



HAL
open science

A Study of the Superposition of a Hybrid PV/CPV Utility-Scale Power Plant

Philippe Camail, Bruno Allard, Maxime Darnon, Charles Joubert, Christian
Martin, Joao Pedro Trovao

► **To cite this version:**

Philippe Camail, Bruno Allard, Maxime Darnon, Charles Joubert, Christian Martin, et al.. A Study of the Superposition of a Hybrid PV/CPV Utility-Scale Power Plant. 17TH INTERNATIONAL CONFERENCE ON CONCENTRATOR PHOTOVOLTAIC SYSTEMS (CPV-17), Apr 2021, Freiburg (Allemagne), Germany. hal-04052847

HAL Id: hal-04052847

<https://hal.science/hal-04052847v1>

Submitted on 30 Mar 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

A Study of the Superposition of a Hybrid PV/CPV Utility-Scale Power Plant

P. Camail^{1,2}, B. Allard¹, M. Darnon², C. Joubert¹, C. Martin¹ and J. Trovao³

(1) Laboratoire Ampère - CNRS UMR 5005 | (2) LN2 / 3iT - CNRS UMI 3463 | (3) Université de Sherbrooke

Objectives & Issues

- Cloud passages suppress CPV energy production.
- Inverters enter standby mode when input voltage <200V
- It takes about 1min to start inverters
- ➔ **What is the impact of inverter start-up time on CPV systems energy production?**
- ➔ **Can we reduce this impact by hybridizing CPV systems with flat panel PV?**

Approach

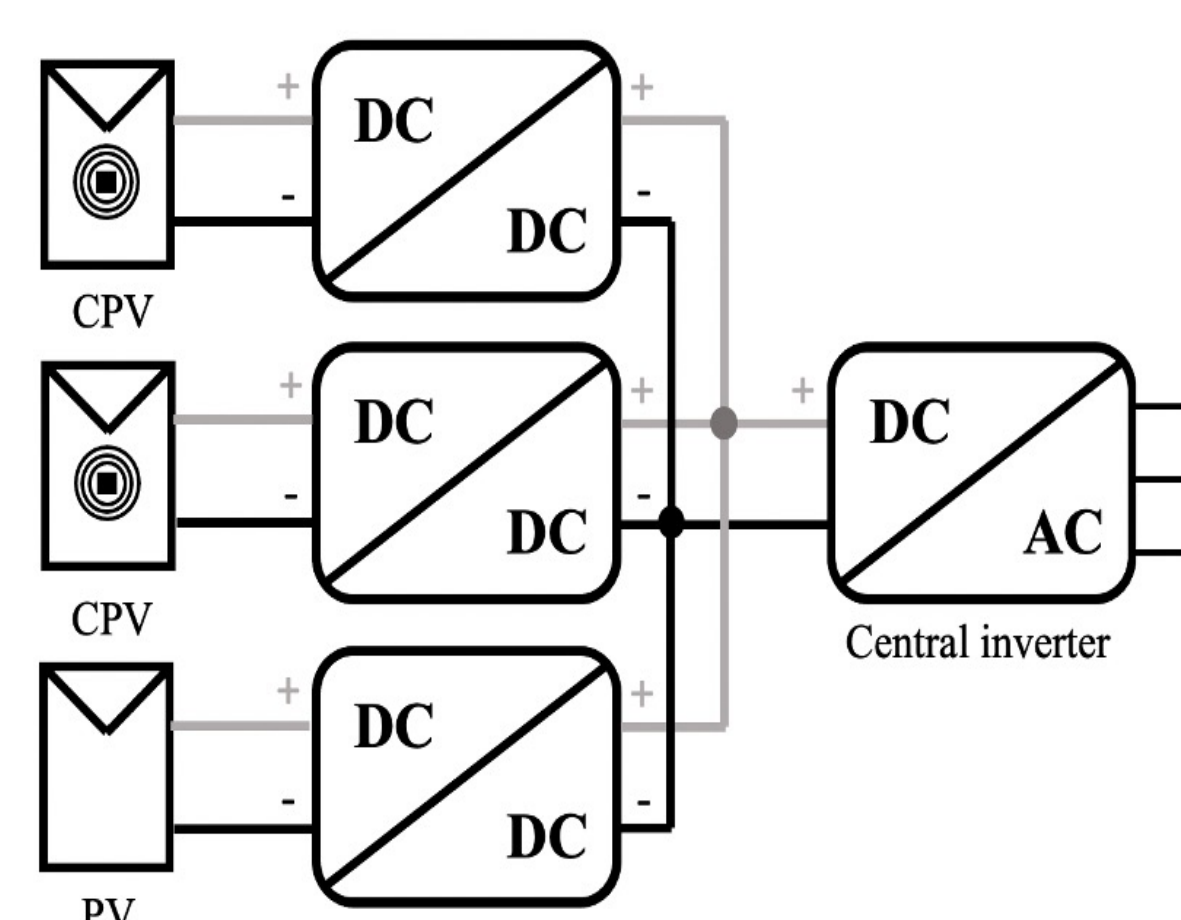
Data from U. Sherbrooke CPV park (8 trackers – 240kW)

