

**Institut für Luft- und Kältetechnik Dresden gGmbH**

**Kühlung mit Photovoltaik – Beispiele und Chancen**

**Cooling with photovoltaic – examples and chances**

- ▶ Independent, nonprofit R&D institute
- ▶ Founded 1964
- ▶ Re-founded 1990
- ▶ Approx. 150 employees  
(> 70% with college degree)
- ▶ > 3000 m<sup>2</sup> test area
- ▶ > 12 Mio. Euro revenue p.a.

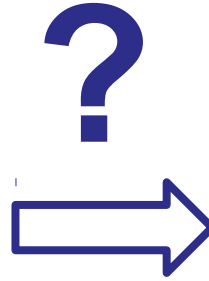
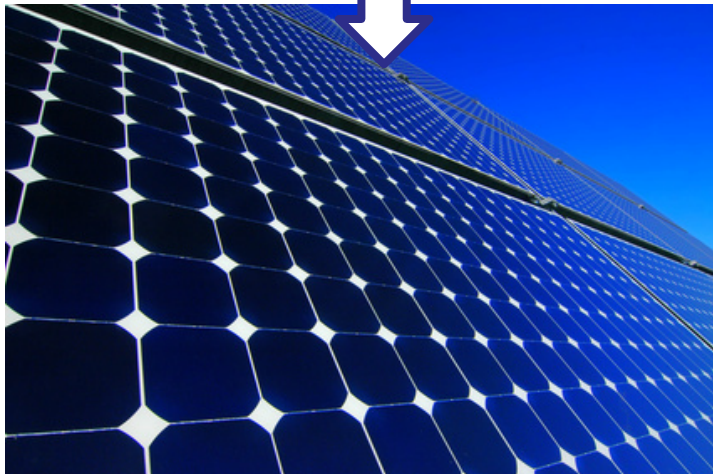


