NTNU

Institutt for bygg– og miljøteknikk

Optimalisering av bygningsintegrerte solcellepanel i Brekstadbukten

Optimization of Building Integrated Photovoltaics at Brekstadbukten

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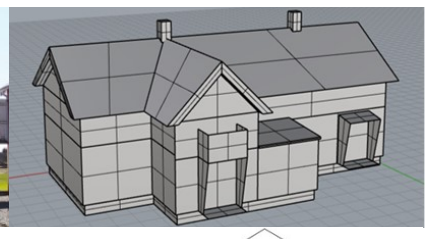
BIPV on Listed Houses at Brekstad

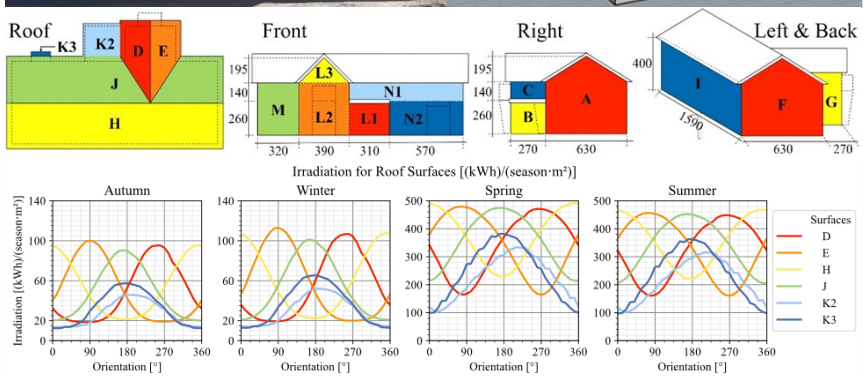
Introduction and project description

Our research focuses on the implementation of Building Integrated Photovoltaics (BIPV) on listed houses in the new residential area of Brekstad, Norway. The project involves 22 old houses being relocated to create a harmonious architectural style in a new area called Brekstadbukta. The main objective is to evaluate the feasibility and benefits of installing BIPV on these houses, as well as the new ones planned to be built in the same style. Solar power is gaining popularity due to its contribution to reducing the environmental footprint. By simulating the houses in Rhinoceros 3D, we calculated the potential energy production from different areas such as facades and roofs. The findings will help convince Ørland municipality to adopt BIPV, making the new residential area, Brekstadbukta, partially self-sufficient in electricity and reducing the overall cost. Additionally, surplus power can be sold back to the grid.

Methodology

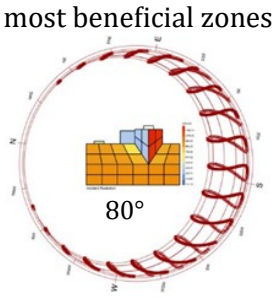
Our research involved thorough inspections of the buildings and the local area. Using CAD 3D modelling software, Rhinoceros 3D, and the parametric modelling tool Grasshopper, we collected data by simulating the houses. To analyze irradiation, we employed various components from plugins like Ladybug and Radiance Tool. We also utilized components from Colibri to automate simulations with a wide range of iterations. By simulating all possible orientations and seasons, including the solstices and equinoxes, we obtained a comprehensive evaluation of energy production potential. The data from numerous data points were merged to represent different surfaces, such as facades and roofs.

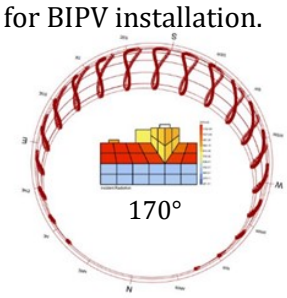


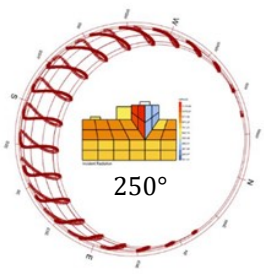


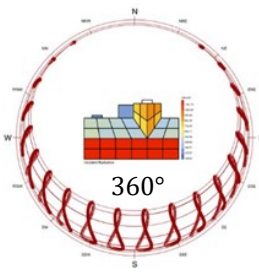
Results and Findings

Our findings revealed that solar energy production is significantly lower during the winter months due to the sun's low maximum altitude and fewer daylight hours. The angle of the roof also plays a crucial role in energy production. Based on our analysis, we identified four optimal rotations (80°, 170°, 250°, and 360°), and we have created a table suggesting the most beneficial zones for BIPV installation.

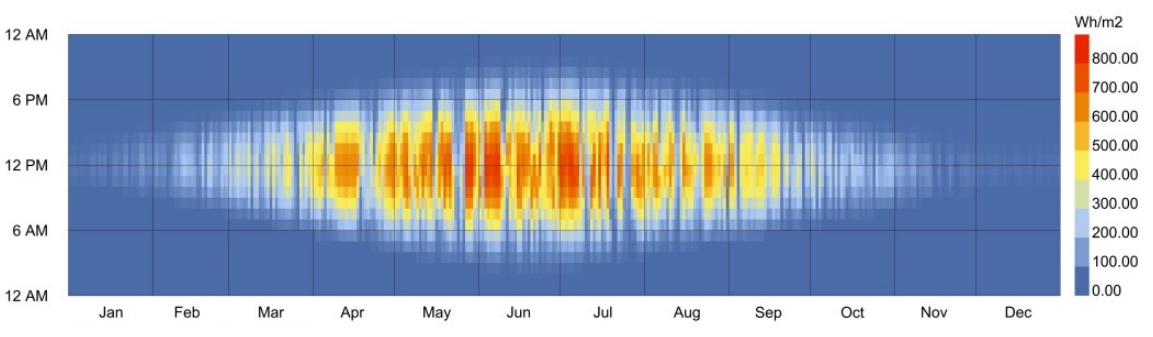








Global Horizontal Radiation for Brekstadbukta



Conclusion and Implications

In conclusion, our research demonstrates that installing BIPV on listed houses in Brekstad is highly worthwhile. The estimated production capacity can potentially cover the power consumption of a Norwegian household. However, considering the current technology, storing solar power for later consumption is not yet cost-effective, especially during the winter months when production is lower. Nevertheless, surplus power can be sold back to the grid, reducing electricity bills and contributing to mitigating climate change. It is important to note that our simulations did not account for windows, doors, or shading from surrounding structures. Further research can explore these factors for a more comprehensive analysis.

Wind Speed at Brekstad