

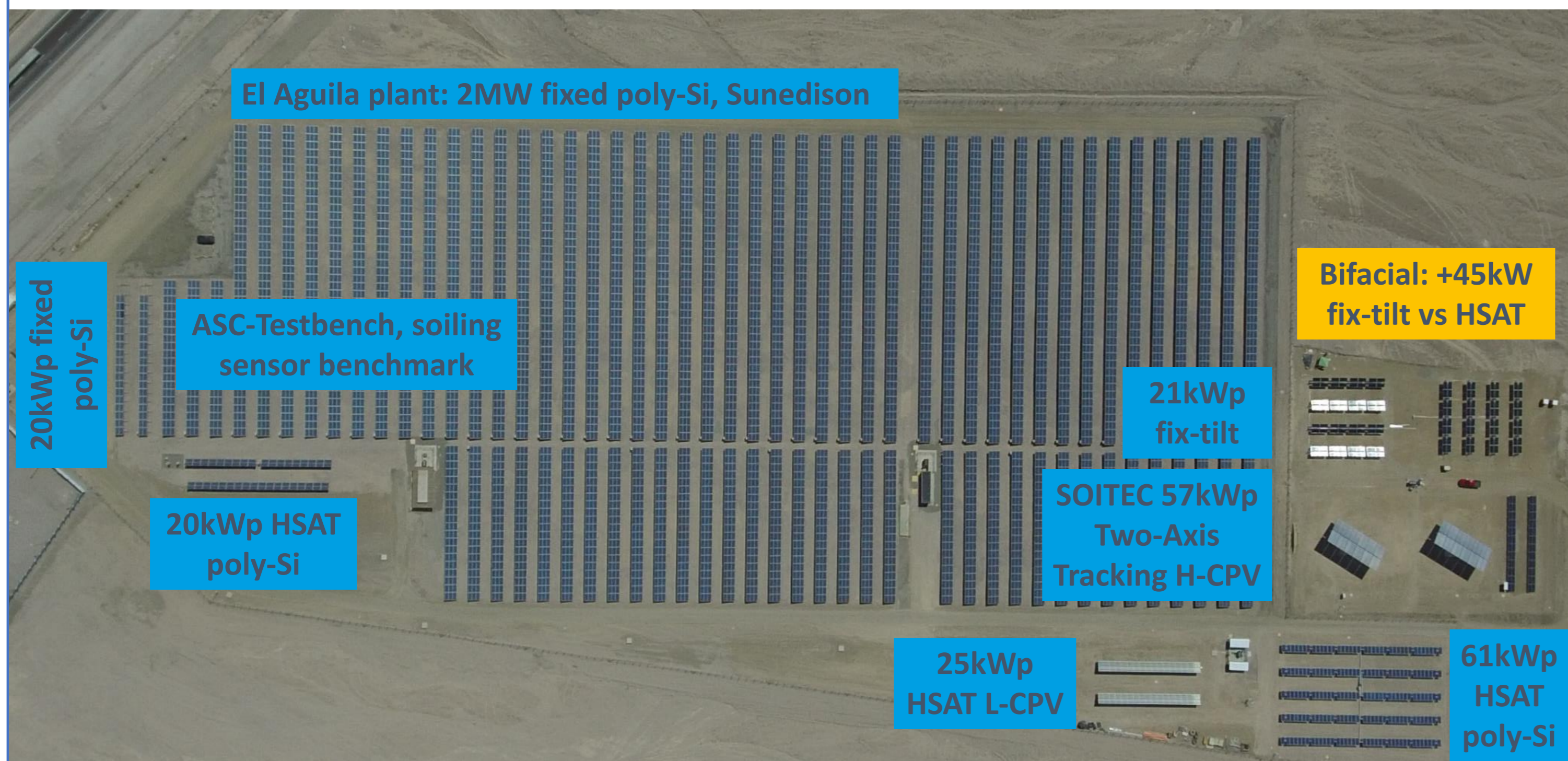
Outdoor Bifacial gain test results in the Atacama Desert

Four technologies in direct comparison, installed in HSAT and fixed tilt

**Thore Müller, Byungkeun Song,
Camila de Matos Pasos, Stijn Scheerlinck**

FIELD TESTING

At El Aguila 2MW PV power plant in Arica, northern Chile, ENGIE Laborelec has a unique outdoor laboratory for utility scale, real-life testing of different kinds of technologies at real system level in real operational and environmental conditions.



