

# Open Source PhotoVoltaics Library for Systemic Investigations

Jovan Brkic<sup>1</sup> Muaz Ceran<sup>1</sup> Mohamed Elmoghazy<sup>1</sup> Ramazan Kavlak<sup>1</sup>  
Anton Haumer<sup>2</sup> Christian Kral<sup>1</sup>

<sup>1</sup>TGM Wien XX, College of Engineering, Austria, dr.christian.kral@gmail.com

<sup>2</sup>OTH Regensburg, Germany, anton.haumer@oth-regensburg.de

For the planning of photovoltaic power plants standard software tools are used. Most of these software tools use statistical solar data to determine the overall energy harvest of a photovoltaic plant over one year. The calculations rely on stationary location and ideal boundary conditions, e.g., constant ambient temperature. Even though, for example, shadowing may be considered by standard software, the investigation of untypical configurations and problems cannot be performed by such software, as most configurations cannot be changed by the user.

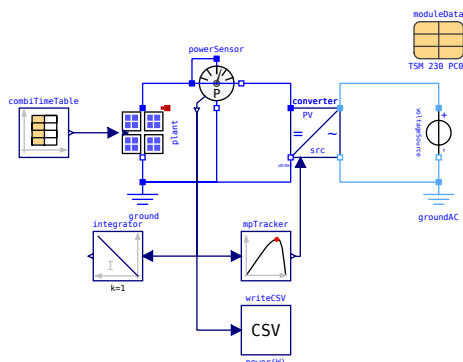
The presented PhotoVoltaics library was developed with the intention to provide a flexible framework for standard and non-standard problems. Particularly, the PhotoVoltaics library can be coupled with other Modelica libraries to perform systemic investigations.

An application library, PhotoVoltaics\_TGM, is provided as add-on, where measured data of two photovoltaic plants of the TGM in Vienna can be compared with simulation results. This add-on library serves as validation of the PhotoVoltaics library.

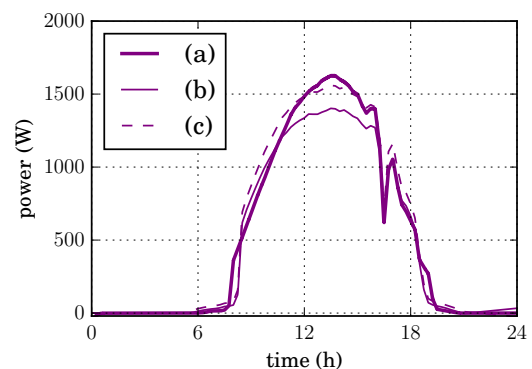
In the PhotoVoltaics library the following components are included:

- Photovoltaic (PV) components (cells, modules and plants)
- Converters (DC/DC, quasi static single and three phase, transient three phase)
- Diodes
- Analytic irradiance models (terrestrial, arbitrary sun location)
- Records of selected industrial module data sheets

Typical applications of the PhotoVoltaics library are systemic investigations which include photovoltaics. Since all photovoltaic components are equipped with a thermal heat port, the influence of temperature on the operational behavior may be investigated. Particularly, the library is capable of investigating of the total energy consumption and generation of alternative building concepts including interaction with the power grid.



Simulation model PV plant at TGM in Vienna



(a) simulated DC power, (b) measured AC power and (c) measured DC power of PV plant

The PhotoVoltaics library was developed during a Diploma project at the College of Engineering, TGM. The library is available at <https://github.com/christiankral/PhotoVoltaics>.