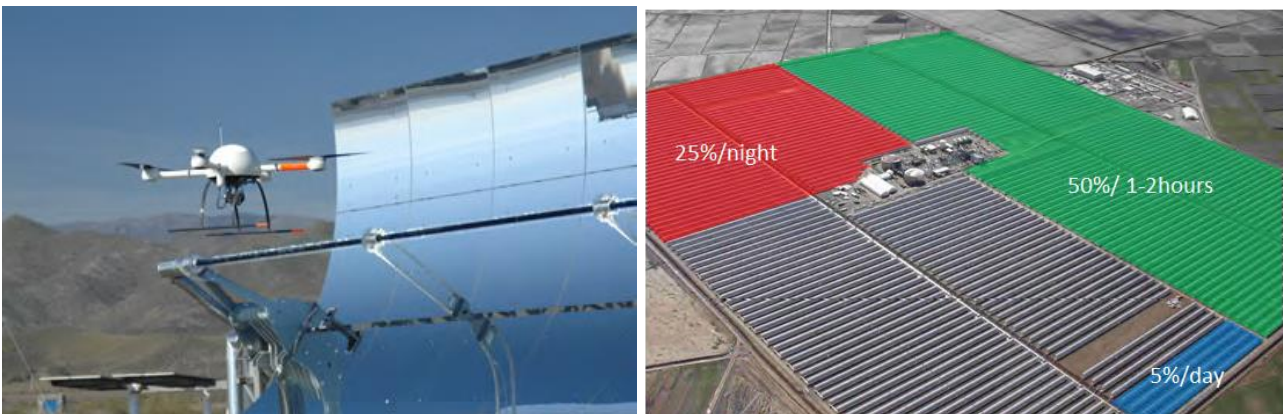


# QFly - Airborne qualification of CSP plants

## An automatic system for inspection and quality assessment of large solar fields

The Institute of Solar Research of the DLR (German Aerospace Center) has developed a tool for airborne characterization of parabolic trough collector fields called QFly, based on an unmanned aerial vehicle (UAV) equipped with a high-resolution digital still camera. Its objective is the identification and assessment of performance optimization potentials in newly erected and operational solar fields of CSP plants. This unique technology was licensed by CSP Services and is now available for commercial application.

Due to the enormous extensions of commercial CSP plants, airborne characterization of the optical and thermal properties of the solar field is the most efficient approach to detect poorly performing areas and to identify opportunities to improve the field performance. The measurement system QFly delivers accurate results for the mirror shape, absorber tube position, module alignment, tracking behavior and thermal losses of receiver tubes. QFly provides the basis for optical acceptance tests of solar fields, necessary for quality control of solar field works, subcontractors, and for warranty claims.



Left: QFly UAV during the inspection of a parabolic trough collector

Right: Typical 50 MW<sub>el</sub> solar field. Colored areas show the measurement time to characterize a certain fraction of the solar field in high resolution mode (blue), survey mode (green), and for thermal characterization (red)

### Characterization of Solar Field Performance

Depending on the objective, different measurement modes are available. **QFly SURVEY** enables the fast characterization of the entire solar field in a single day and provides effective mirror shape and information on the tracking system and collector alignment. **QFly HIGH RESOLUTION** provides very accurate and high-resolved results on mirror geometry and absorber tube alignment for smaller fractions of the solar field. **QFly THERMO** provides information on the state of the insulation of absorber tubes and solar field headers.

### Monitoring of Solar Field Status

Besides performance characterization, QFly can regularly monitor the status of the solar field and its components, such as breakage of mirror panels and receiver glass tubes. Current R&D activities target additionally HTF leakage detection, soiling measurements and the extension of the QFly functionality to heliostat fields.

## Proven System Performance

QFly is the most advanced system in the field of optical characterization of CSP plants. All measurement modes have been validated against independent benchmarks. The mirror shape can be measured with a local uncertainty of  $<0.6$  mrad, the absorber tube position with an uncertainty of  $<2$  mm. Individual orientations of solar collector modules are measured with an accuracy of  $<1.6$  mrad, which outperforms inclinometer measurements. The uncertainty of the temperature measurement of the absorber glass envelope tube is  $<5K$ , which allows for heat loss assessment and receiver classification. QFly has been successfully deployed in operational CSP plants and in several R&D facilities. Even in well performing plants, potential improvements of the optical performance in the range of 1-3 percentage points could be identified. The potential additional yield leads to very short payback periods in the range of months.

## Key Features of QFly

- Quick and complete optical characterization of commercial scale parabolic trough fields
- All relevant characterization and monitoring tasks are covered by a single, versatile system
- High-quality measurement results, comparable to much more elaborate and expensive ground-based measurements
- Low impact on regular plant system operation
- Flexible data interface allows subcontracting of local UAV service providers, which simplifies its worldwide deployment

## Key Benefits

- Delivers complete, spatially resolved information on optical solar field performance, its deficiencies, related causes and possibilities for optimization
- Easily practicable field optimization potential ("low hanging fruits") is usually much higher than costs of measurements, resulting in very short payback times
- Assessment serves as an independent third-party measurement for control of subcontractors, optical acceptance tests and warranty claims
- System can be used for both optical characterization and regular monitoring tasks, thus maximizing its utilization and benefit for the customer

Existing project funding at DLR admits a continuous further development of the QFly system in the next years. This will further increase system features, flexibility and range of application, also for existing clients. For further information on the QFly system, its different applications and its benefits for your specific projects please contact CSP Services.

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