

# Fraunhofer Institute for Solar Energy Systems ISE

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Sorption Technology Development: An Overview

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Fraunhofer Institute for Solar Energy Systems ISE  
Sorption Friends III, Taormina, Sicily  
May 2, 2023

# Fraunhofer Institute for Solar Energy Systems ISE

## Our Business Areas



### Photovoltaics

- Silicon Photovoltaics
- III-V and Concentrator Photovoltaics
- Perovskite and Organic Photovoltaics
- Photovoltaic Modules and Power Plants

### Energy Efficient Buildings

- Solar Thermal Power Plants and Industrial Processes

- Hydrogen Technologies and Electrical Energy Storage

- Power Electronics, Grids und Intelligent Systems

#### Institute Directors:

Prof. Dr. Hans-Martin Henning

Prof. Dr. Andreas Bett

Employees: ca. 1400

Budget 2021: €116.7 million

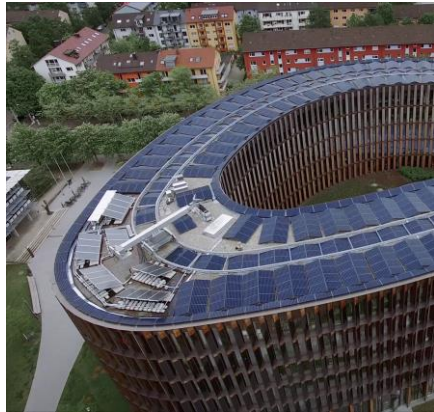
Founded: 1981



# Our Business Areas



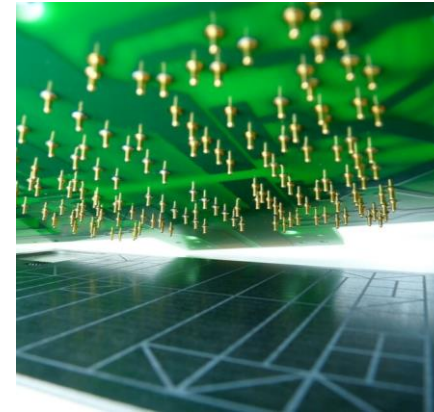
Photovoltaics



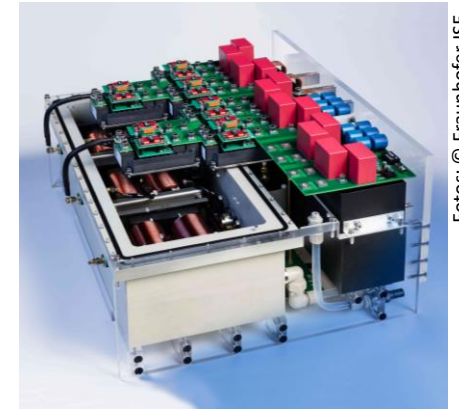
Energy Efficient Buildings



Solar Thermal Power  
Plants and Industrial  
Processes



Hydrogen Technologies  
and Electrical Energy  
Storage

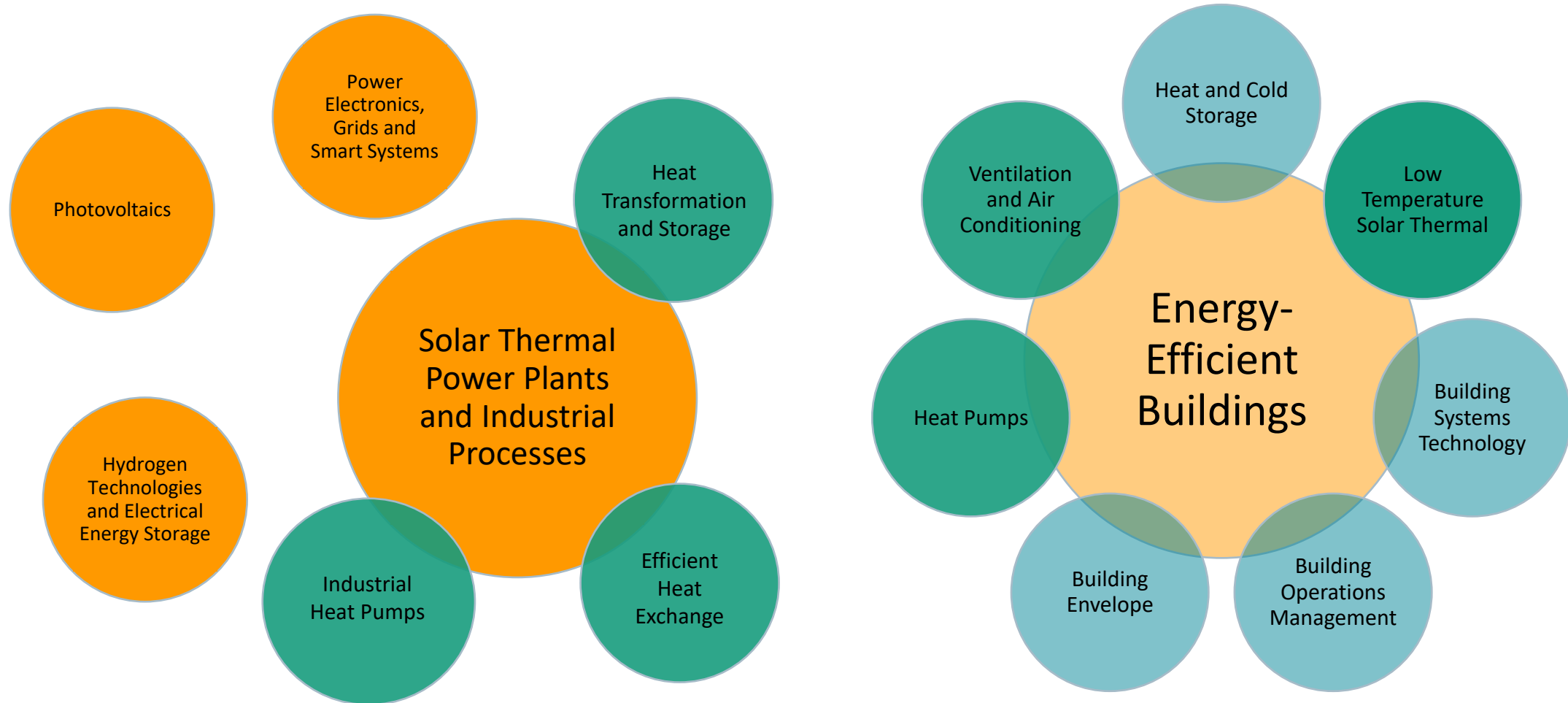


Power Electronics, Grids  
and Smart Systems

Fotos: © Fraunhofer ISE

# Department Heating and Cooling Technologies

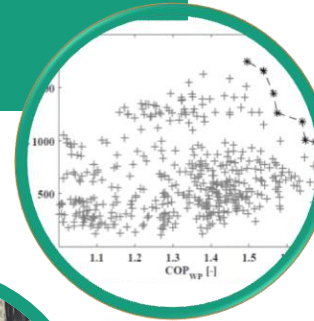
## Research Topics



# Sorption Technology

## Our Expertise

Performance  
Evaluation



Safety and  
Stability



Storage



Innovative Heat Exchanger  
Designs



Thermally Driven Heat Pumps  
and Chillers



Prototyping



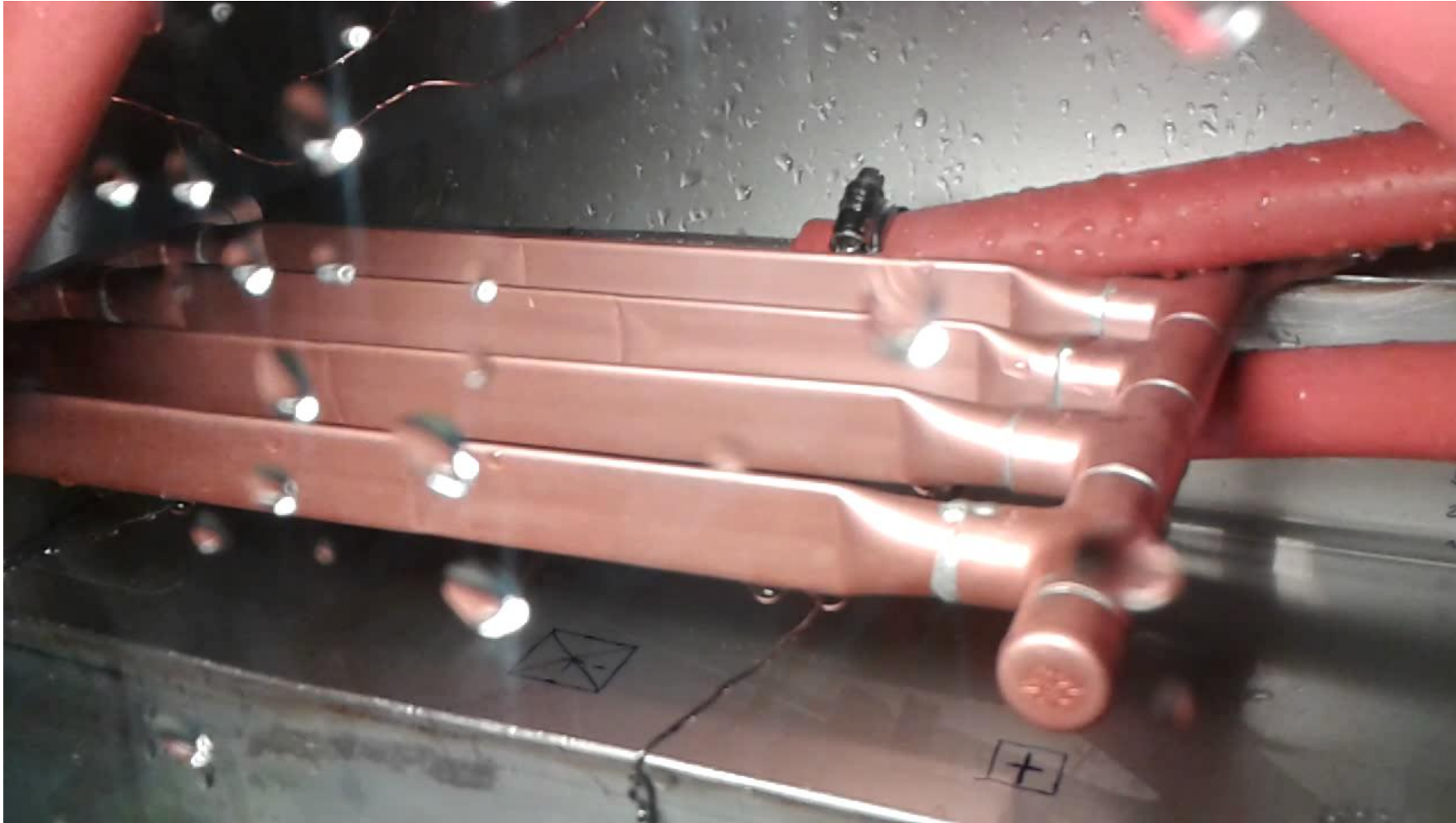
# Sorption Technology

## Highlight: Evaporator development

Gefördert durch:



