SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

TASK 54

Price Reduction of Solar Thermal Systems

Jan Erik Nielsen, SolarKey Int.

Price reduction of solar thermal systems

Task 54 Structure

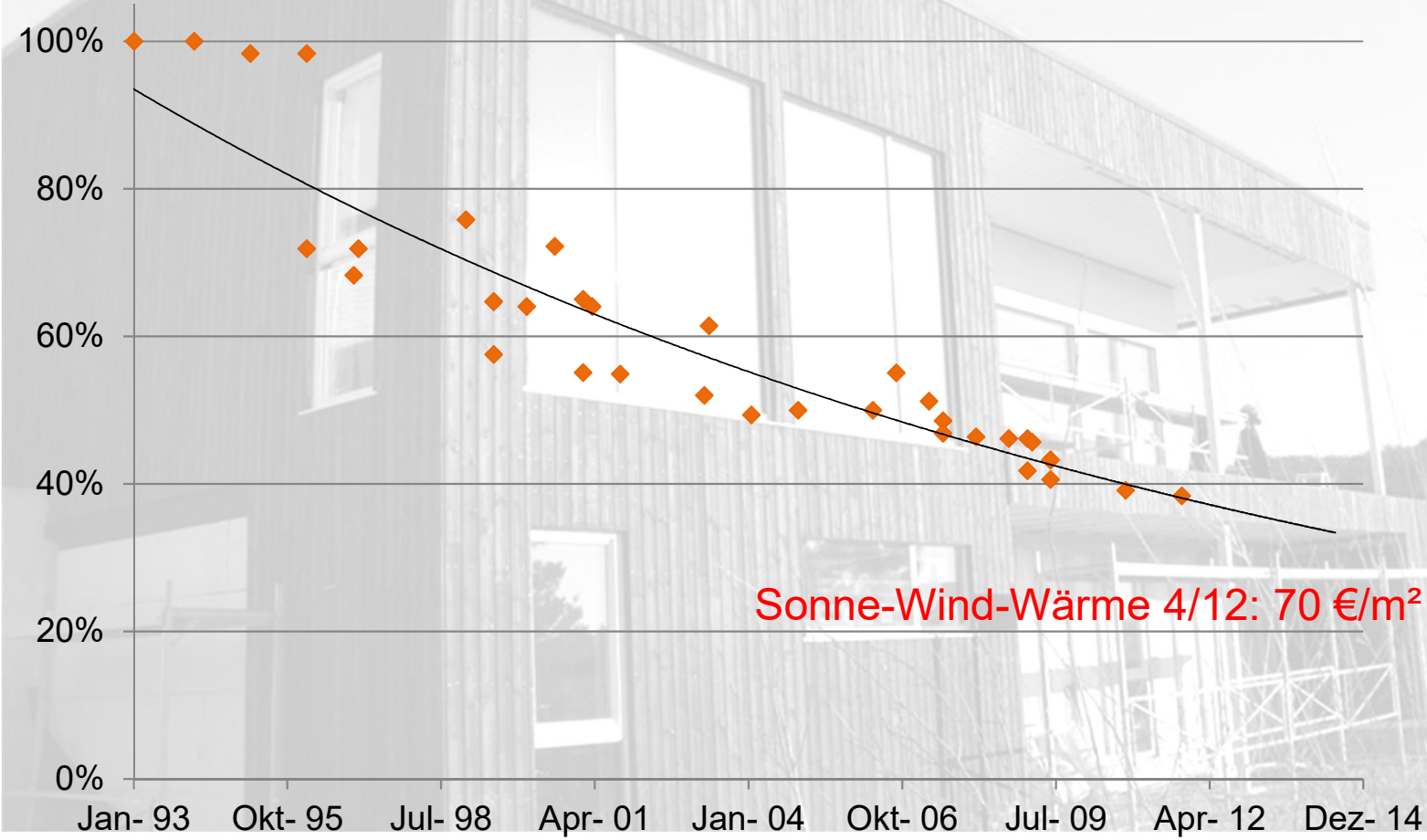
Operating Agent: Michael Köhl, Germany

Subtask A	Market success factors and cost analysis	*Norway, Michaela Meir*
Subtask B	System design, installation, operation and maintenance	*Germany, Stephan Fischer*
Subtask C	Cost-efficient materials, production processes and components	*Austria, Gernot Wallner*
Subtask D	Information, dissemination and stakeholder involvement	*Germany, Sandrin Saile*

Past Cost Development

Development of production costs of collectors since 1993:

Decrease about 4%/year



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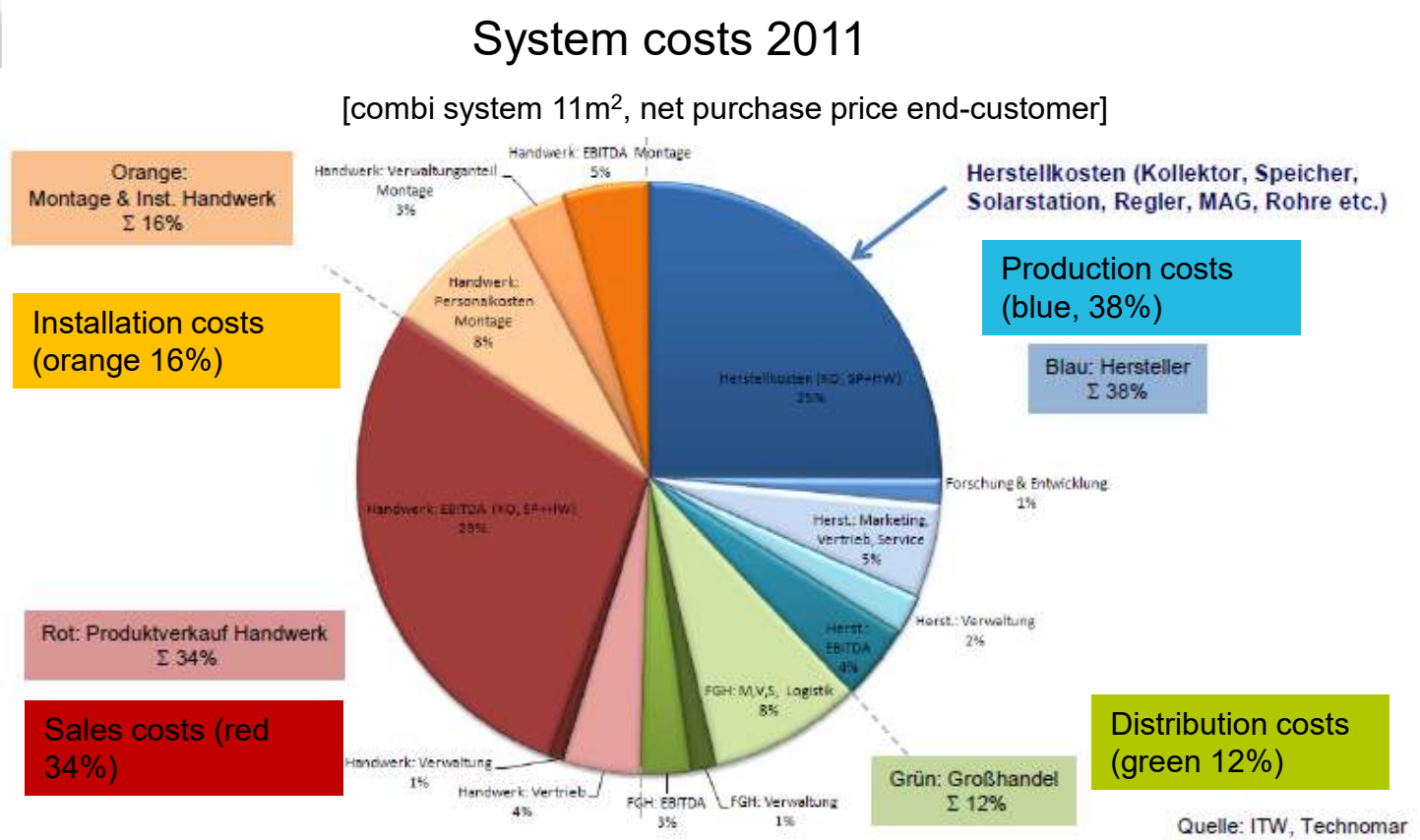
Cost Structures

