Improvements Developed during the IEA SHC Task 54

Technical Improvements

TASK 54

Dr. Alexander Thür[1]
Dr. Federico Giovannetti[2]
Dr. Stephan Fischer[3]

[1] University Innsbruck, Austria
[2] ISFH, Germany
[3] IGTE, Germany

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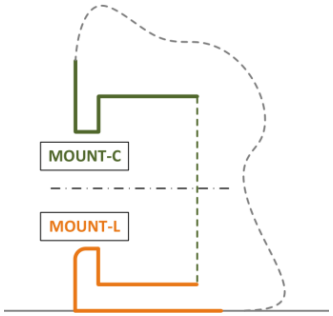
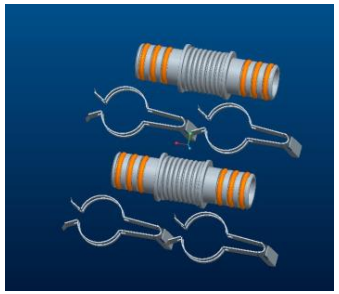
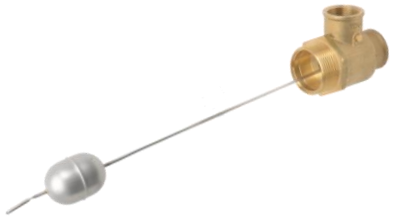
Some technical improvements investigated in the frame of TASK 54