aufgrund eines Beschlusses  
des Deutschen Bundestages

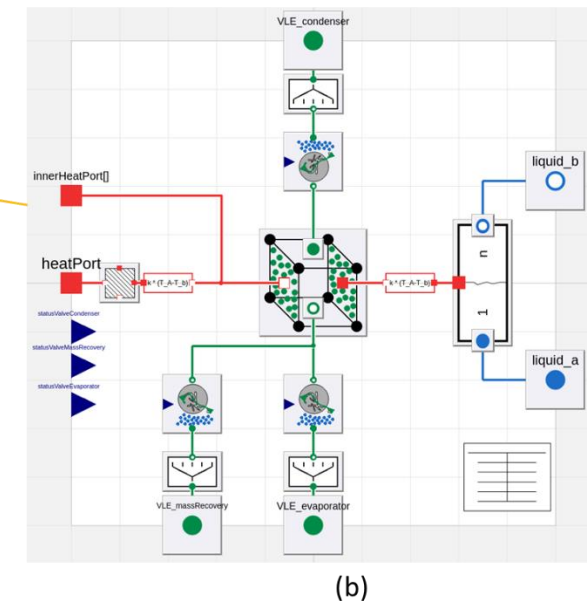
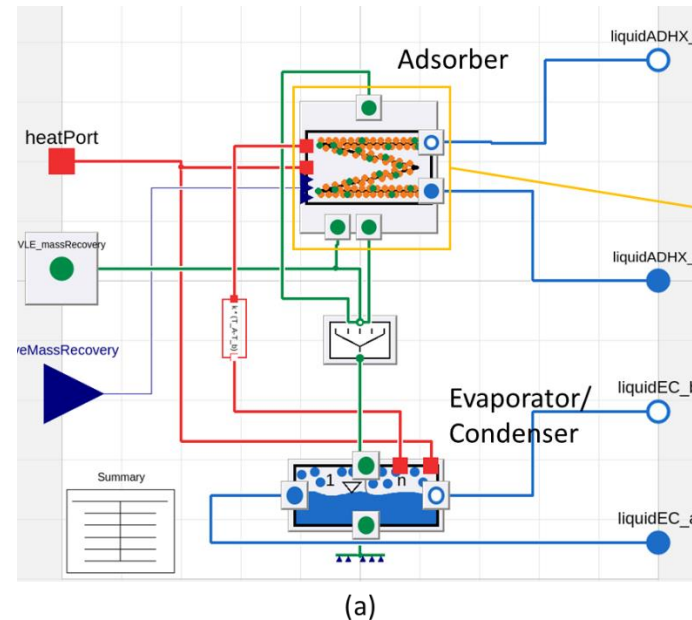




