# Optimizing energy consumption in buildings

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## Machine learning techniques, including artificial neural networks, were employed to estimate building energy performance

In this study, the building energy balance computed in EnergyPlus served as the primary physical model. MATLAB was used to develop the artificial neural networks. A recurrent neural network (Long Short-Term Memory, LSM) was selected to predict building energy demand.

The objective of the training process is to minimize the mean squared error between the predicted output sequence and the corresponding actual values in the training dataset.

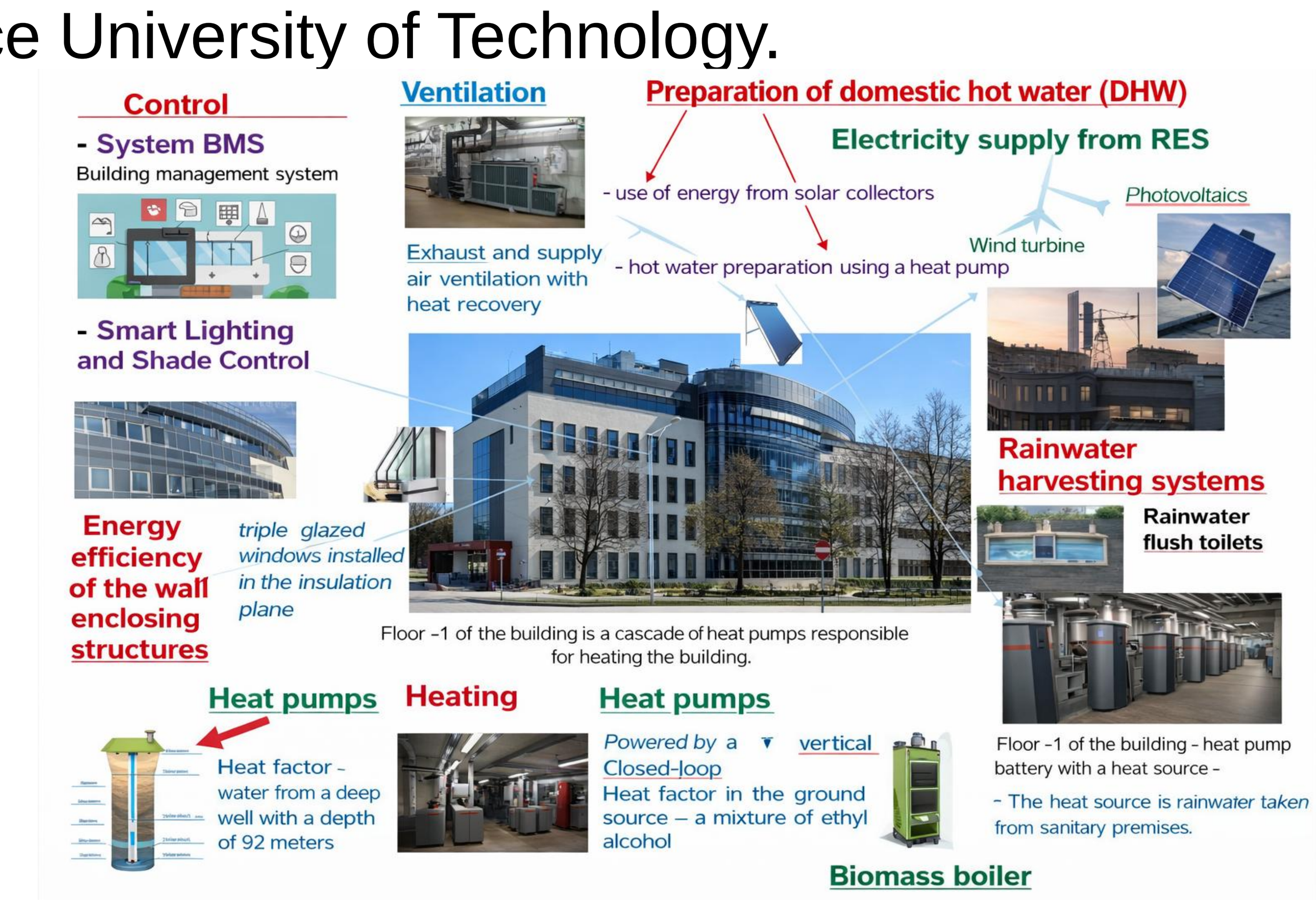
The LSM model is primarily designed to predict room temperatures and the associated heating energy demand over the study period. Actual temperature data were collected and logged by the Building Management System (BMS), providing reference data for model training, validation, and forecasting. A single LSM network was applied to predict hourly heating demand, rather than using separate models for fixed temperature setpoints. This approach enables the model to account for dynamic setpoint changes rather than being limited to static values.

