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# Scalable Energy Intelligence for Global Retail Operations

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***Abstract***

*Managing energy consumption across thousands of retail facilities presents a massive data challenge, necessitating scalable analytics to automate ISO 50001 and ISO 50006 certification reporting. While ISO 50006 traditionally recommends linear regression for establishing Energy Baselines, these standard techniques often fail at a global scale due to the high dimensionality of data and non-linear operational variables. This study details the development of one of Europe's largest Energy Management Systems, designed to transition energy from a static cost sheet item to a granular, actionable business intelligence tool.*

*Our approach integrates disparate data sources from over 13,000 facilities, including warehouses and stores. To address inconsistencies in data completeness and sensor reliability, a robust preprocessing pipeline was established to link consumption data with location master data, e.g. building types and inventories, and exogenous variables like ambient temperature. Methodically, the system improves upon standard ISO 50006 techniques by deploying XGBoost regressors adapted for time-series data. These models enable precise counterfactual modeling, allowing the organization to meet the EU Energy Efficiency Directive and achieve a central group-wide certification.*

***Keywords:*** *Energy Intelligence, ISO 50001; ISO 50006; XGBoost; Retail Analytics; Energy Efficiency Directive.*

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