**Public funded (60%):**  
Industry-oriented research  
Collaborative research  
Pre-competitive research

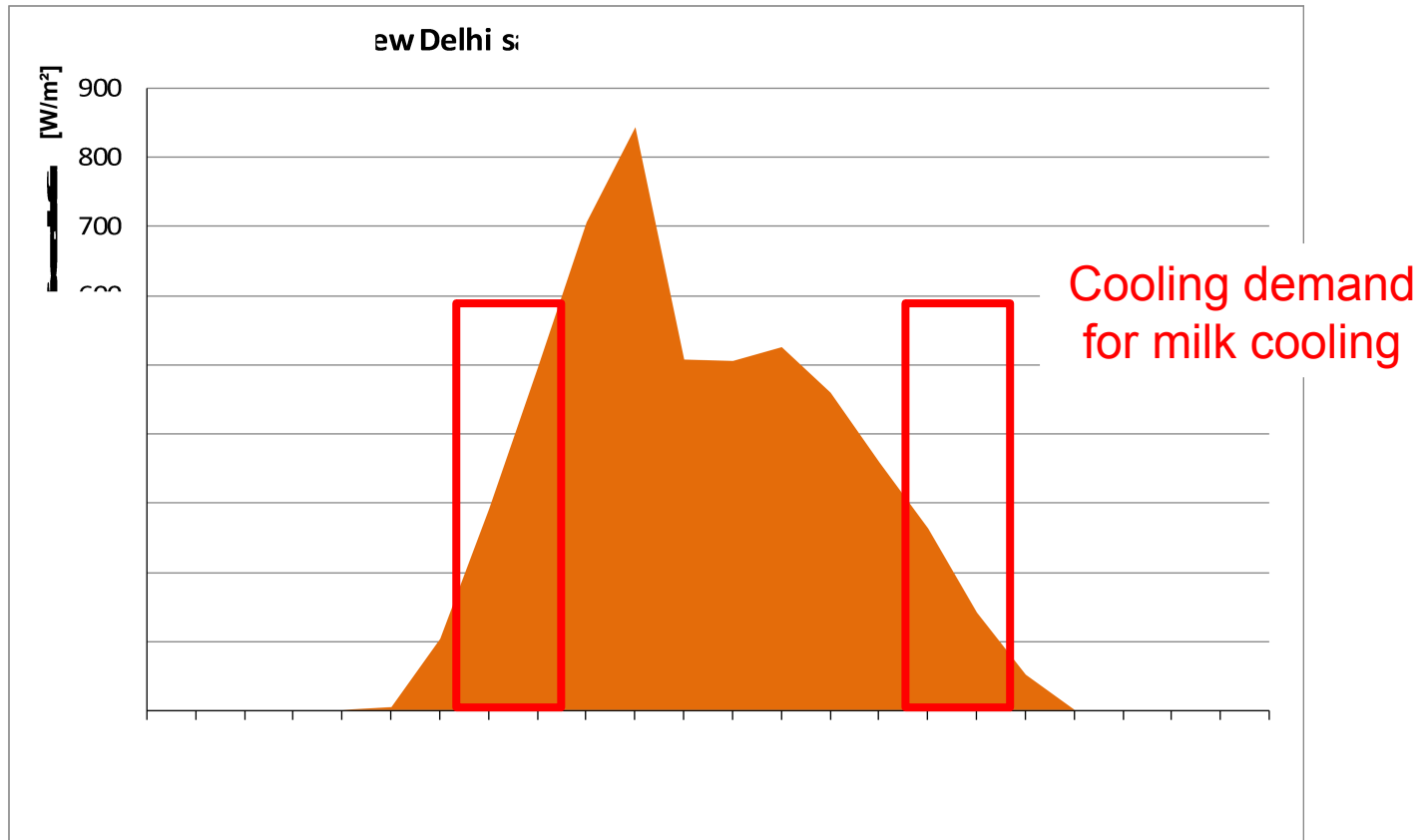


**Industry (40%):**  
R&D, measurements, planning  
Prototype construction  
Technology transfer



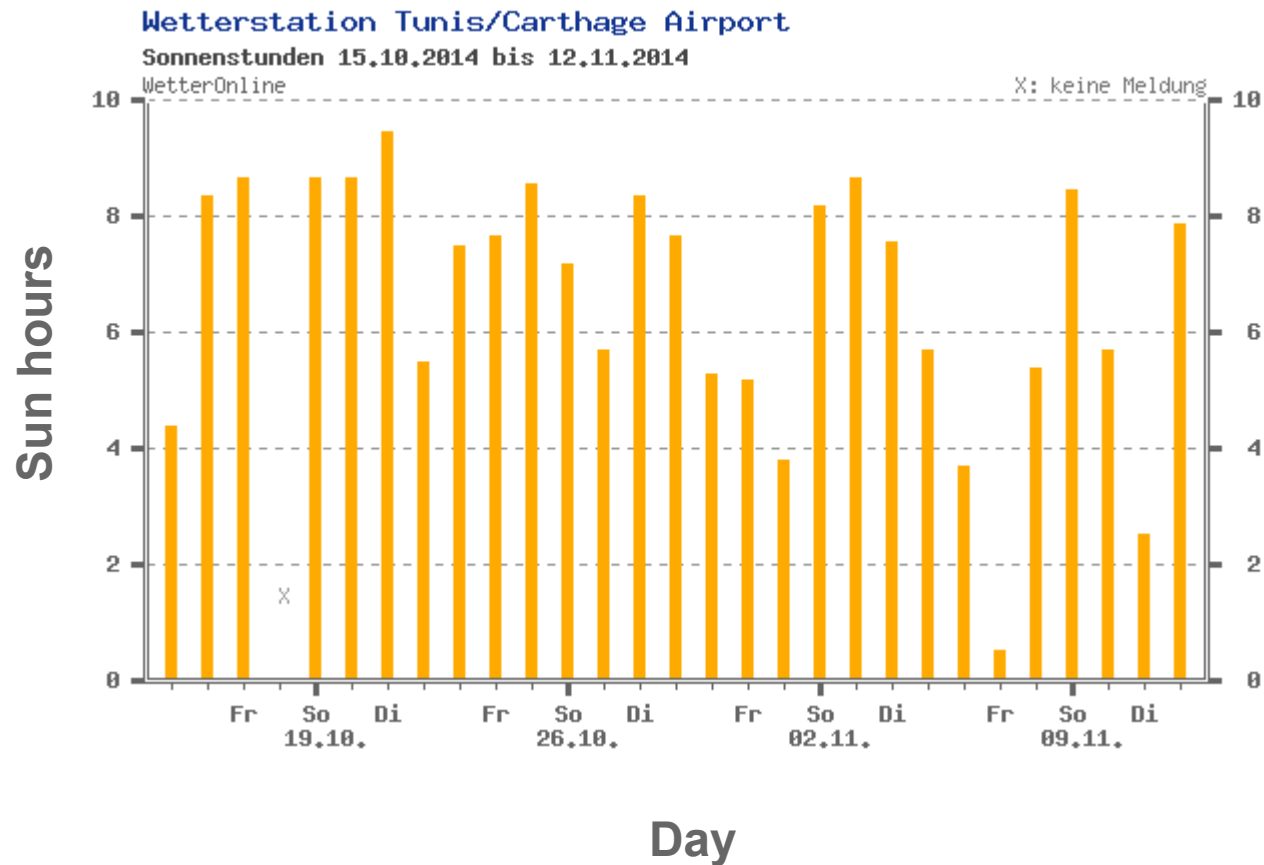


# Time dependence of energy supply

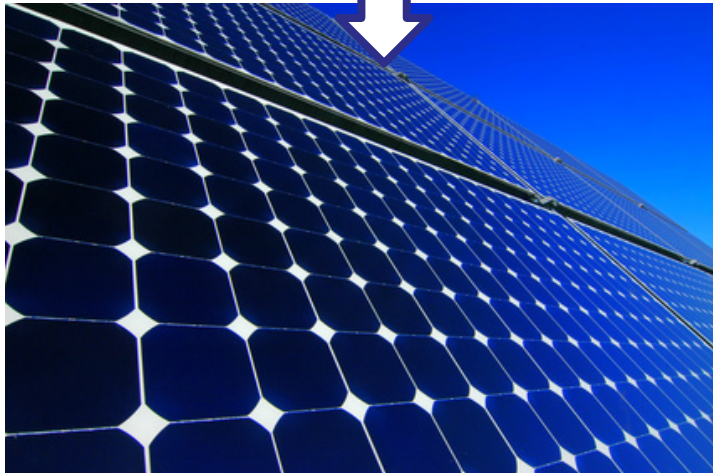