Combi-system (11 m2) price in 2011



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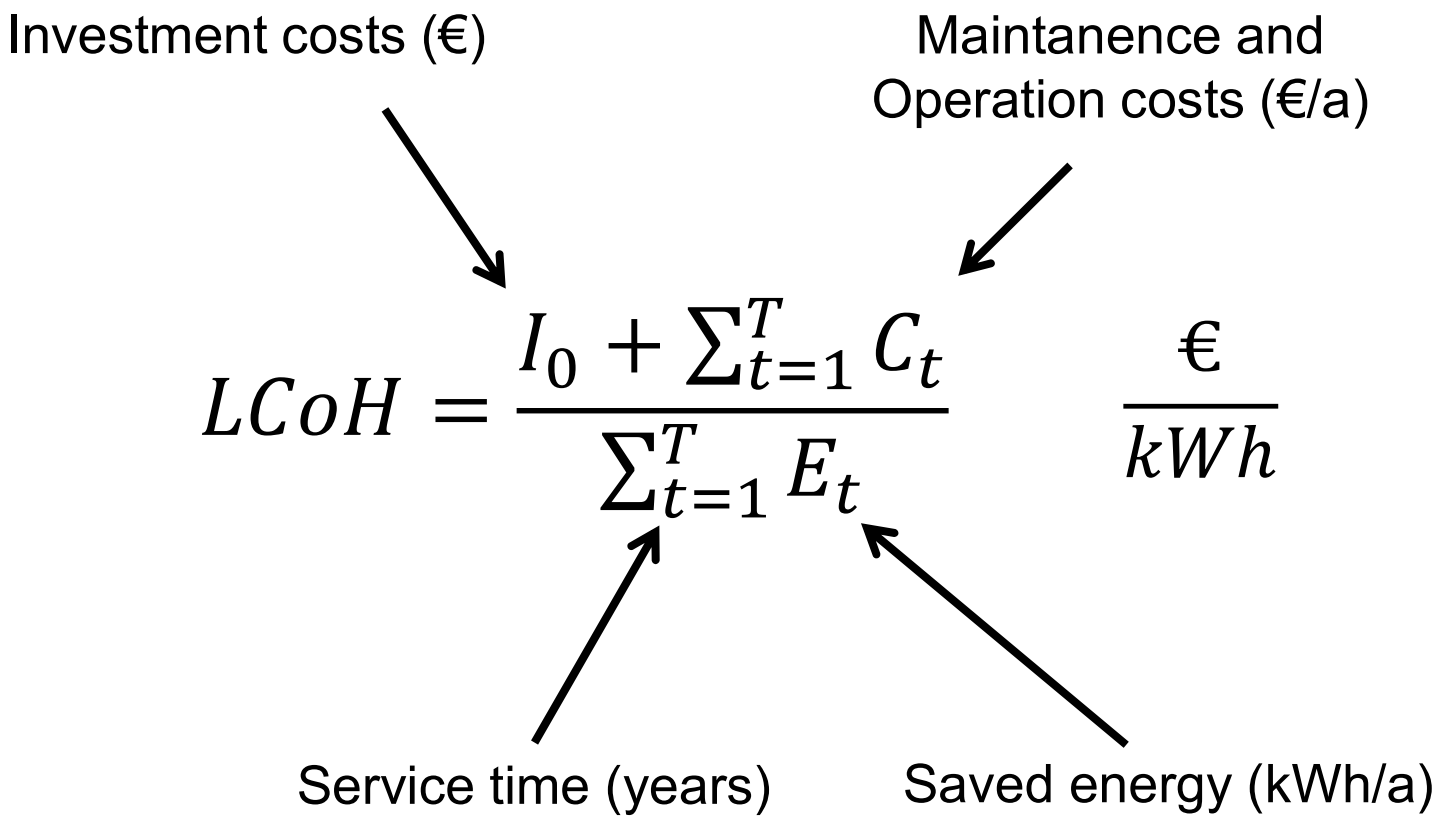
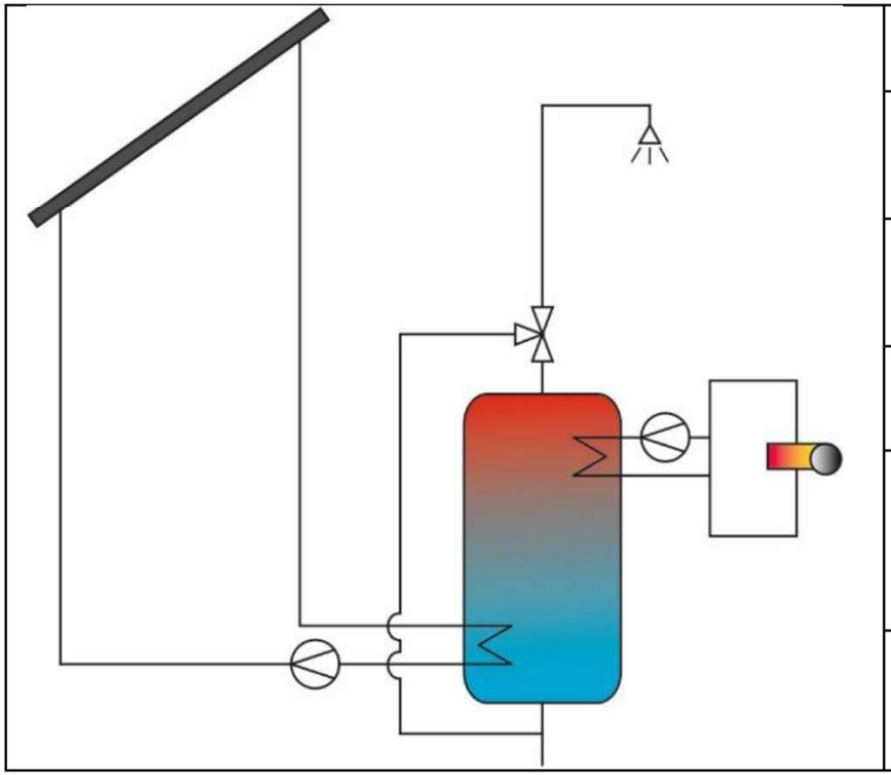
LCoH – Levelised Cost of Heat Formular