# Sorption Technology

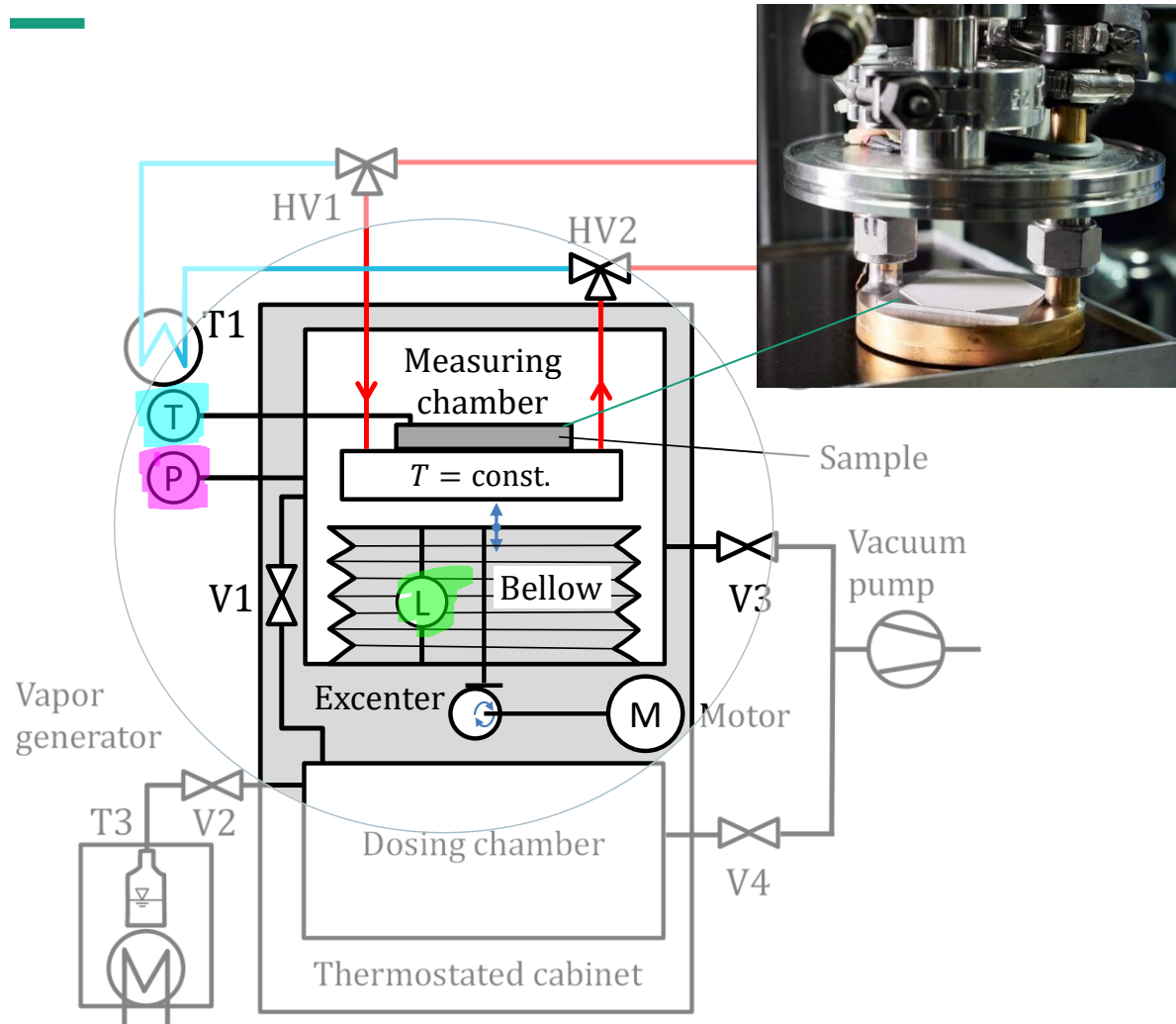
## Highlight: Project AdoSan-LXB

- Compact and efficient adsorption modules for chillers and heat pumps (adsorber, evaporator, module, device)
- Gas-driven heat pump development: hydraulic design and control, performance evaluation

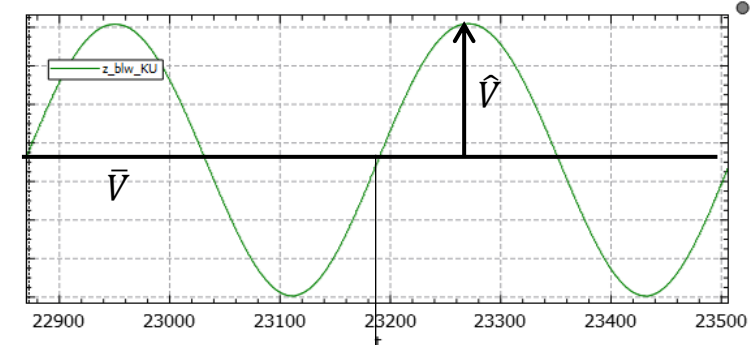


# Sorption Technology

## Highlight: Frequency Response Analysis

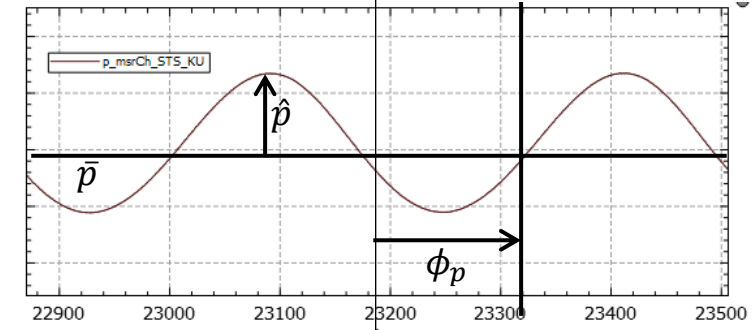


(L) Position (mm)  $\sim$  Volume



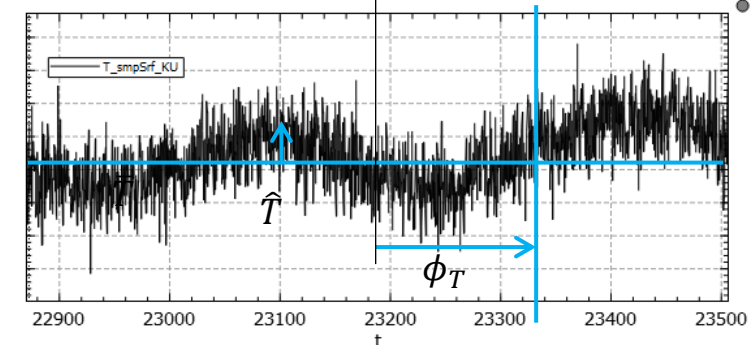
Excitation

(P) Pressure (mbar)



