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

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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

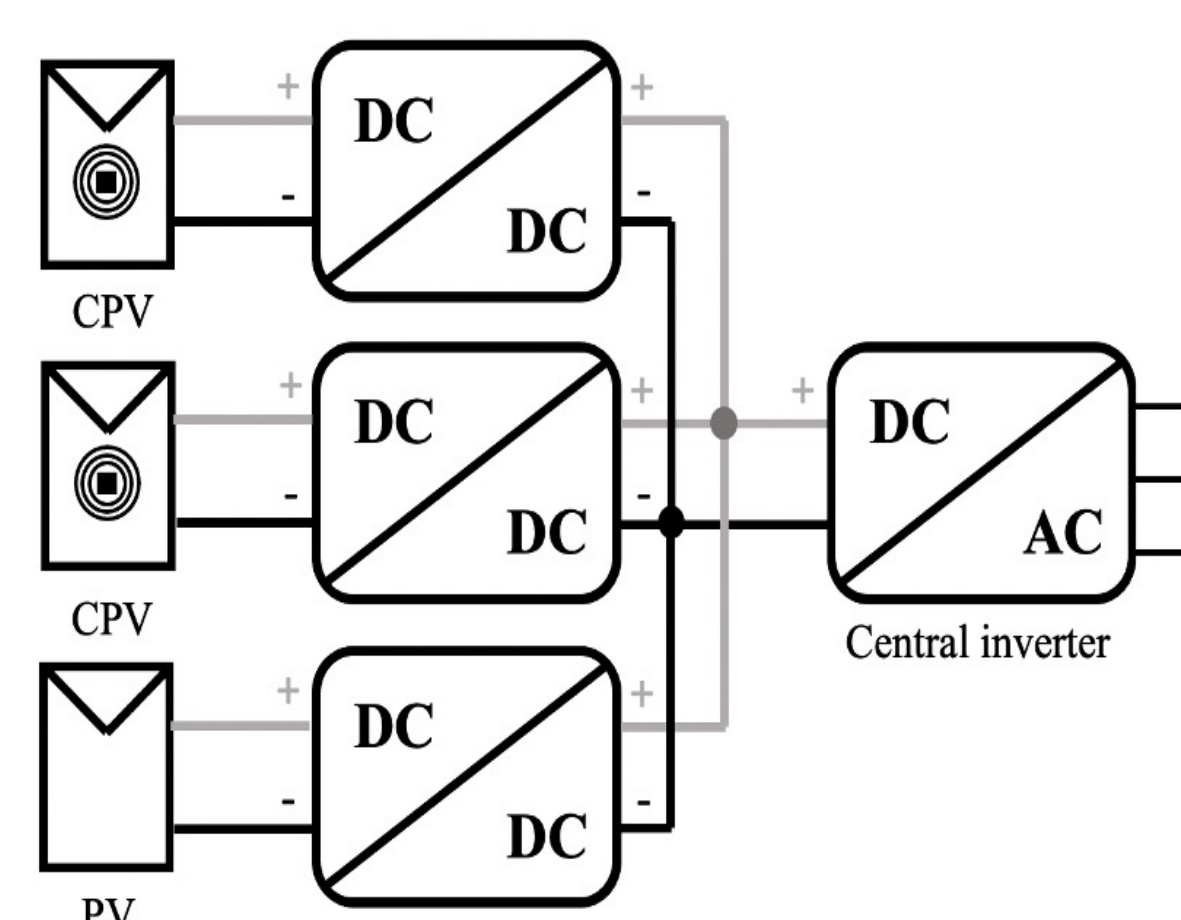
Data from U. Sherbrooke CPV park (8 trackers – 240kW)

