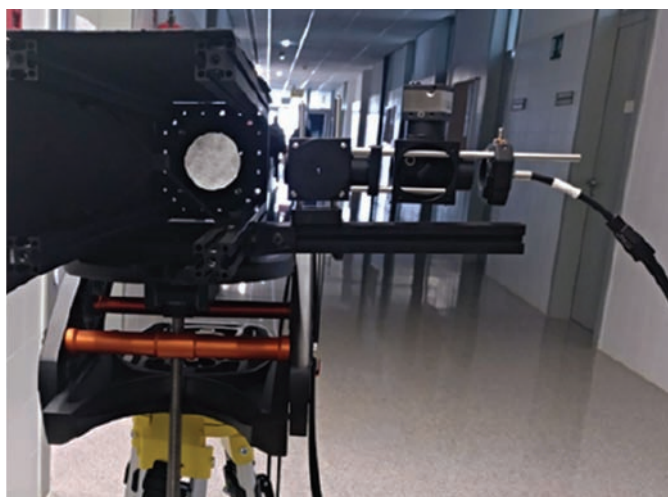




# HIGH-ACCURACY REAL-TIME MONITORING OF SOLAR RADIATION ATTENUATION



## CONTEXT

- Atmospheric attenuation is crucial for a proper CSP plant design and operation.
- This information is difficult to measure and generally not available thus having a strong impact in the technology risk.
- New and accurate measurement, characterization, modelling and estimation techniques are needed for central receiver solar power plants.

## TECHNOLOGY

- Uses sun's radiation as light source.
- Telescopic self-calibrated sensors to avoid background light and noise.
- Measures the spectral distribution of light at two distances.

## BUSINESS MODEL

- Patent pending (P201830758).
- Attenuation monitoring system for installation in Solar Tower plants.
- Attenuation modelling for prospective studios and forecasting in operational Plants.

## MAIN FEATURES



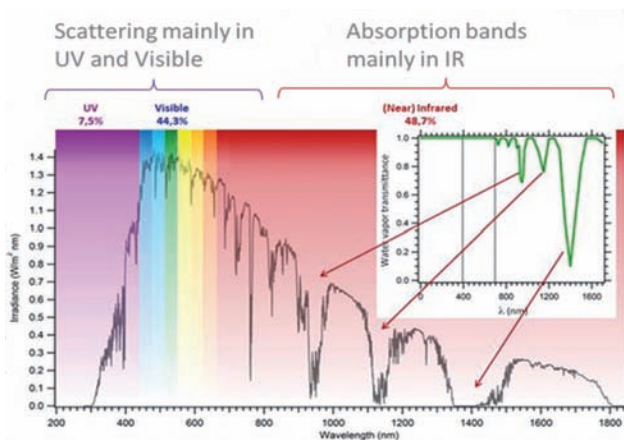
The National Renewable Energy Centre of Spain (CENER) develops applied research in renewable energies, and provides technological support to companies and energy institutions in six areas: wind, solar thermal and photovoltaic solar energy, biomass, smart and efficient buildings and districts, and grid integration of energy. CENER is a technology centre with worldwide recognized prestige, activity and experience.



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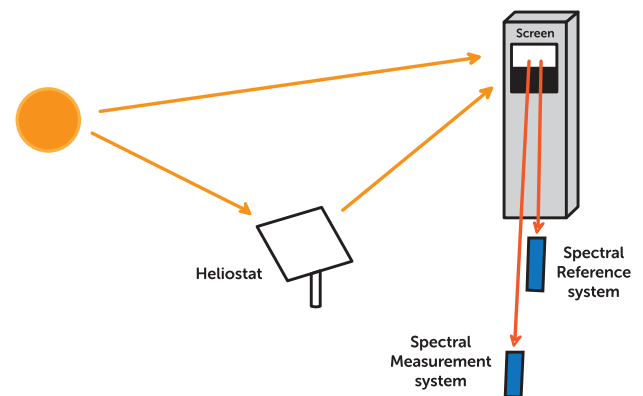
## STATE OF THE ART

- Current systems measure, at best, less than the 70% of the solar spectrum.
- Extinction has been commonly considered by ray-tracing and plant optimization tools only for standard atmospheric conditions.



## SOLUTION

- Optical sensors only “see” the light source. Digital camera assures proper focusing.
- Calibrated with black target to remove scattered light contribution.
- Two-spectrophotometers measure simultaneously and in real-time practically the full solar spectrum.



## DEVELOPMENT STATUS

Fully functional system validated at relevant scale (> 500 m) during 2018.

First commercial system to be installed in a CSP plant in 2019.



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