
Improvements Developed during the IEA SHC Task 54

Technical Improvements

TASK 54

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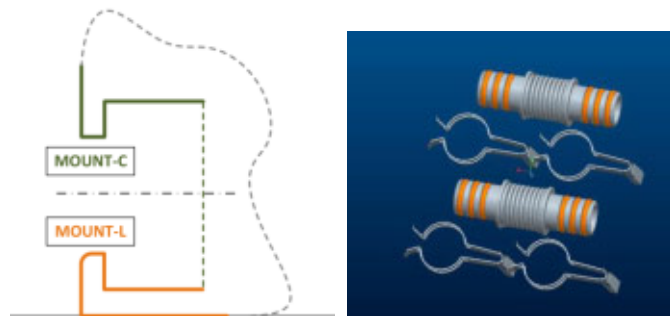
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ISEC 2018
Graz, Austria

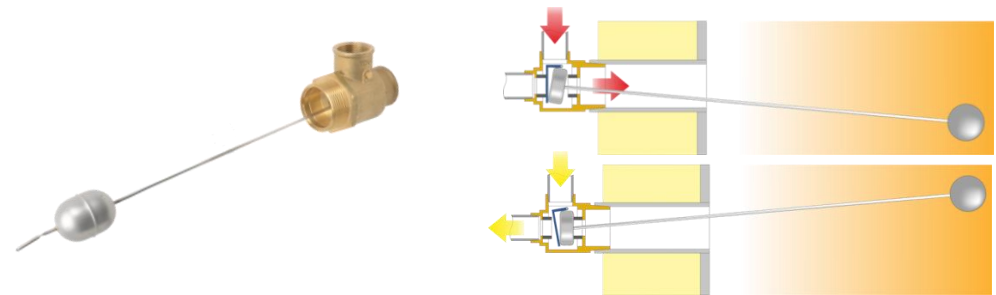
19 September 2018

Some technical improvements investigated in the frame of TASK 54

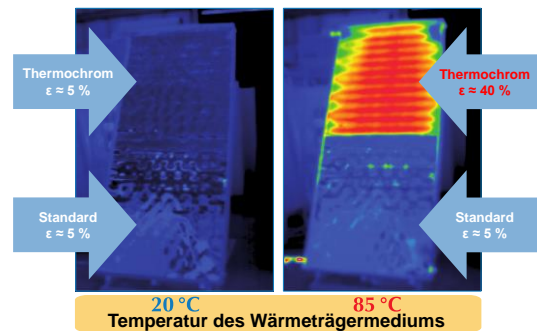
Standardization



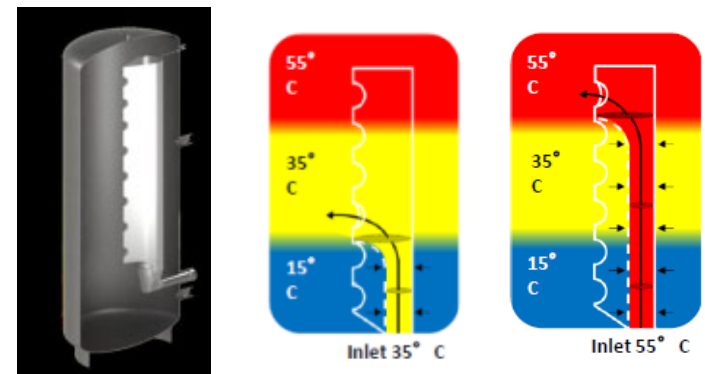
