Simulation of Solar Cooling Systems

Polysun

- Combination solar thermal + heat pump + PV
- Component database
- World-wide presence, multi-language
- 12’000 active licenses (3’000 in teaching)

Andreas Witzig

- Electrical Engineer, PhD in Optoelectronics at ETH Zurich
- Solar Institute SPF in Rapperswil (2001)
- Spin-Off Vela Solaris (2003)
- Institute for Computational Physics (2015)
  Zürcher Fachhochschule ZHAW

ETH Eidgenössische Technische Hochschule Zürich

SPF Solartechnik Prüfung Forschung

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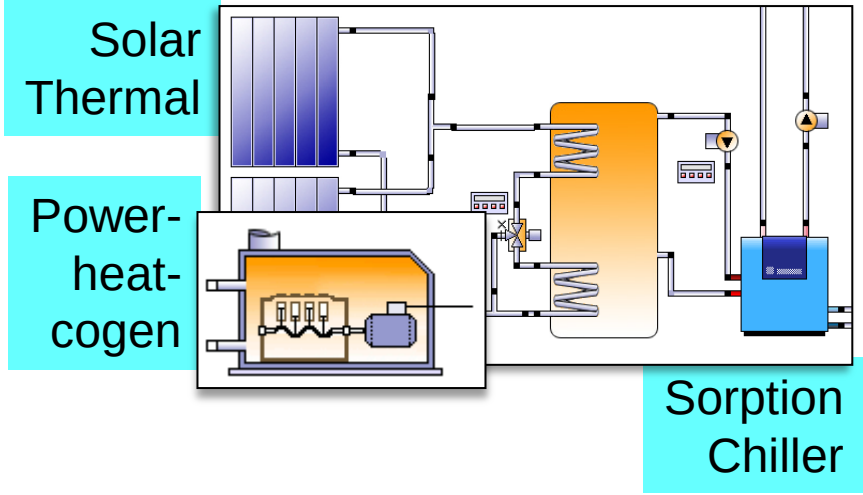
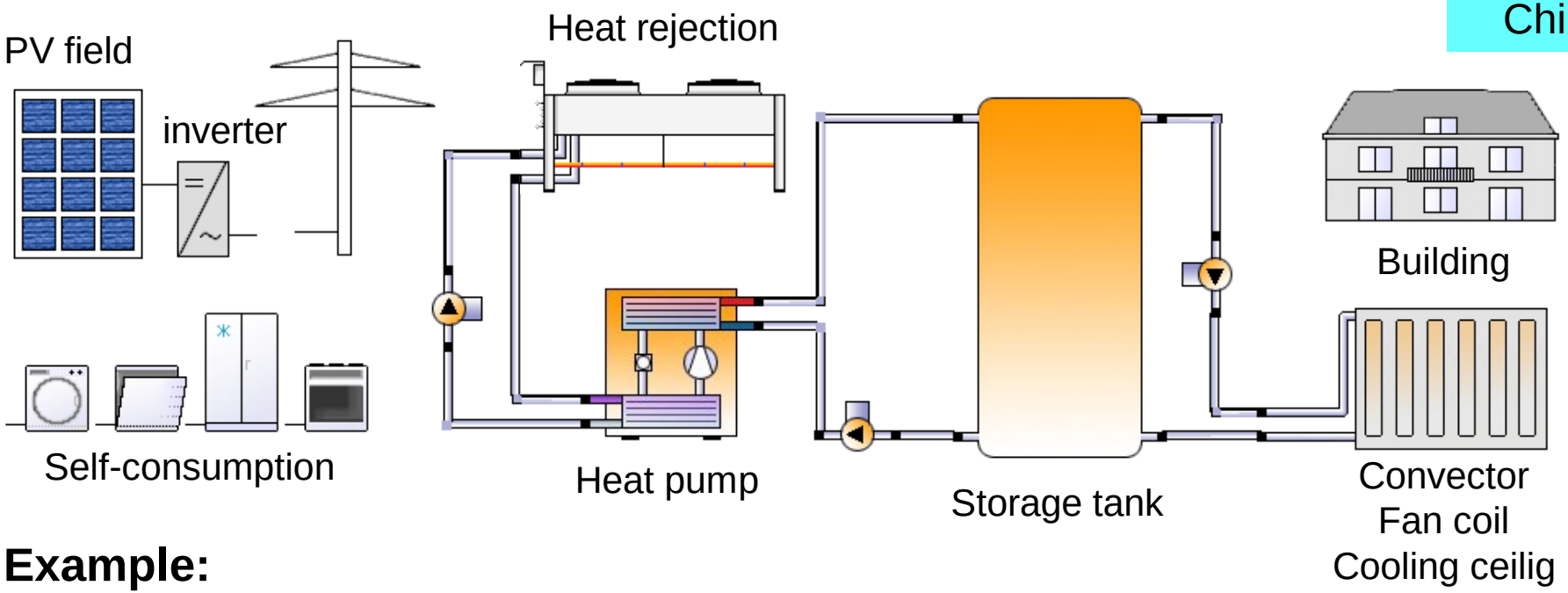
zh aw School of Engineering