Dansk referenceanlæg

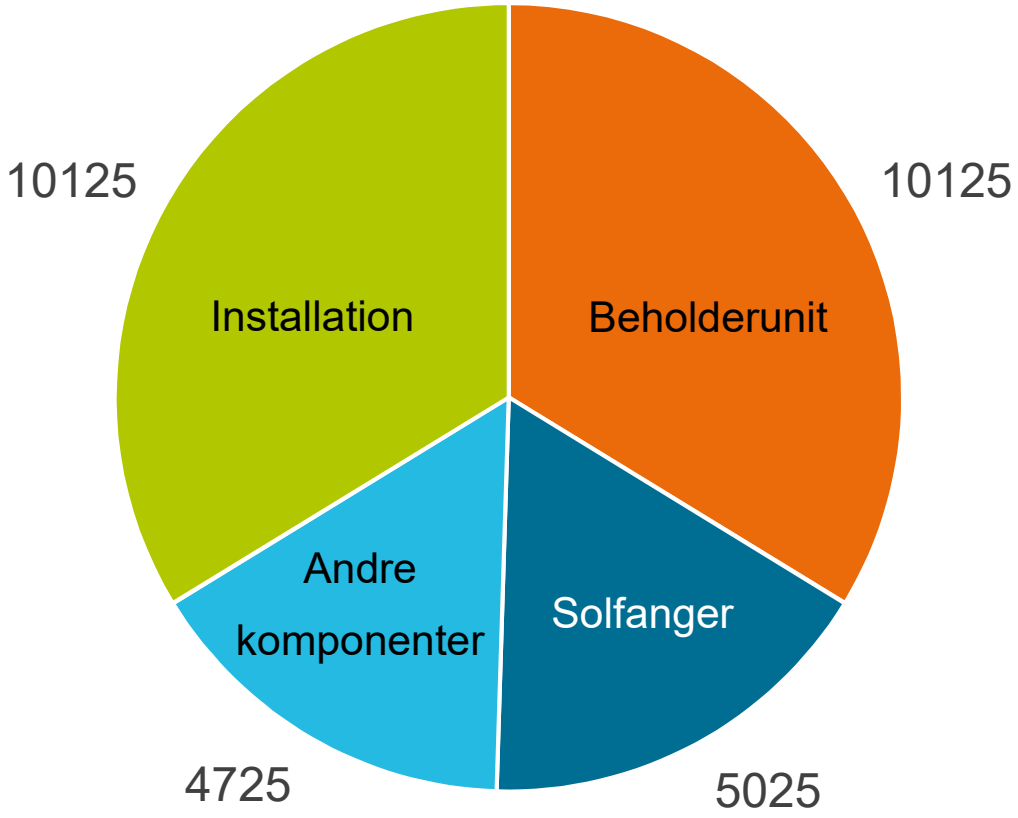
Hydraulic Scheme of the System



Key data	
Collector area (one collector)	2.36 m²
Heat store volume	255 l
Location	Copenhagen, Denmark
Hemispherical irradiance on horizontal surface	$\Sigma G_{hem,hor}$ =1150 kWh/(m² a)
Lifetime of system	30 years

Dansk referenceanlæg

Fordeling af omkostninger/priser [kr]