## Sun hours in Tunis



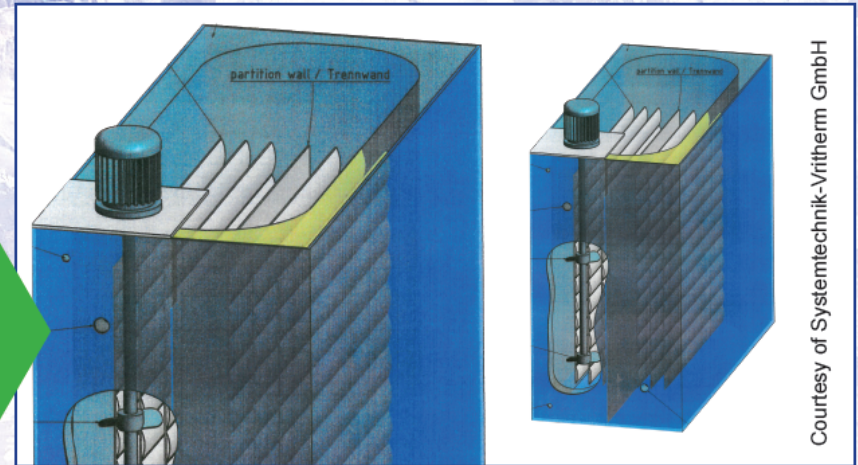
# Challenge: Energy storage



pictures: fotolia, Danfoss



versus



Courtesy of Systemtechnik-Vritherm GmbH

## 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 m<sup>3</sup> 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