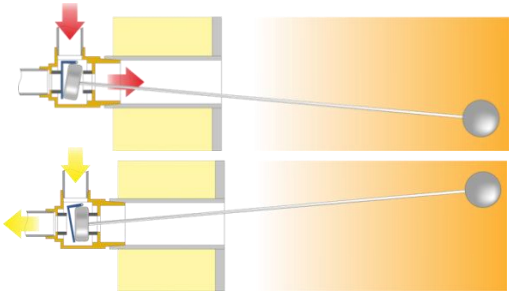
Standardization



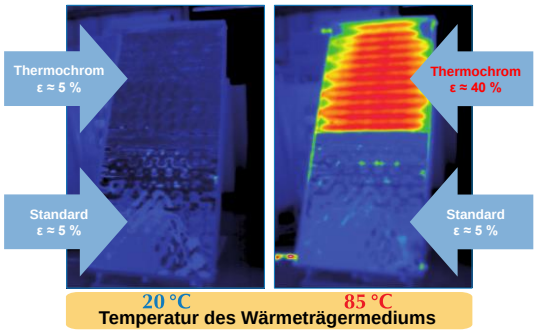


Simplified system control strategies

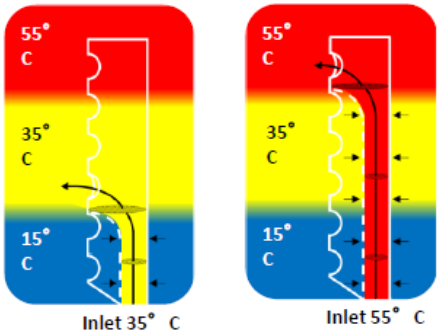




Collectors for overheating protection



More efficient storage systems



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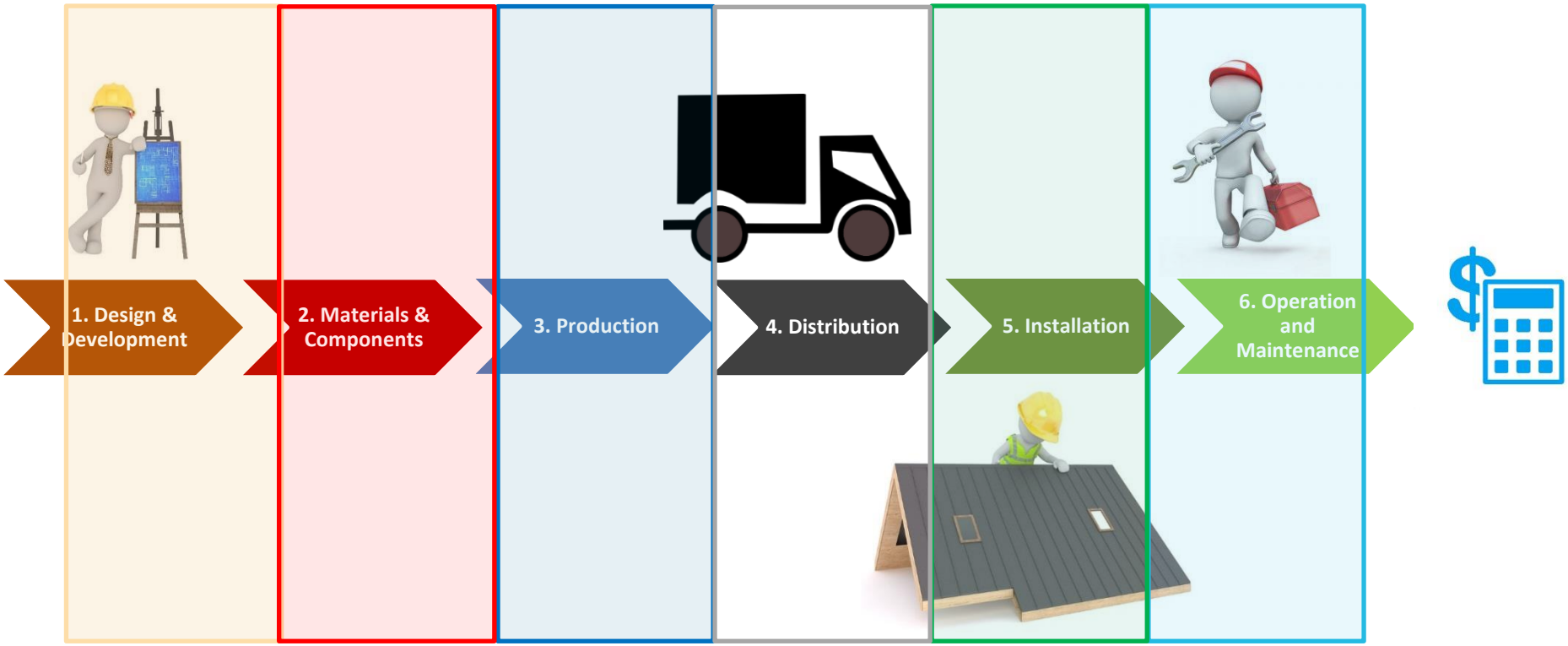
Technical Improvements
along the Solar Thermal Value Chain



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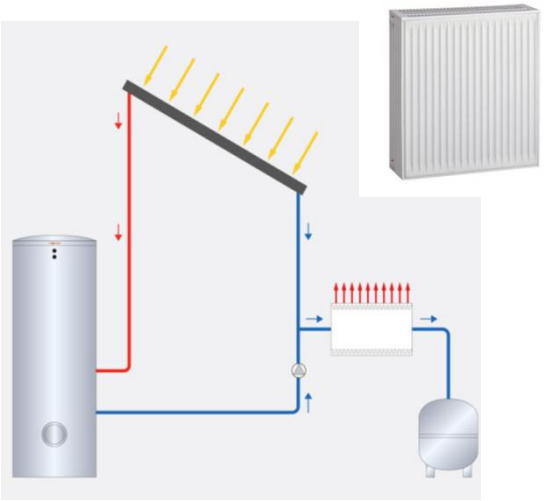
Case study 1: Overheating protection – State of the Art

Cooling devices

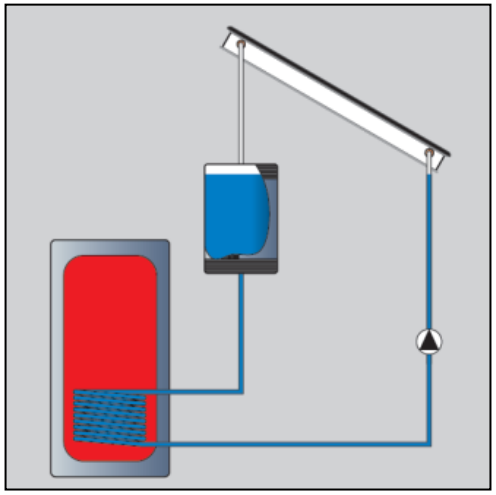


Source: Viessmann

Shading

Source: Home Power Inc.