LCoH = 0.72 kr/kWh

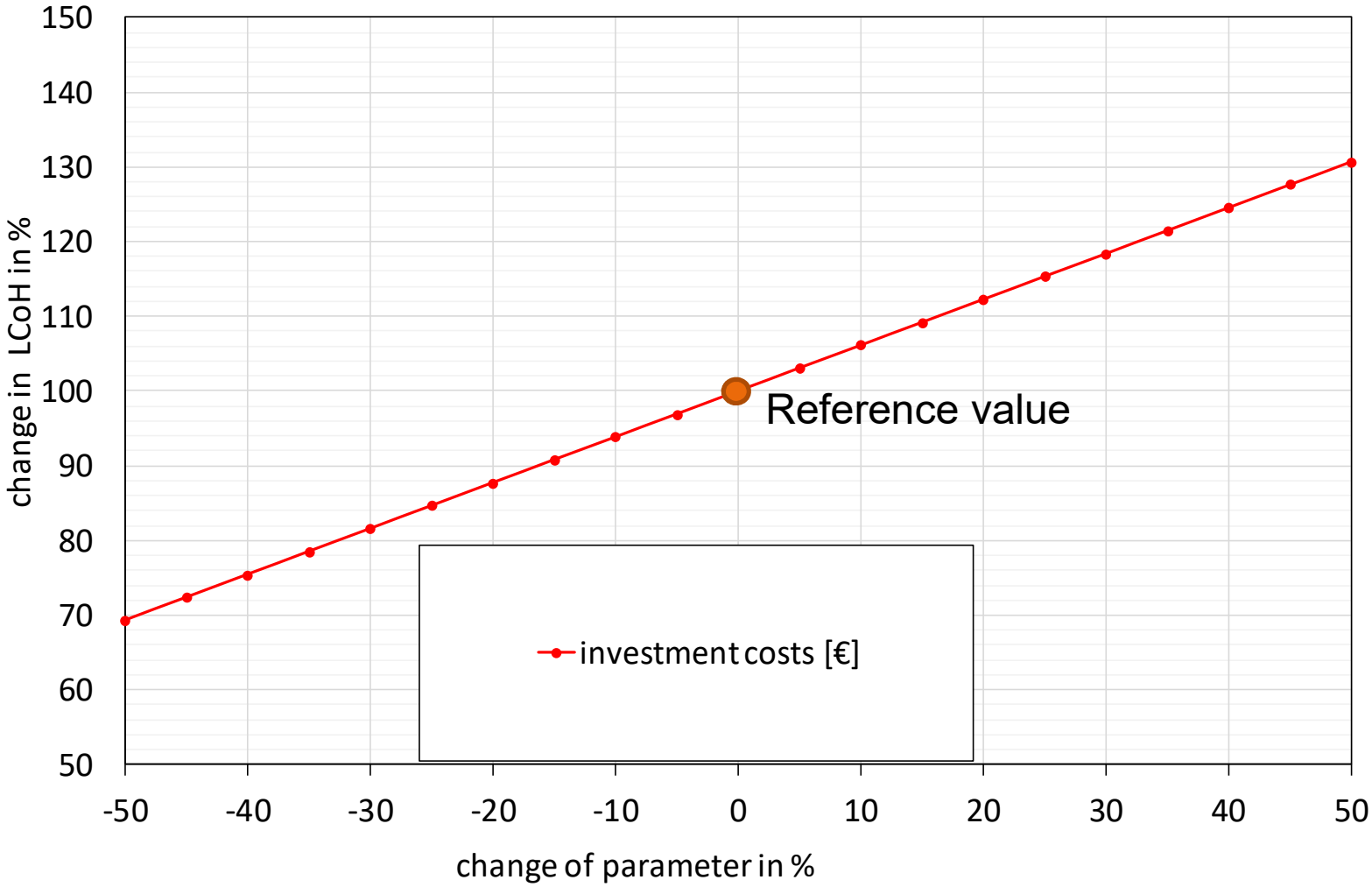
Alle priser ex. moms

Economical aspects, reference systems and cost calculation

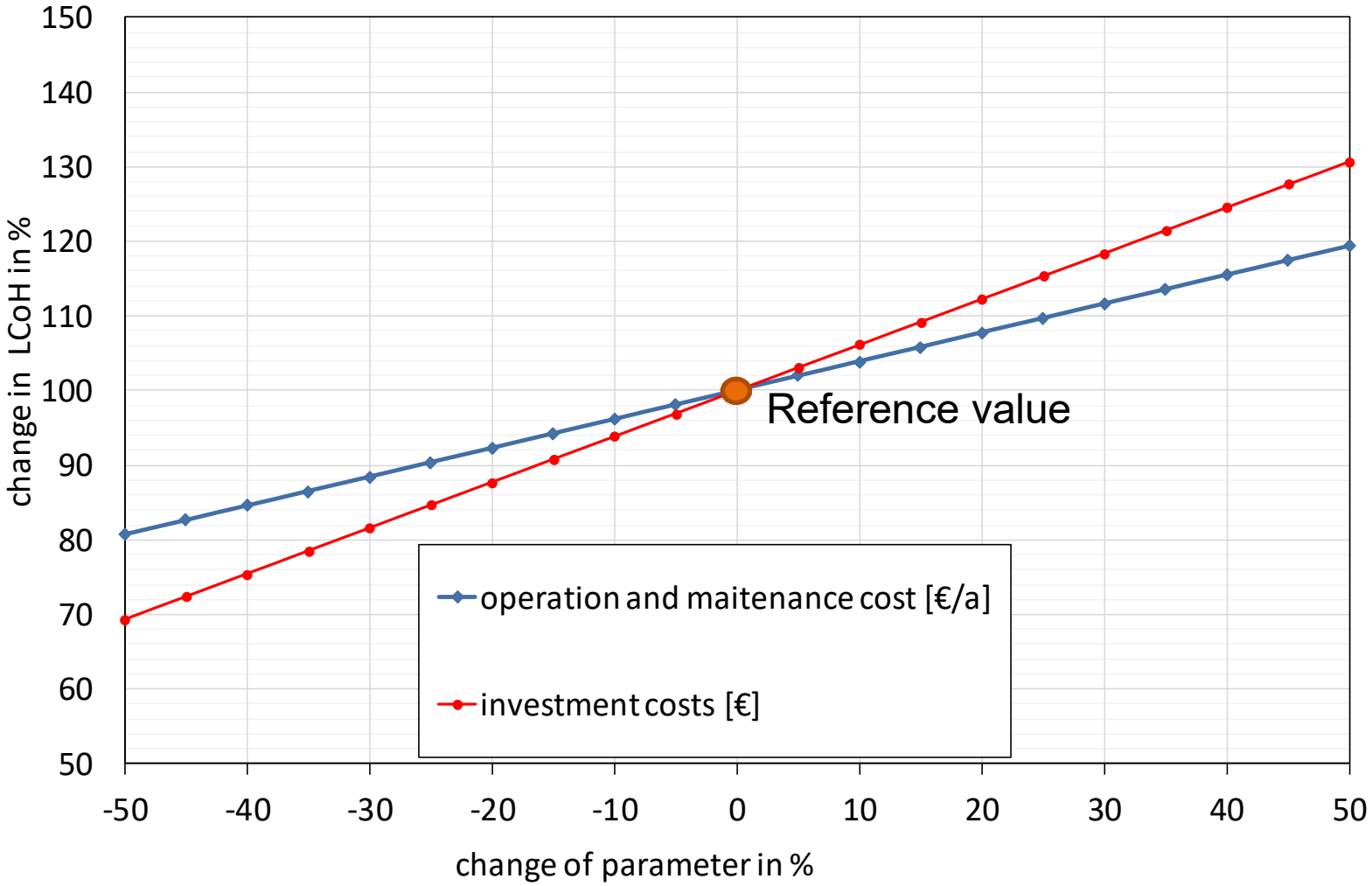
How to reduce costs (LCOE)?

- **Reduce Investment costs by**
  - cheaper materials and components
  - standardized components, systems and installation
  - …
- **Reduce operation & maintenance costs**
  - highly reliable systems
  - energy efficient pumps and controllers
  -…

Sensitivity analysis solar domestic hot water preparation (SFH) Germany



Sensitivity analysis solar domestic hot water preparation (SFH) Germany



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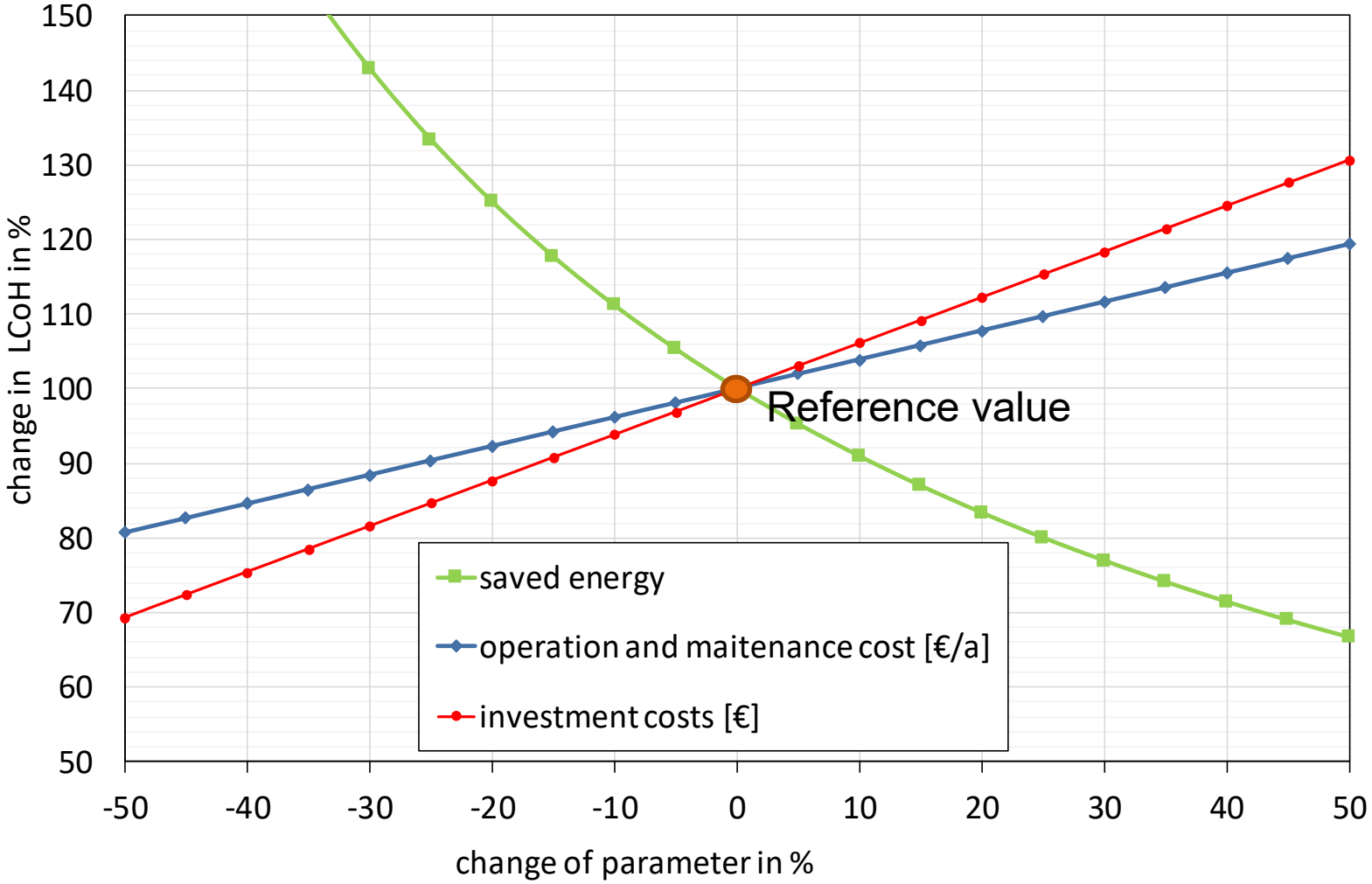
Economical aspects, reference systems and cost calculation

How to reduce costs (LCOE)?

