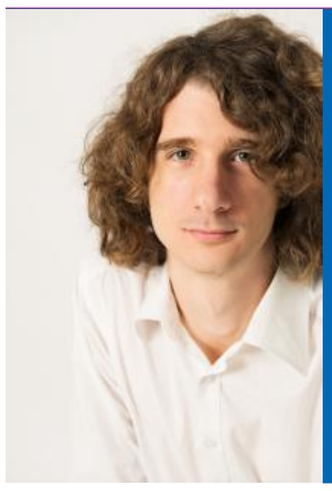

Development of a multi-criteria performance assessment framework for next-generation building-integrated PV

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Background

Steadily decreasing prices of PV applications open the possibility to spread the use of on-site renewable energy generation. The growing popularity of installing PV systems due to legislative requirements and sustainability raises new challenges especially in urbanized areas, for which building-integrated photovoltaics (BIPV) systems may offer solutions. Also new opportunities arise, thanks to emerging technologies such as thin-film PV, which brings the possibility to integrate additional functions and aesthetic design to on-site electricity generation. BIPV has the potential to drive the growing demand for renewable energy even further.

Fig. 1.: BIPV measurement facility at SolarBEAT measurement station

Many new BIPV concepts are being developed, including ventilated PV facades and roofs, semi-transparent PV windows, building elements with shapes that enhance PV yield, coloured PV with special spectral coatings, BIPV solar shading systems, etc. There is a need for performance prediction tools to support decision-making during product development and to ensure optimal market adoption of such innovative concepts.

Objectives

The goal of this PhD project is to support the development of innovative BIPV concepts by developing and applying a performance assessment framework, with building performance simulation taken as a starting point. Current capabilities will be critically analyzed and possibly extended to achieve the necessary multi-criteria approach that evaluates BIPV concepts at different levels (physical domains, spatial scales, modelling resolution) in relation to stakeholder needs in various use cases. The main tool in the evaluation method will be a virtual testbed that can investigate the performance of BIPV applications from various aspects.

Expected capabilities of assessment framework

- Analyse a given BIPV concept for better understanding of how it works and in which ways it affects building performance.
- Predict the performance of a building equipped with BIPV in order to optimize the characteristics of the building and the BIPV construction.
- Manage expectations and risks by robustness assessment based on robustness and uncertainty analysis to support decision making and marketing of BIPV products.

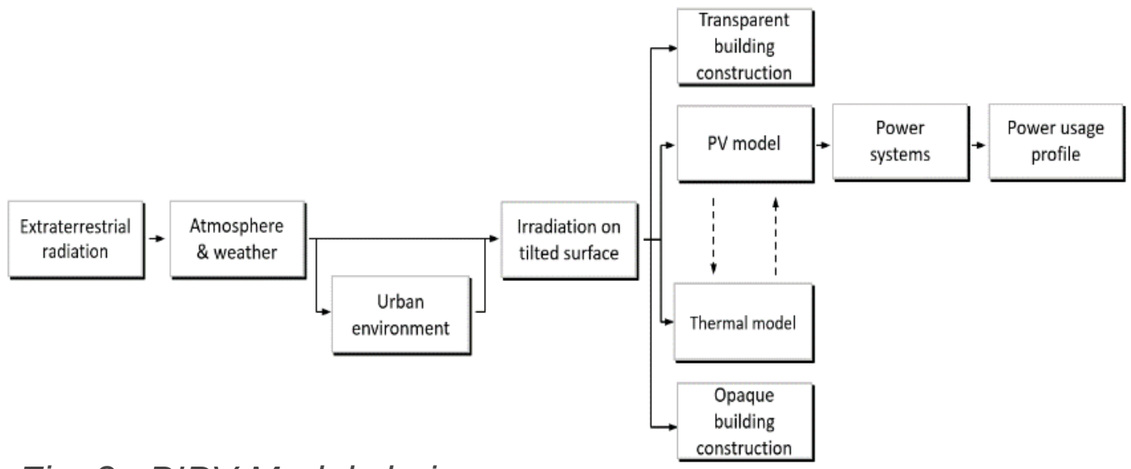

Fig. 2.: BIPV Model chain.