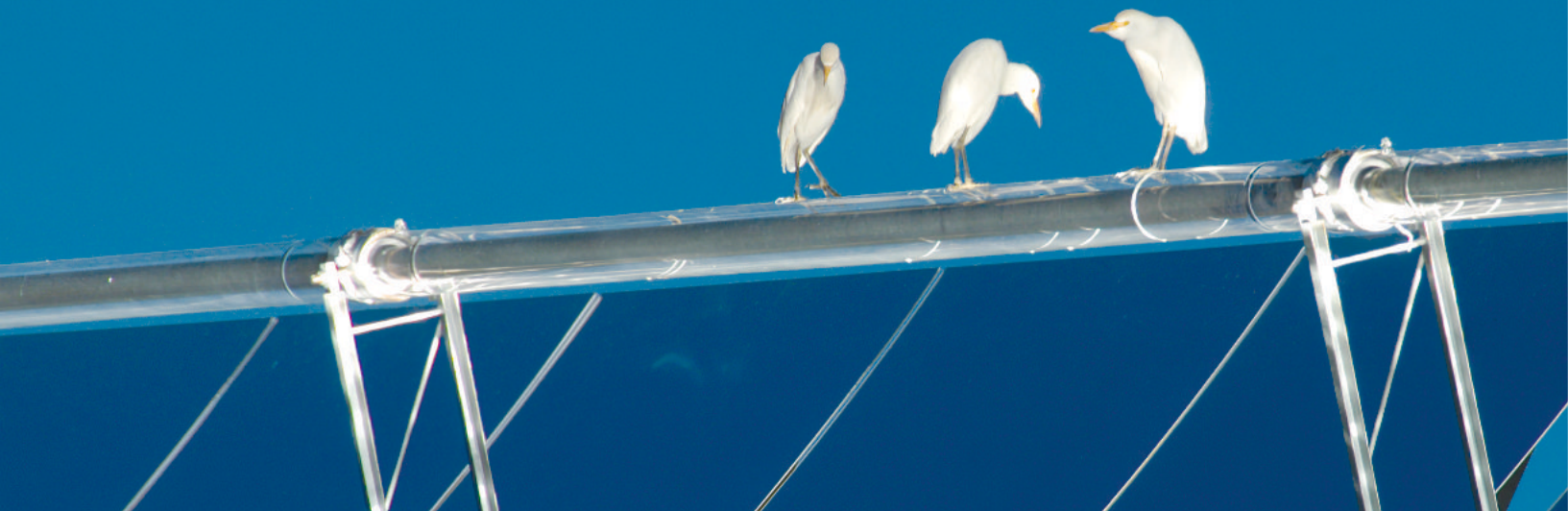


HyMATE

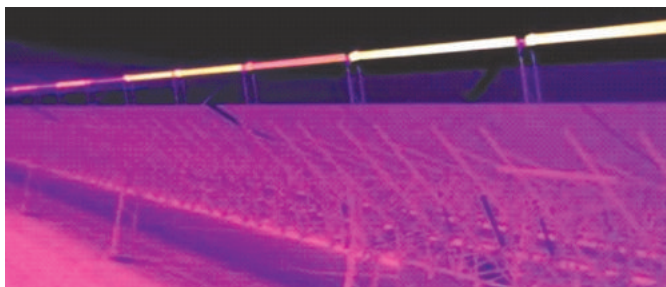
Hydrogen Mitigation System



The Challenge

The thermal oil used as heat transfer fluid (HTF) in solar power plants degrades over time, resulting in a constant **build-up of hydrogen**. This poses a risk to the receivers. Once their built-in getters reach the maximum capacity, **heat losses increase dramatically (x4)**. This phenomenon occurs much earlier than expected – typically within just 7 to 12 years of plant operation.

Within a few years, over 50% of the solar field can be affected, resulting in a **20% drop in annual power output**. Costly receiver repairs or replacements become mandatory, severely impacting both maintenance costs and plant performance.