Simplified system control strategies



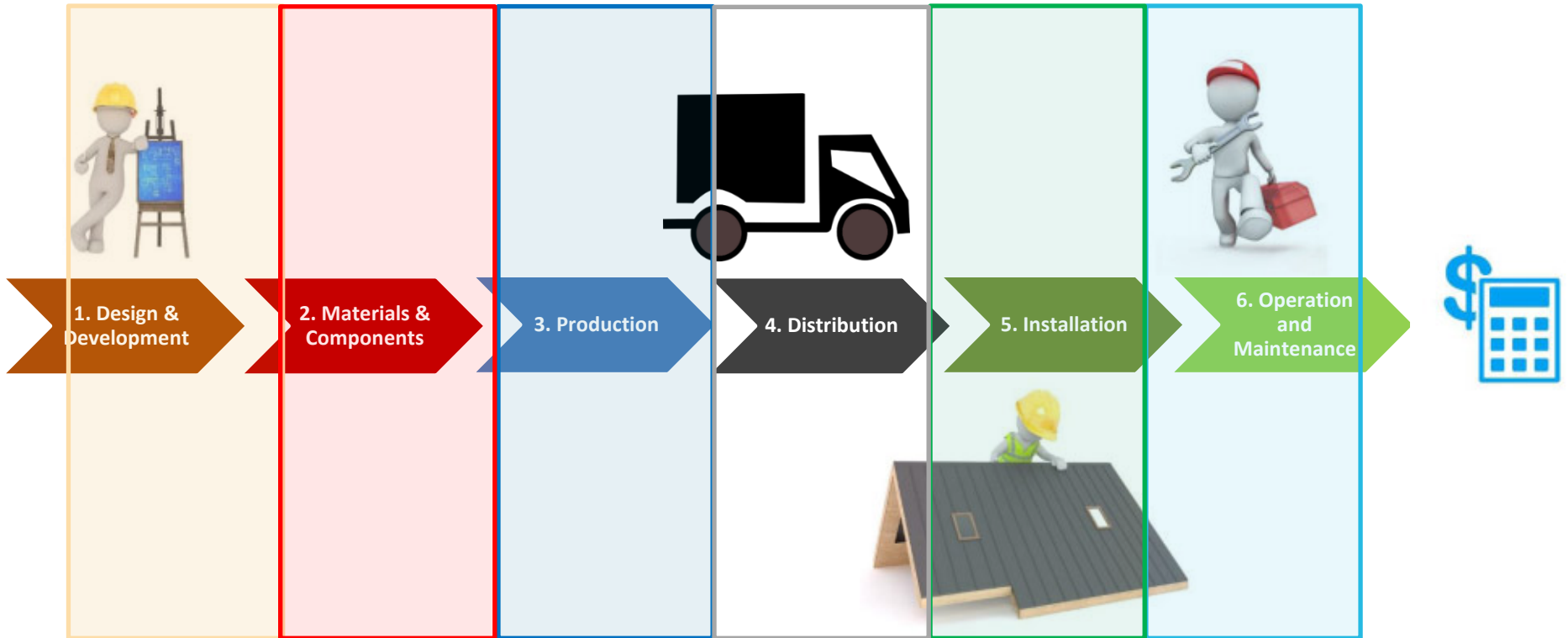
Collectors for overheating protection



More efficient storage systems

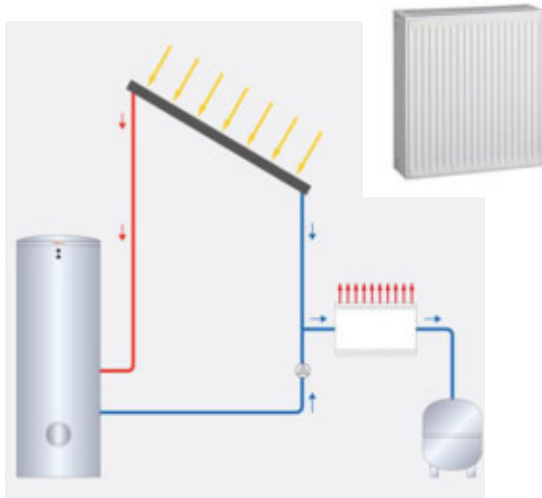


Technical Improvements along the Solar Thermal Value Chain



Case study 1: Overheating protection – State of the Art

Cooling devices



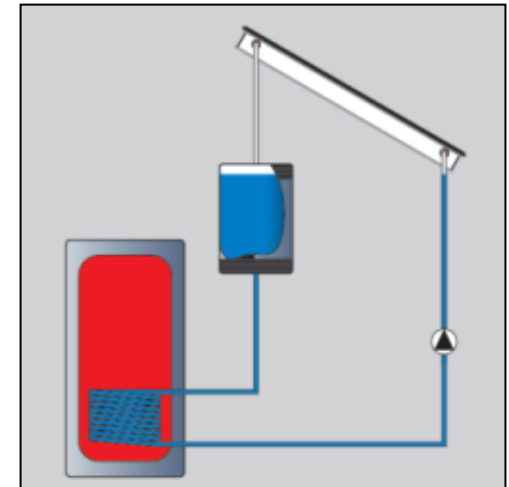
Source: Viessmann

Shading



Source: Home Power Inc.

Drainback

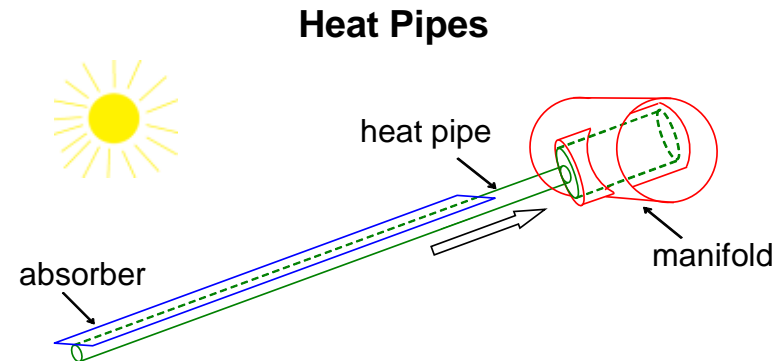


