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Building Integration of Solar Thermal Systems – TU1205 – BISTS



Solar Air Heating Collectors (SAHC)

Korbinian Kramer,
 Christoph Thoma,
 Christian Welz


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Agenda

- Luko-E
- Test Stand for SAHC
- Variants of SAHC
- Impressions
- Basics for SAHC
- Recent R&D on SAHC


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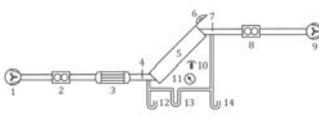


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Recent achievements: Luko-E



Fraunhofer TestLab Solar Thermal Systems :
Test stand for un- / covered SAHC




EN ISO 9806:2014





Solar Keymark




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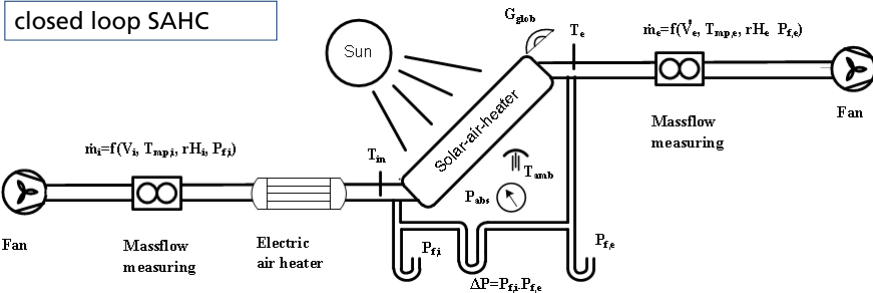


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Test stand



closed loop SAHC




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Test stand

open loop SAHC

- ansaugen der **Umgebungsluft**
 $\vartheta_{in} = \vartheta_{amb}$
- Es können nur Wirkungsgrad**punkte** bei **unterschiedlichen**

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Test stand for uncovered SAHC

- Test stand for collectors up to 6m² (3m x 2m), 15 m² (3m x 5m) respectively, without wind channel
- Specified back cover (EnEV 2009)
- Specific and controlled wind speed
- Flow rate 100 up to 2500 m³/h
- 2-axis Tracker (0,1° exact)
- 0° - 90° tilt angles

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Test stand for uncovered SAHC




Foto: Teststand für unbedeckte Luftkollektoren mit integrierter Folie als Windkanal



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Variants

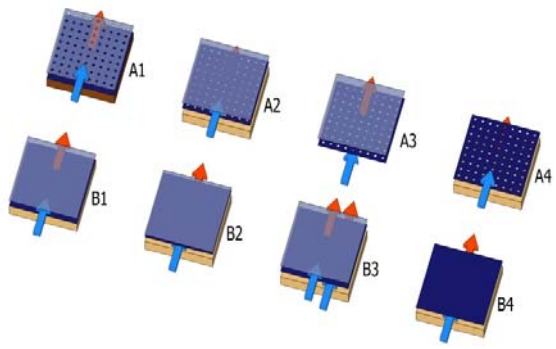




Figure 3 shows the different technical variants of SAHC [8]. Variants A1 to A3 and B1 to B3 are treated as glazed collectors. The light blue plane represents the transparent cover, the dark blue plane the absorber and the beige block represents isolation. Variants A4 and B4 are described as unglazed. Variants B1 to B4 are part of a closed loop of an air heating system, thereby potentially reaching higher outlet temperatures. Where else the variants A1 and A4 are heating ambient air in a single path through. Variant A2 and A3 could be used in both flow patterns. The blue arrow symbolizes the cold inlet air flux and the red is representing the hot air flux. From this arrows one can see, that some variants are from the point of view of the absorber, under flow (B2, B4), over flow (B1) or passed through (A1 to A4).


[1] Korbinian Kramer, "Interaction of Regulation and Innovation: Solar Air Heating Collectors", Energy Procedia, Volume 30, 2012, Pages 1311-1321, doi: 10.1016/j.egypro.2012.11.144