Response

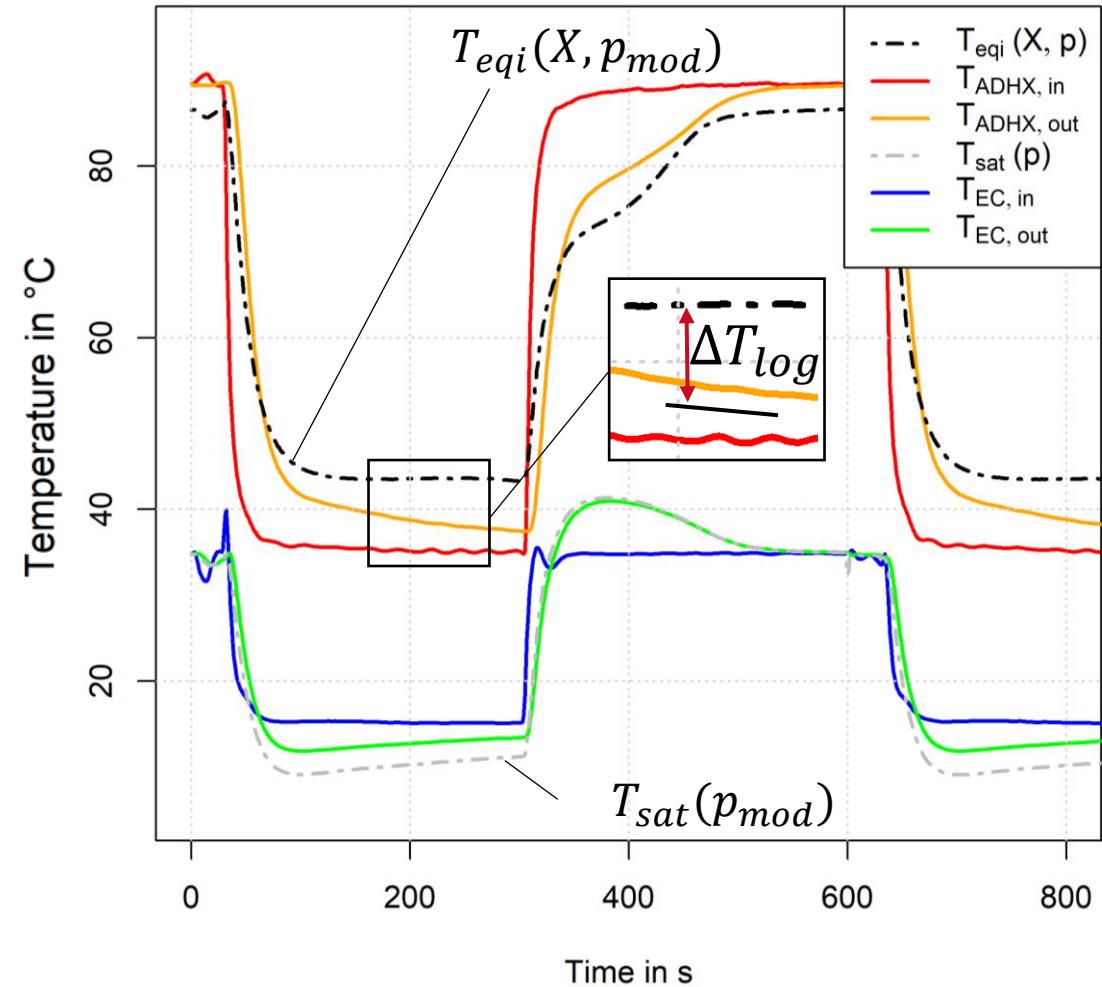
(T) Temperature ( $^{\circ}\text{C}$ )





