

# HTF Monitoring

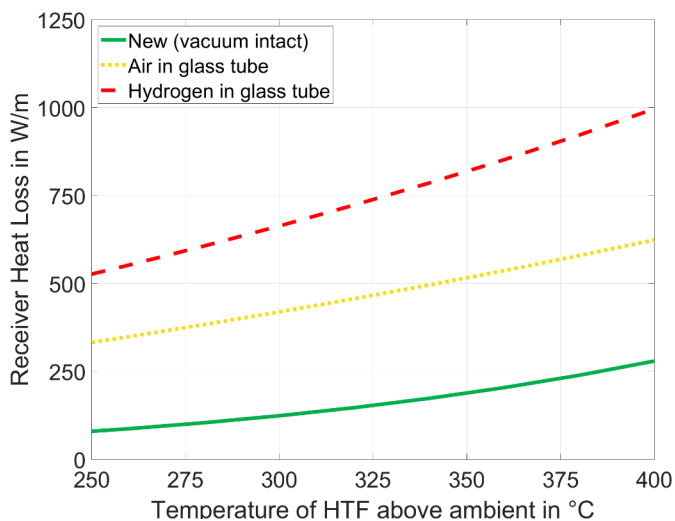
## Fluid and Component Services



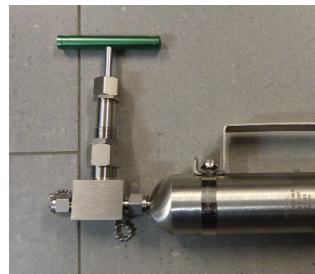
The thermal oil used as heat transfer fluid (HTF) of parabolic trough power plants gradually degrades at usual operating temperatures, which leads to the formation of hydrogen.

The hydrogen permeates slowly into the evacuated glass envelope of the receivers and destroys the thermal insulation effect of the vacuum. When this happens, the receiver tubes have to be exchanged **to avoid excessive heat losses and associated energy production losses** (compare green and red curve in the diagram below).

CSP Services knows how to analyze and mitigate this issue and offers corresponding solutions. As **one-stop-shop for monitoring and controlling the hydrogen concentration**, we offer specialized equipment and analytical methods as well as expert support on **mitigation measures**.



## Sampling Equipment



Gas-tight sampling bottle



Transport case

HTF sampling station for hydrogen analysis

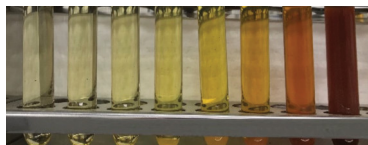


## HTF and Hydrogen Analysis



Hydrogen measurement station for monitoring on-site

HTF samples (degradation)



Getter pills

### Laboratory Analyses:

- Hydrogen concentration
- Hydrogen formation rate
- High and low boiler concentration
- Getter saturation status
- HTF properties and physical parameters (water and particle content, density, heat capacity, etc.)

## Mitigation Measures

Depending on the results of the analyses we offer expert advice for further actions and additional assessment:

- Modelling of hydrogen formation in the plant with our **in-house simulation software** to apply **optimized venting** schemes for hydrogen reduction – including economic modelling for cost optimization

- Testing and systematic improvement of **reclamation and ullage system** operation – the cleaner the HTF the lower the hydrogen formation
- **HyMATE: Hydrogen removal system** as add-on for the power block commercially available



QScan: Drone inspection

## Complementary Services

Our aerial plant inspection service **QScan** gives a quick and complete overview of the current state of the receivers in the entire solar field. It determines the glass surface temperatures of all receivers and distinguishes between undamaged receiver, **broken/missing glass**, and **air or hydrogen in the glass tube**.

## Component Services

Apart from our HTF services, we offer highly specific laboratory testing for mirrors, receivers and other key components of CSP plants in close cooperation with specialized laboratories, such as the DLR QUARZ-Center for receiver and mirror certification:

- **Receiver testing** (optical and thermal efficiency, accelerated ageing, bellow fatigue test, durability and spectral analysis of selective coatings)

- **Mirror testing** (optical performance including shape accuracy and specular reflectance, pad angles and positions, pad adhesion, durability tests in climate chambers)
- **Inclinometer** calibration
- **Material tests** (e.g.: heat insulation properties, metal composition, molten salt decomposition and purity, etc.)

Part of the offered services and solutions were developed in cooperation with the German Aerospace Center (DLR) in the publicly funded project HyConSys.



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