Cooling and heating with PV & Compression Chiller





Example:

- Building 9m ×11.2m, 3 floors, low energy building
- Cooling in summer (T_{sp}=21°C) and heating in winter (T_{sp}=26°C)
- PV field assumed to cover the entire roof (82m^2)

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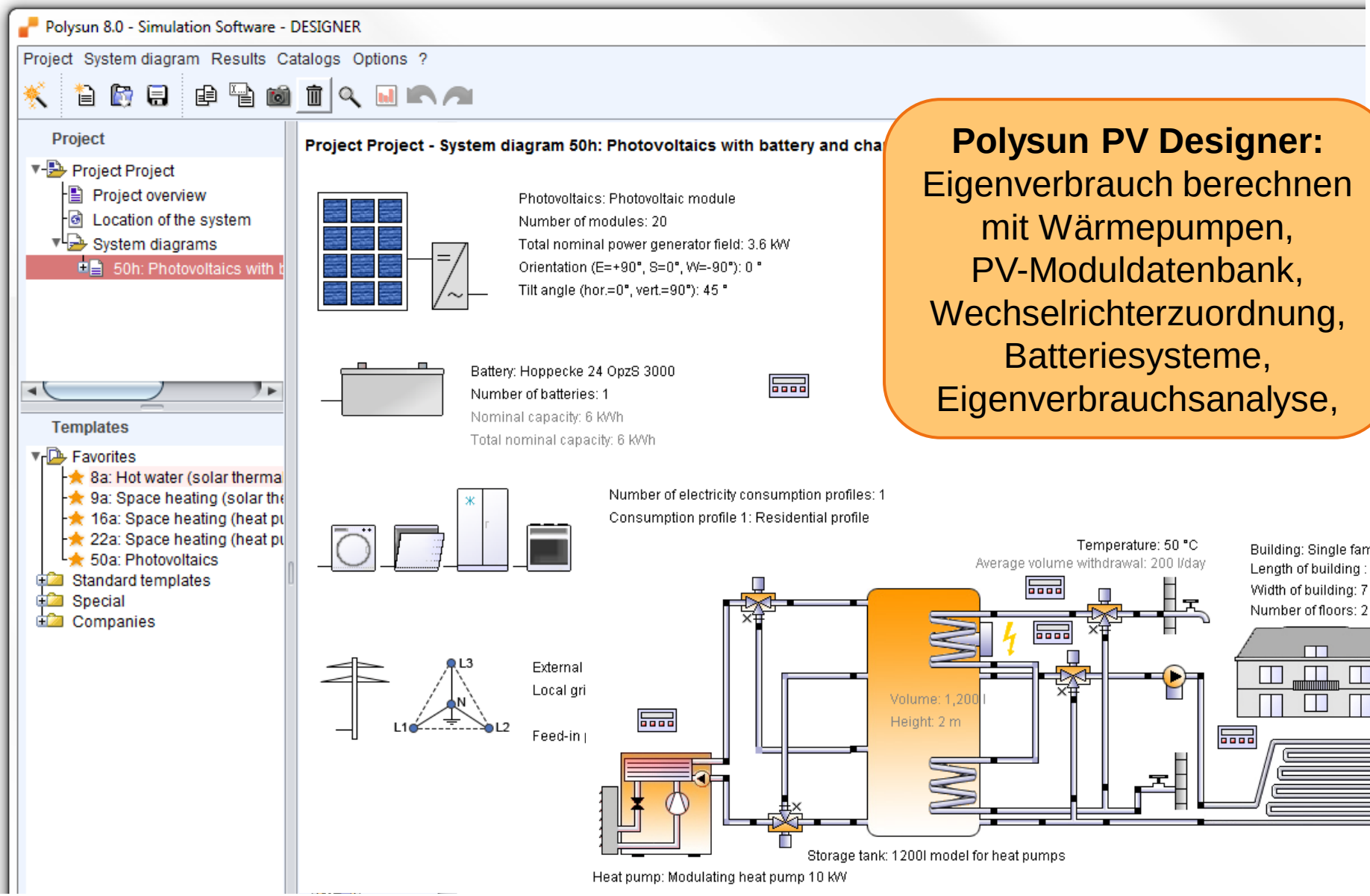

