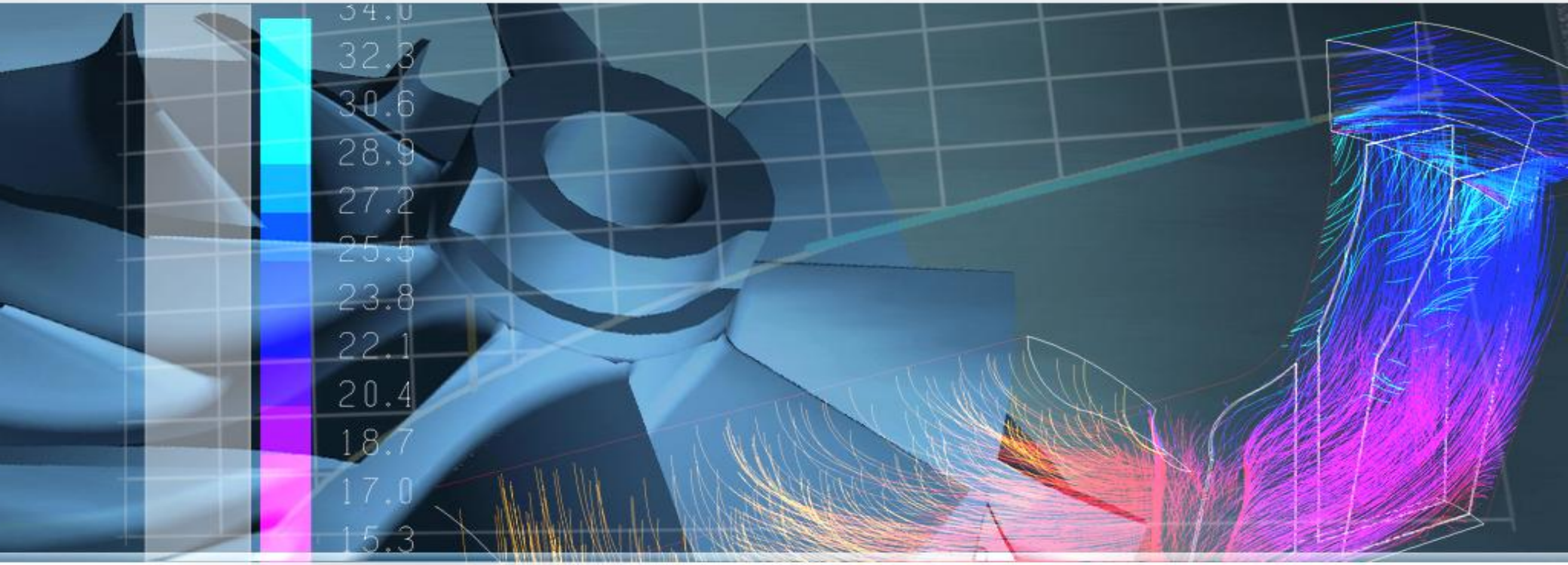
ILK Dresden



Institut für Luft- und Kältetechnik Dresden gGmbH

Kühlung mit Photovoltaik – Beispiele und Chancen

Cooling with photovoltaic – examples and chances

ILK Dresden - General

- **Independent, nonprofit R&D institute**
- **Founded 1964**
- **Re-founded 1990**
- **Approx. 150 employees**

  (> 70% with college degree)
- **> 3000 m² test area**
- **> 12 Mio. Euro revenue p.a.**

Public funded (60%):
Industry-oriented research
Collaborative research
Pre-competitive research

