



Posterprämierung Posters: remise des prix

Stefan Nowak, NET Nowak Energie & Technologie AG SA

21. Schweizer Photovoltaik-Tagung
21^e Congrès photovoltaïque suisse

Statistik **Statistique**

		2023	2022	2021	2020	2019	2018	2017	2016	2015	2014
Kategorien		31	27	25	29	36	25	29	28	27	42
A	Solarzellen	5	6	7	5	4	4	5	9	5	13
B	Module	2	2	1	3	4	0	3	1	3	6
C	PV-Gebäudeintegration	2	4	2	1	5	1	5	2	3	4
D	Wechselrichter und Speicherkonzepte	2	1	4	1	4	3	2	6	1	3
E	Innovative Anwendungen	7		2	5	3	0	0	0	0	4
F	Netz- und Systemintegration	2	2	2							
F alt	Ausbildung				0	0	0	0	0	0	1
G	Anlagen, Messungen, Erfahrungen	5	9	3	9	7	7	11	8	13	5
H	Software- und Simulationstools	5	1		2	4	5	3	0	2	5
J	Umweltaspekte und Recycling										
K	Digitalisierung in der Energiewirtschaft	1	1	2							
L	Markteinführung und Rahmenbedingungen		1	2	3	5	5	0	2	0	1

Jury



Thomas Biel

Hartmut Nussbaumer

Stefan Nowak

Stefan Oberholzer

Peter Cuony

Kriterien Critères

Inhalt

Innovationswert

Gestaltung

Contenu

Valeur d'innovation

Conception





Preis «Anwendungsorientierte Arbeiten»
Prix «Travaux Orientés vers la Pratique»

Teilnahme an der 22. Schweizer PV Tagung
Participation au 22e Congrès PV Suisse

Lausanne, 21.-22. März Mars 2024

21. Schweizer Photovoltaik-Tagung 21^e Congrès photovoltaïque suisse

Preis anwendungsorientiertes Poster Prix poster orienté sur la pratique

Unter Würdigung der Kriterien «Inhalt», «Innovationswert» und «Gestaltung» hat die Jury folgendes Poster ausgezeichnet. En reconnaissance des critères « contenu », « valeur d'innovation » et « conception », le jury a récompensé le poster ci-dessous.

Titel titre
Performance comparison of Power Optimizer versus String Inverter Systems

Autor & Institut auteurs & institut
C. Allenspach, F. Baumgartner
ZHAW School of Engineering, IFEF Winterthur

Bern, 21.3.2023

Stefan Nowak
Leiter der Jury
Directeur du jury

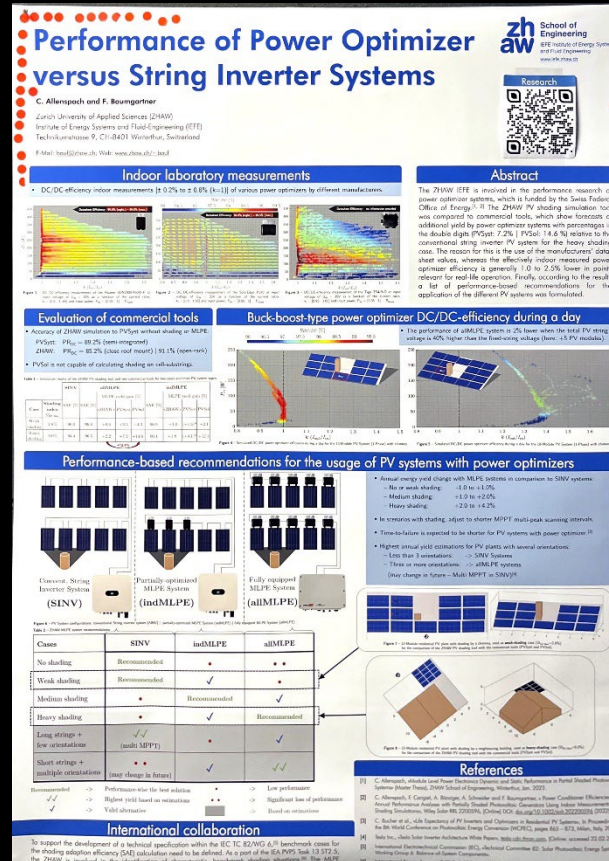
Stefan Oberholzer
Leiter Forschungsbereich PV und CSP - BFE
Chef du domaine Recherche PV et CSP - OFEN