Polysun PV Designer:
Eigenverbrauch berechnen
mit Wärmepumpen,
PV-Moduldatenbank,
Wechselrichterzuordnung,
Batteriesysteme,
Eigenverbrauchsanalyse,

Results for cooling in winter and summer

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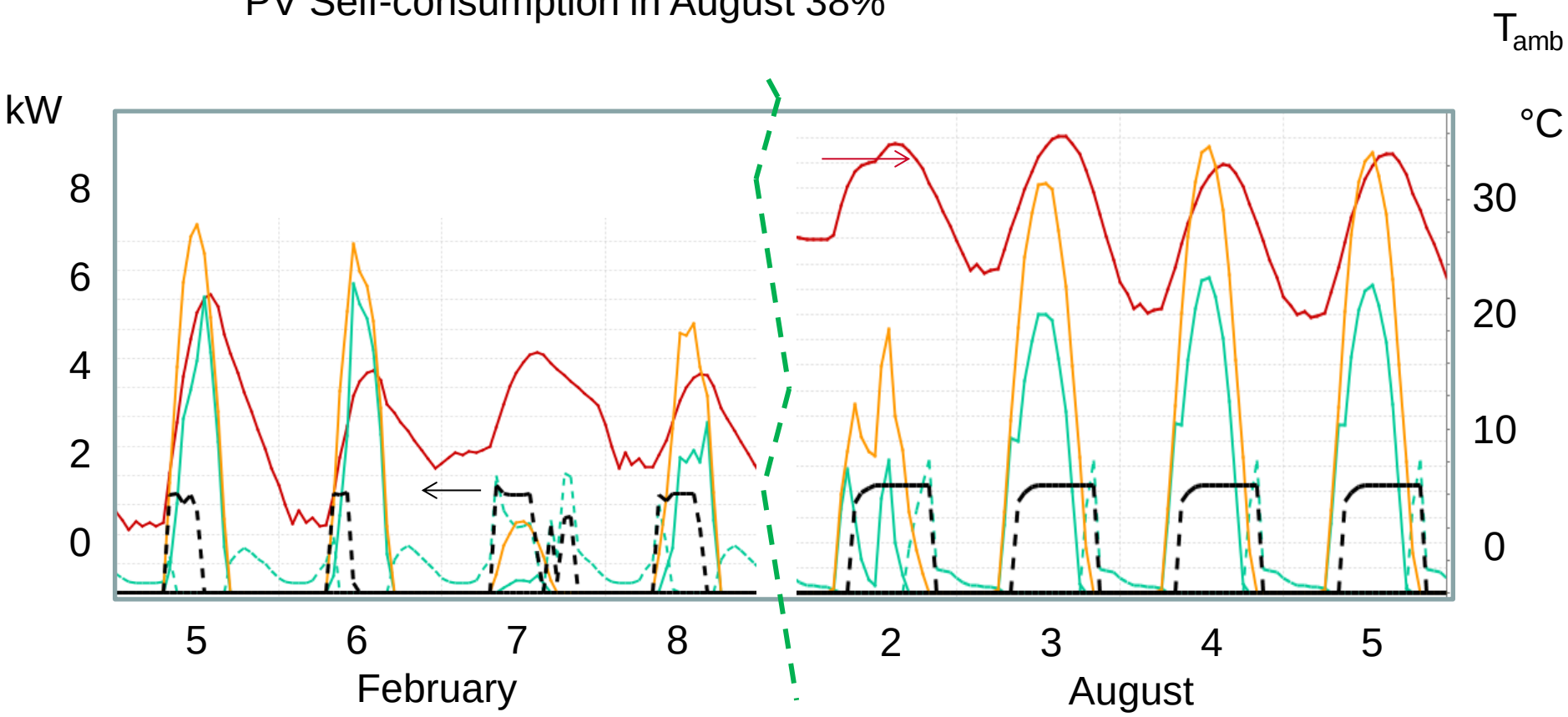
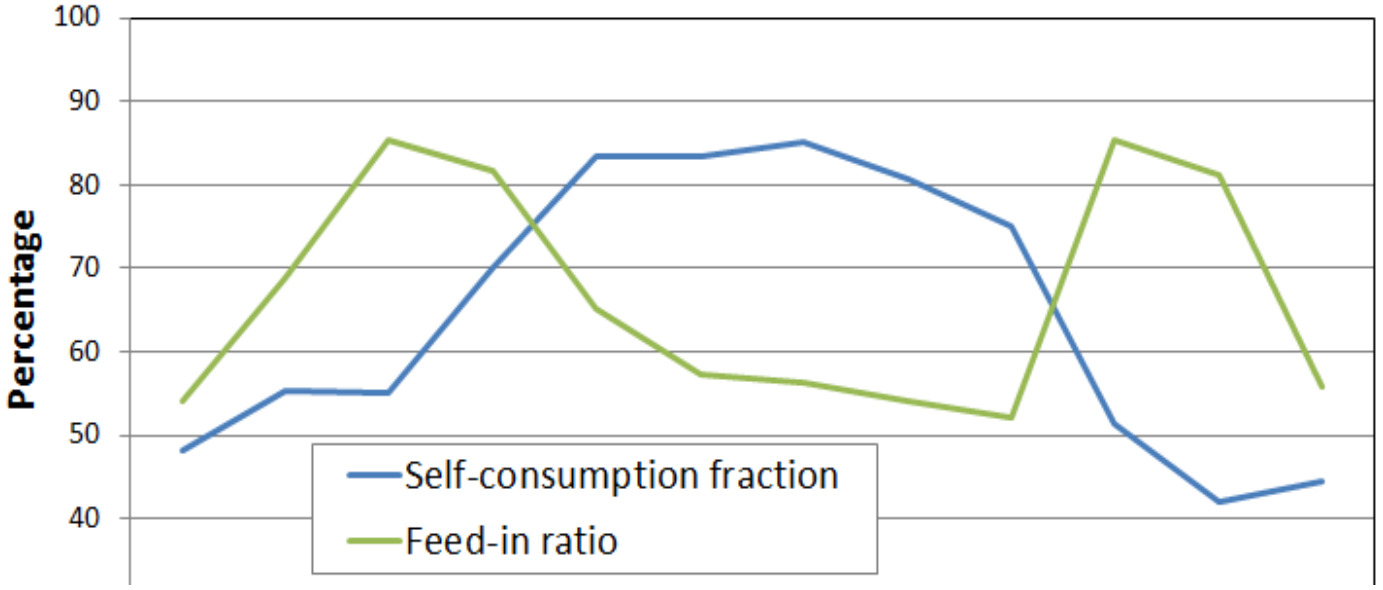
PV Self-consumption in August 38%