↔

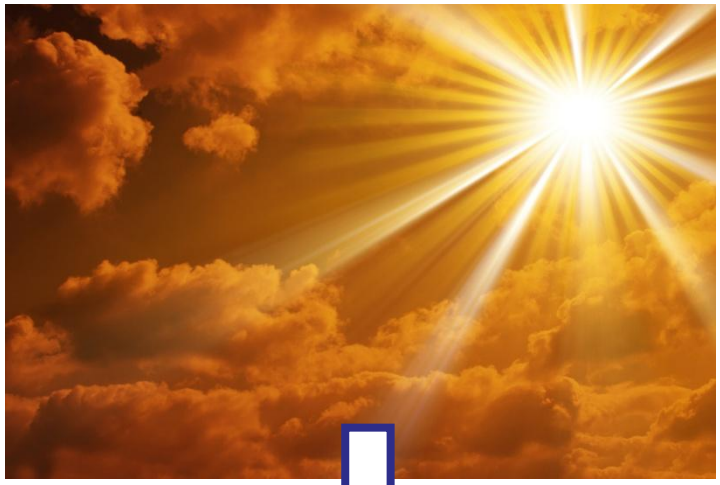
Industry (40%):
R&D, measurements, planning
Prototype construction
Technology transfer

The Technology

?