Source: Solar Technologie Int.

Case study 1: Collectors with overheating protection

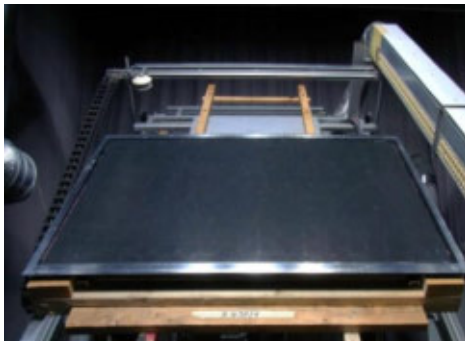
Working principle

- “Automatically” power shut-off by increasing heat losses
- Reduction of stagnation temperature



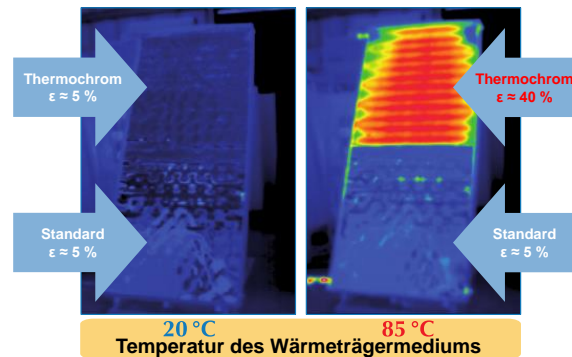
Institute for Solar Energy Research Hamelin ISFH

Thermo-induced U-value switcher



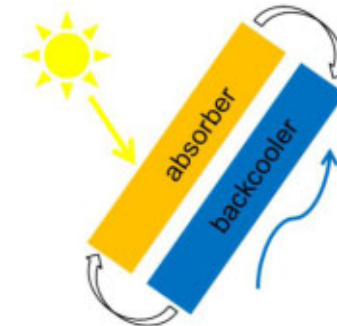
HSR University of Applied Science Rapperswil