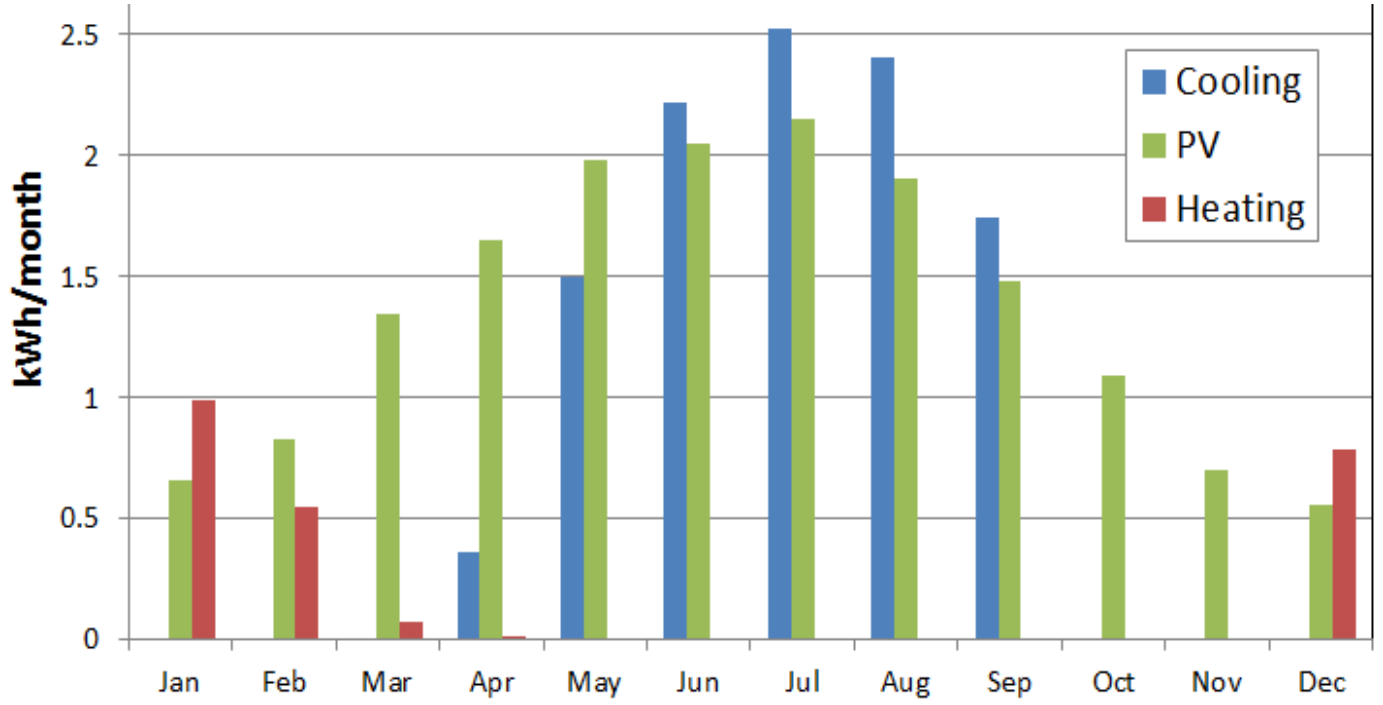


Outside temperature
Photovoltaic electric production
Electric power to (solid) and from (dotted) grid
Heatpump electric consumption