pictures: fotolia, Danfoss

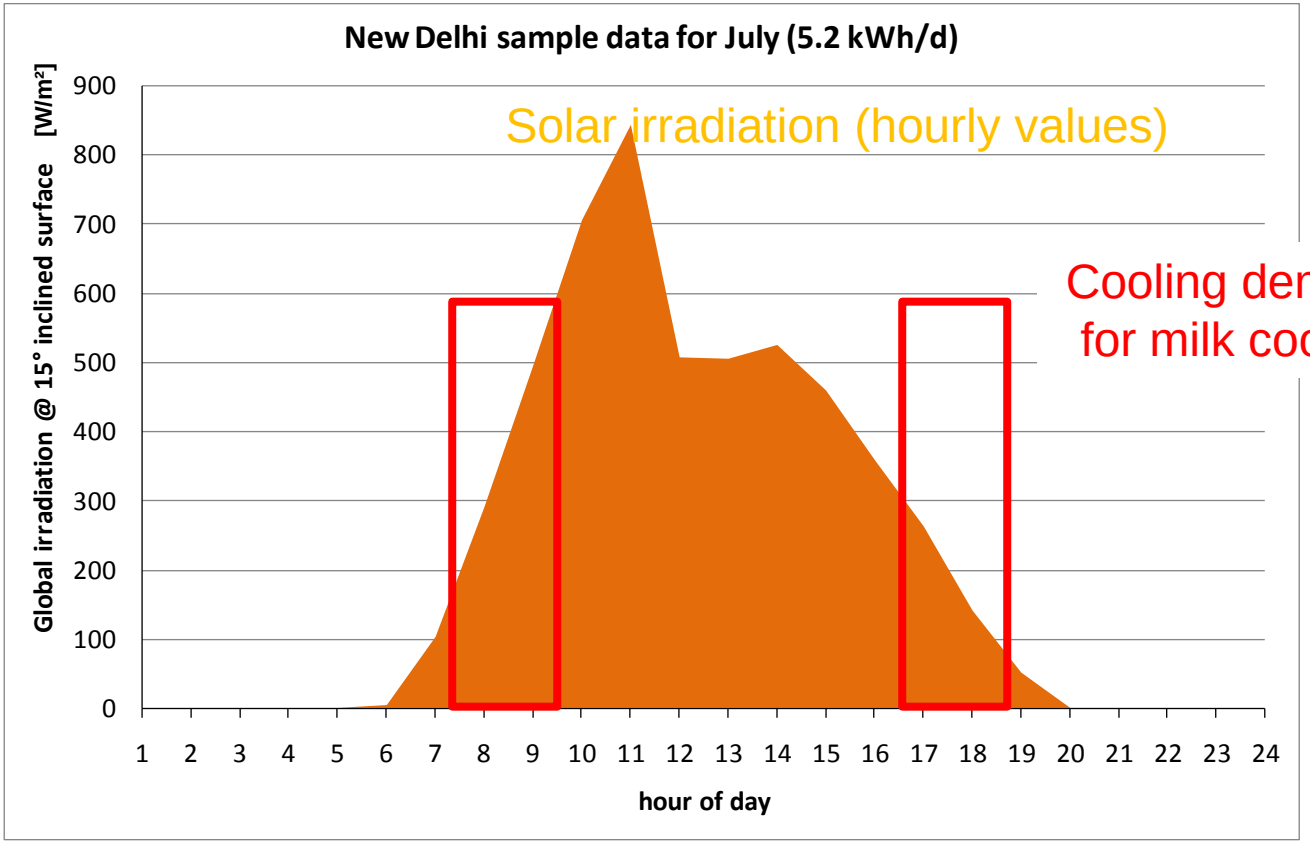
The Technology



pictures: fotolia, Danfoss

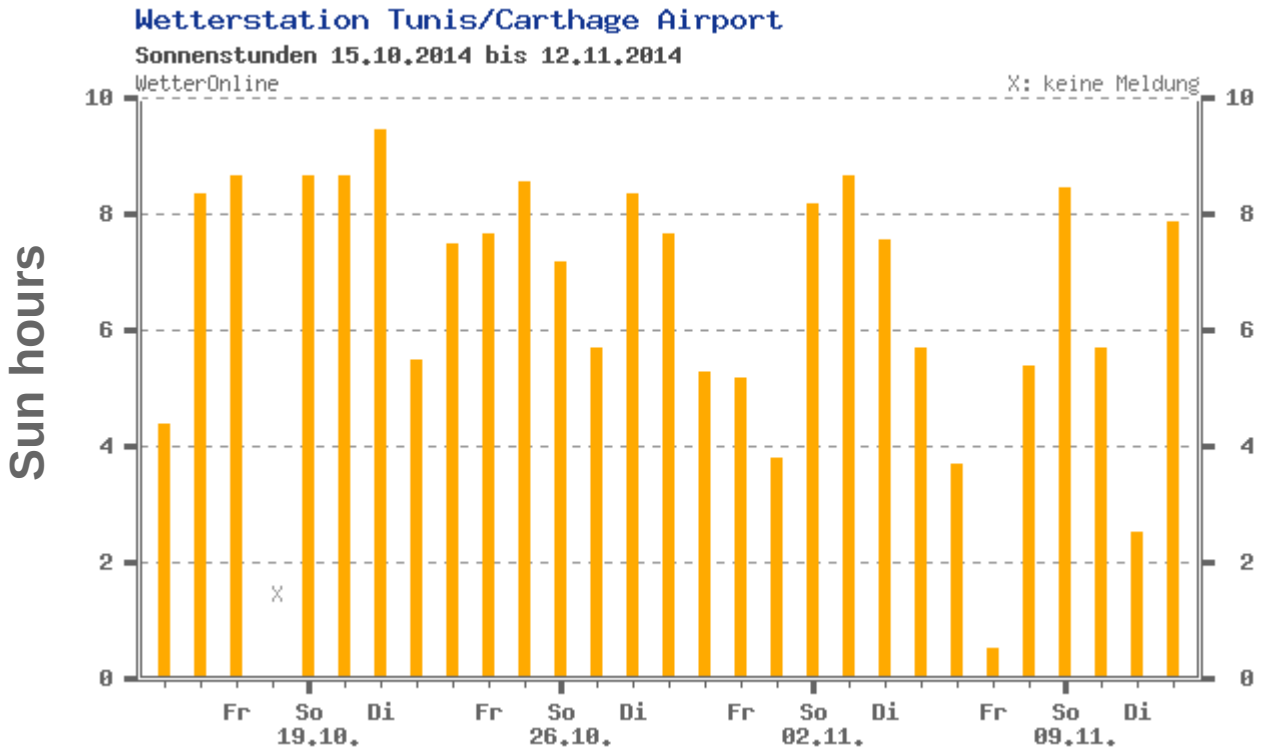
Time dependence of energy supply (Variation over a day)