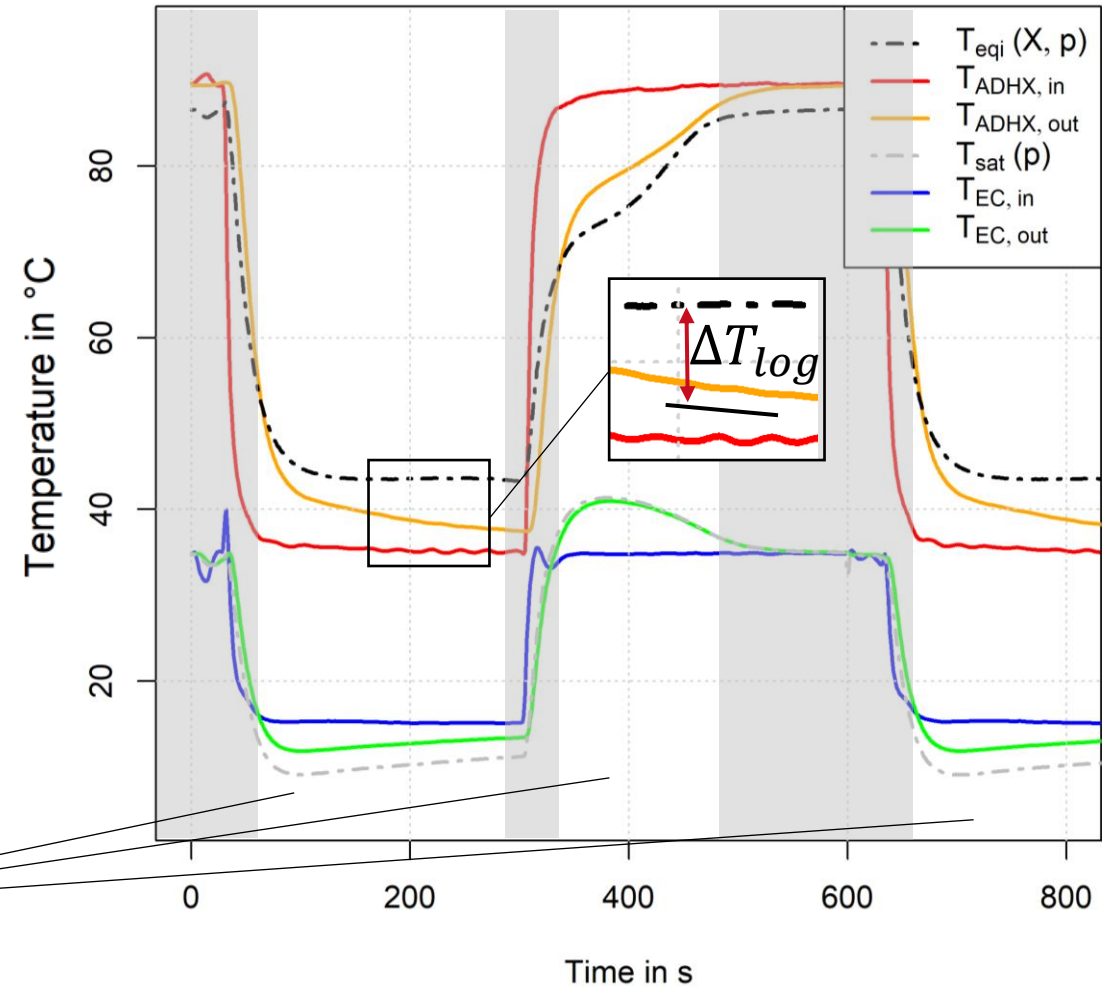
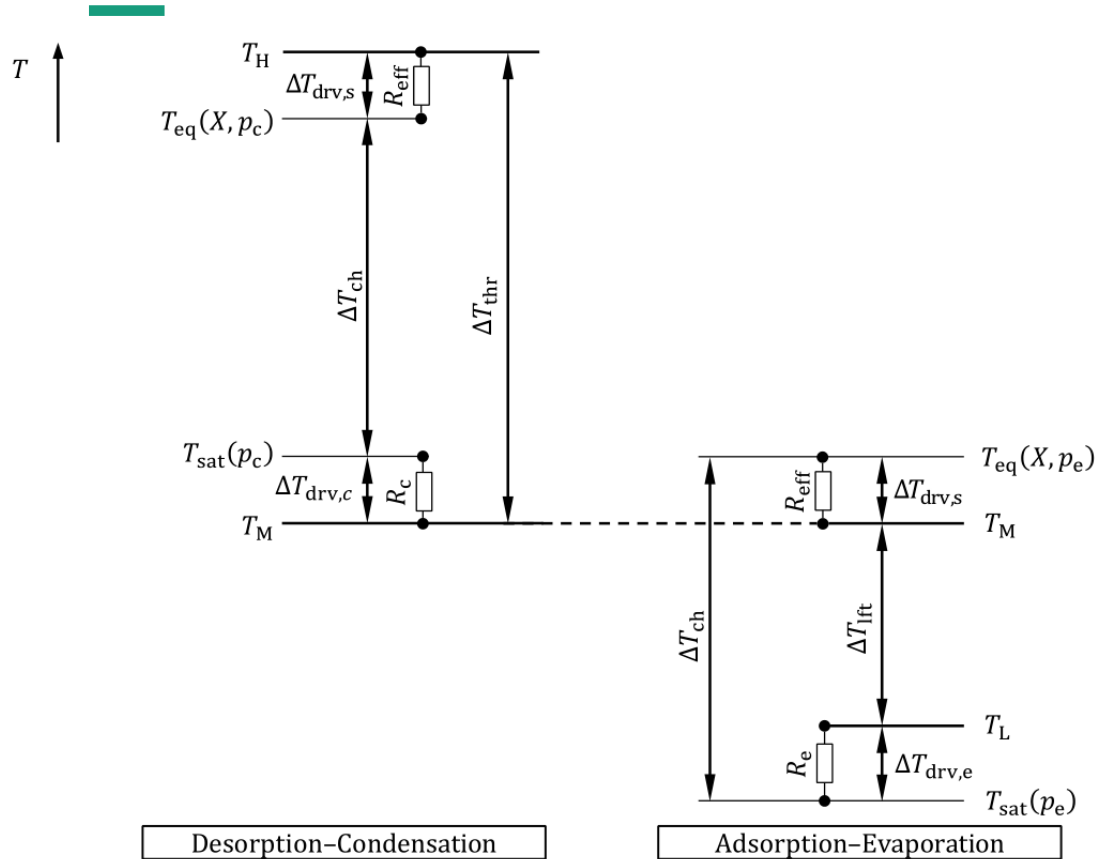
# Sorption Technology