Rooftop
PV Installation
2° inclination

Location:
Rome, Italy





Various tilt angles

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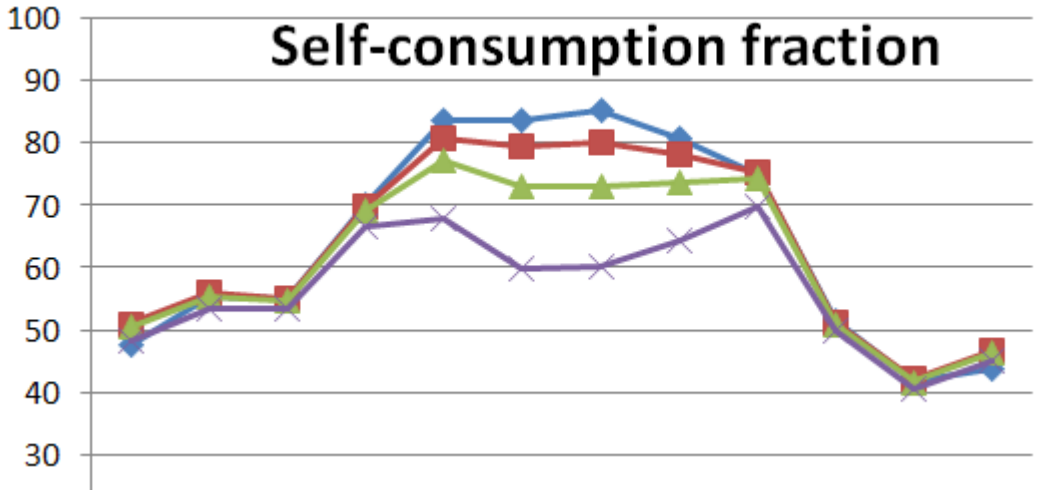
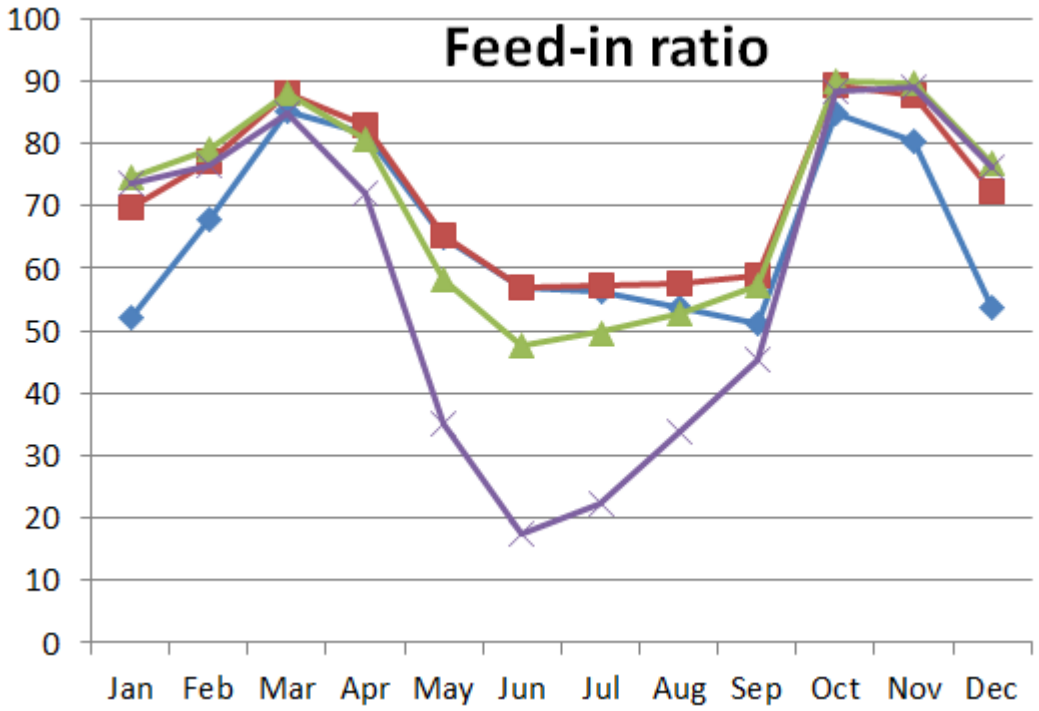