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energieschweiz



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Preis «Wissenschaftliche Entwicklungen» Prix «Développements Scientifiques»

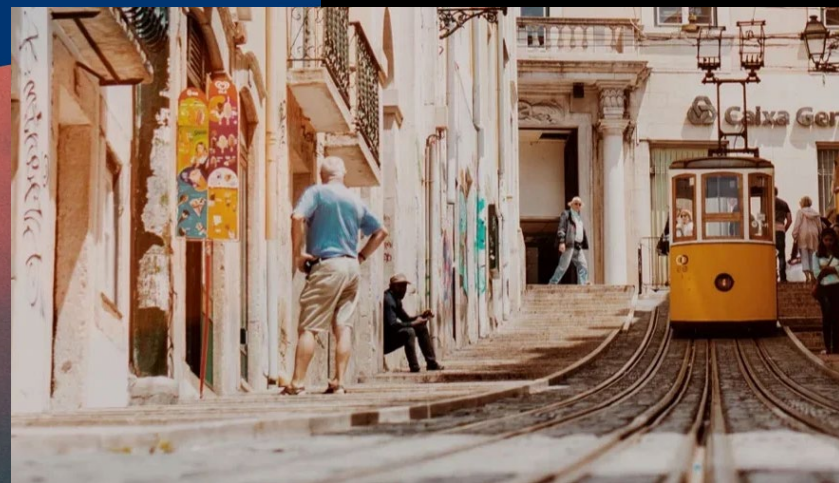
18 — 22
September
2023

Lisbon
Portugal

CCL
Lisbon
Congress
Centre

EU
PVSEC
2023

40th European
Photovoltaic Solar Energy
Conference and Exhibition



21. Schweizer Photovoltaik-Tagung 2q^e Congrès photovoltaïque suisse

Preis wissenschaftlich-technisches Poster Prix poster scientifique-technique

Unter Würdigung der Kriterien «Inhalt», «Innovationswert» und «Gestaltung» hat die Jury folgendes Poster ausgezeichnet. «reconnaissance des critères « contenu », « valeur d'innovation » et « conception », le jury a récompensé le poster ci-dessous.

Titel titre
Effect of satellite-derived insolation data on the accuracy of Performance Ratio Estimate's

Autoren & Institute auteurs & instituts
E. Özkalay, A. Virtunani, A. Fairbrother, A. Skoczek, G. Friesen, C. Ballif
SUPSI-DACD-ISAAC

Bern, 21.3.2023

Stefan Nowak
Leiter der Jury
Directeur du jury

Stefan Oberholzer
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University of Applied Sciences and Arts
of Southern Switzerland

21. Nationale
Photovoltaik-Tagung 2023

Institute for Applied Sustainability to the Built Environment

Effect of satellite-derived insolation data on the accuracy of Performance Ratio Estimates

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MOTIVATION

- Insolation sensors to measure received solar resources are not widely used in residential (or commercial/industrial) installations. For larger systems, these sensors are frequently reported to lack maintenance or regular recalibrations. Data from local meteorological ground stations are valuable and accurate since the instruments are usually well-maintained, but they are sparsely distributed and hence not a suitable data source for many PV systems.
- For these reasons, PV systems' short- and long-term performances have often been analyzed using satellite-derived insolation data. Despite the fact that higher uncertainties are associated with satellite-derived insolation data, no studies have been conducted to quantify this impact when assuming PV plant's performance (PR).

This work quantifies the accuracy of satellite-derived insolation (open-source and paid service) and then understands the impact of satellite-derived insolation data on the accuracy of PR estimates. In order to do that, ground-measured insolation data and PR time series computed using ground-mounted sensors are used as benchmarks.

GROUND-BASED AND SATELLITE-DERIVED DATA

	Ground	CAMS	Solargis
Instrument	Pyranometer CM13	Satellite (open-source)	Satellite (paid-service)
Time-step	1 minute	1 minute	5 minutes
GHI	✓	✓	✓
DHI	✓	✓	✓
DNI	✓	✓	✓
G _{tot}	✓	✓	✓

Table 1: Ground-based and satellite-derived insolation monitoring systems.