- **Increase solar energy yield by**
  - improved installation
  - higher thermal performance of components and systems
  - new system concepts
  - …
- **Increase of operation time of the system**
  - highly reliable materials
  - good installation
  - …

Sensitivity analysis solar domestic hot water preparation (SFH) Germany



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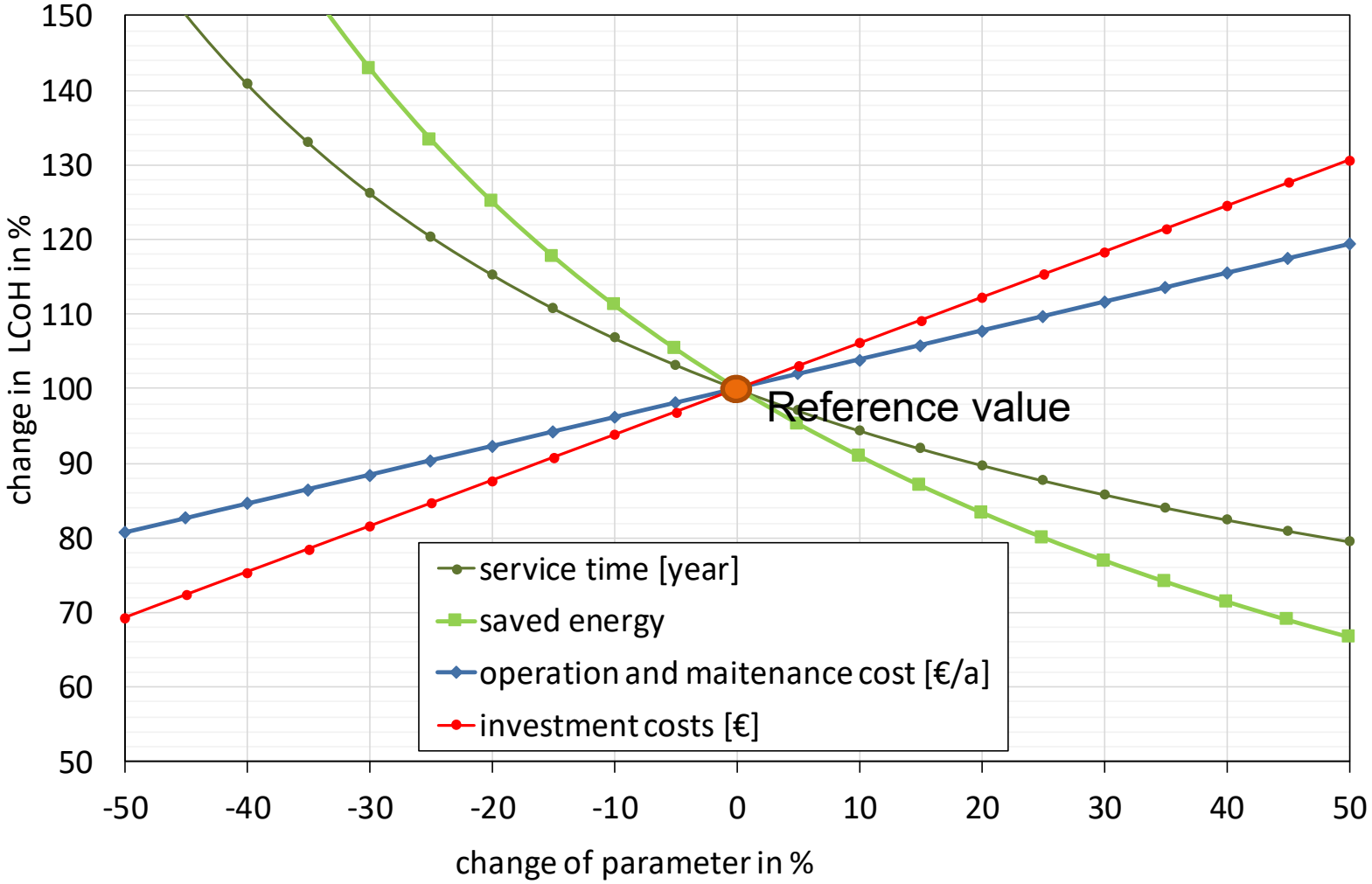

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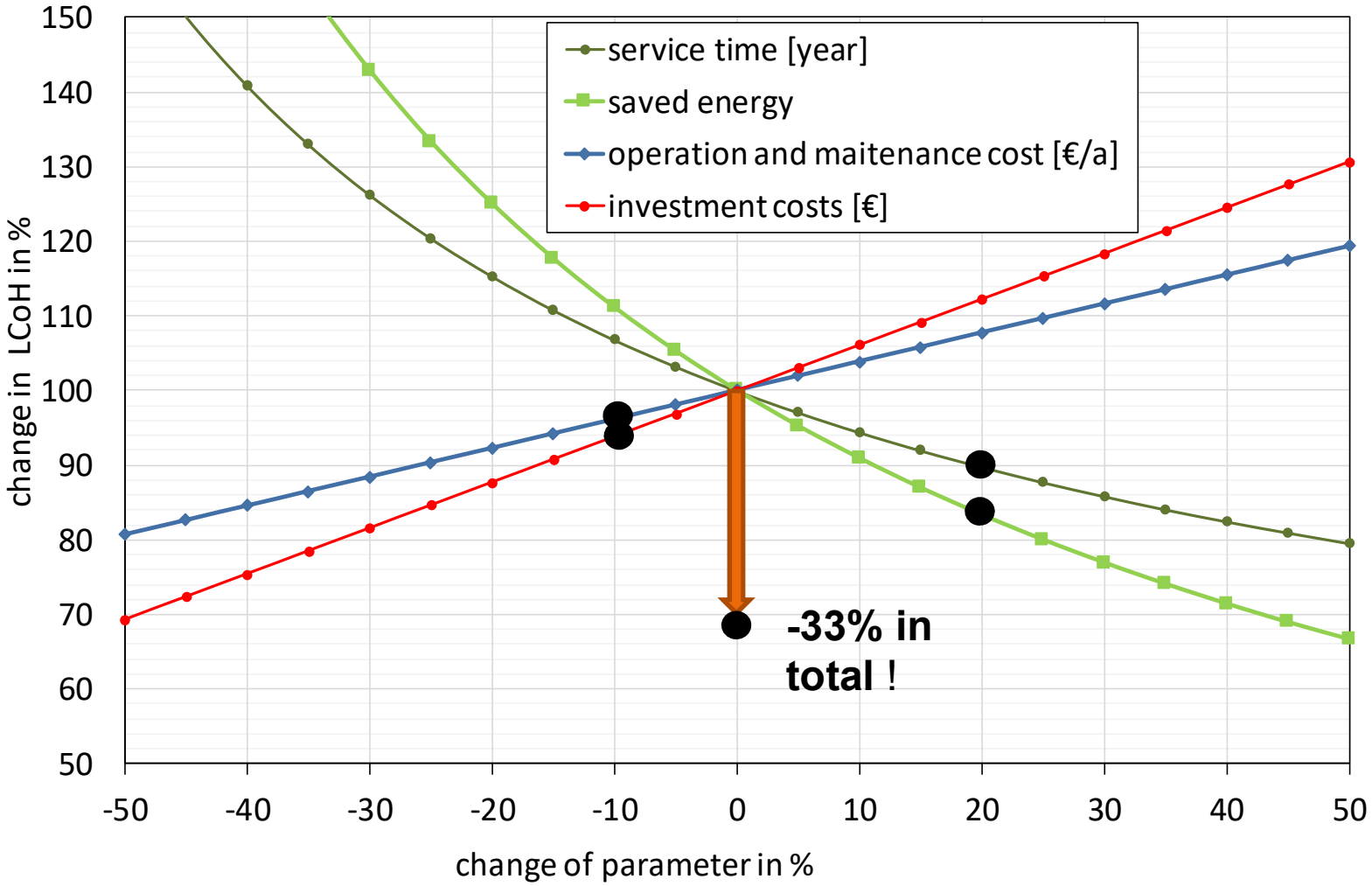
Sensitivity analysis solar domestic hot water preparation (SFH) Germany



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Subtask B: System design, installation, operation and maintenance

Progress in Subtask B:

