

Passive Cooling, Active Control: A Radiative Cooling Platform

by Dr. -Ing. Lajos Szabó

PO Day in Budapest 05/03/2026

About TITK e.V.

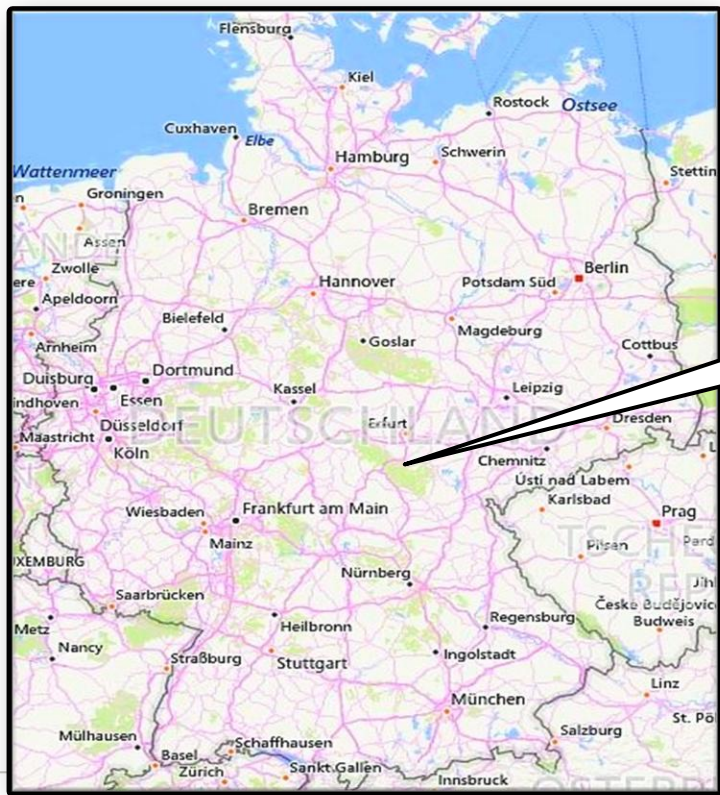


Thuringian Institute of Textile and Plastics Research

- Founded in 1991
- Team of 140 scientists and laboratory, technical and commercial assistants
- Research expertise from fibers in the textile to the ultra-modern polymer materials.
- TITK is an industry-oriented research institute
- TITK also plays an important role in the professional training of young men and women



Rudolstadt, where?



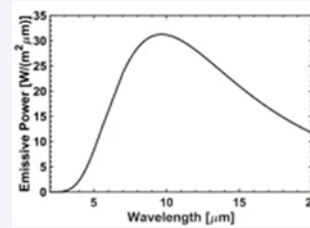
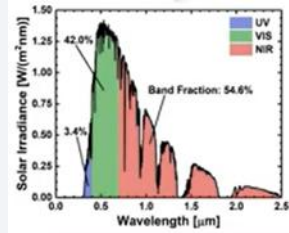
The Sky as a Thermodynamic Resource



Earth (300K)

Sun (6000K)

Outer Space (3K)