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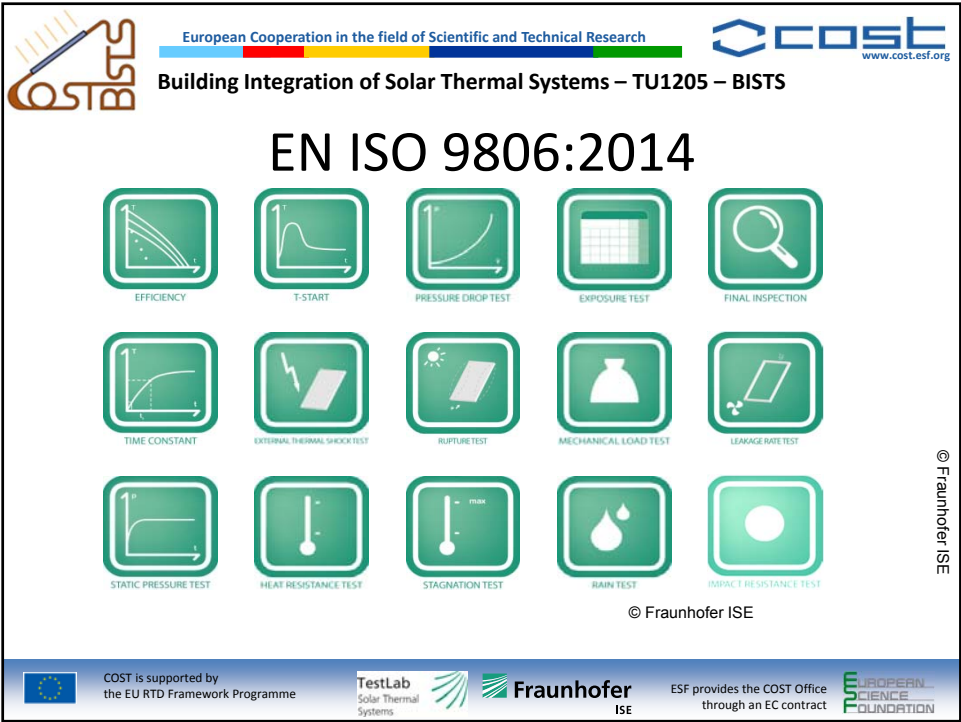
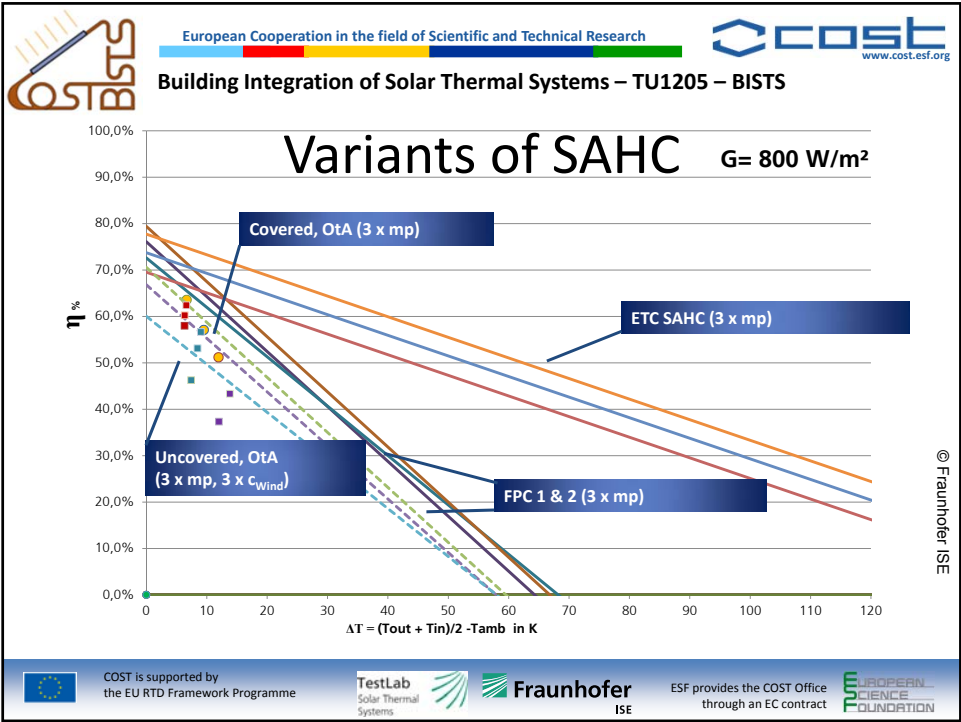
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Impression: Test of SAHC at the Fraunhofer TestLab Solar Thermal Systems



