



Increasing the proportion of winter electricity through design optimisation of photovoltaic roof systems



Hartmut Nussbaumer*, Lona Tulinski, Roger Hiltbrand, Selina Pfyffer, Markus Klenk

Zurich University of Applied Science, SoE, Institute of Energy Systems and Fluid Engineering Technikumstrasse 9, 8401 Winterthur, Switzerland
*phone: +41 58 934 4799, *e-mail: hartmut.nussbaumer@zhaw.ch

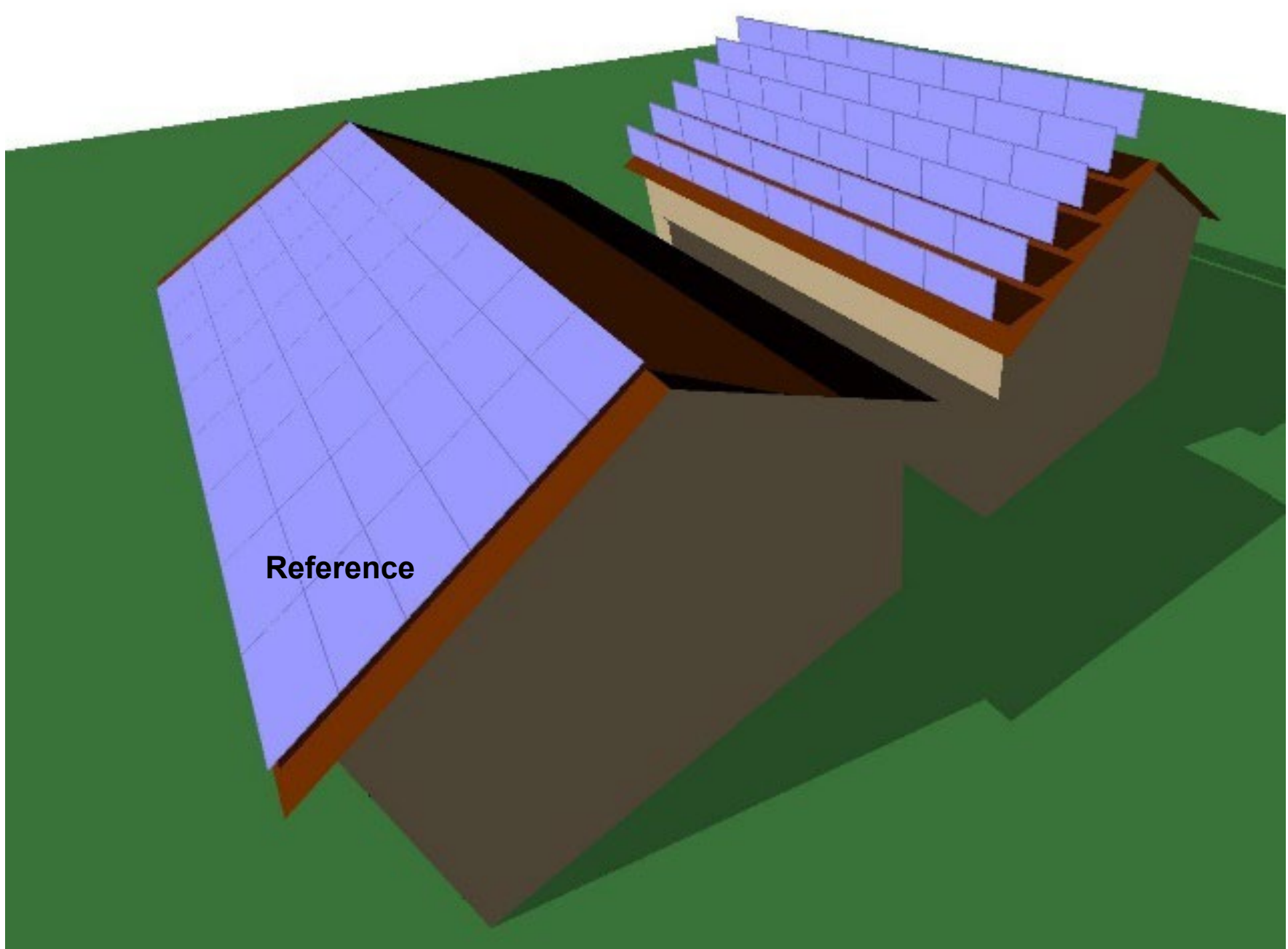
Motivation

- Seasonal change of energy yield of photovoltaic energy in production in high latitude areas
- Reducing the need for seasonal storage
- High irradiance in alpine regions compared to midland in the winter season
- Alternative to ground mounted alpine PV systems