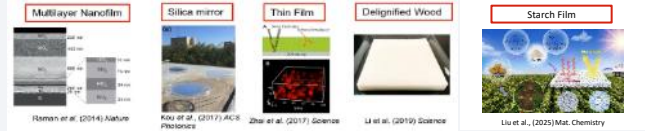
Solar Water Heating



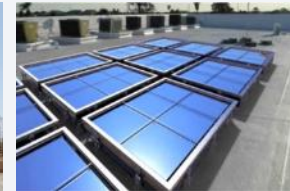
Solar Photovoltaic



Solar Tower



Yakhchal
400 BCE



California Institute of Technology
2015

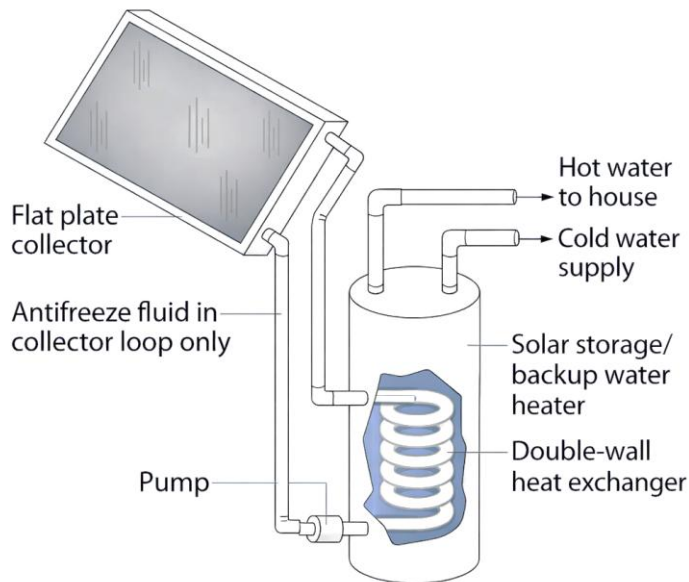


SkyCool Systems
2023

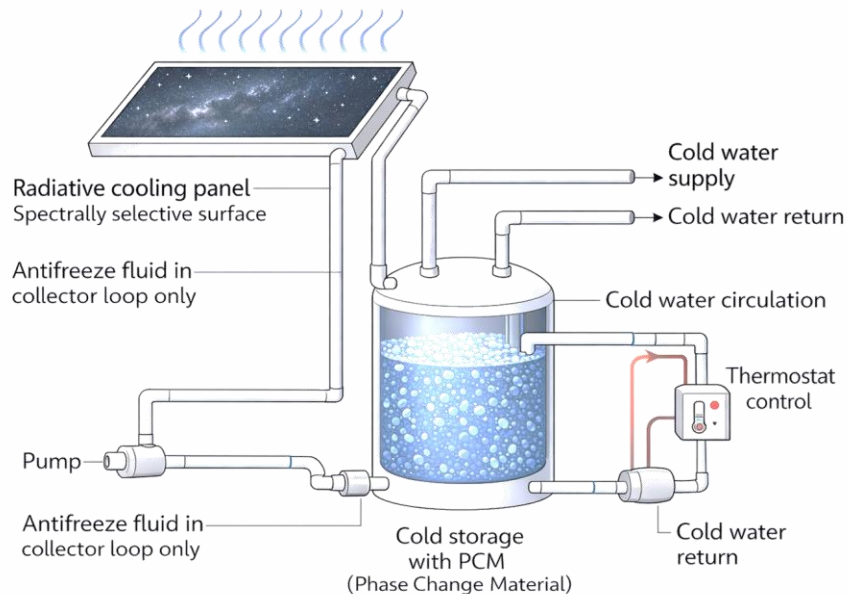
Reengineering Existing Technology for New Applications



Active, Closed Loop Solar Water Heater









Radiative Cooling System with PCM-Storage








Key Requirements for a Successful Consortium



What TITK e.V. can do:

-  Development of spectrally selective radiative cooling materials and coatings
-  Design and engineering of cooling panels and thermal modules
-  Development and integration of cold storage materials such as PCM
-  Heat exchanger design using polymer and hybrid material solutions
-  Material characterization and thermal performance testing
-  Reliability, durability, and environmental testing under realistic conditions

What we are looking for:

-  Integration of fluid circulation and thermal management concepts
-  Heat exchanger design hybrid material solutions
-  Multiphysics simulation and system performance modelling
-  Prototyping, demonstrator development, and pilot scale production
-  Project coordination, system integration support, and technology transfer to industry

Benefits and Limitations of Radiative Cooling Systems



Disadvantages of Radiative Cooling



Strong dependence on weather, humidity, and cloud cover



Limited cooling power compared to conventional refrigeration



Large surface area often required



Performance varies with climate and time of day



Integration into existing systems can be complex



Technology still emerging for large scale applications

Advantages of Radiative Cooling



Very low or zero electricity consumption in passive operation



Can achieve temperatures below ambient under suitable conditions



Reduces cooling energy demand and peak loads



Silent, low maintenance, and potentially long lifetime



Scalable and compatible with renewable energy systems



Can be combined with thermal storage for improved usability





Let's talk about new projects!



Vibration Testing with Climatic Chamber at TITK



Climatic chamber for combined testing

- WEISS climatic chamber synchronized with vibration
- Temperature range: -70 °C to 180 °C
- Temperature ramp: up to 5 K/min
- Humidity option: 10 to 95 %rH (dew point up to 94 °C)
- Usable volume: 1080 mm x 1100 mm x 950 mm, load up to 100 kg

Electrodynamic vibration system

- Electrodynamic shaker system SW8142 28 (28 kN rating)
- Test modes: sine, random, resonance search, shock, sine on sine
- Typical standards: IEC 60068 2 6, IEC 60068 2 27, IEC 60068 2 64,
IEC 60068 2 38, IEC 60068 2 57
- Key performance: 7 to 2700 Hz, ± 26 mm, up to 3 m/s, up to 60 kg