Drainback



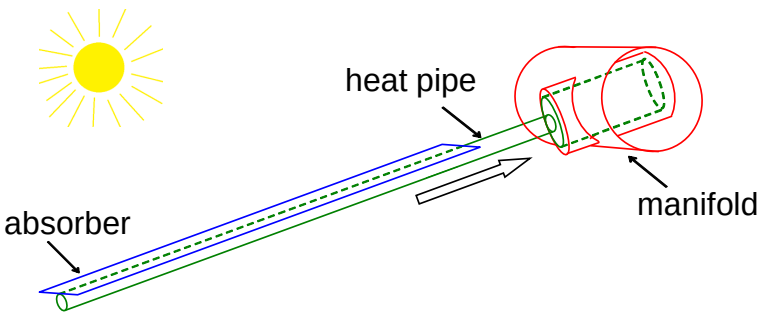
Source: Solar Technologie Int.

Case study 1: Collectors with overheating protection

Working principle

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

Heat Pipes



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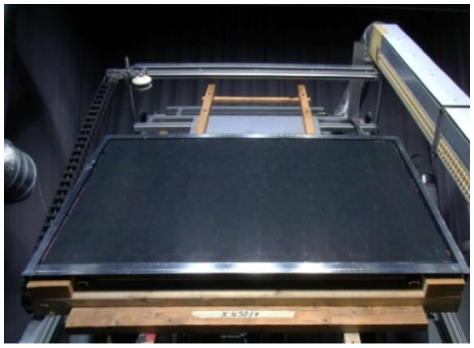
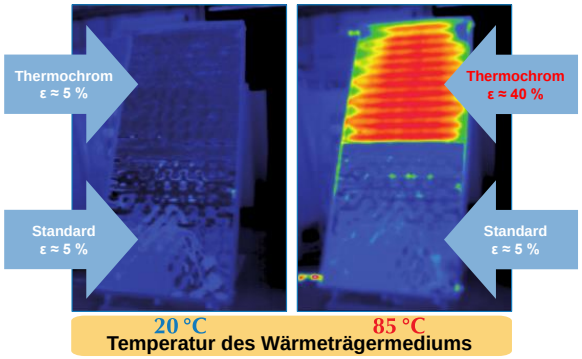
Thermo-induced U-value switcher



