EXPLORING THE EFFICACY OF RANDOM LINEAR PARAMETER MODELS FOR FORECASTING HEATING DEMAND IN DISTRICT HEATING NETWORKS

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Abstract – The heating and cooling sector accounts for approximately half of the global energy consumption, making it a pivotal focus for energy transition efforts. District heating and cooling networks have emerged as efficient, innovative, and dominant technologies in various regions. Accurate forecasting of heating demand within these networks is imperative for effective energy transition and responsive demand management. While existing forecasting techniques primarily concentrate on limited parameters such as ambient temperature and time of day, this paper explores the multifaceted impact of various factors, including ambient temperature, energy prices, number of consumers, building types, and solar radiation, on heating demand. Through a comprehensive study of these determinants, a robust and efficient forecasting model is developed in this research. Specifically, a novel Random Linear Parameter Model (RLPM) is introduced for hourly heating demand forecasting within district heating networks. The model's performance is assessed and compared with existing forecasting models, namely Linear Regression, ARIMA, and RLPM. A notable advantage of the Random Parameter Linear Regression model lies in its capability to recognize unobserved parameters influencing demand and account for unobserved heterogeneity, providing a robust framework for incorporating these factors into the forecasting process. This study aims to underscore the proposed approach advantages in terms of accuracy and its ability to estimate the determinants of heating load, thereby offering reliable future forecasting. The findings have the potential to significantly contribute to optimizing district heating systems by delivering more nuanced and dependable predictions of heating demand.

Keywords – Data-driven model; econometric models; energy forecasting; forecasting techniques; heating demand determinants