# Predicting the Energy Efficiency of Buildings

Contributor: Sümeyra KUZU/Kiron-Thrive
Company: Thrive – Kiron Organization
Company origin: Germany
Tested in:

## AI use case attributes

**Industry**

Energy • Real Estate Management and Development • Others

**Organizational function**

Operations • Quality • Research & Development • Sustainability

**Value gain**

Cost Saving • Enhanced Quality • Increased Efficiency

**AI capabilities**

Analysis • Optimization

**Data source**

Structured

**Technology type**

Supervised learning

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Type: Industry | Stage: PoC

## Brief description

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## Implementation proficiency

**Risk classification**
Limited risk

**Required resources**

## Brief description

This project, facilitated by Thrive/Kiron, explores energy efficiency of buildings. Using publicly available datasets (UCI Energy Efficiency Dataset and Kaggle), machine learning models predict heating and cooling loads based on building features. Insights help guide energy-efficient building design.

## Problem statement

Many buildings consume excessive energy due to suboptimal design choices, resulting in higher operational costs and carbon emissions. Predicting energy consumption based on design features can help reduce costs and environmental impact. Critical assumptions:

- Public datasets sufficiently represent real-world energy patterns.
- Machine learning models can capture key relationships between building features and energy loads.

## The idea or concept

Train predictive models (e.g., Linear Regression, Random Forest) on the UCI/Kaggle datasets to estimate heating and cooling loads. Use feature importance analysis to identify which building

Limited risk

### Required resources

Jupyter Notebook Python-Libraries(scikit-learn, pandas,seaborn, etc.)

## The idea or concept

Train predictive models (e.g., Linear Regression, Random Forest) on the UCI/Kaggle datasets to estimate heating and cooling loads. Use feature importance analysis to identify which building characteristics most strongly affect energy consumption. Translate findings into recommendations for more energy-efficient building designs.

## Who are the users?

- Architects
- Civil engineers
- Energy consultants
- Building managers

## Goal

- Predict energy consumption for buildings
- Identify which building features most affect energy use
- Test whether AI can realistically help optimize energy efficiency

## Outcome

- Models show good prediction accuracy (measured with $R^2$ and RMSE)
- Feature importance analysis highlights key factors for energy consumption
- PoC demonstrates that AI can be used to support energy-efficient building design

## Learnings

- Choosing the right building features and preparing the data properly is very important for the models to make accurate predictions.
- Different models (Linear Regression and Random Forest) perform differently depending on the complexity of the features.
- Testing with real building data in the future will improve the reliability of the predictions.

## Critical milestones & next steps

- Test predictions on real building data
- Create a recommendation tool for designers
- Challenges: limited dataset size, generalization to different building types

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## Note

- This PoC demonstrates feasibility and provides insights into building energy consumption.
- Next steps include testing with real building data and integrating results into design recommendations.