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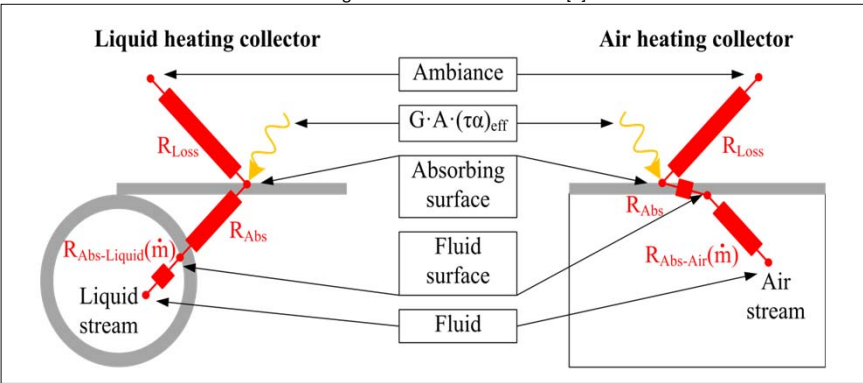
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Basics of Heat Transfer in SLHC and SAHC

Following slides are based on work of [2]



[2] Christian Welz, Christoph Maurer, Paolo Di Lauro, Gerhard Stryi-Hipp, Michael Hermann, „Mass Flow, Pressure Drop, and Leakage Dependent Modeling and Characterization of Solar Air Collectors“, Energy Procedia, Volume 48, 2014, Pages 250-263, doi: 10.1016/j.egypro.2014.02.030