Most favorable condition for PV / CPV hybridization

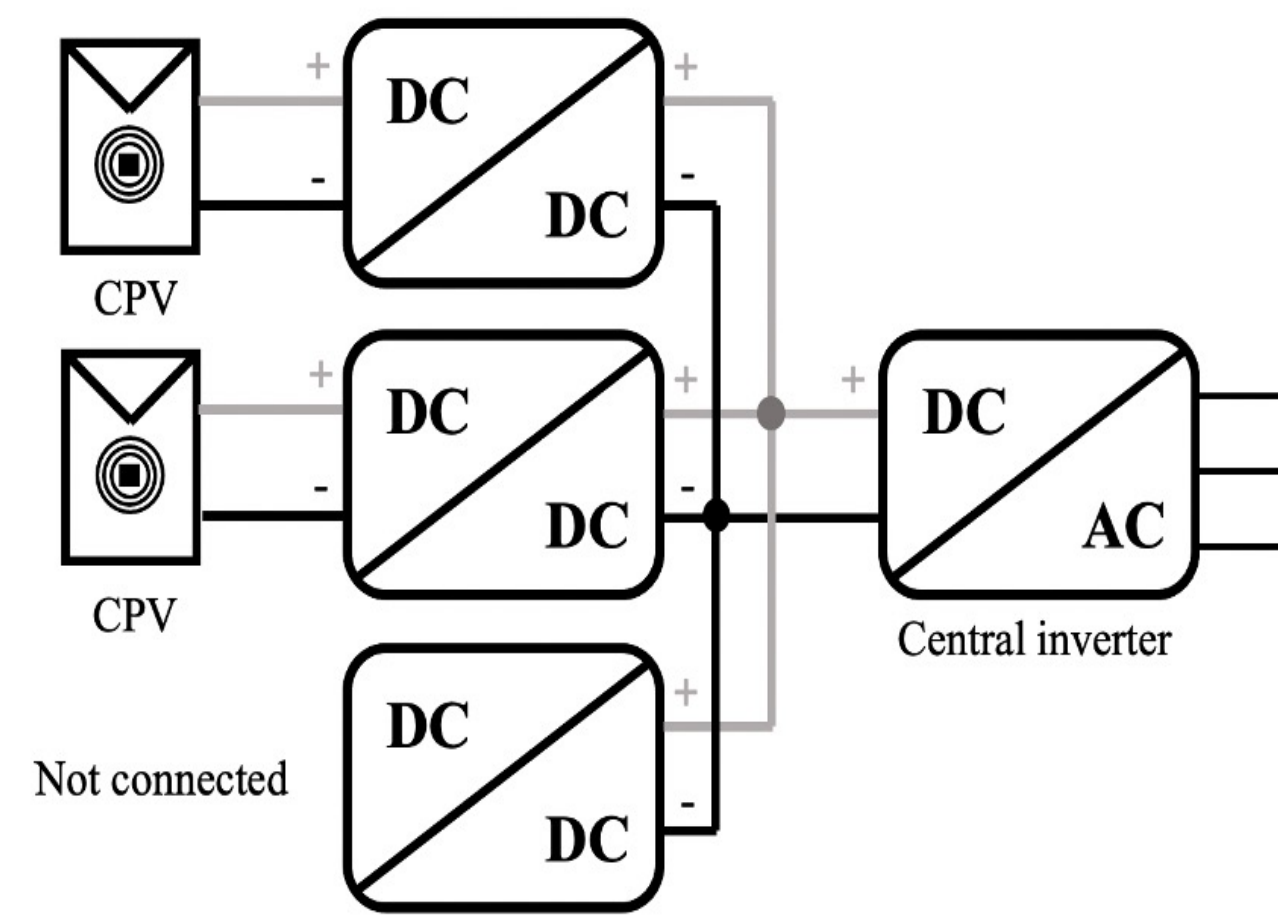
➔ Days with intense DNI drops but a non-zero GNI