- Mismatch of energy supply and cooling demand
- Example: PV-Milk cooling



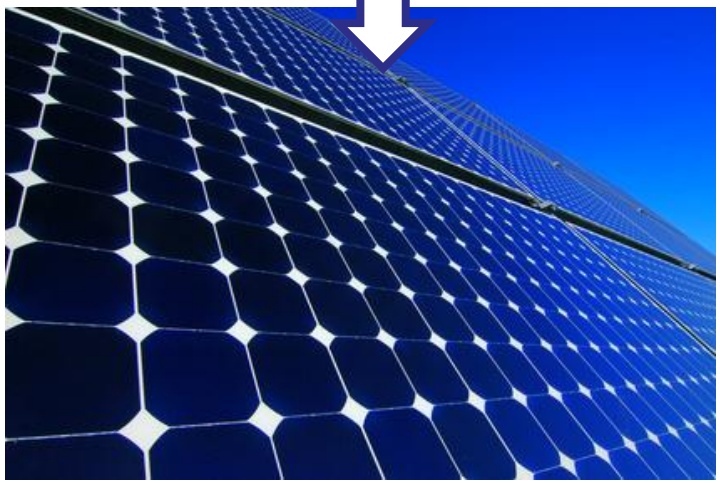
Time dependence of energy supply (Variations from day to day)

Sun hours in Tunis

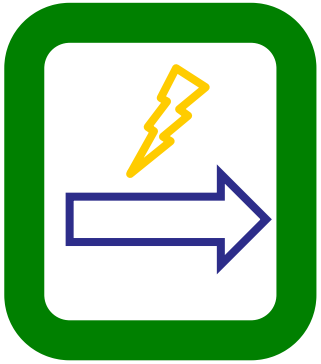


www.wetteronline.de

Challenge: Energy storage



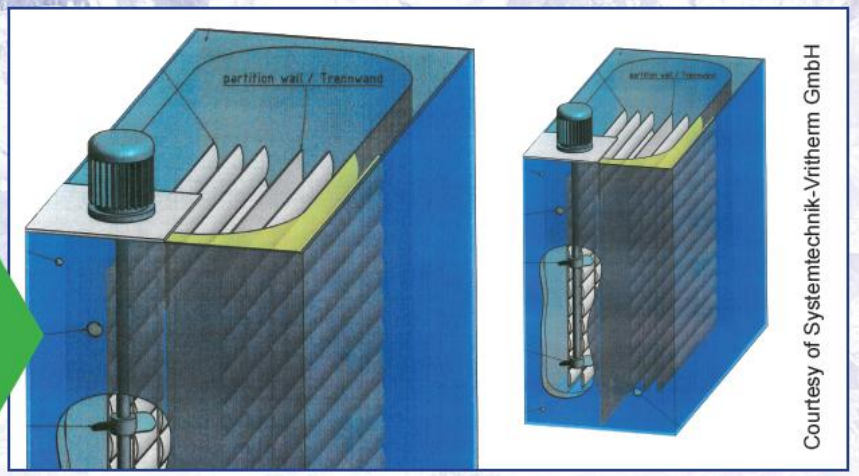
Options for energy storage



pictures: fotolia, Danfoss

Storage concepts

versus



VRLA Battery

- simple system integration
- maintenance required
- restricted lifetime
- environmental hazards

Ice Storage

- complex system integration
- negligible maintenance requirements
- very long lifetime
- disposal with low environmental risks

Application examples I

Solar cooling container - Reefer

- 20ft container with 23 m³ cold room
- PV generator: 3.4 kWp
- nom. cooling power: 5.1 kW (-5°C / 45°C)
- room temperature: 0°C to +10°C (adjustable, fan controlled)
- ice storage for cooling over 3 days without sun

Cooling system for cold storage of perishable goods and food stuffs

Application examples II

Milk collection center

System for cooling and cold storage of milk

- 20ft container with milk storage
- PV generator: 3.4 kWp
- nom. cooling power: 11.3 kW (15°C / 50°C)
- milk storage and refrigeration capacity: 1000 l
- large ice storage with 70 kWh
- two-stage milk cooling with secondary fluid cycle