## Introduction

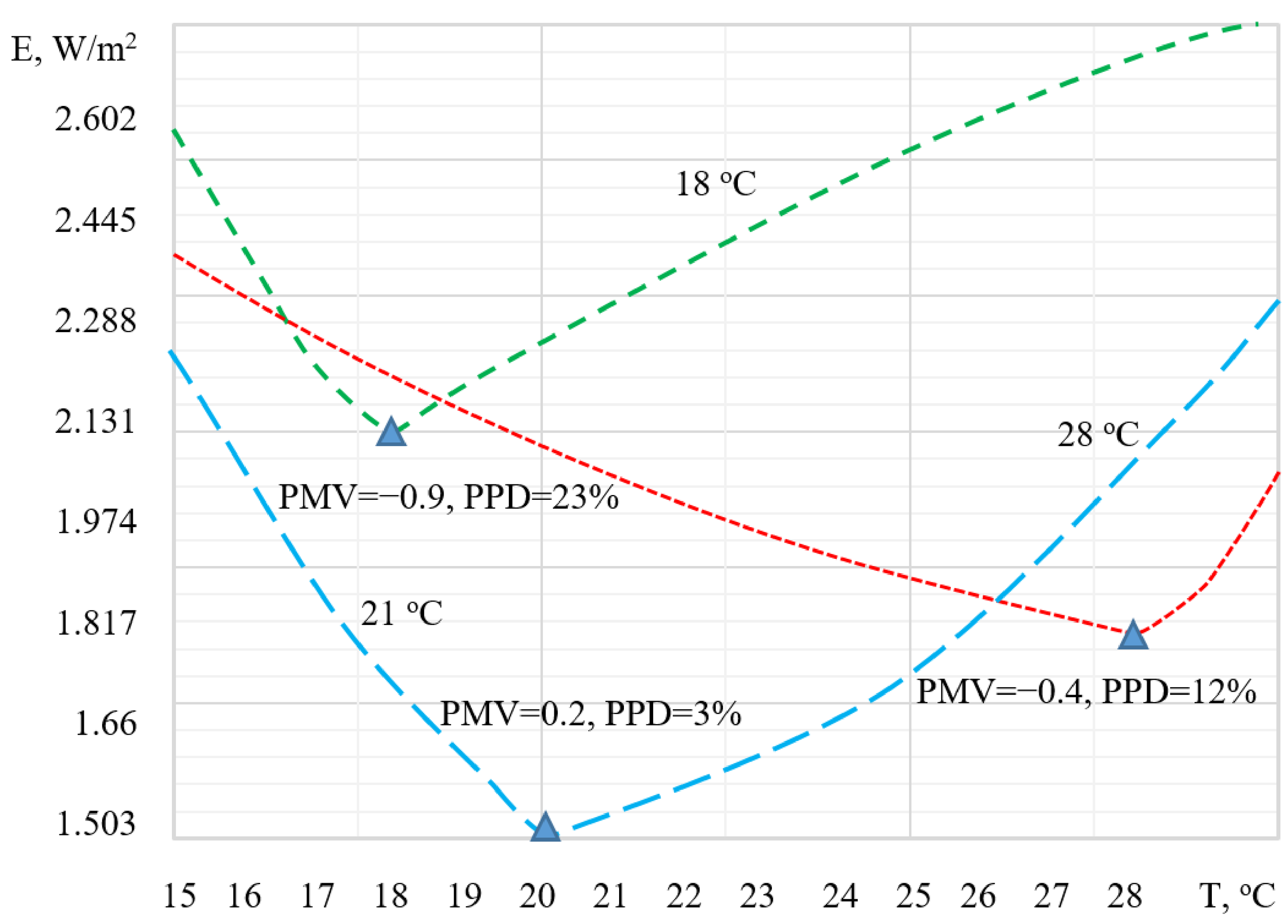
The control strategy incorporates real-time feedback to continuously update operating parameters. Planning accuracy is progressively improved through dynamic optimization, enabling rapid responses to load fluctuations and precise control of energy consumption. This planning approach ensures a dynamic balance between efficient energy system operation and occupant comfort requirements by integrating real-time monitoring, predictive modeling, and multi-objective optimization based on energy cost and availability. Such prioritization minimizes overall energy consumption while maintaining required comfort levels. System efficiency is further enhanced by selecting energy sources that operate at the highest efficiency under varying demand conditions.