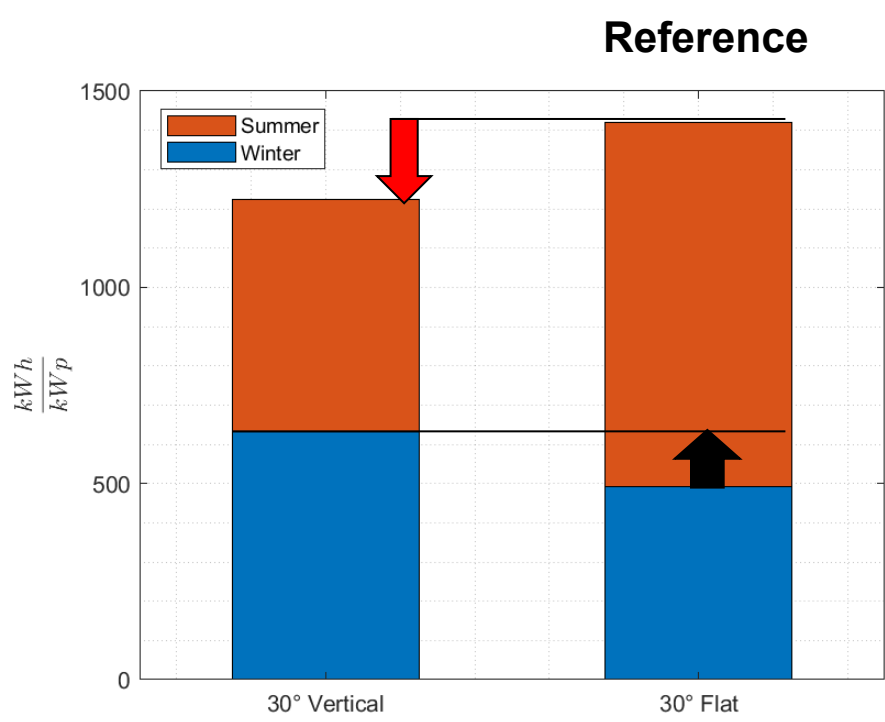
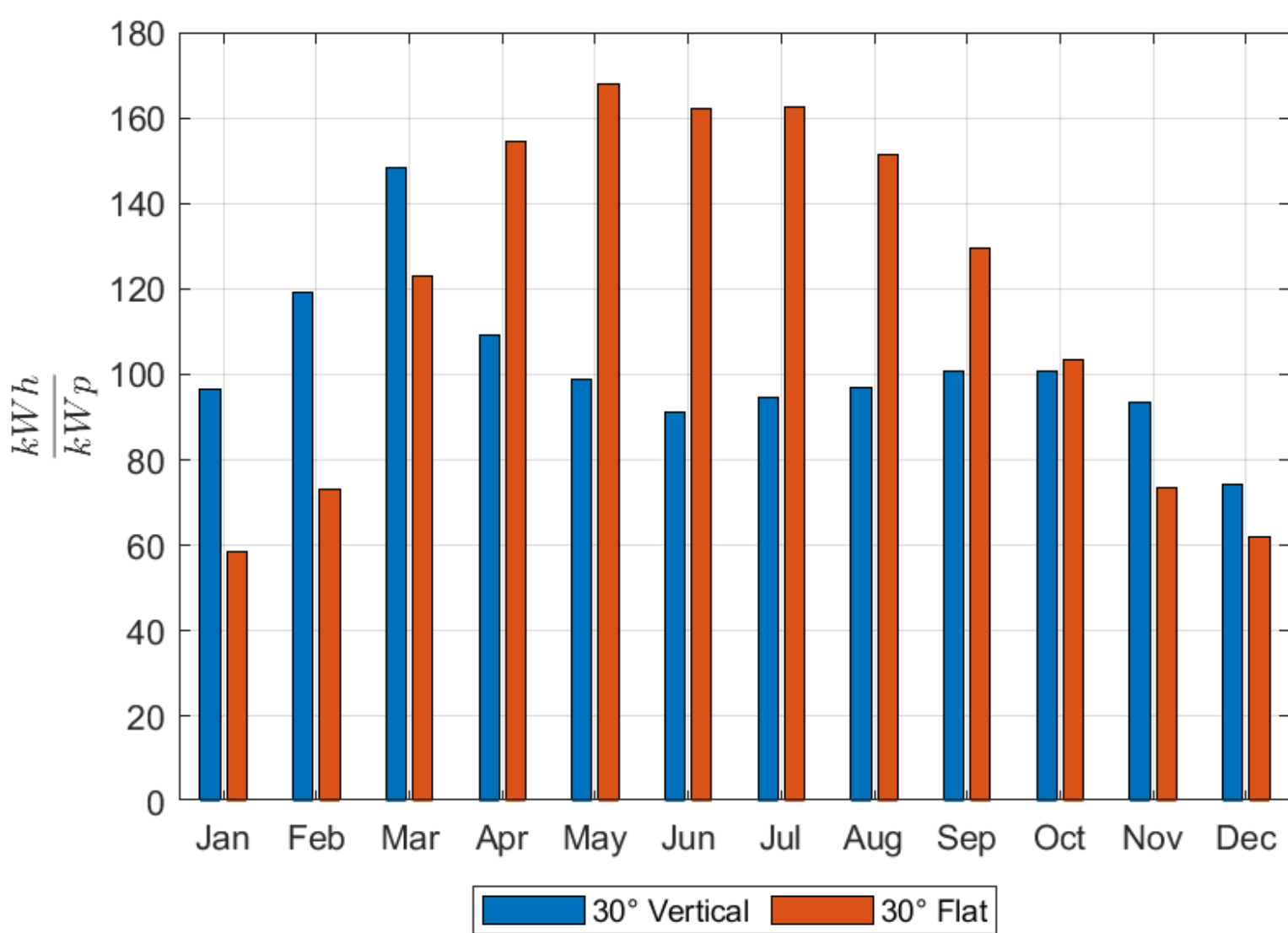
Pitched roofs