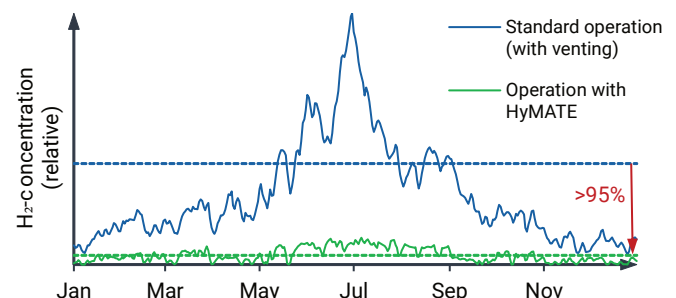


Infrared image of hot parabolic trough receivers

The Solution

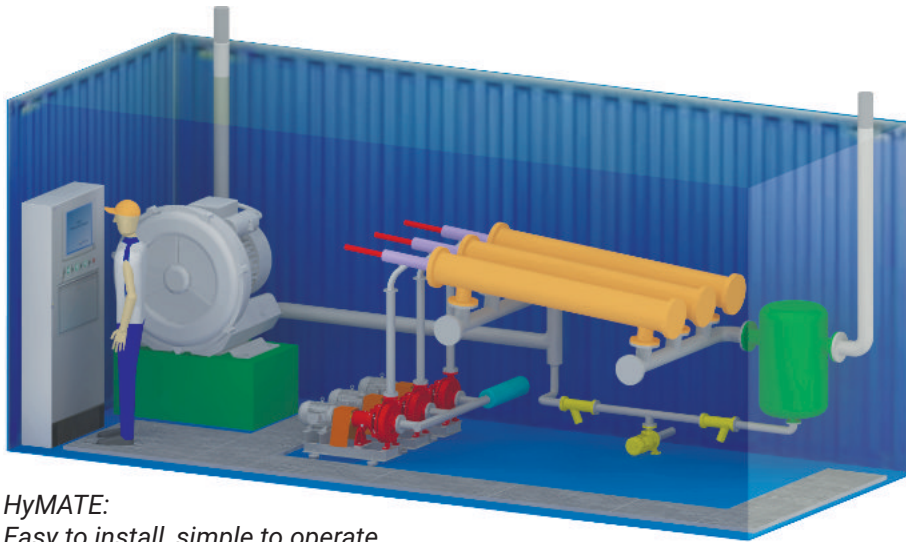
Our hydrogen mitigation system **HyMATE** provides a **permanent solution** to this problem. The fully automated system **continuously removes hydrogen** from the HTF and **monitors its concentration**. Key benefits include:

- Highly effective hydrogen reduction (over 95%)
- Immediate effect within a few days
- Automatic real-time monitoring of hydrogen levels
- Easy to install and operate
- Environmentally friendly, as only water is released



Yearly progression of hydrogen concentration in HTF

Smart Design - Complete Service - Full Guarantee



HyMATE:
Easy to install, simple to operate

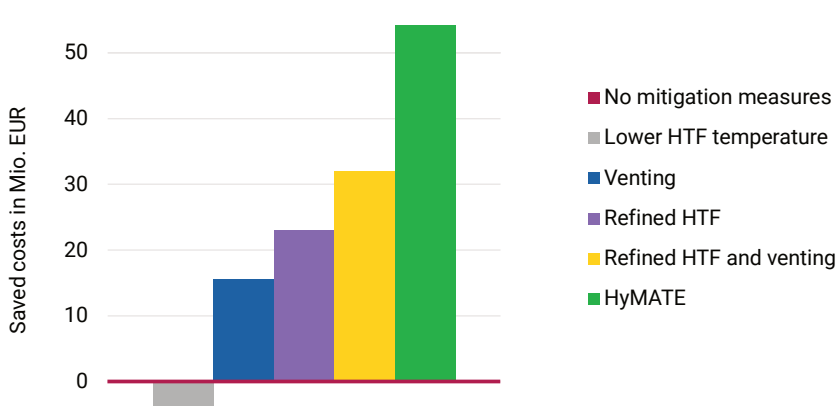
- **Containerized solution:** Fully pre-assembled and tested before shipment
- **Turnkey system:** Clear interfaces, swift installation, immediate operation
- **Modular design:** Highest system availability, reduced spare parts
- **Top quality:** Made, tested, and certified in Germany
- **Carefree operation:** Automated system with full-service maintenance contracts
- **Guaranteed** low hydrogen levels

Cost Assessment

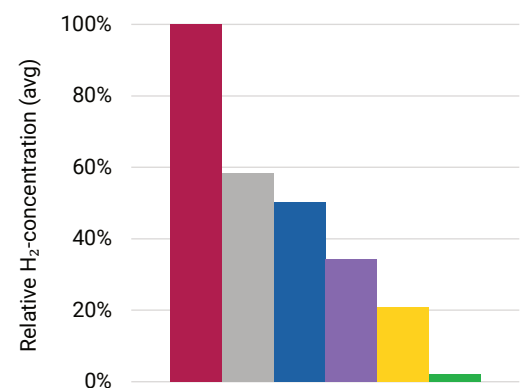
Previously available methods for reducing hydrogen in HTF lack the effectiveness of **HyMATE**:

- Operation at lower HTF temperature: Reduces hydrogen formation at the cost of reduced turbine performance
- Venting: Removes hydrogen only partly with constant costs for nitrogen replacement and filters
- HTF refining: Reduces hydrogen formation, but requires high initial and continuous treatment efforts

None of these methods are sufficient to avoid the problem, and they are significantly more expensive!



Example case: Potential for higher profits for a 100 MW plant with storage



Average H₂-concentration for a 100 MW plant with different mitigation measures

Protect your receivers with HyMATE and maintain the performance of your plant throughout its lifetime!

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