Hybrid inverter



Full-CPV inverter



Results

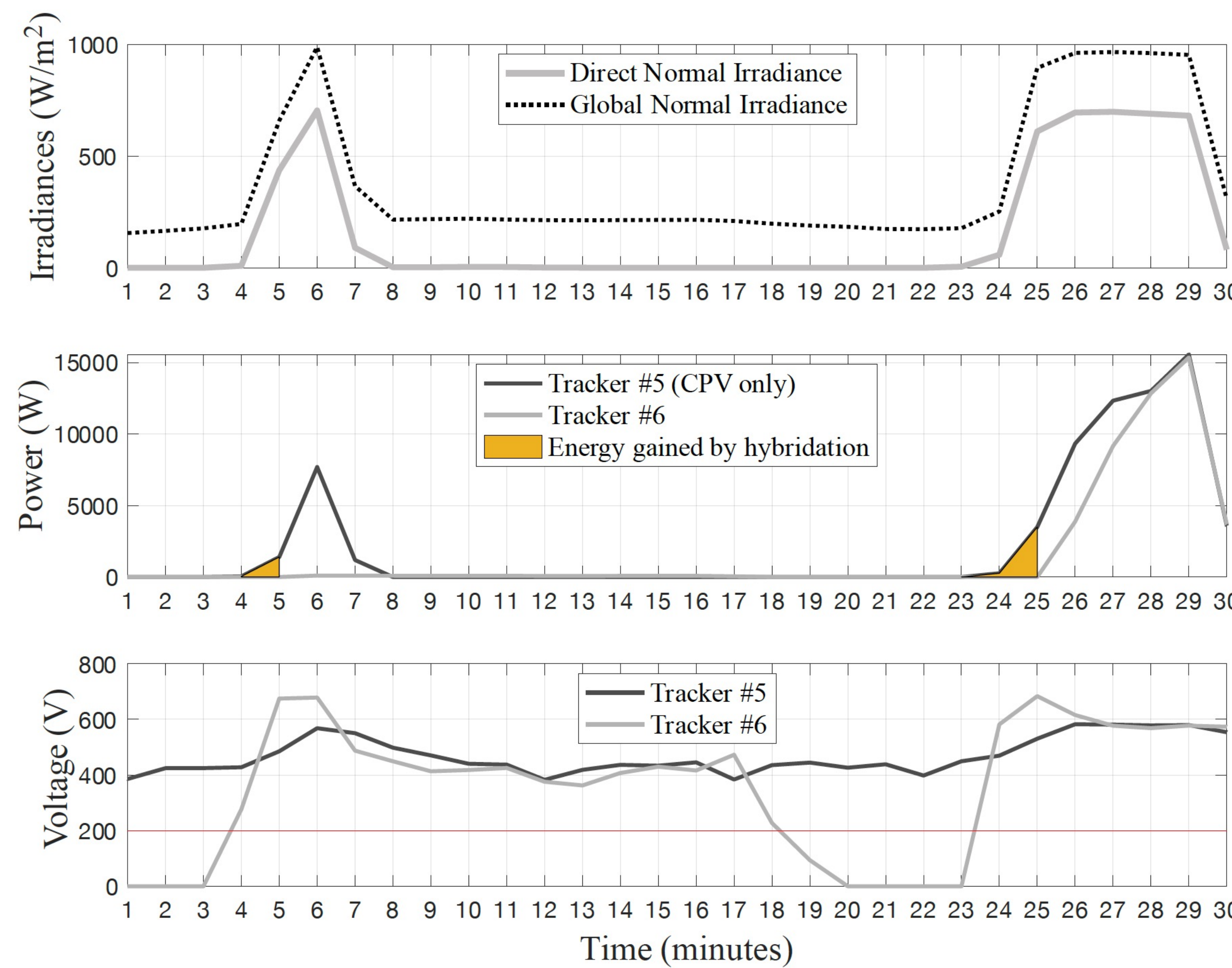


Fig.1 GNI and DNI (top), power of trackers #5 and #6 (middle) and voltage across one input of the corresponding inverters (bottom), the red line corresponds to the trigger voltage of the inverter