Thermochromic Absorber



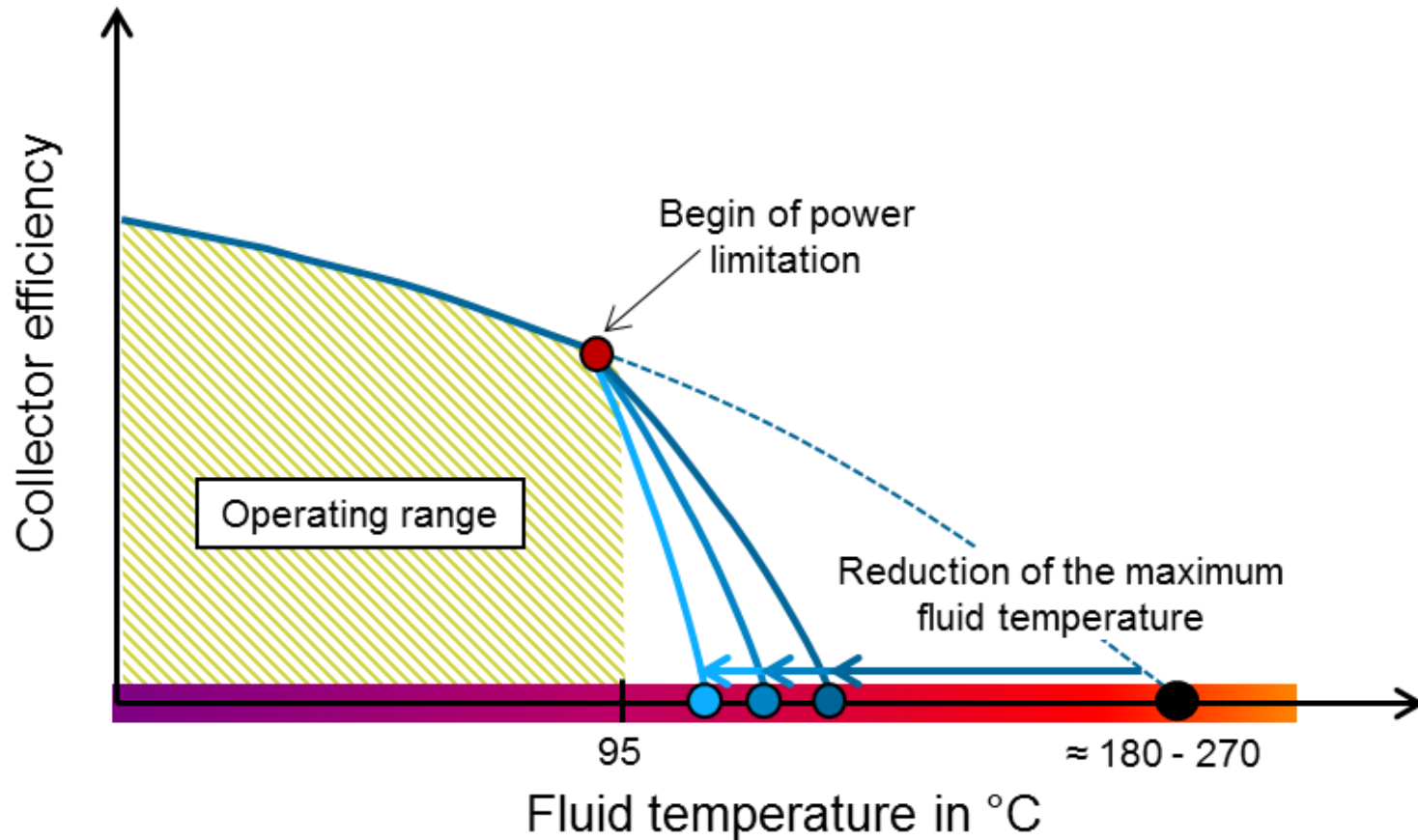
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Thermomechanical Valves