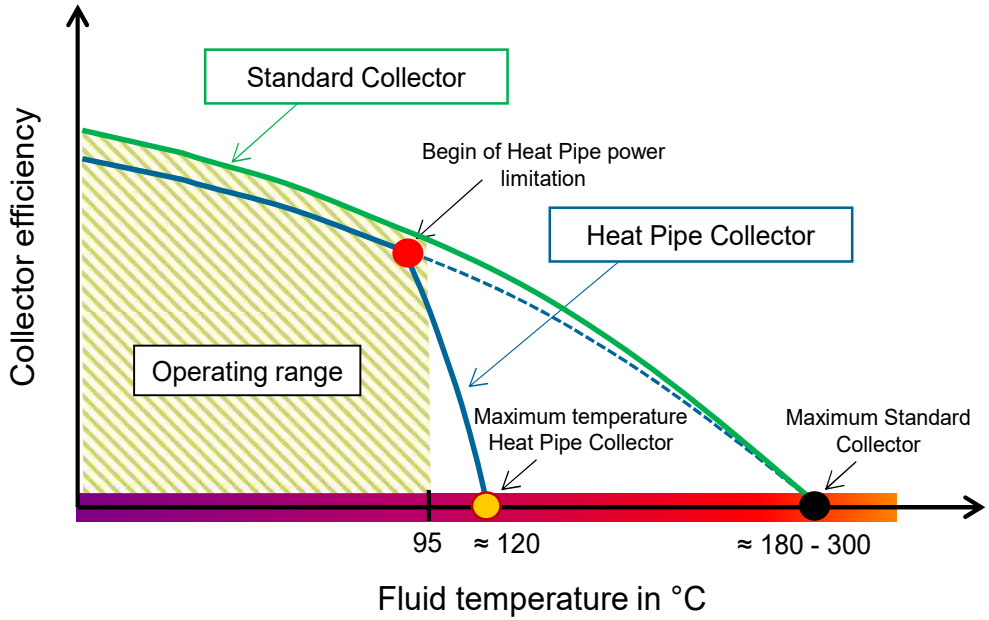
B.1: Definition of standardized components

- A standard collector design was evaluated based on the investigation of 212 collectors certified with Solar Keymark. The proposal is presently under discussion with collector manufacturers.
- A 300l-Storage with D=0,55 m is a good compromise, concerning the fractional energy savings, the volume for the steel and the insulation and the length of the weld-seam.
- The above mentioned standards were presented to the CEN TC 312 committee at the plenary meeting on October 19th, by the Subtask leader.

Subtask B: System design, installation, operation and maintenance

Progress in Subtask B:

B.3: Technical aftersales costs



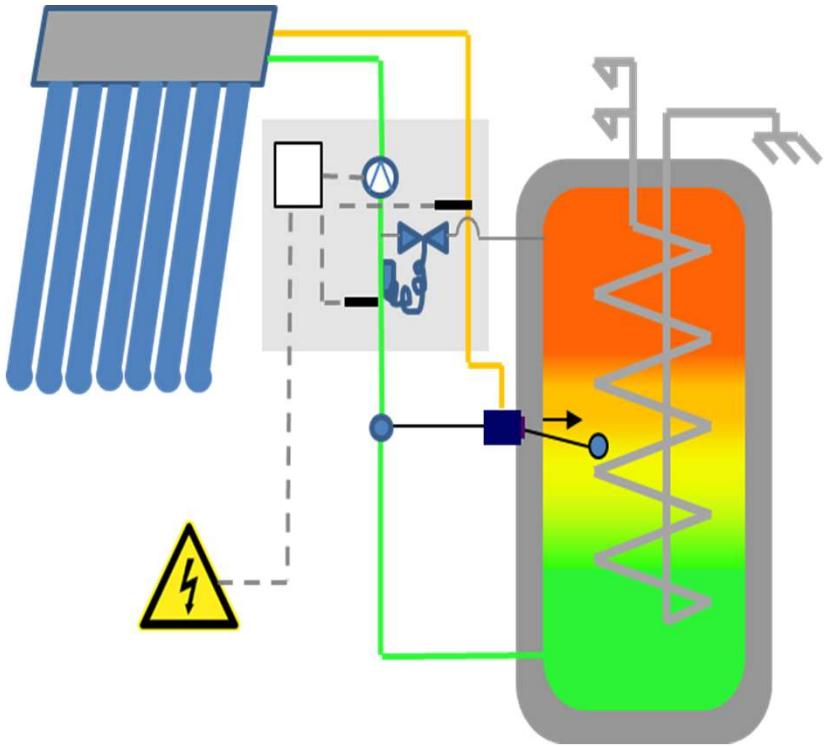
- The work related to a flat plate collector with a temperature limit of 120°C developed by ISFH and KBB showed that the temperature limitation can lead to a significant cost reduction for the hydraulic system as well as for the maintenance costs,
- The investment and operation costs could be reduced because of a collector temperature limitation to 100 °C as
- SPF for the cost reduction for domestic hot water system in multifamily houses showed cost reduction potentials between 21 % and 39 % depending on the assumptions.

Subtask B: System design, installation, operation and maintenance

Progress in Subtask B:

B.5: New proposals for a 40% price reduction

Conico Valves showed that a water-based vacuum-tube solar systems with automatic thermosiphonic (back-up) frost protection, using Thermo-Differential Valve technology can result in a **significant reduction** of the investment and operation costs because no controller and solar heat exchanger is required.



still in process

Subtask C : Cost-efficient materials, production processes and components

Gernot Wallner, Austria

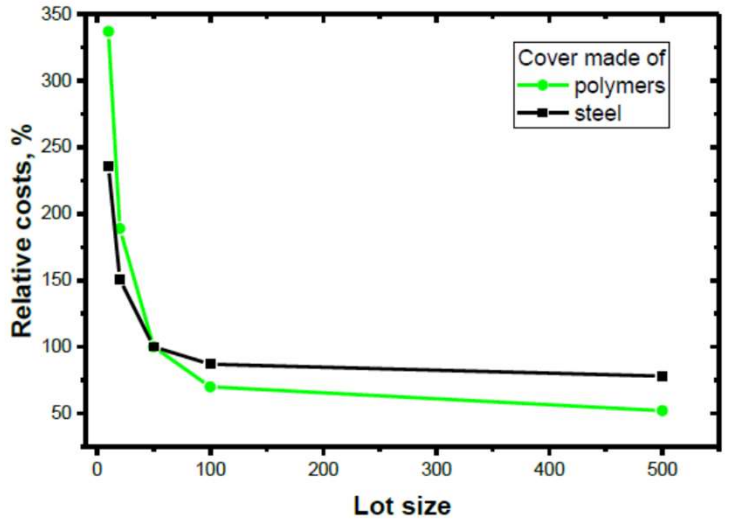
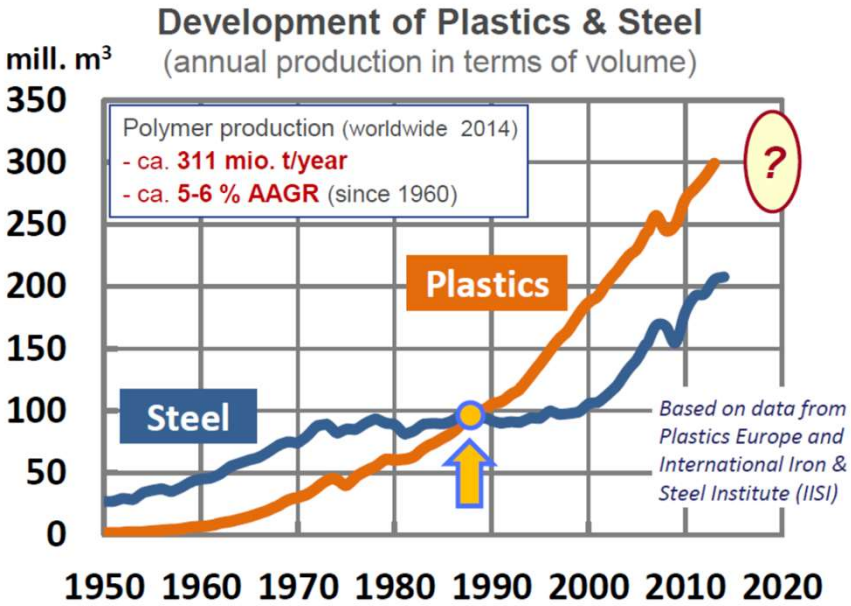


Fig 3. Relative costs for covers of centrifugal pumps for the pulp&paper industry made of polymeric materials (green) or steel (black)



PLASTICS – MATERIALS OF THE 21. CENTURY !?