Most favorable condition for PV / CPV hybridization

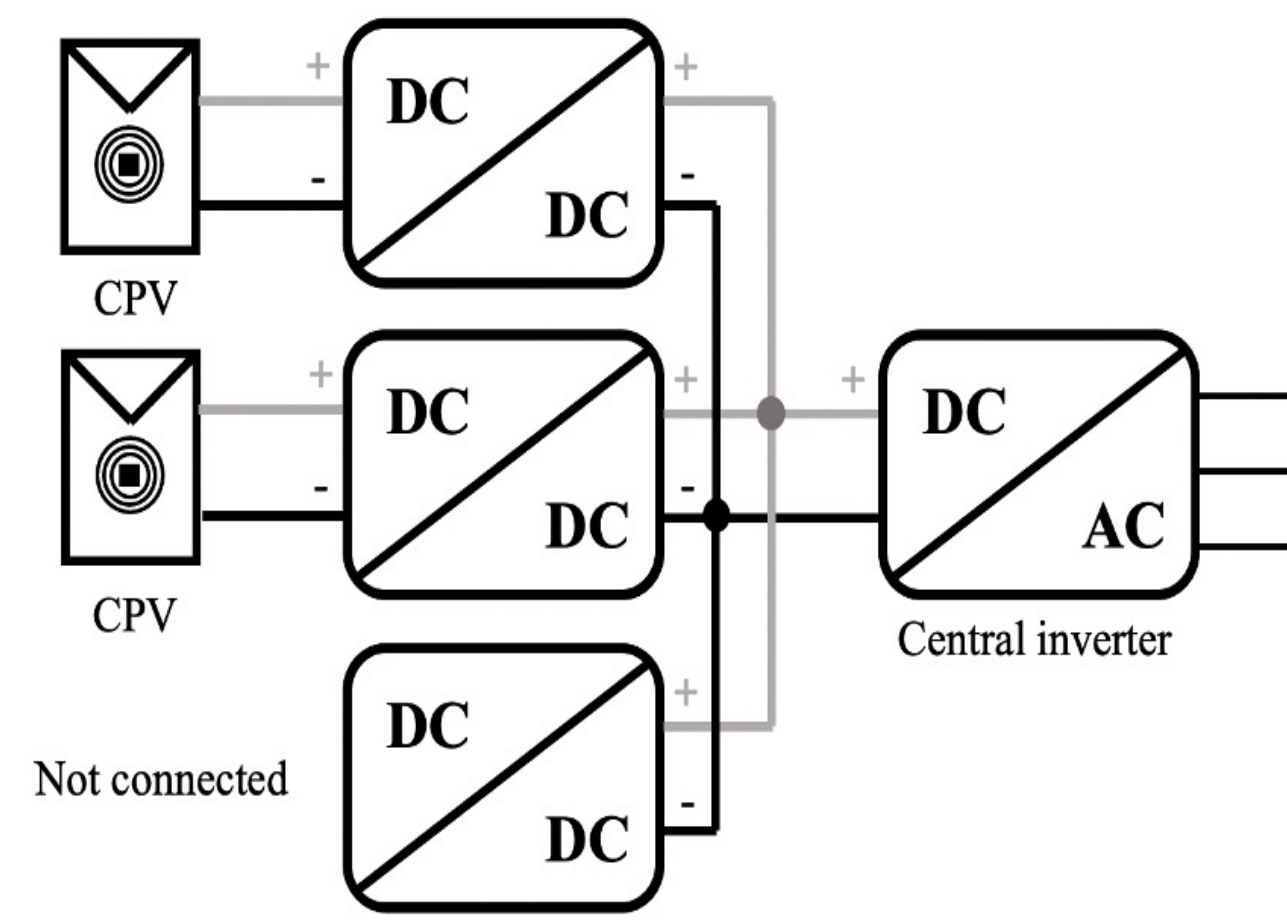
➔ Days with intense DNI drops but a non-zero GNI