University of Innsbruck

Case study 1: Collectors with overheating protection



Case study 1: Collectors with overheating protection

Metal Piping /
EPDM-Insulation
> 95 °C



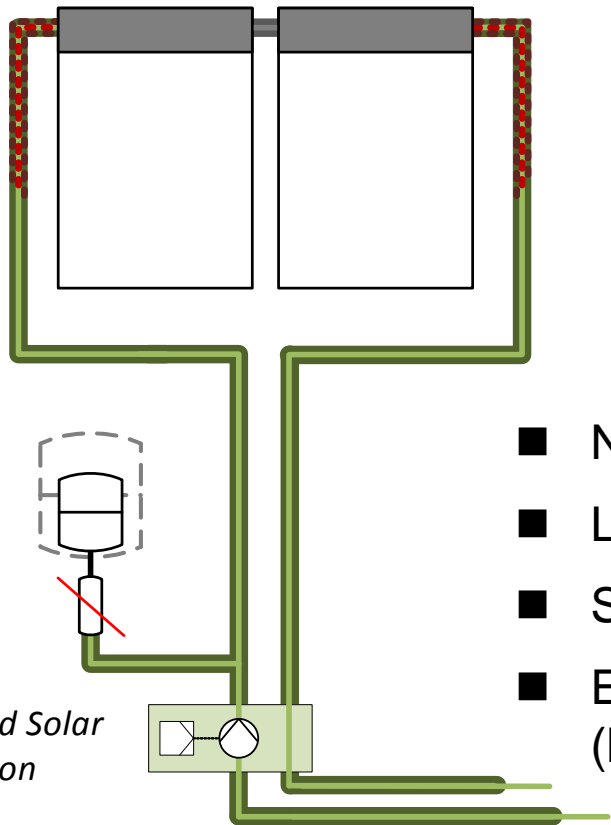
Pre-Insulated
Polymeric Piping
< 95 °C
for short times up to 110°C