- **Verpackung** (1)
  (inkl. Gütertransport/Logistik)

- **Infrastruktur- & Bautechnik** (2)

- **Mobilität** (3)

BMW i3

Boeing 787

- **Information, Telekommunikation**

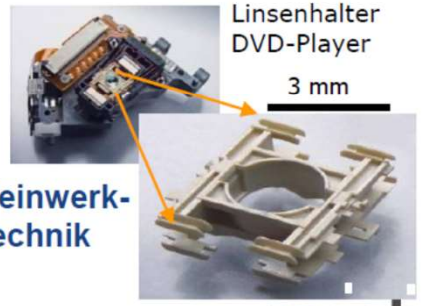
JKU

- **Sport/Freizeit**

Simplon

- **Medizintechnik**

- **Feinwerk-technik**



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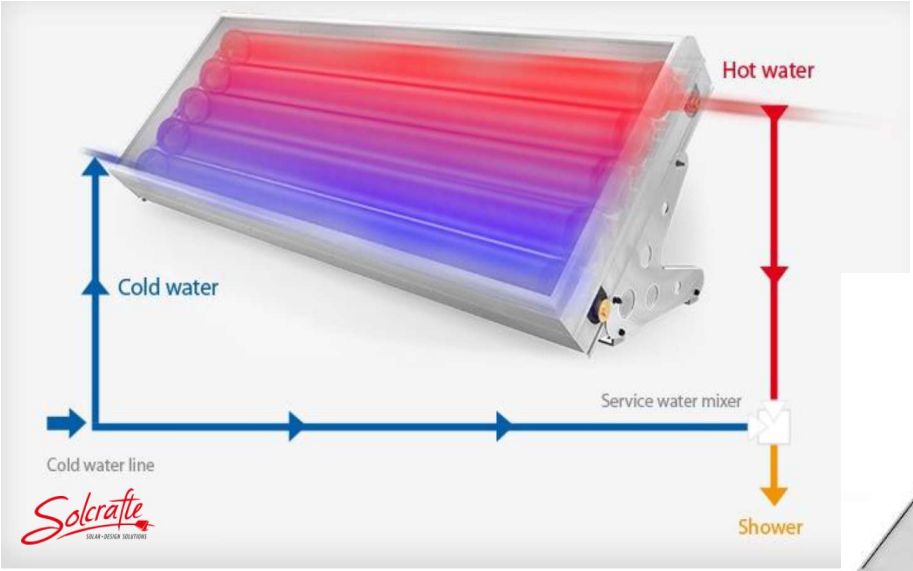
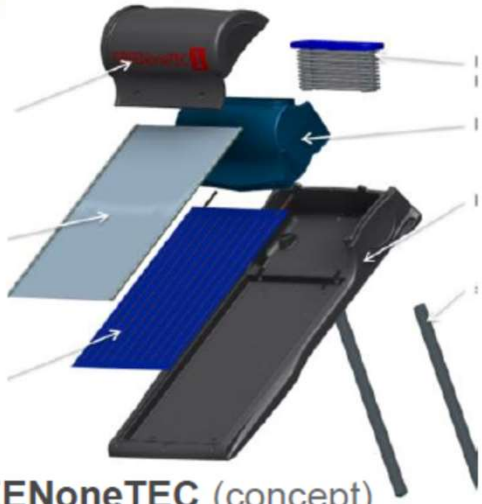
Subtask C: Cost-efficient materials, production processes and components

Progress in Subtask C:

GreenOneTech Integrated storage made of Polyamide



Type	100	150	200



GREENoneTEC (concept)
Thermosiphon Polymer Collector

MAGEN eco-Energy
Polymer Collector

Sunlumo Technology GmbH
One World Collector

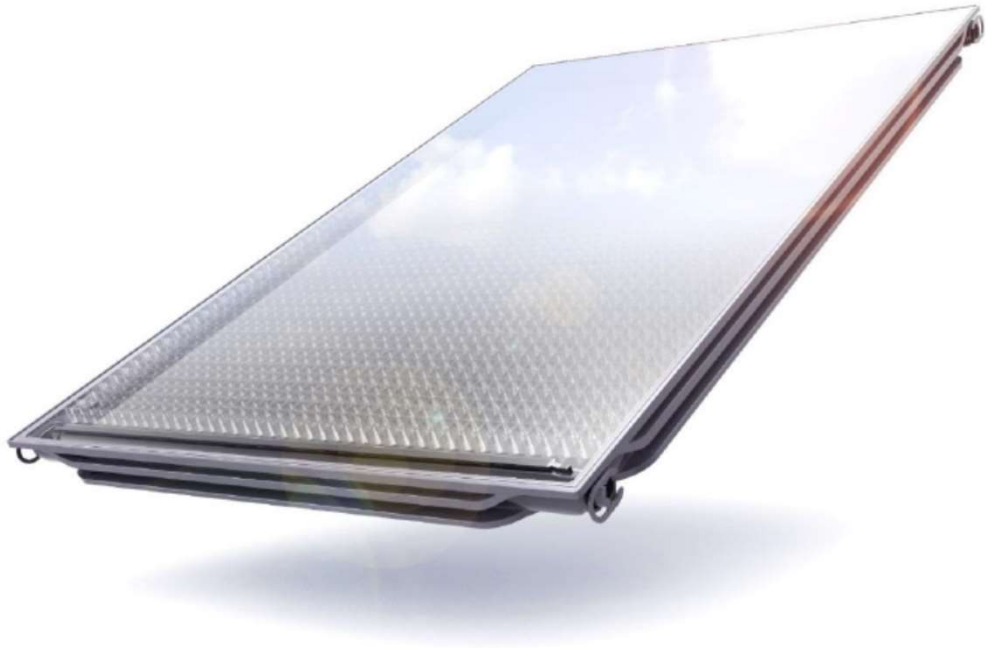


Fig1. One-World-Solar-Collector © Sunlumo Technology GmbH

Fig3. Smartphone control of One-World-Solar-System
© Sunlumo Technology GmbH

Fig2. Polymer-made solar pumping group with push-fit connectors and piping
© Sunlumo Technology GmbH

Fig4. One-World-Solar-System with polymer-made hot water storage
© Sunlumo Technology GmbH

Fig5. Polymer-made domestic hot water storage with integrated One-World-Solar-System components
© Sunlumo Technology GmbH

Sunlumo all-polymeric pumped DHW-system

Fig4. One-World-Solar-System with polymer-made hot water storage
© Sunlumo Technology GmbH

SolarThermal Energy Technologies

Towards All-Polymeric Collector Designs & Systems

solpol

Novel Polyolefin-Compounds for Solarthermal Systems (Borealis, AGRU)

Example 1: PO absorber material

System type & service requirements
- pressurized OHC system
- service life: **20+ years**
- region: Graz (Austria)