BIFACIAL PILOT

The bifacial pilot consists of eight strings of 16 panels each, arranged in two configurations (fix tilt and HSAT). Each string has its own MPPT, irradiance, albedo and yield are measured redundantly. Our measurement campaigns aim to compare different types and technologies of bifacial panels, understand which factors influence the bifacial gain and to find measures to increase the total yield.



Figure 1 shows a view of the HSAT group of the bifacial pilot as well as the meteo station and albedometer

In order to assess the bifacial gain, one of each pair of strings per technology has their rear sides covered. The bifacial gain is then assessed as their relative difference. Module temperature and in plane (rear and front) irradiance are monitored.



Figure 2 shows a view of the FIX-TILT group. One of each two strings has their rear side covered.

MEASUREMENT RESULTS FOR THE BIFACIAL GAIN

Measured bifacial gain for P-PERC dual-glass modules in El Aguila in FIX-TILT and HSAT configuration.

Left: Daily profiles. In Blue: whole period; Grey: weekly profiles

Right: Daily average bifacial gains

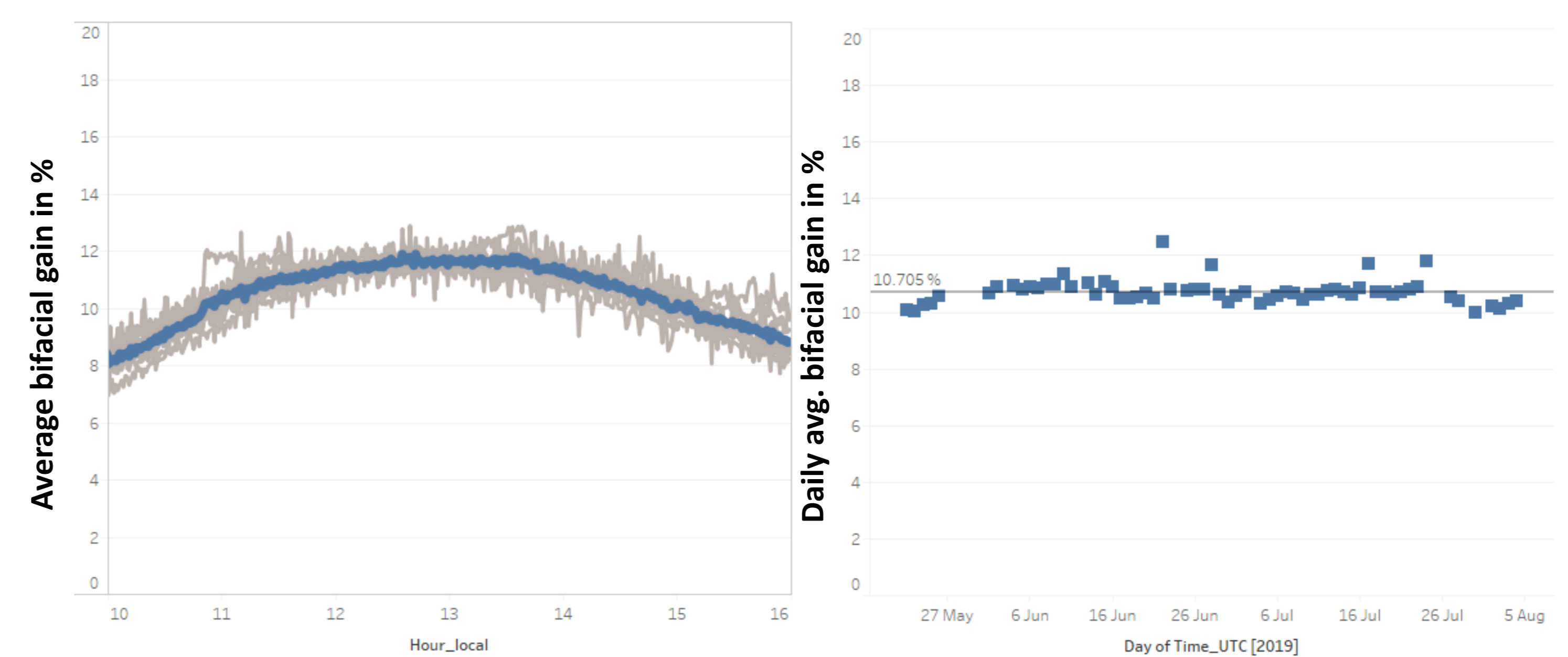


Figure 3 shows measured results for HSAT

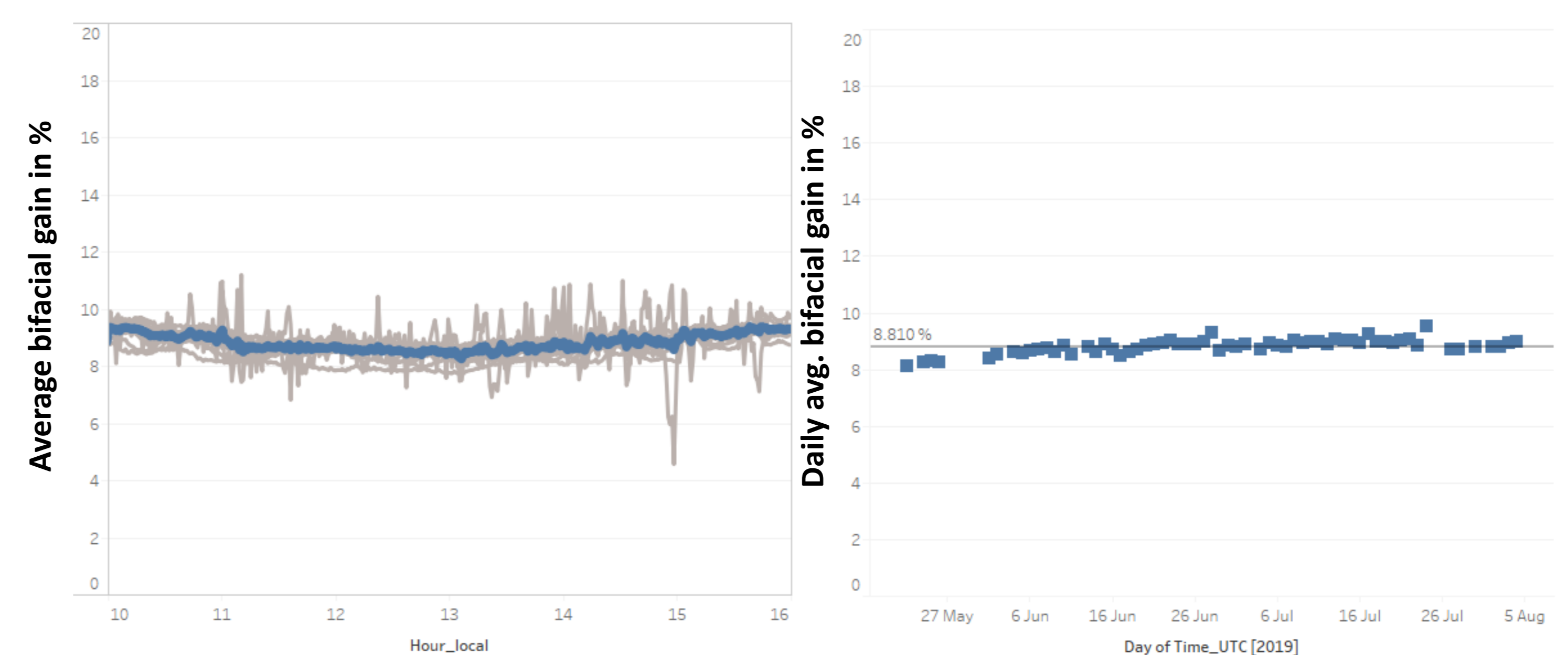


Figure 4 shows measured results for FIX-TILT

DISCUSSION

- Daily averages are stable during 2,5 month measurement campaign with values around 10,7% for HSAT and 8,8% for FIX-TILT
- The results presented here are taken around winter solstice with the sun very far in the north. Unfavorable front side irradiance conditions for HSAT panels explain the high bifacial gain compared to fixed-tilt. It is expected that fixed-tilt gains surpass those of HSAT for summer.
- Albedo is 20% and stable (as measured with the Albedometer). Results filtered for irradiance intensive noon hours (10:00 – 16:00).
- Fixed-tilt and HSAT show different daily profiles of the bifacial gain. For HSAT the peak is reached around noon, for fixed-tilt there are higher values in morning and evening.
- ENGIE is building bifacial power plants in Mexico, Saudi Arabia and in the USA.

OTHER RELATED FIELDS OF APPLIED RESEARCH

- Cleaning robot testing in relation to panel and ARC degradation
- Cleaning frequency and O&M optimization based on data analysis
- Fault detection via IR drone inspection
- Albedo assessment and satellite data validation
- Bifacial yield assessment and simulation model validation

Contact:

Thore Müller, thore.mueller@engie.com

Byungkeun Song, byungkeun.song@engie.com