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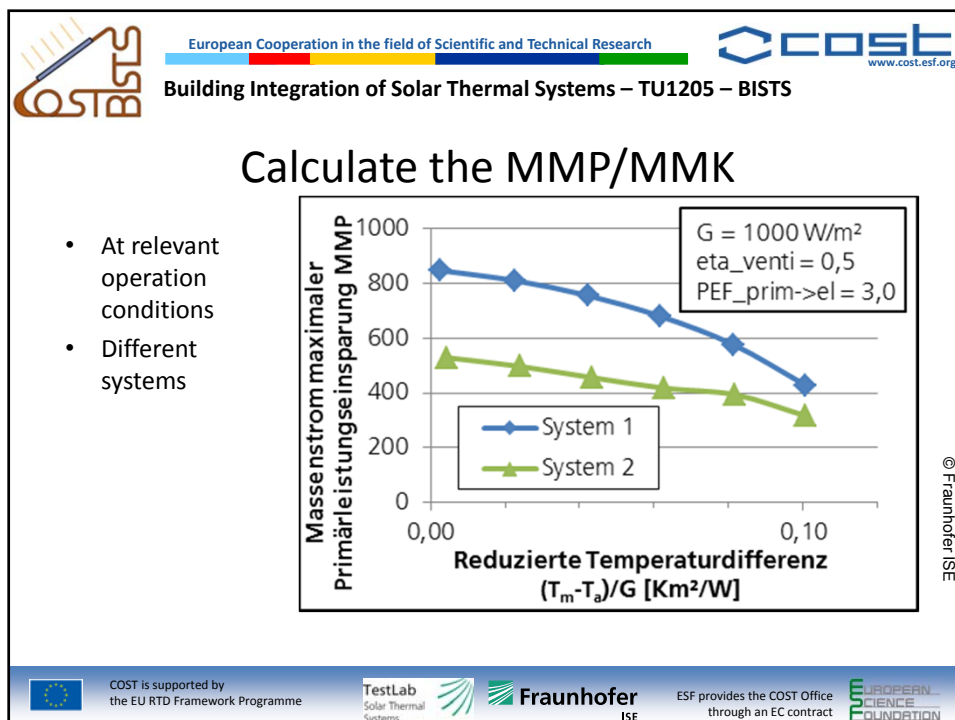
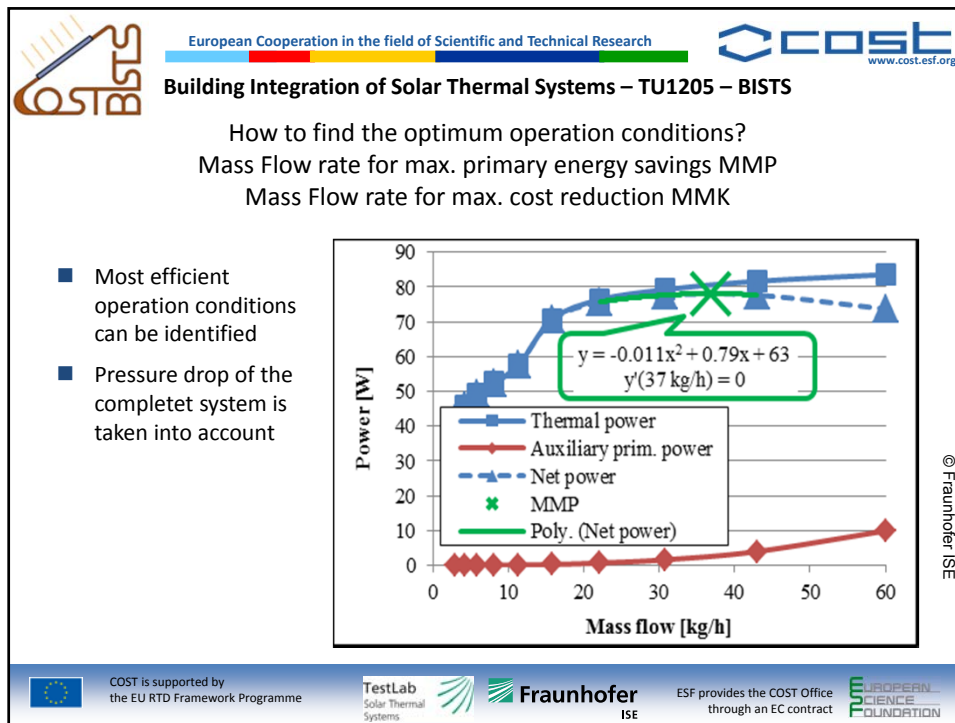
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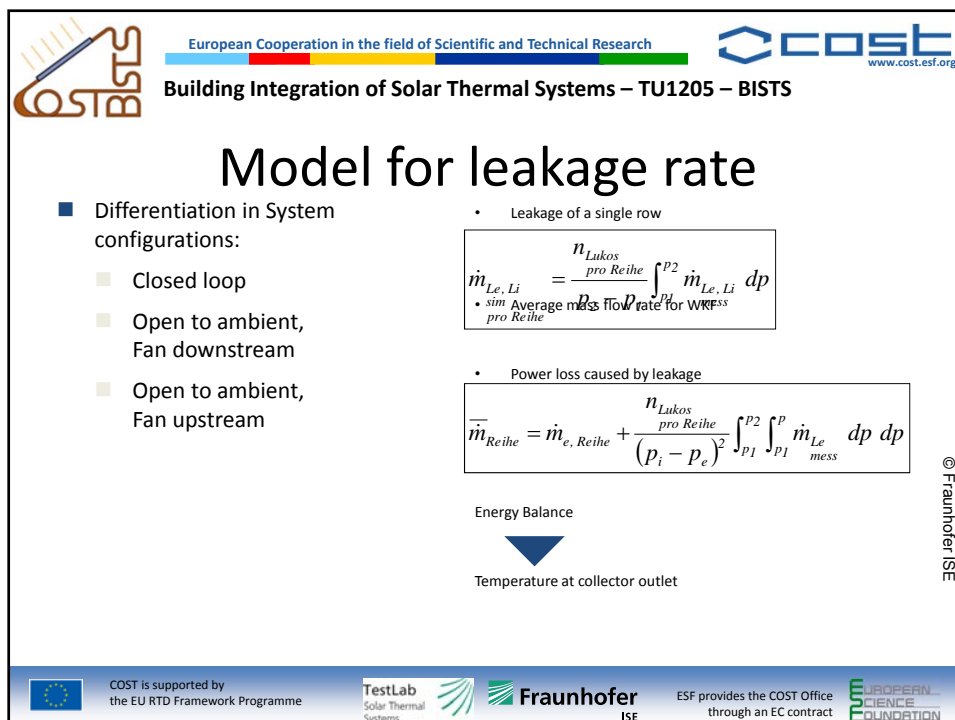
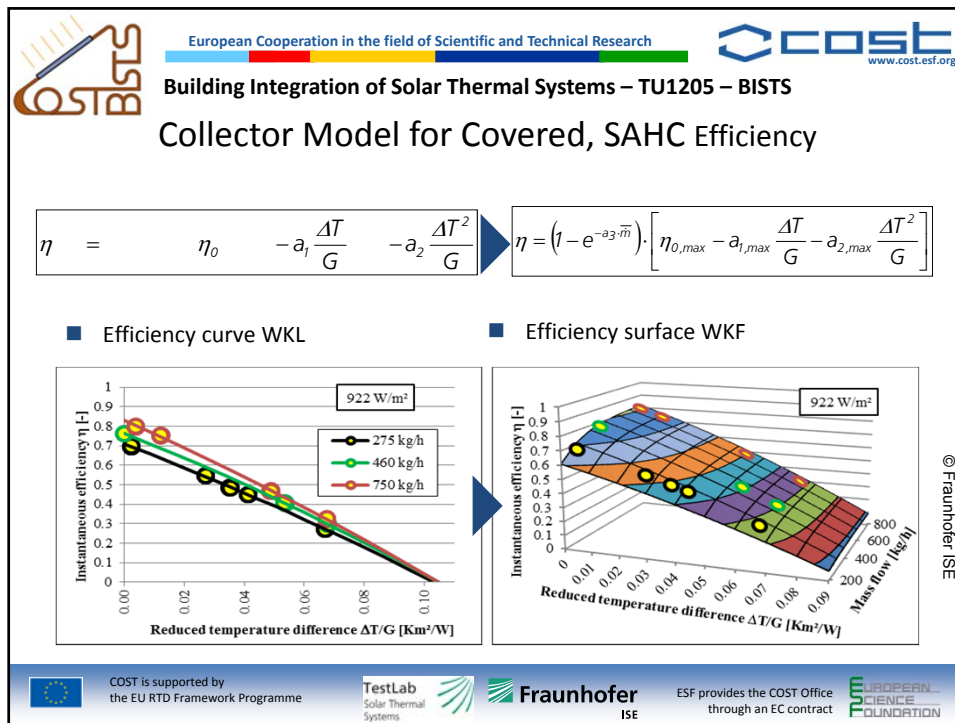
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TRNSYS-Type 832