Smaller Expansion
Vessel

Omit Ballast
Vessel

Optimized Solar
Station

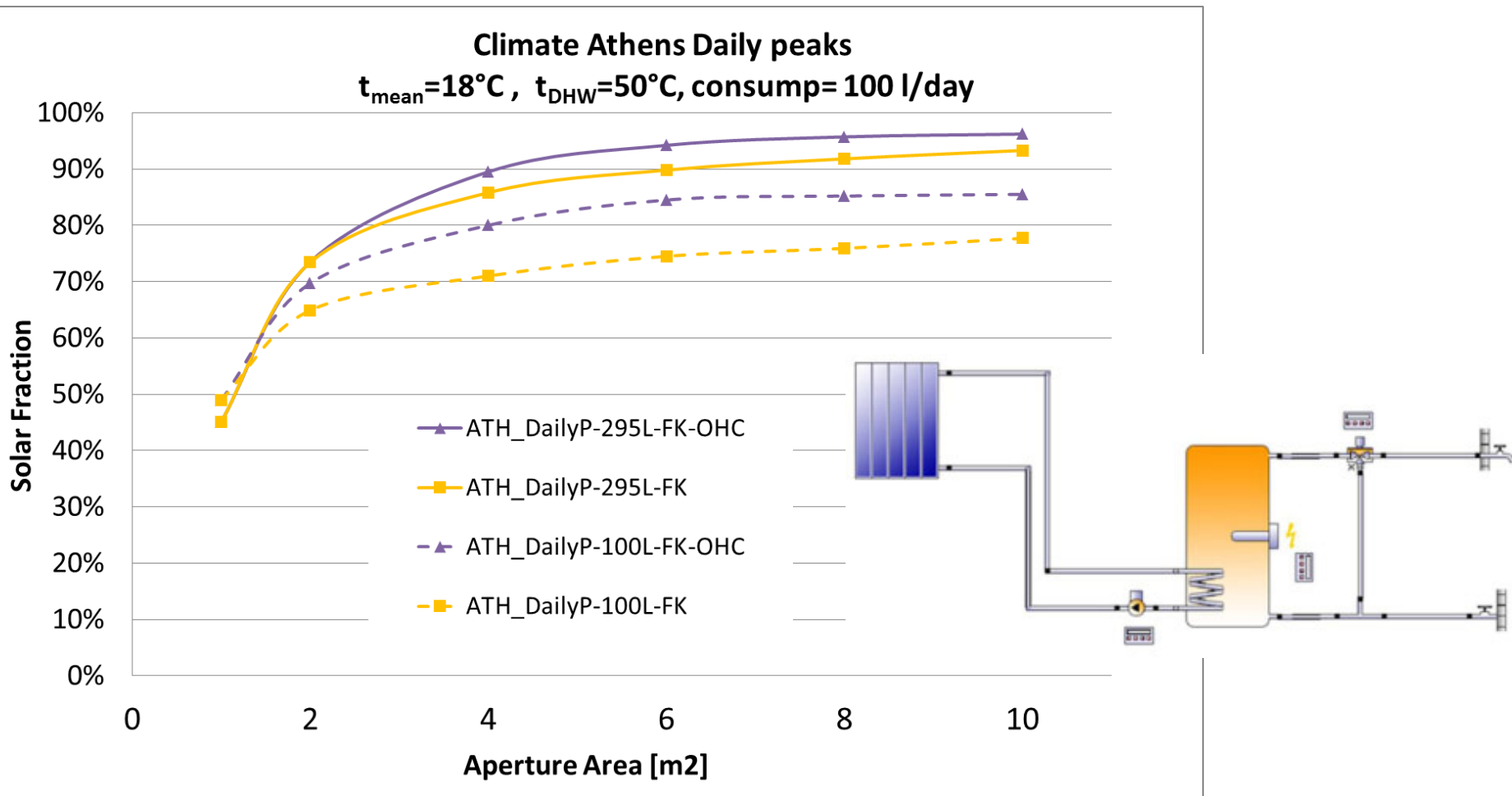


Advantages

- No vaporization of solar fluid
- Lower thermomechanical stress
- Simpler systems
- Extended lifetime of components (heat carrier)

Case study 1: Collectors with overheating protection

Cost reduction potential by tank size reduction due to system performance increase.



Case study 1: Collectors with overheating protection

Expected improvement for heatpipes-systems

Solar Domestic Hot Water System	Reference System	Expected improvement	Heatpipe System
Investment System [€]	2.600	- 18 / - 9 %	2.135 / 2.359
Installation [€]	1.250	- 20 / - 8 %	1.000 / 1.150
Maintenance [€/a]	77	- 55 / - 39%	35 / 47
Energy saving [kWh/a]	2.226	+0 %	2.226
Lifetime [a]	25	+0 %	25

Case study 1: Collectors with overheating protection

Cost reduction potential heatpipes-systems

Levelized Cost of Heat (LCoH) – SDHW System

LCoH_{sol,fin} Reference System (without VAT)	0.113 €/kWh
LCoH_{sol,fin} Heat pipe system (without VAT)	0.081 – 0.093 €/kWh
Cost reduction potential für solar heat	18 - 28%

Case study 1: Collectors with overheating protection

Cost reduction potential heatpipes-systems

Levelized Cost of Heat (LCoH) – SDHW System

LCoH_{ov,fin} Conventional System (without VAT)	0.113 €/kWh
LCoH_{ov,fin} Heat pipe system (without VAT)	0.115 – 0.117 €/kWh
Additional effort for solar assisted SDHW	2 - 4 %

Case study 2: Standardization



Standardization & mass production lead to...

- Lower production costs
- Easy packaging, storage, logistics
- Easier installation
- Low failures
- Higher energy efficiency

but

are not established in solar thermal!!