## How to make your poster?

The development and validation of an energy consumption model were carried out for the existing energy-efficient, smart, renewable energy–based teaching and laboratory building "ENERGIS" at the Kielce University of Technology.

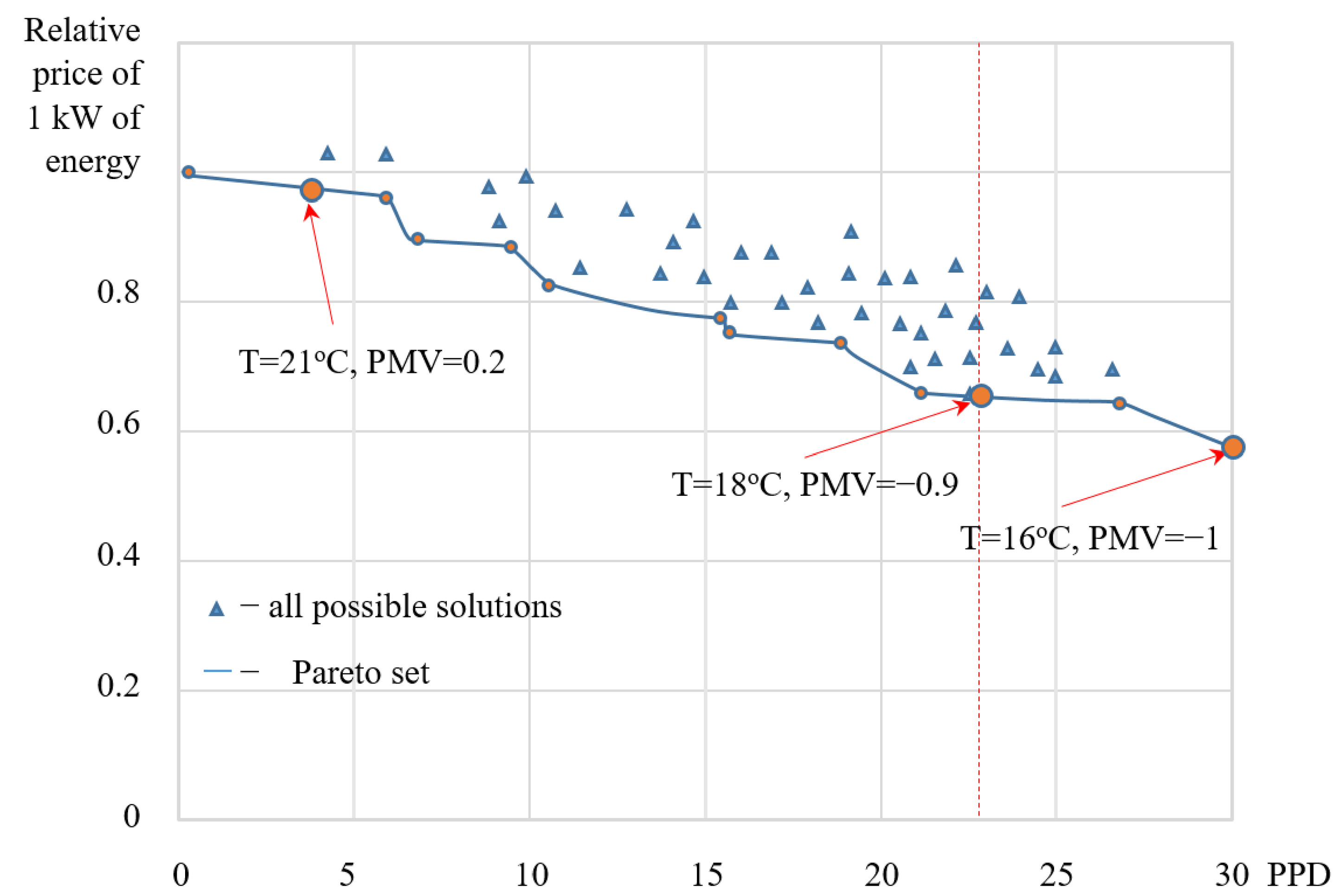



## Formatting / design rules




Dependence of the exergy value on the air temperature for different values of the radiation temperature:
1 – 18 °C; 2 – 20 °C; 3 – 28 °C.

## Visual conclusion




Pareto graph for optimizing energy supply of selected premises