## Highlight: Modelling in Simplified Model



# Sorption Technology

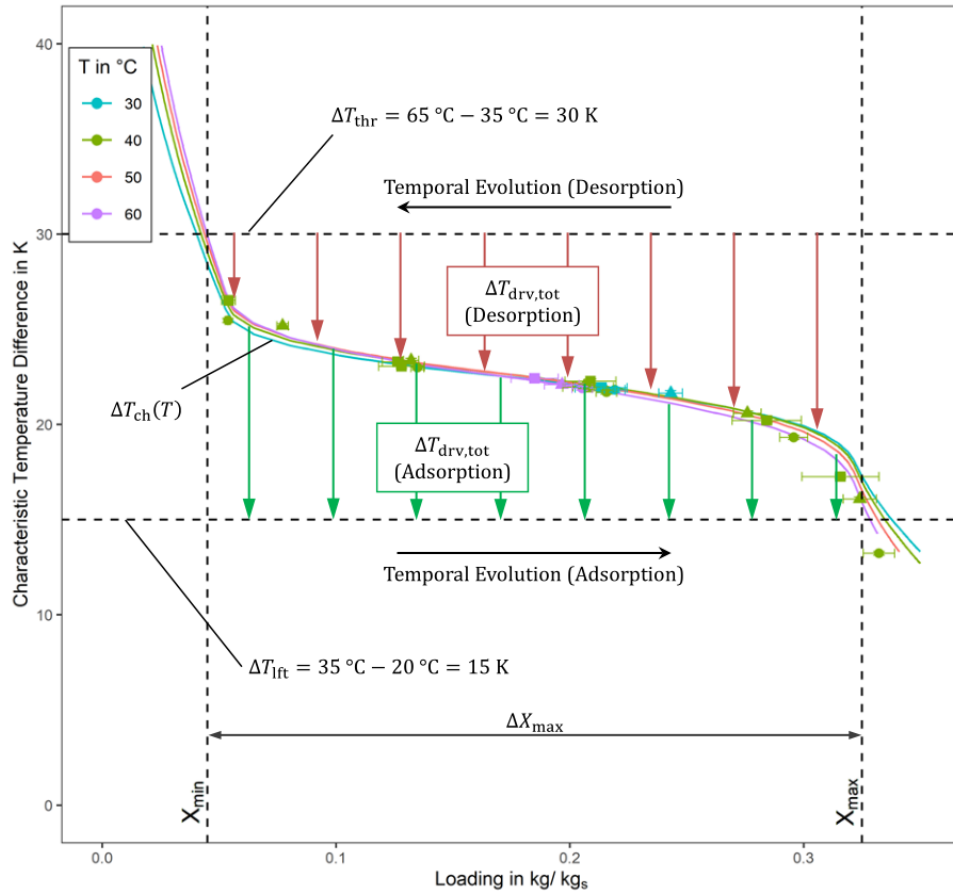
## Highlight: Modelling in Simplified Model