- Extension of Types 832 for SAHC including
 - Mass flow dependent efficiencies
 - Leakage



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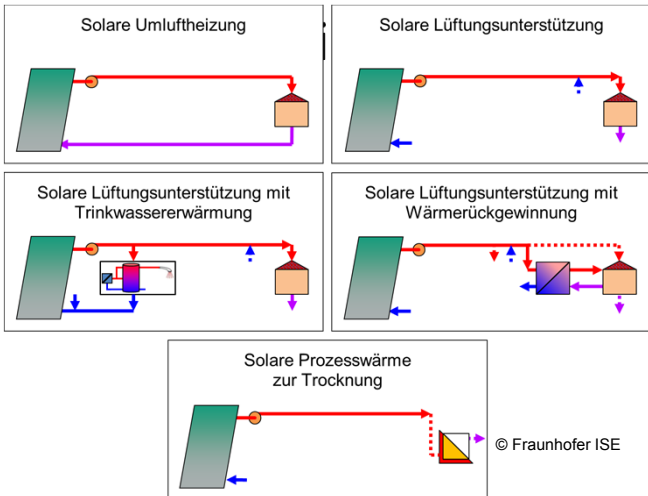
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Modellierte und simulierte



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Further readings

- Kramer K. *Relation of ecological policy instruments and technological innovation in the solar thermal branch*, in Proceedings of ISES Solar World Congress, October 2009, Johannesburg 2009
- Stryi-Hipp G, Kramer K, Richter J, Thoma Ch, Fortuin S, Mehnert S et al. *Towards an unified standard for solar air heating collectors*, in Proceedings of ISES Solar World Congress, 28.08. - 02.09. Kassel 2011
- Thoma C, Cerezo JDM, Kramer K, Richter J, Mehnert S, Stryi-Hipp G. *Temperature measurement in air ducts – an optimized method for Solar Air Heaters*, in Proceedings of Eurosun 2008, Lisbon 2008
- Banse S. *More Companies, more square meters*, in Sun & Wind Energy 12/2011, BVA Bielefelder Verlag GmbH & Co. KG, Bielefeld 2011
- Thoma C., Cerezo J., Kramer K., Richter J., Mehnert S, Stryi-Hipp G. *Temperature measurement in air ducts - an optimized method for solar air heaters*, in Proceedings of Eurosun Conference 2010, Oktober 2010, Graz
- G. Stryi-Hipp, K. Kramer, J. Richter, C. Thoma, S. Fortuin, S. Mehnert and C. Welz *Current status of standards for solar air heating collectors*, in Proceedings of ISES 2011, 28.08-02.09., Kassel



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