Global System for
Mobile Communications

Case study 2: Standardization in solar thermal systems

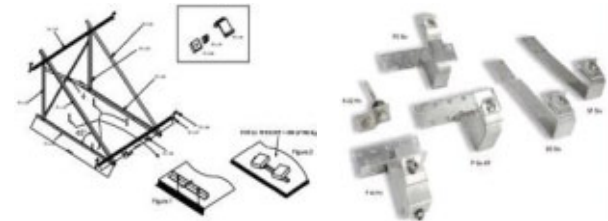
Different collectors



Different mounting systems

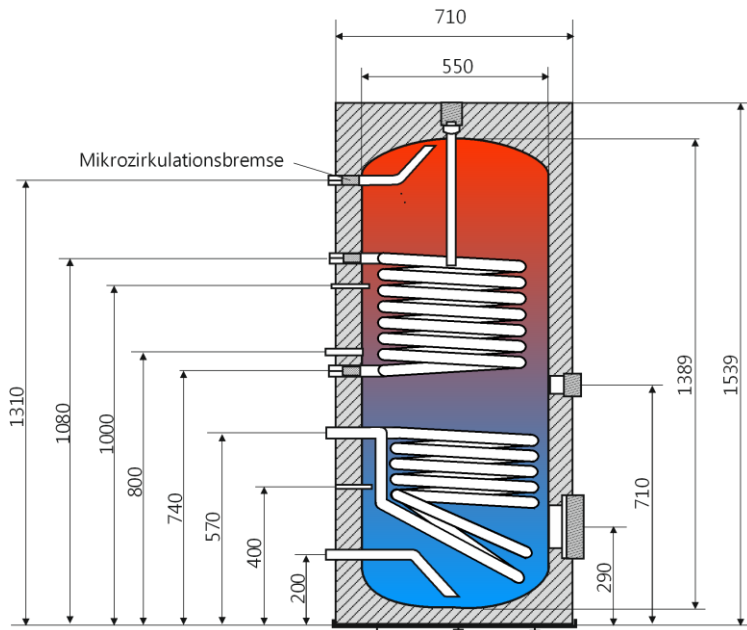


Different storage tanks

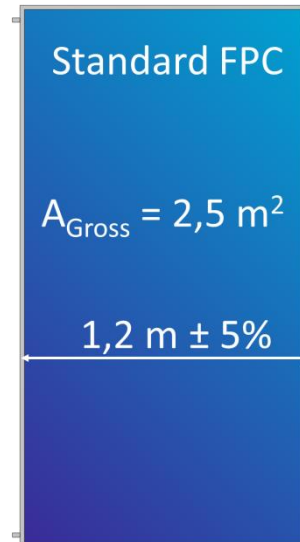


Case study 2: Standardization - TASK proposals

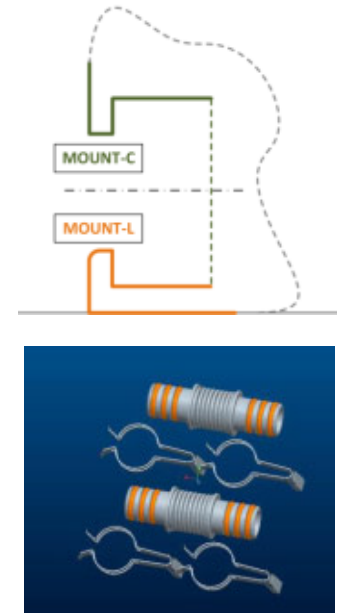
Standardized storages



Standardized collectors



Standardized mounting systems



Case study 2: Standardization

Expected Improvement for SDHW System

Solar Domestic Hot Water System	Reference System	Improvement	„Standardized“ System
Investment System [€]	2.600	-10 %	2.340
Investment Installation [€]	1.250	-10 %	1.125
Maintenance&Operation [€/a]	97	-24 %	74
Energy saving [kWh/a]	2.226	+10 %	2.449
Lifetime [a]	25	+10 %	27.5

Case study 2: Standardization

Cost reduction potential for SDHW systems

Levelized Cost of Heat (LCoH) – SDHW System

$LCoH_{sol,fin}$ Reference System (without VAT)	0.113 €/kWh
$LCoH_{sol,fin}$ Heat pipe system (without VAT)	0.080 €/kWh
Cost reduction potential für solar heat	29%

Case study 2: Standardization

Cost reduction potential for SDHW systems

Levelized Cost of Heat (LCoH) – SDHW System

$LCoH_{ov,fin}$ Conventional System (without VAT)	0.113 €/kWh
$LCoH_{ov,fin}$ Standardized system (without VAT)	0.114 €/kWh
Additional effort for solar assisted SDHW	1%

Conclusion

- TASK 54 analysed several technical improvements for cost reduction
- **Standardization** and **temperature limitation** in the solar loop are identified as most promising general approaches
- Cost of solar heat can be reduced by about **30% with single measures**
- **Higher cost reduction** by combining different measures are possible
- Cost of heat for improved solar assisted DHW systems is **comparable to the** cost of heat for **conventional** systems

Thank you for your attention!



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More on Task 54:

<http://task54.iea-shc.org>



https://twitter.com/iea_shc_task54