Bachelor's Project Proposal
Machine Learning Approaches for Power Grid Load Forecasting

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1 Abstract

This project focuses on developing machine learning models for load forecasting in the Swiss energy grid, using historical data on energy consumption, production, and cross-border exchanges. The datasets include detailed information on total energy consumed and produced in the Swiss control block, grid feed-ins, net outflows, and energy trades with neighboring countries (Germany, France, Austria, and Italy). By leveraging this data along with weather and seasonal factors, the project aims to improve the accuracy of short-term and long-term load forecasts using advanced machine learning techniques such as LSTM, Transformers, and Gradient Boosting, while comparing their performance with traditional models.

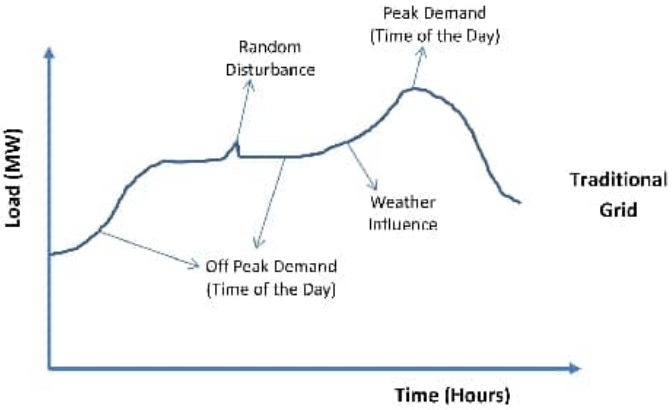

Figure 1: Load and influence

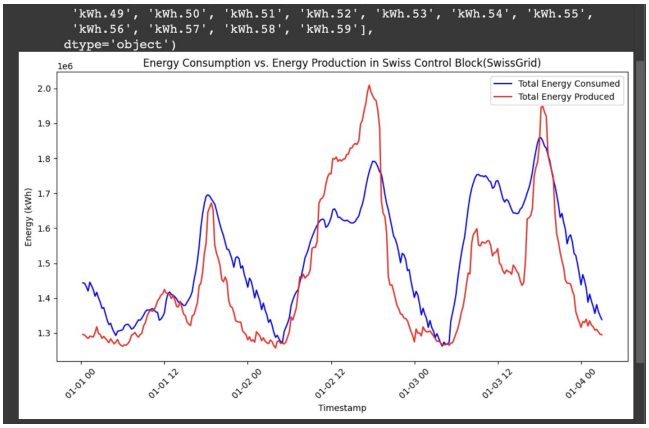

Figure 2: Plotted Energy Production visuals (Python3)

The goal of which is to combine Machine Learning, Data Structures, and Physics to predict real-life energy trends.

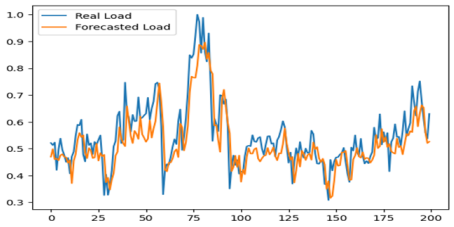

Figure 3: Endgoal

2 Objectives

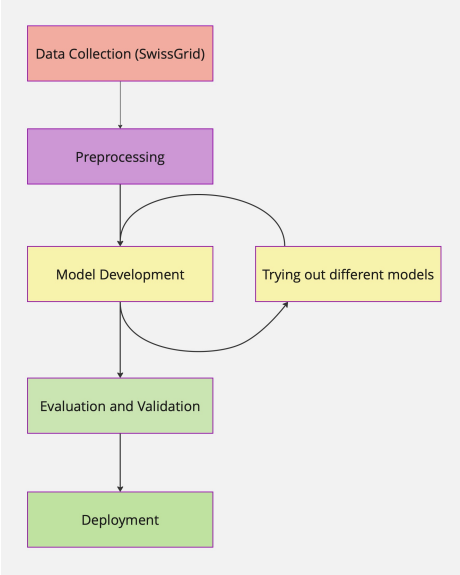

Figure 4: Product Cycle

The primary objectives are:

1. Develop a scalable, modular framework for load forecasting that can be integrated into real-time energy grid management systems.

2. Implement the framework for use in operational energy load prediction systems.

3 Resources Required

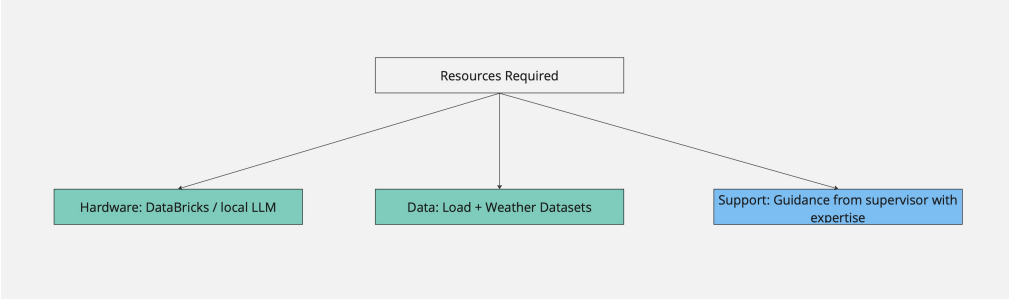

Figure 5: Requirements

Most notably:

- Support and guidance from the researchers and engineers who produced the data.

4 Organisation

Result	**Approximate Date**
Data Collection and Preprocessing	Feburary 2025
Feature Engineering and Exploratory Analysis	March 2025
Model Prototyping and Short-Term Forecasting Framework	April 2025
Long-Term Forecasting Framework and Theoretical Analysis	Mai 2025
Final Evaluation, Report Writing, and Submission	June 2025

References

- Figure 1: `https://engineering.electrical-equipment.org`
- Figure 2: Coded using SwissGrid Data
- Figure 3: `https://grid2040.ku.edu.np`