HSR University of Applied Science Rapperswil

Thermochromic Absorber



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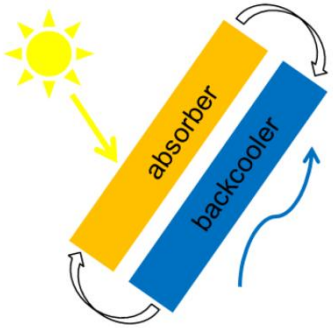
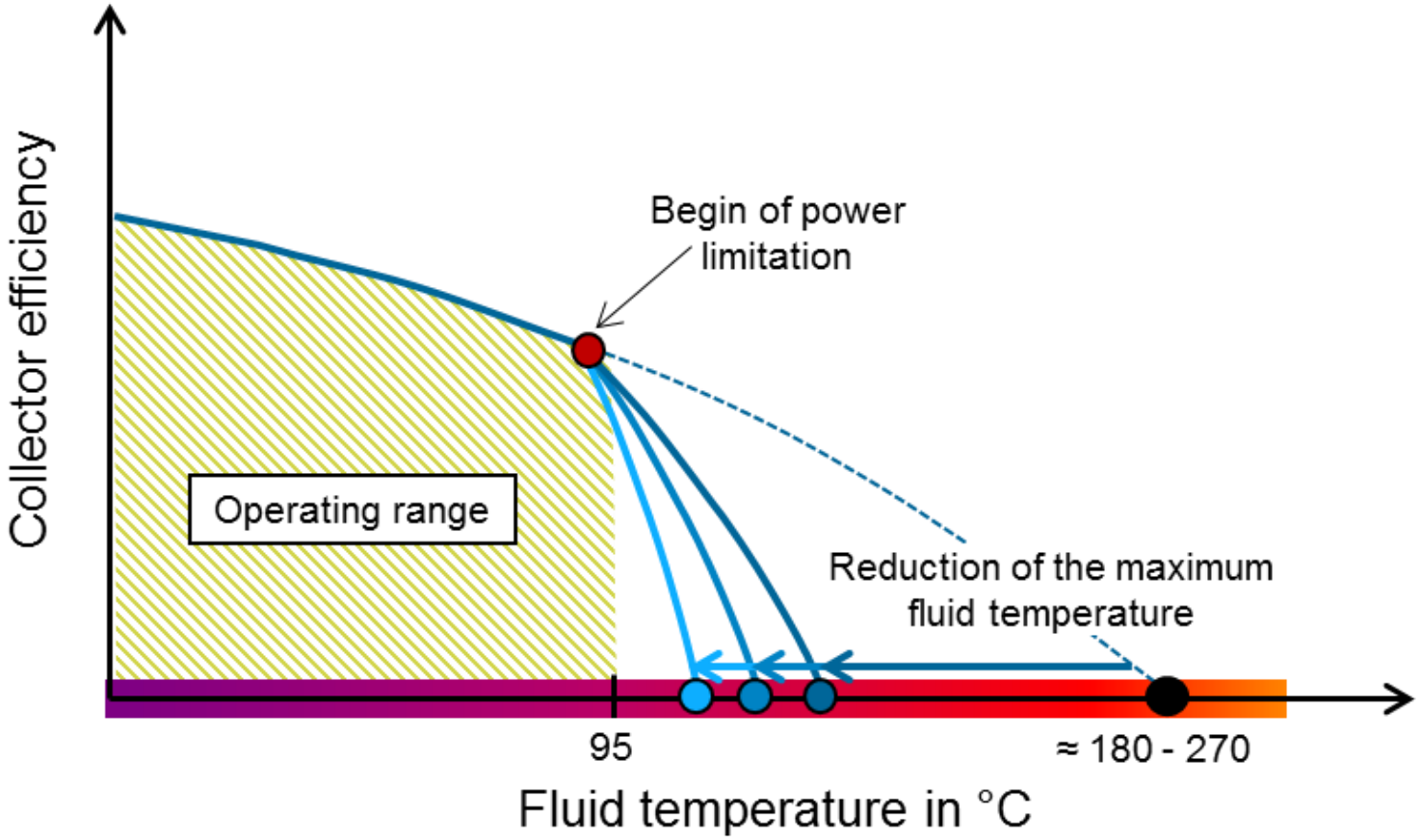
Thermomechanical Valves



University of Innsbruck

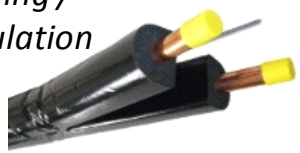
Case study 1: Collectors with overheating protection



