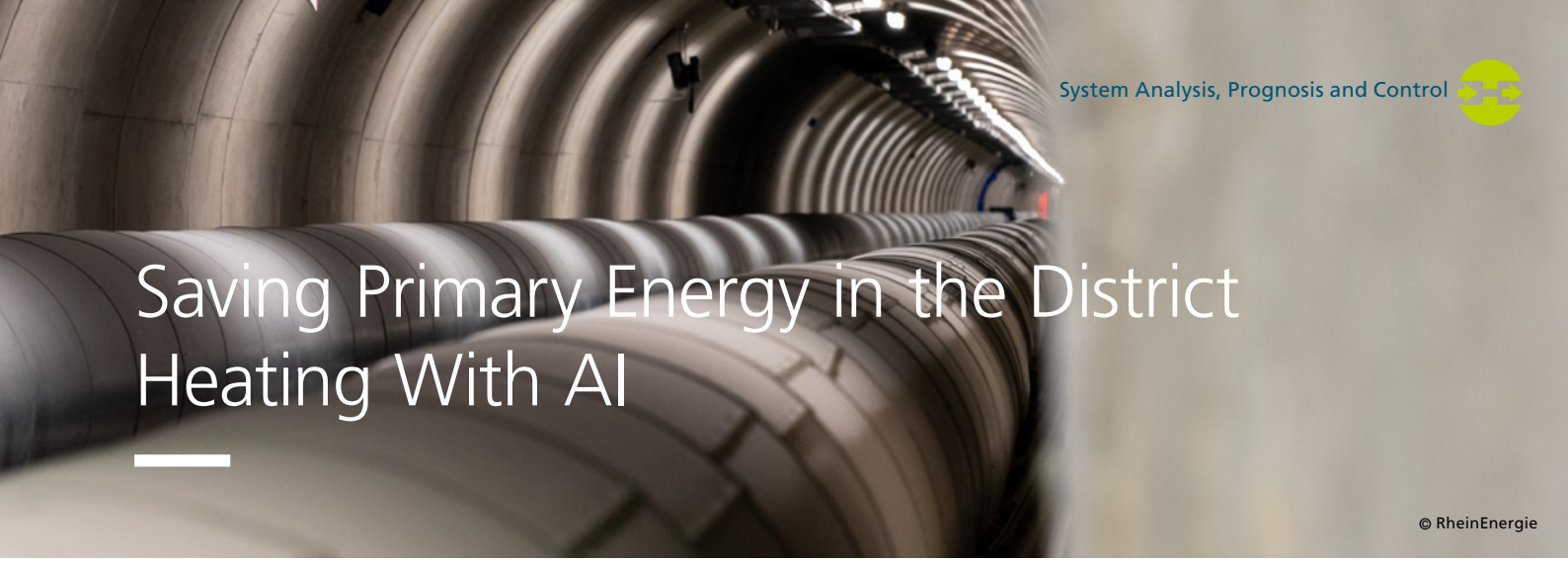

Saving Primary Energy in the District Heating With AI

The temperature must be right in the heat tunnel.

AI methods can be used not only to optimize consumption in the extensive district heating network, but also to save primary energy at the Fraunhofer ITWM. In a pilot project with the energy service provider RheinEnergie AG, a team from the "System Analysis, Prognosis and Control" department has succeeded in improving the processes around boilers and thus saving a significant amount of primary energy – especially gas.

In general, heating networks are divided into a primary and a secondary side: the boilers are located on the primary side and generate the heat, which is pushed into the secondary side, i. e. into the grid, at a transfer point. "Our task was to control heat generators in such a way that the current demand in the network is covered, but at the same time as little surplus energy as possible is fed into the network," says project manager Dr. Christian Salzig. "The demand at the transfer point is interesting, i. e. where the heat passes from the primary to the secondary circuit. To determine this, we use machine learning methods to create individual, weather-related load profiles." Based on these load profiles, the developed prediction models can forecast the heat demand for the coming hours very precisely and controle the generators accordingly.

Keep Mains Temperature Stable

In addition to demand-based control, another problem with the heat supply was resolved in the project: Measuring points on the grid side report current temperatures, but due to the length of the grid there are runtime delays. It can therefore happen that too little energy is detected in the network and the machines heat up even though the heat currently produced will already cover the demand. This leads to significant temperature oscillations in the grid. For this reason, predictive controllers have been developed that take transport delays into account and almost completely eliminate these oscillations. This allows the energy supplier to controle heat generation precisely to the predicted demand. This allows the temperature in the grid to be lowered without jeopardizing the security of supply, which leads to significant savings in primary energy.

Ensuring Security of Supply

Furthermore, the researchers can use their method to predict whether it is worth starting up an additional heat generator or whether it is better to run the lead boiler at its output limit for a short time in order to compensate for spontaneous fluctuations. External sources, such as electricity-driven CHP units or waste heat from connected businesses, present a particular challenge here. The intelligent control system therefore ensures that the heating plant has a control reserve that can always compensate for unplanned failures of external heat sources.

The ongoing evaluation shows: Depending on the outside temperature, the implemented AI controllers save between six and thirteen percent natural gas. The controllers are currently being implemented in other local heating systems at RheinEnergie AG.

www.itwm.fraunhofer.de/heating-ai-en

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