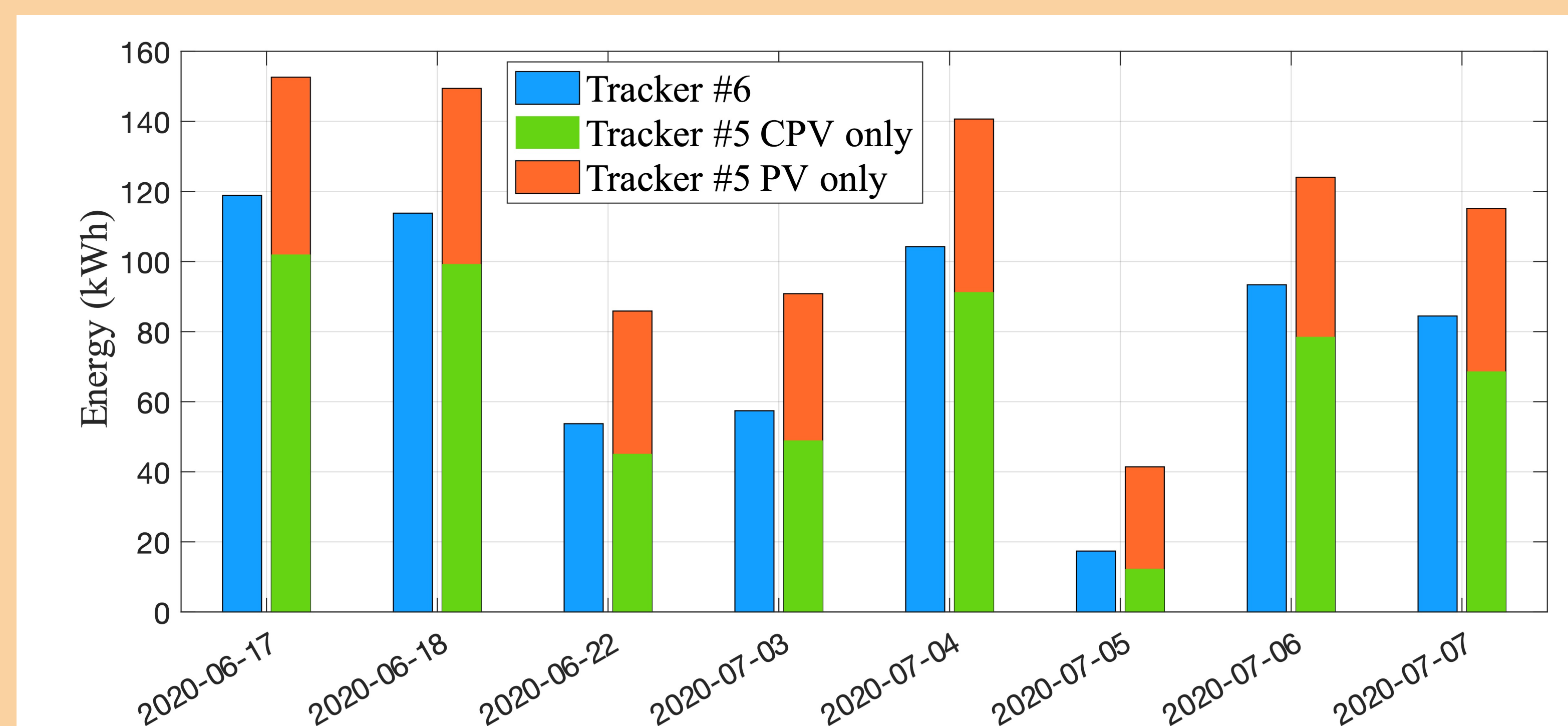


Fig.2 Energy yielded by trackers #5 and #6 during 8 days with intense DNI drops

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

