

## AI-Driven Integration of Sky Imager-Based Short-Term Solar Forecasting in Building Energy Management

Department: Sustainable Development

Research group: Energy and Resources

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### Project description

This project aims to develop an AI-driven framework that integrates sky imager-based short-term solar forecasting into building energy management systems (BEMS) to optimize photovoltaic (PV) energy utilization in smart buildings. The ultimate goal is to enhance grid management by enabling buildings to act as flexible, reliable participants within the energy grid. By using real-time solar irradiance forecasts from sky imagers, the project will allow BEMS to adjust energy consumption and storage strategies based on predicted PV generation. By combining AI algorithms with cutting-edge sky imaging technology, the project seeks to improve the operational efficiency of PV systems in smart buildings, ultimately reducing reliance on external energy sources and lowering carbon footprints.

The assistant will contribute to key aspects of the project, including:

1. **Data Preprocessing and Preparation:** Focus on basic sky-image data cleaning and organization under guidance. Introduce methods to handle inconsistencies and prepare data for AI models, providing foundational experience in data handling.
2. **AI Model Development Support:** Assist in implementing pre-selected machine learning algorithms and fine-tuning model parameters, rather than developing from scratch. This activity could include understanding and applying model structures suited to forecasting, with supervision.
3. **System Integration Insight:** Collaborate with an experienced mentor to understand and support the integration process with the building's energy management system (BEMS), focusing on setting up the model and data flows rather than end-to-end system design.
4. **Performance Evaluation:** Conduct basic performance evaluations with a focus on understanding metrics and model accuracy. Adjust model settings under guidance to improve forecasting accuracy and document insights.
5. **Documentation and Reporting Assistance:** Document methodologies and challenges and assist in preparing reports, especially focusing on the technical and grid impact aspects, with mentorship on report structuring and academic writing.

This role will provide the assistant with an in-depth understanding of AI-driven forecasting, its application in energy management, and the importance of grid-responsive buildings in the transition to sustainable, renewable-powered energy systems.

### Job requirements

Particular job requirements (i.e. lab experience, background knowledge and/or computer skills)

- Basic programming skills in Python or MATLAB, with a willingness to learn AI model development.
- Familiarity with data analysis techniques; prior experience with libraries like Pandas or NumPy is beneficial.
- Understanding of renewable energy principles, especially PV systems, with some knowledge on grid management concepts.
- Interest in machine learning and forecasting, with an eagerness to develop these skills.
- Strong analytical mindset and ability to document results in a clear, structured format.