## ► 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

## ► PV – Ice maker



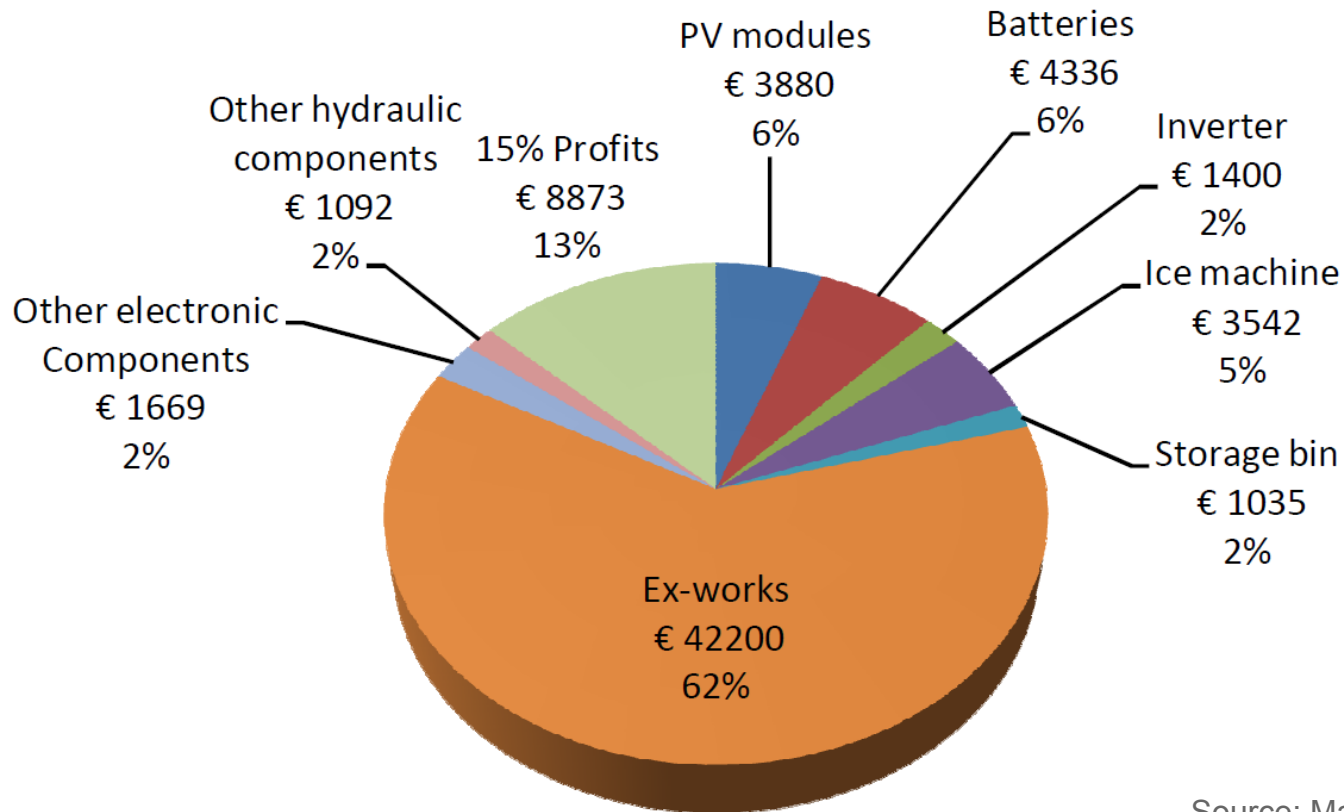
- 20ft container with ice maker
- PV generator: 5.1 kWp
- nom. cooling power: 5.9 kW (-10°C / 45°C)
- 250 kg crushed ice per day
- water tank
- UV water disinfection
- ice storage size for two daily outputs

Specially developed ice machine with high efficiency



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

## Initial Investment Cost



Source: Master thesis R. Faerron



# Contributions to the investment costs

## ► 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

- ▶ 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.