Application examples III

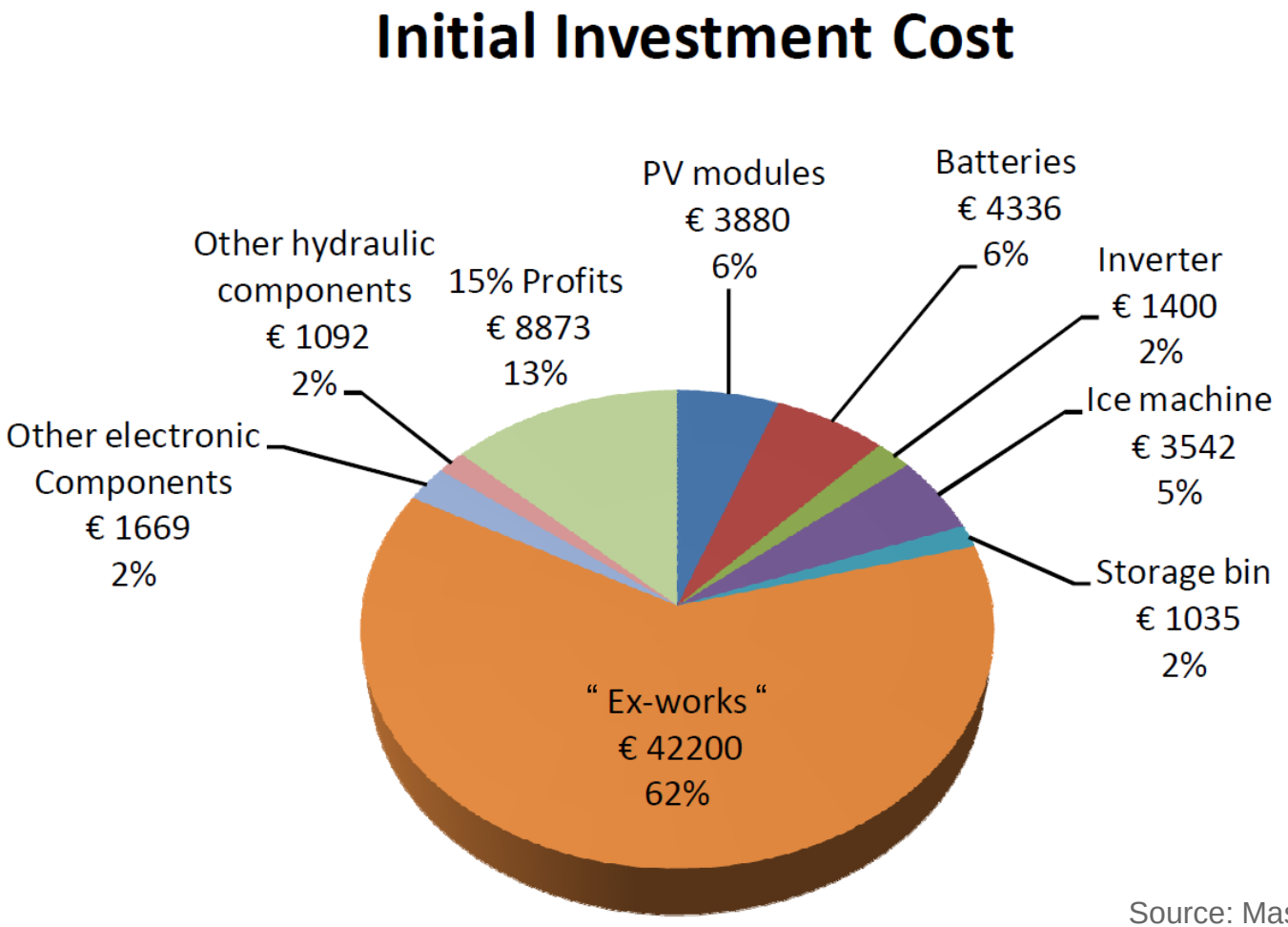
- **PV – Ice maker**

- 20ft container with ice maker
- PV generator: 5.1 kWp
- nom. cooling power: 5.9 kW (-10°C / 45°C)
- 250 kg crushed ice per day
- water tank
- UV water disinfection
- ice storage size for two daily outputs

Specially developed ice machine with high efficiency

Challenge - Investment costs

- Example: PV – Ice maker (ca. 100 kg/day; ca. 68 000 €)