Hybrid inverter



Full-CPV inverter



Results

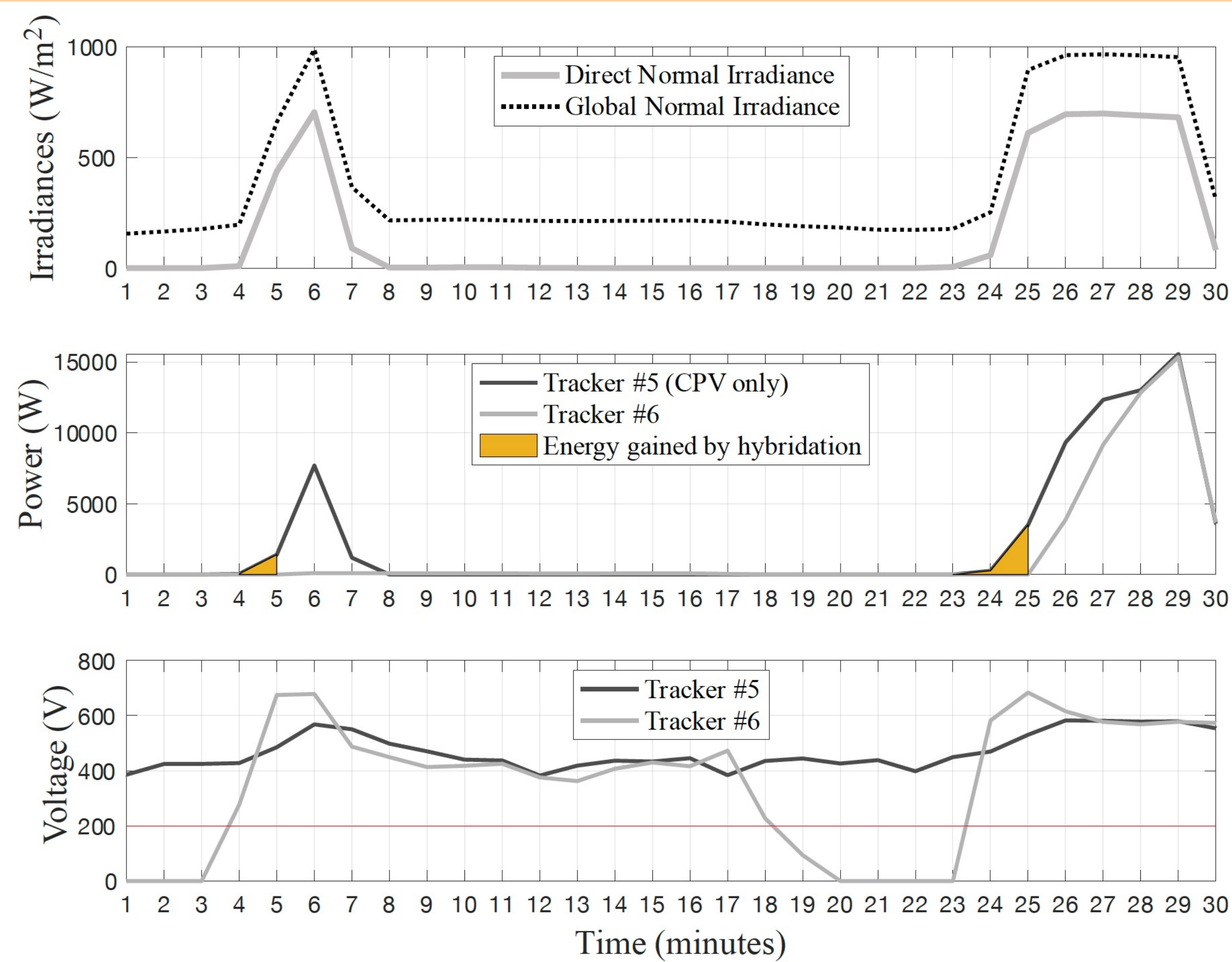


Fig.1 GNI and DNI (top), power of trackers #5 and #6 (middle) and voltage across one input of the corresponding inverters (bottom), the red line corresponds to the trigger voltage of the inverter