Case study 1: Collectors with overheating protection

Metal Piping / EPDM-Insulation

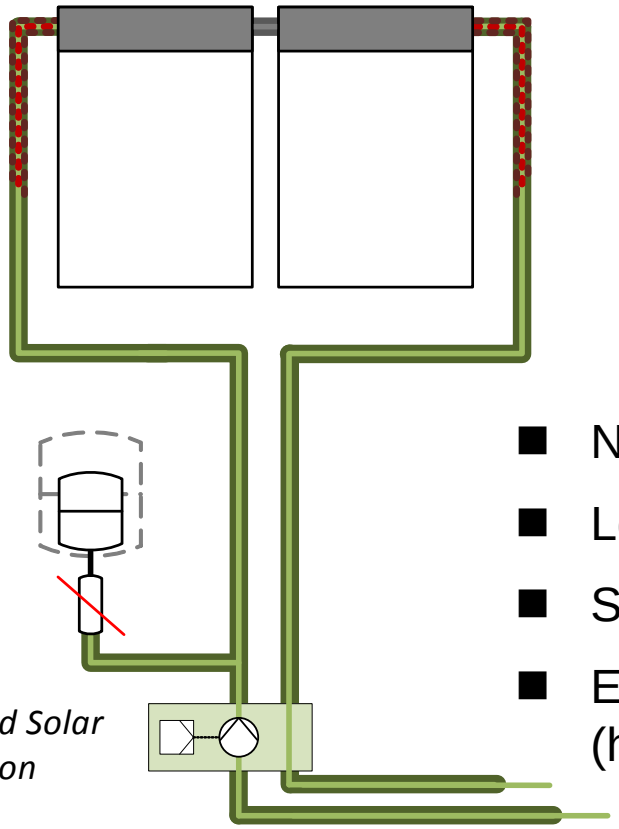
> 95 °C



Pre-Insulated Polymeric Piping

< 95 °C

for short times up to 110°C

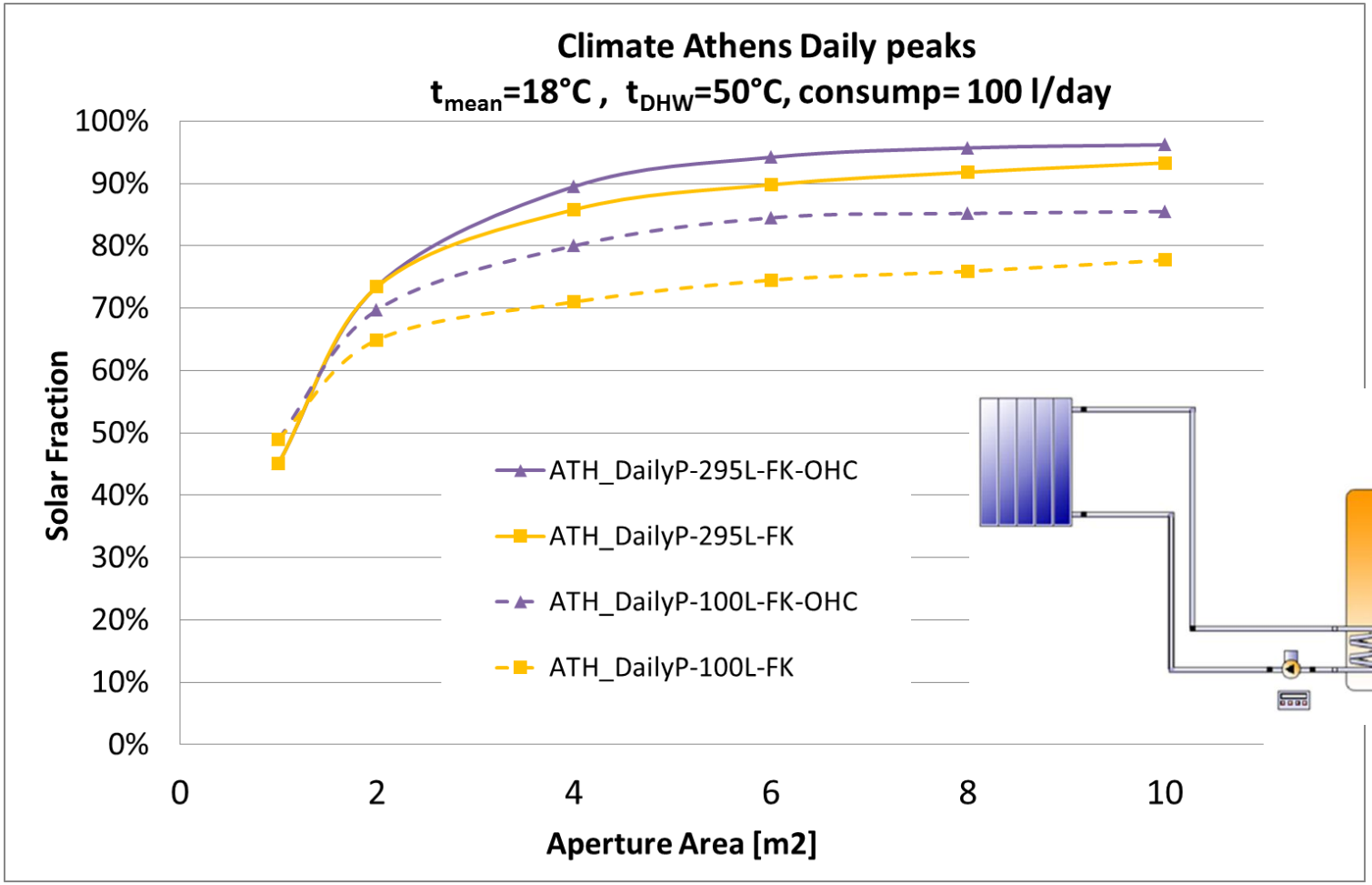


Advantages

- 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.