Source: [www.aspencompressor.com](http://www.aspencompressor.com)





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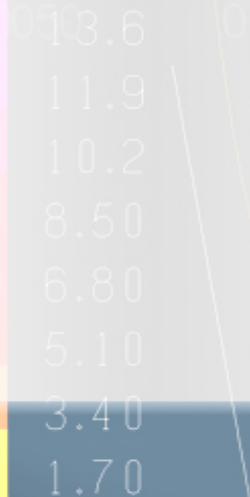
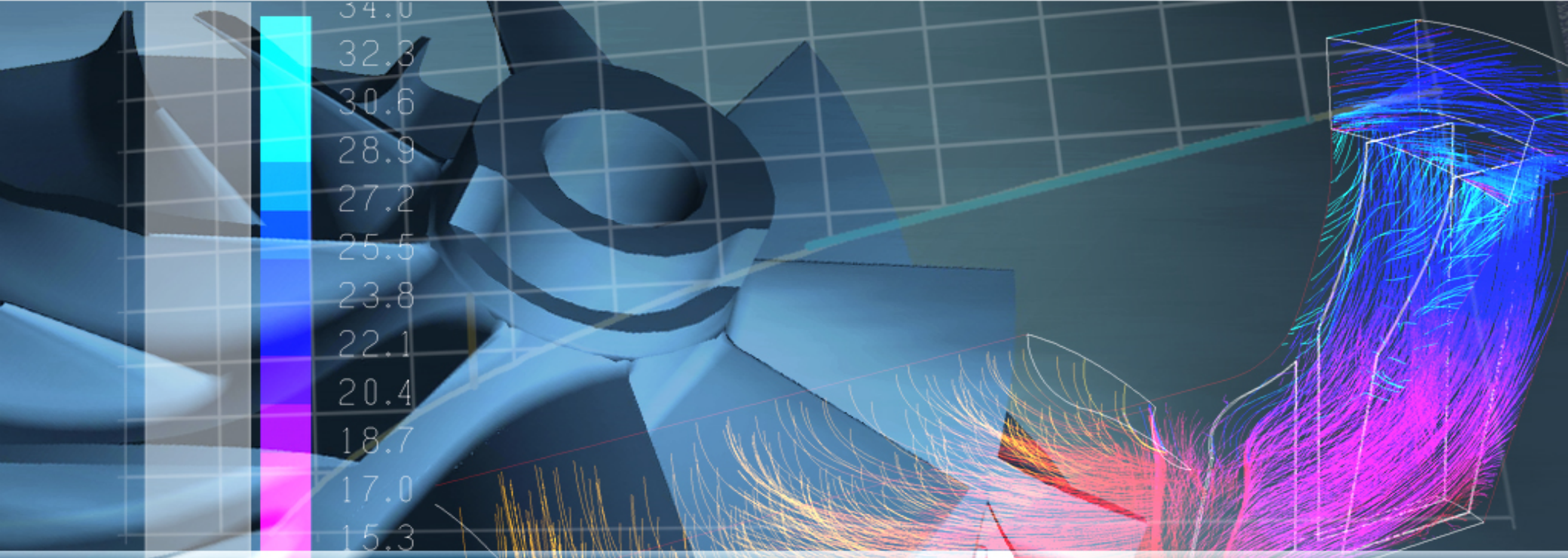
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