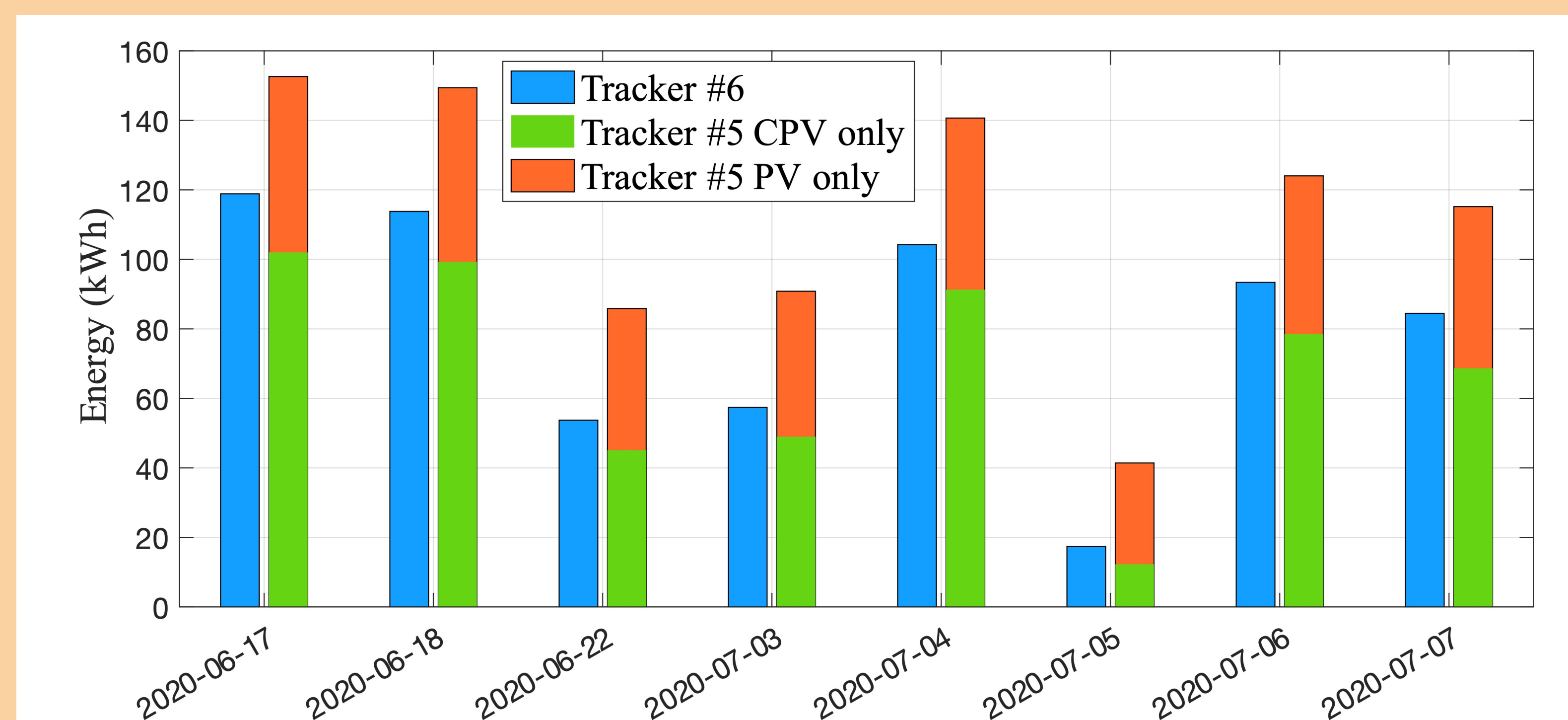


Fig.2 Energy yielded by trackers #5 and #6 during 8 days with intense DNI drops

Full-CPV inverter ➔ voltage drops to 0V twice
Hybrid inverter ➔ PV panels maintain >200V all day long

➔ **Gain of energy (yellow region in fig. 1)**

Over a 8-day period: gain of hybridization is below tracker to tracker uncertainty

➔ **No significant improvement of energy production**

Conclusion

- **Hybridizing PV and CPV avoids latency due to inverter start-up time**

but

- **Energy gain is below tracker to tracker**

➔ **Little economic interest of hybridizing PV/CPV**

Work is in progress to generalize this to other regions

[1] Yamada, Noboru, Hirai, Daiki, "Maximization of conversion efficiency based on global normal irradiance using hybrid concentrator photovoltaic architecture", Progress in Photovoltaics: Research and Applications, 2006.

[2] Algora, Carlos, Rey-Stolle, Ignacio, Handbook of Concentrator Photovoltaic Technology, 2016.

Acknowledgements