Modules orientated along the roof pitch

Elevated modules do not lead to module shading in snowy conditions



Specific energy yields



28% higher winter yields for vertical and 14% lower annual yields compared to reference

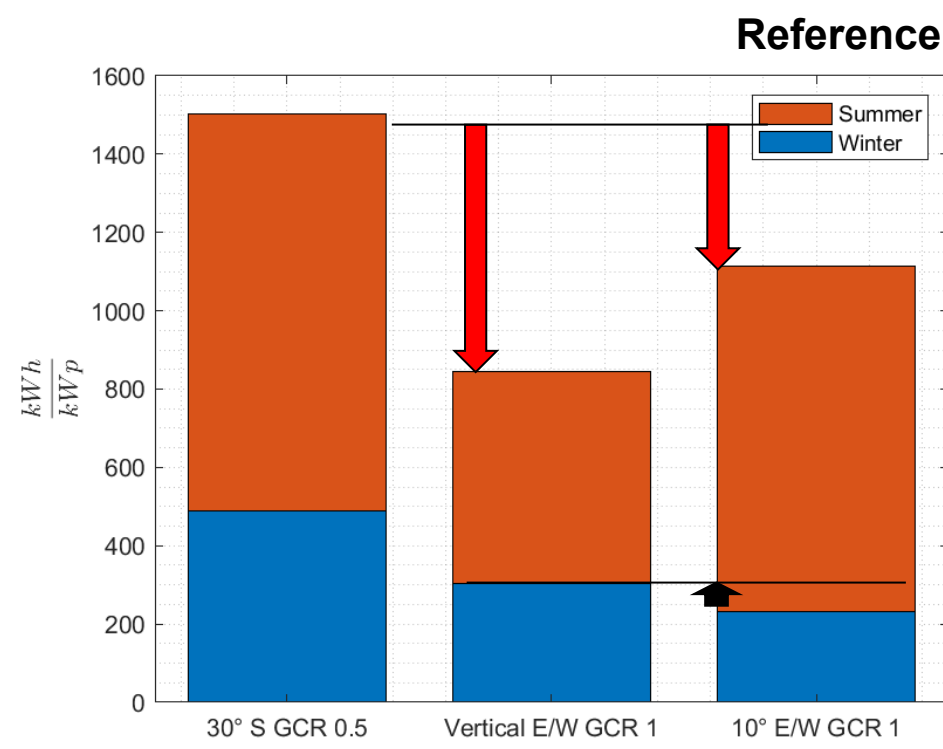
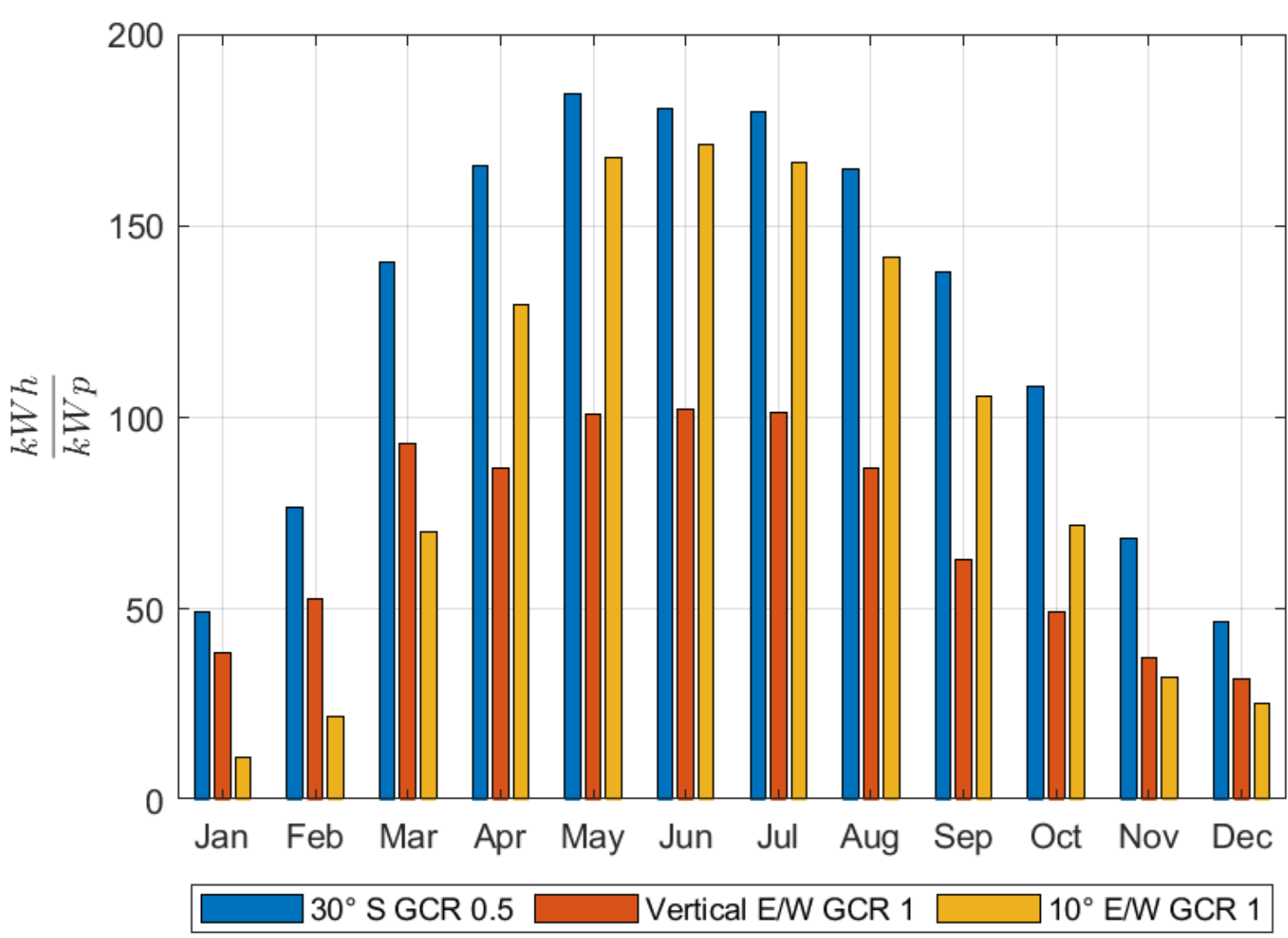
Conclusions

