Study of climate's change impact on the heating industry with ML

Degree programme : MAS Data Science

Climate change and regulations challenge Europe's heating sector. This study quantifies their impact on heating demand using Groupe-E Celsius SA data (2019–2024). Forecasting models show a +1°C rise cuts demand by 2 MWh/year per substation. Combined effects may reduce demand by 50%. Findings highlight major savings via analytics, urging investment in forecasting and data-driven strategy.

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Climate change and stricter building regulations pose significant challenges to the European heating industry, particularly for district heating companies. This study investigates the quantitative impacts of rising temperatures and regulatory changes on heating demand, using Groupe-E Celsius SA's operations as a case study. The research analyzes energy consumption data from four Swiss regions (Vevey, Cousset, Boudry, and Düdingen) spanning 2019-2024, combined with meteorological data from corresponding weather stations. The methodology employed the Cross-Industry Standard Process for Data Mining (CRISPDM) framework, implementing three forecasting models: XGBoost, Prophet, and Temporal Fusion Transformer. Temperature scenario analysis examined five climate scenarios ranging from baseline conditions to +3°C increases. The study utilized time series cross-validation with performance metrics including RMSE, MAE, and R^2 scores. Results demonstrate that a +1°C temperature increase leads to an average 2MWh annual reduction in heating demand per substation across the studied regions. XGBoost outperformed Prophet in statistical significance but showed limitations in seasonal pattern recognition. Temperature scenario modeling revealed that combined climate and regulatory impacts could reduce heating demand by up to 50%. The research identifies substantial optimization opportunities through production scheduling, dynamic pricing models, and predictive analytics implementation. The study concludes that systematic data analytics adoption could potentially save millions of CHF annually while enabling proactive adaptation to climate change impacts. Primary recommendations include establishing a dedicated four-person data analytics team to leverage existing data assets and implement scenario-based forecasting for strategic planning.