Paper presented at OTTI SAC in Rome

80m² PV,

Location:
Rome, Italy



Summary

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- Grid-coupled PV: optimize self-consumption fraction and feed-in ratio.
- Use for cooling in summer and heating in winter
- Including batteries is readily available
- Facade challenge: solar radiation incident angle in summer
- Locations in Europe: propose to use ~60° also in facades (which also can be used to provide shading in summer)

Outlook: Polysun GUI also for facade

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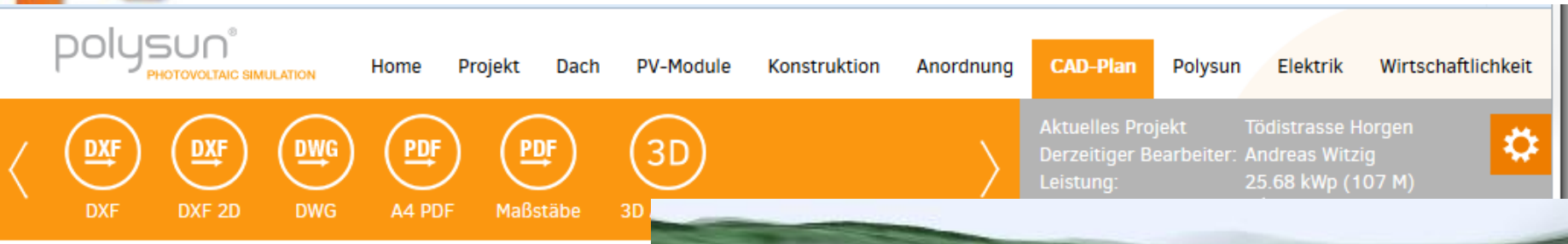

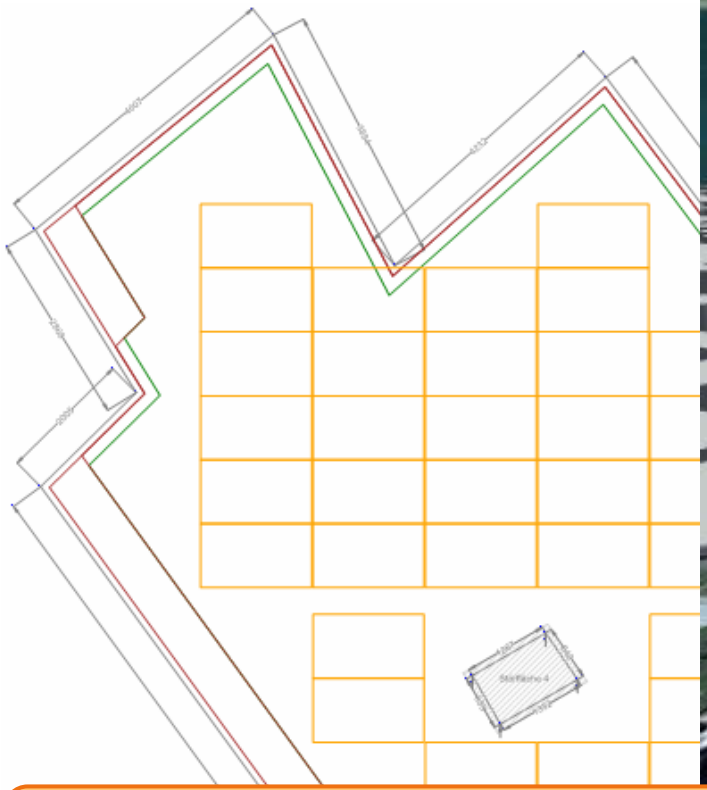

Polysun PV Constructor: Dachplaner, Statikberechnung, PV-Moduldatenbank, Wechselrichterzuordnung, Batteriesysteme, Eigenverbrauchsanalyse,