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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	- 64 / - 50%	28 / 39
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)	0.078 – 0.089 €/kWh
Cost reduction potential für solar heat	**21 - 31%**

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

GSM™
Global System for
Mobile Communications

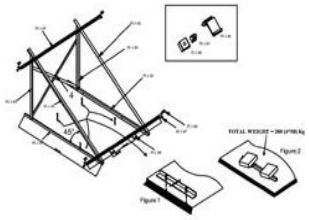
but
are not established in solar thermal!!

Case study 2: Standardization in solar thermal systems

Different collectors

Different storage tanks

Different mounting systems



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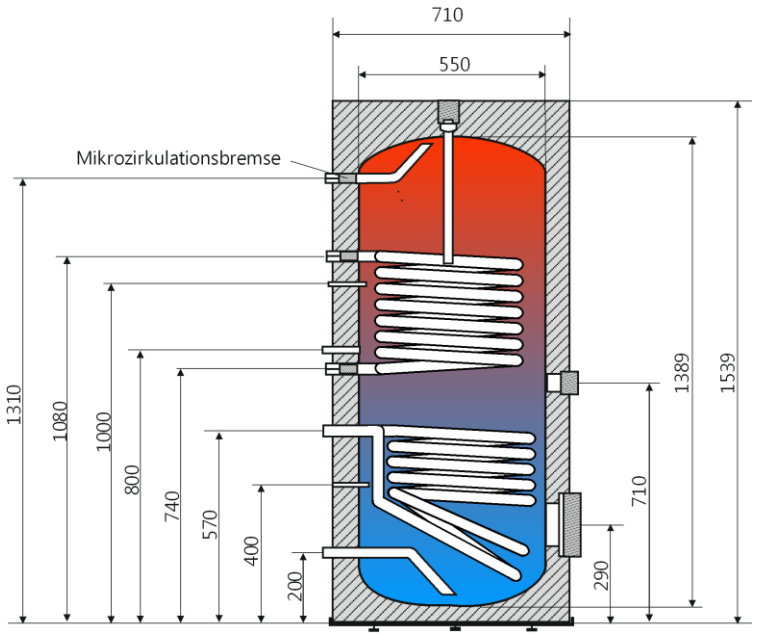
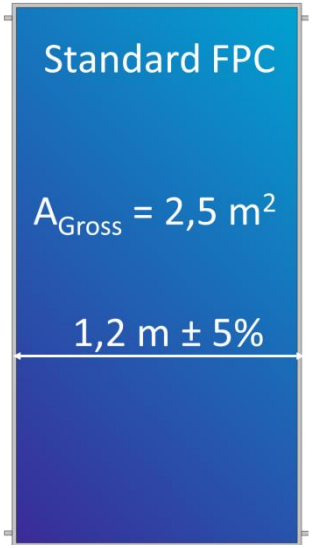
Case study 2: Standardization - TASK proposals

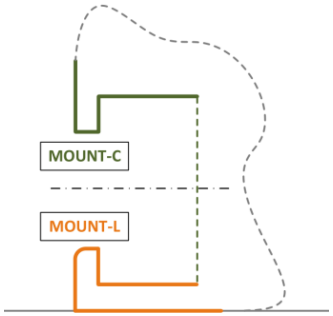
Standardize dstorages

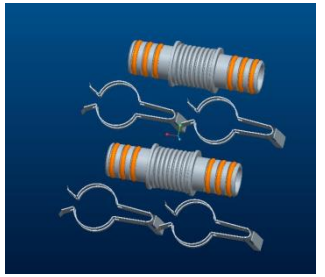


Standardized collectors



Standardized mounting systems





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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!

universität innsbruck

Arbeitsbereich für
Energieeffizientes Bauen

University of Innsbruck

Alexander Thür

www.uibk.ac.at

Alexander.Thuer@uibk

More on Task 54:

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