Source: Master thesis R. Faerron

Contributions to the investment costs - peripherals

- **Example: PV – Ice maker**

Components included in "ex-works"	
Mounting of the modules	Internal cabling and cables
PV cables and cabling	Door and mounting of the door
PV rack at the container	Internal wall and floor covering
Switching cabinet	Mounting of the ice machine
Battery cabinet	Mounting of water tank and water supply system
Machine room	Small parts
Container, container modifications	Putting into operation
Coating of the container	

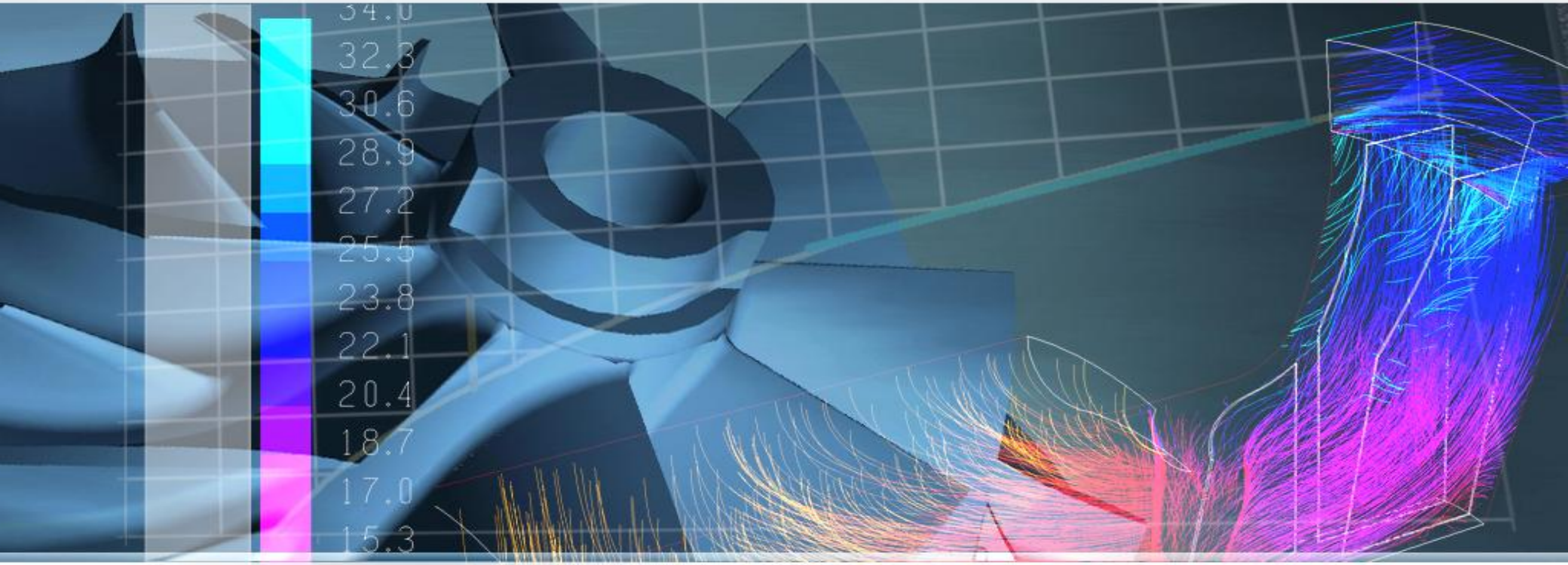
Source: Master thesis R. Faerron

Chances

- A great variety of solar cooling applications is technically feasible.
- In most cases economic constraints restrict a realization.
- Mutual efforts are required to overcome economic difficulties.

Example of a small compressor for applications with low cooling demand

Transport of a cooling container ready for operation at ILK Dresden



Institut für Luft- und Kältetechnik
gemeinnützige Gesellschaft mbH
Bertolt-Brecht-Allee 20, 01309 Dresden

Dr. Jörg Waschull, Wolfgang Hernschier

Tel.: **+49 351 / 4081-750**
E-Mail: **solar@ilkdresden.de**