- Best option depending on
- Duration of snow period
 - Additional value of winter energy
 - Energy demand as a function of daytime
 - Shading of horizon and obstacles
 - Additional costs for mounting of modules with higher tilt angles
- Higher tilt angles up to vertical installation of modules in alpine regions can make economic sense

Flat roofs

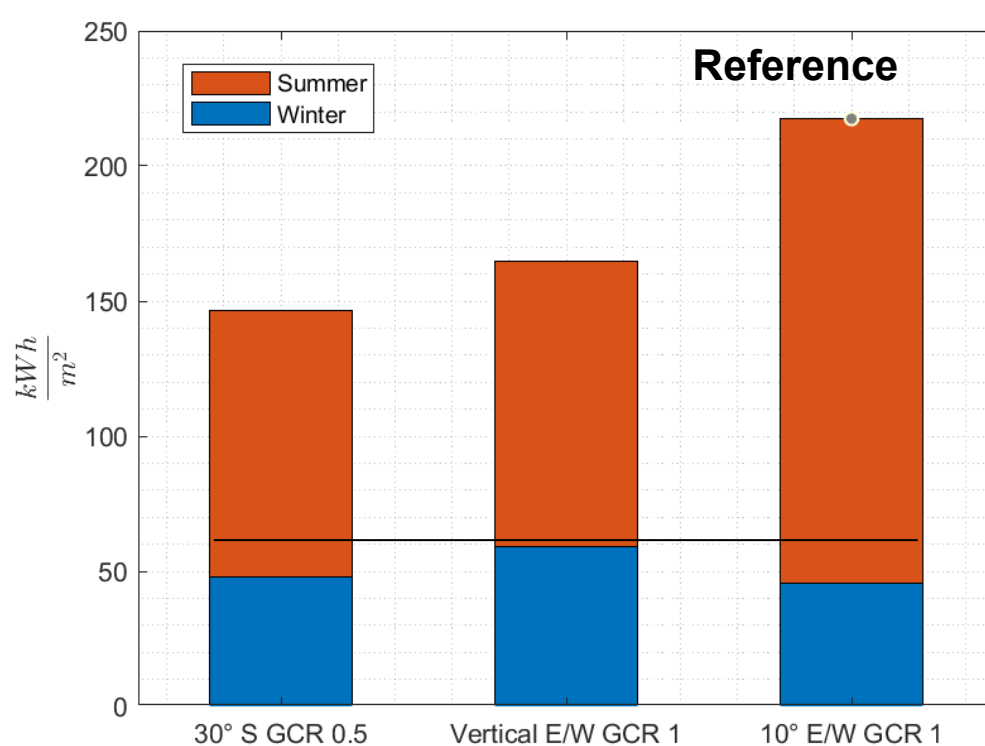
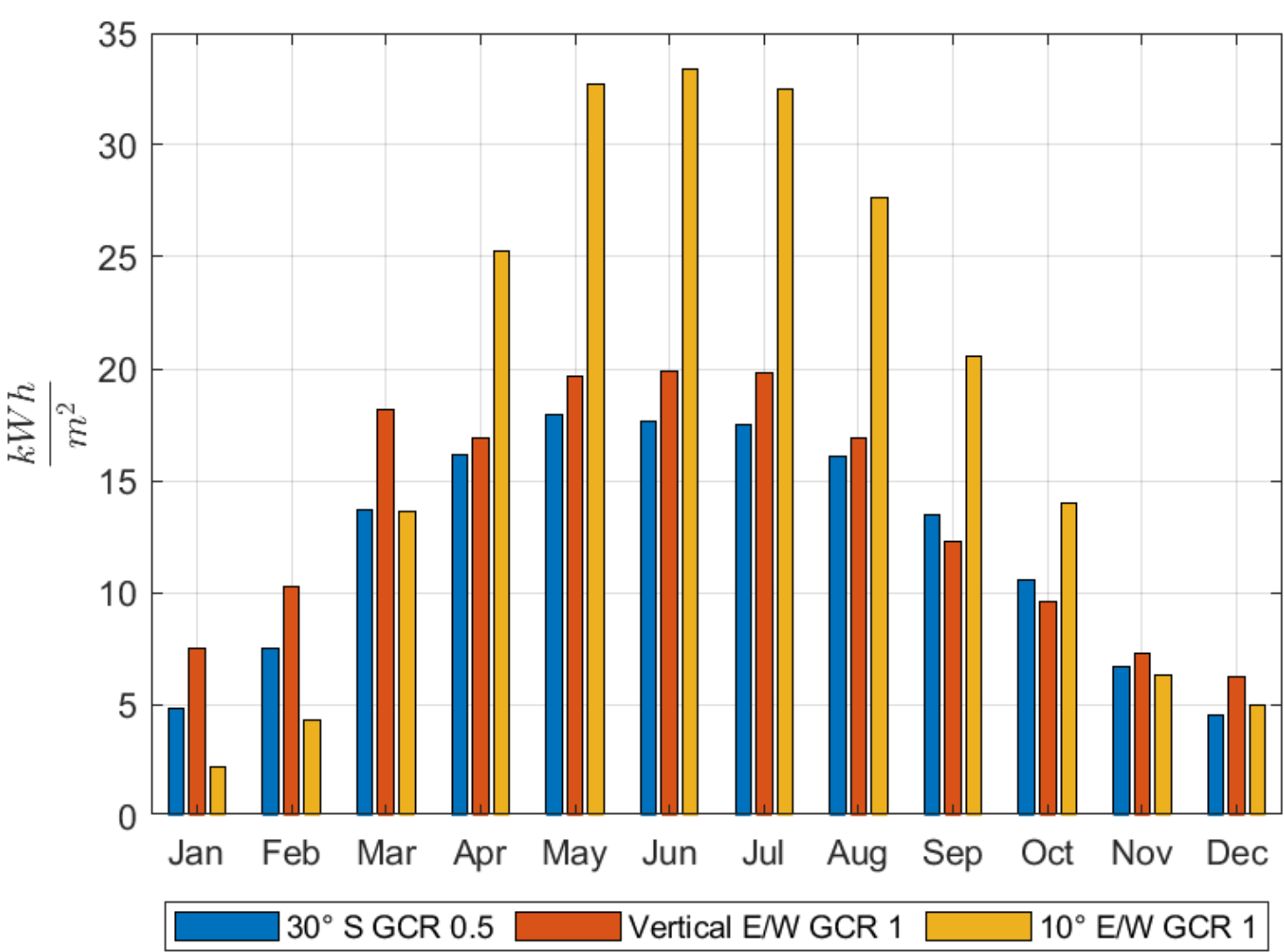
Reference east/west	South	East/west vertical
GCR 100%	GCR 50%	GCR 100%
monofacial	bifacial	bifacial
tilt angle 10°	tilt angle 30°	vertical
Elevation 0 m	Elevation 0.5 m	Elevation 0.5 m

Specific energy yields



- +28% higher winter yields for vertical installation compared to reference
- Lower specific annual yields

Energy yield per roof area



East/west orientated vertically mounted modules deliver the highest energy yield per area

Acknowledgement

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