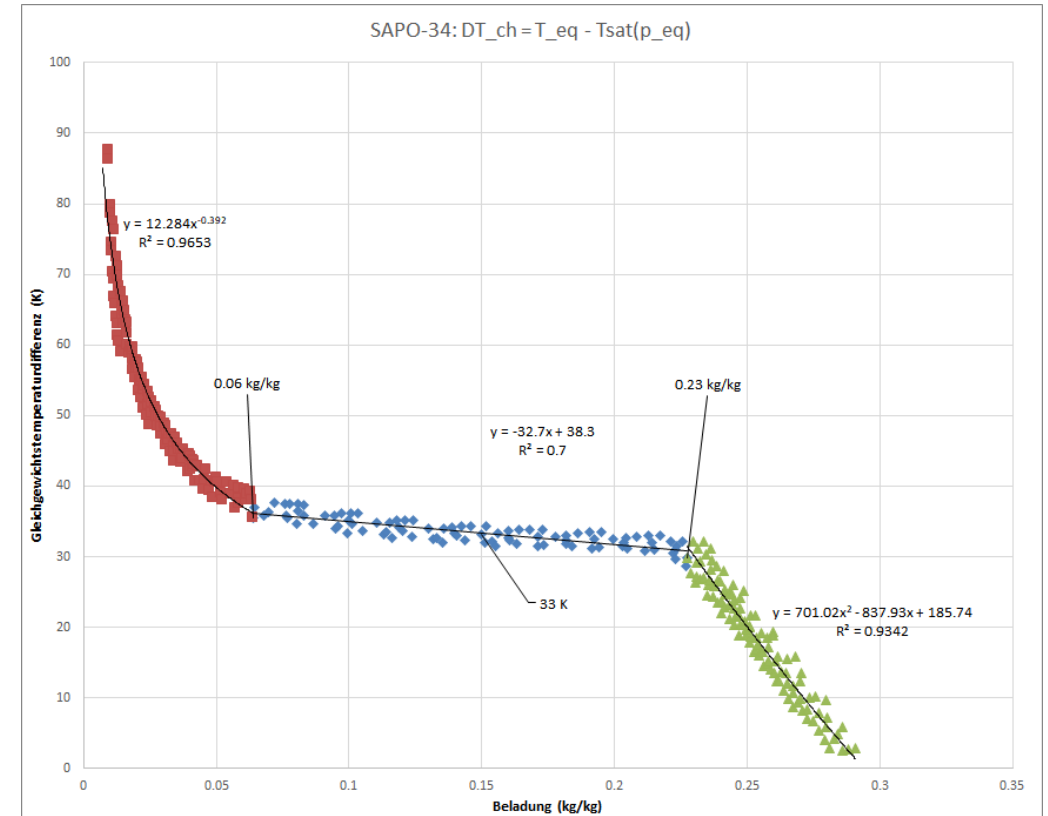
„quasi-isothermal“ states

# Sorption Technology

## Highlight: Modelling in Simplified Model



**Aluminium Fumarate**  
(Data ISE, Cycle conditions 20/35/65 °C)



**SAPO-34**  
(Data Fahrenheit)

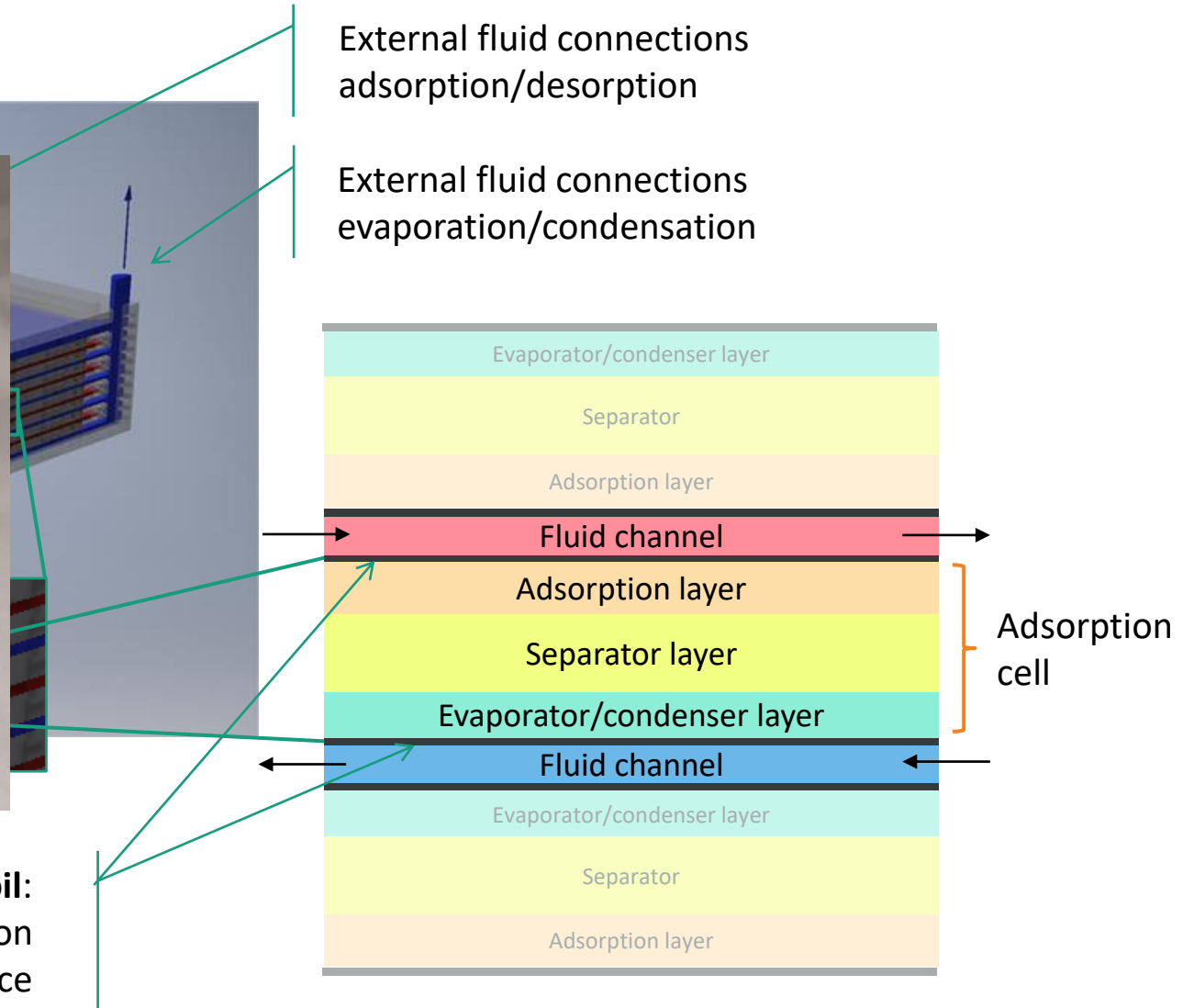


# Sorption Technology

Highlight: Stacked cellular design: “foil module”



Aluminium **composite foil**:  
vacuum encapsulation  
+ HX-surface



# Adsorption technology

## Further applications in focus

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- Heat transformer: measurement of silica gel adsorption modules as heat transformers
- High temperature sorption heat pumps: very hard to compete with compression heat pumps  
low TRL research on high temperature storage (electrically driven?) for process heat
- AC beds as safety measure for compression heat pumps with natural/flammable refrigerants: a lot of work for propane heat pumps, but also mobile applications
- Open sorption: coating technology available, but currently no projects/people for this topic; on system level, work on sorption wheels for battery production (very high requirements on dry air, dew point  $-40^{\circ}\text{C}$  or even  $-60^{\circ}\text{C}$ ), also integration in drying processes
- CCU: material characterization competences and infrastructure moved to other departments at ISE with focus on CCU/DAC; support on adsorption background

A photograph of a modern, curved, multi-story building with a glass and metal facade. The building is surrounded by greenery, including trees and a lawn. In the foreground, there are three tall flagpoles with white flags featuring the Fraunhofer logo. The sky is blue with some light clouds.

# Contact

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