RESULTS & DISCUSSION

Uncertainty of Satellite-Derived Data

Fig. 1 shows that Solargis GHI and G_{tot} data have better precision (lower RMSE) and accuracy (lower MBE) than CAMS data. The precision of both satellite-derived data (RMSE) improves with lower temporal resolutions for both GHI and G_{tot}.

The uncertainty of satellite (G_{CAMS}) data was calculated using the approach in the report of IEC PVPS Task 16 [1] (Fig. 2). The uncertainty of the pyranometer is 2.7% (k=2) at 1000 W/m², considering the pyranometer specifications, calibration procedure, secondary calibration, maintenance, measurement, and environmental conditions [1].

- The UC of G_{tot} decrease significantly with longer temporal intervals as some errors cancel each other out, similar to RMSE.
- Solargis G_{tot} has, on average, 1.8% lower uncertainty than CAMS G_{tot} for all temporal resolutions, except for the yearly resolution (0.7%).

Uncertainty of Performance Ratio (PR)

The uncertainty of PR was calculated by propagating the uncertainties of G_{tot}, P_{in} by Psan IIB at SUPSI (PV-Lab1.6k, k=2, spectrum corrected [2]) and the outdoor P_{max} by maximum power point tracker (1.74%, k=2, incl. uncertainty of tracker [3]) (see Table 4).

- P_{in}/P_{max} has about 1.7% lower uncertainty than P_{in}/P_{max} for all temporal resolutions, except for the yearly temporal resolution (0.6% lower).
- The uncertainties of monthly and yearly PR_{long-term} are 1.1% and 0.3% higher than the best case (3.6%, uncertainty of PR_{long-term}), respectively.

CONCLUSION

- Monthly and yearly PR values with an uncertainty below 5% can be obtained using satellite-derived insolation data without having to deal with regular calibration and maintenance of an on-site pyranometer to check general status of a PV system. However, there is a trade-off (lower cost and time vs accuracy).
- Depending on the purpose and requirements of use, one of the appropriate satellite-derived data sources (open-source or paid service) or ground-based measurement options can be preferred.
- Although daily PR has higher uncertainty than monthly PR (8.2% vs 4.7%), since it has about thirty times more data points, the uncertainty arising from analysis to compute long-term performance change (PLR, %/year) may be less. This trade-off will be investigated.

Schweizerischer Bundesrat
Confédération suisse
Confederaziun Svizra
Confederaziun svizra

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References:
 [1] J. A. McInnes et al. (2018), doi: 10.21105/iec.00884
 [2] J. A. McInnes et al. (2017), doi: 10.4230/TPVPS201701480.1.1
 [3] J. A. McInnes et al. (2018), doi: 10.4230/TPVPS201801480.1.1
 [4] J. A. McInnes et al. (2018), doi: 10.4230/TPVPS201801480.1.1

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A wide-angle photograph of a large audience seated in a modern conference hall. The audience is composed of men and women of various ages, many wearing green lanyards. They are seated at long white tables with laptops and water bottles. The room features blue ambient lighting along the walls and ceiling. The text 'Publikumspreis' is overlaid in white at the top, and 'Prix du public' is overlaid in yellow in the center.

Publikumspreis

Prix du public

Im Tool werden Strahlungsdaten mit Ausschussabieten verschneitten, um die

Ausschlussgebiete entfernen

RV-Anlagen können nicht auf kalte Oberflächen geklebt werden. Dem Grunde

Die Basis des Stahlschmelztes ist die Metanorm. An 46 Teststandorten wurden mit

1. Zuerst wird der relative PV-Ertrag abhängig von Globalstrahlung (GHI) und Höhe

[Illegible text]



¹ *European Commission*, 2020. Analyse Strukturzusammenhangs CH (EU). Schlussbericht. https://ec.europa.eu/economy_finance/sites/default/files/2020-06/analyse_strukturzusammenhangs_ch_eu.pdf.

² Bundesgesetz über dringliche Massnahmen zur kurzfristigen Bereitstellung einer

* Remund, J., Albrecht, E., & Stöckelberger, D. (2019). Das Schweizer Py-Potential basierend auf jedem Gebäude.

Photocatalytic Synthesis of Red Dye/Black. 2227

[†]photovoltaik.at (Schweiz: Wasserstrom.net/zwiss, Ausgabe 10-2002).



Herzlichen Glückwunsch !
Félicitations cordiales !