Example 2: PO liner for buried, large-volume hot-water stores

Service requirement
- service life: **30+ years**

Research goal: **Polyolefins (PE, PP)** with **15+ °C** enhanced long-term temperature resistance (incl. science-based lifetime assessment)

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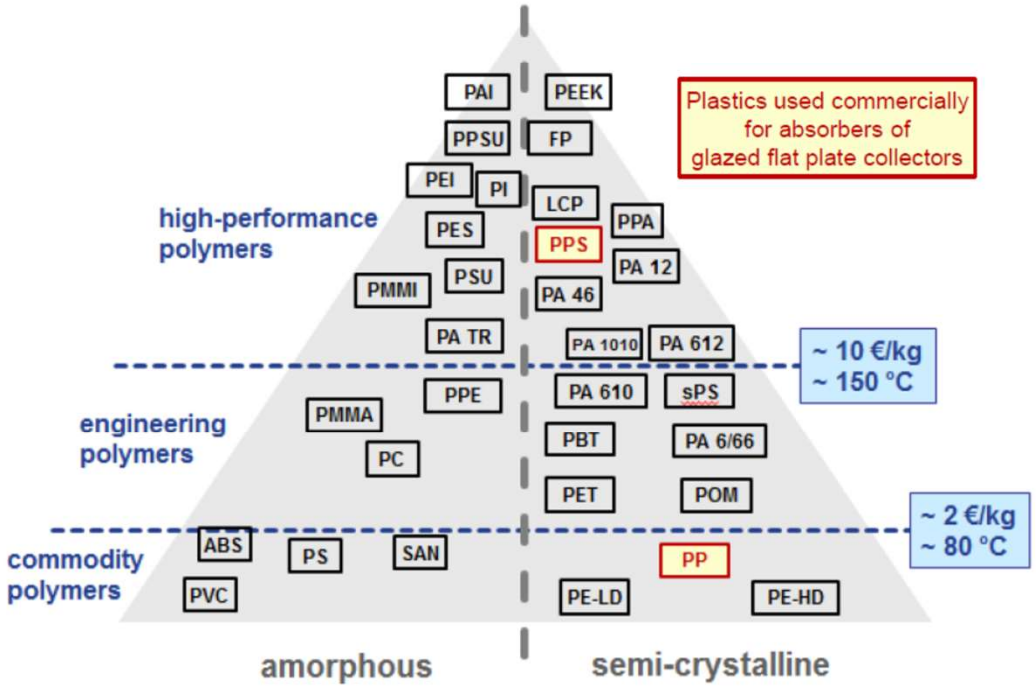
SolarThermal Energy Technologies

Towards All-Polymeric Collector Designs & Systems

solpol

Performance/Price Pyramid of Plastics



Primary overall aims

Performance/Price Requirements

- With OH-control:
  polyolefins (PE, PP)
  – thermal stability **plus ~15 K**
- Without OH-control:
  high-performance plastics
  – price reduction to **< 6 €/kg**

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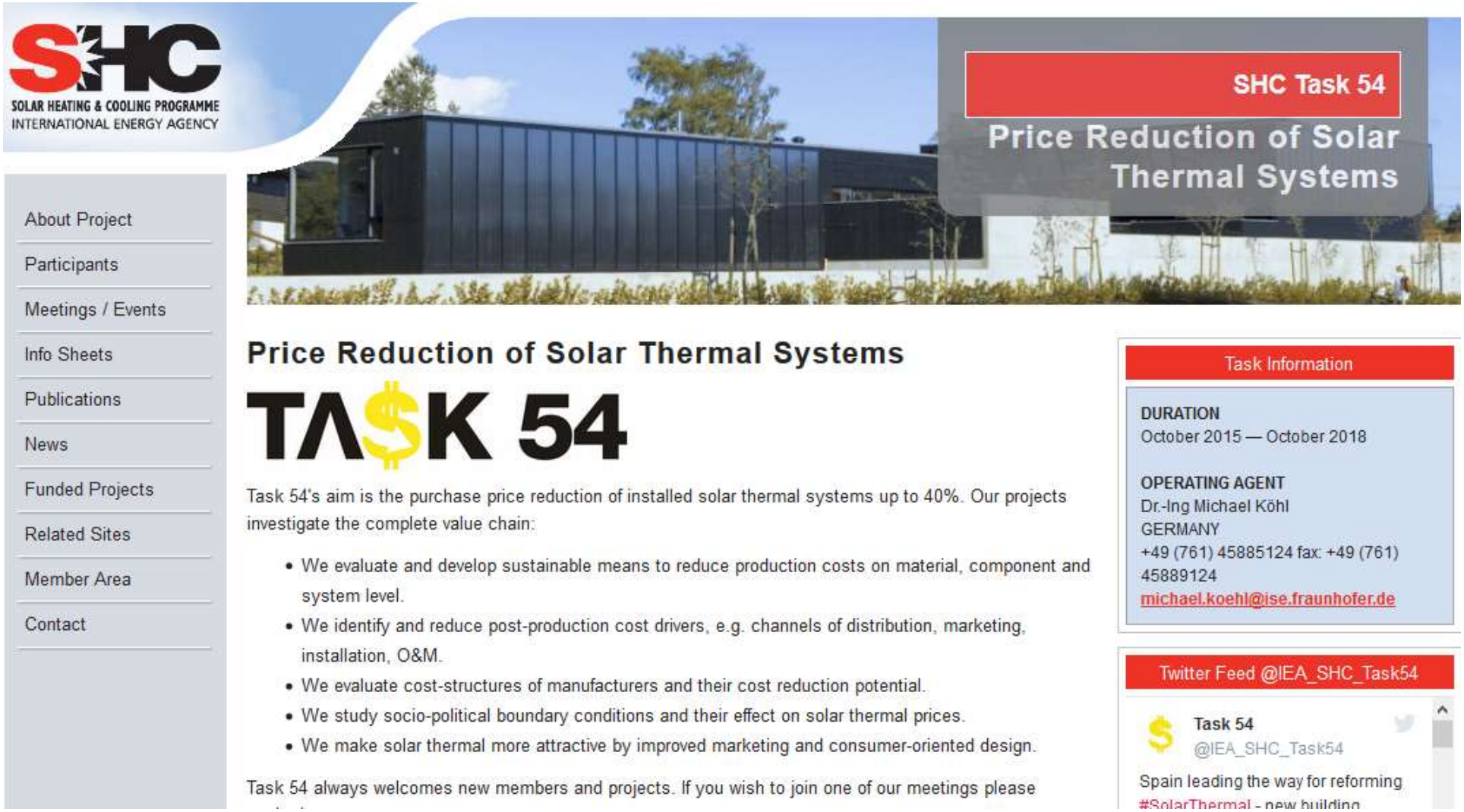
Task 54 Participants so far

- Advanced Polymer Compounds (Austria)
- AEE INTEC (Austria)
- Aventa AS (Norway)
- DTU & Solar Key Int. (Denmark)
- Fraunhofer ISE (Germany)
- Grundfos (Denmark)
- ISFH (Germany)
- KBB Kollektorbau (Germany)
- Linuo Paradigma (China)
- Pleion SRL (Italy)
- Sunlumo Technology (Austria)
- Tecsol (France)
- University of Aachen (Germany)
- University of applied science Ingolstadt (Germany)
- University of Florence (Italy)
- University of Linz, IPMT (Austria)
- Universtity of Kassel (Germany)
- University of Stuttgart ITW/TZS (Germany)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SHC Task 54
Price Reduction of Solar Thermal Systems
About Project
Participants
Meetings / Events
Info Sheets
Publications
News
Funded Projects
Related Sites
Member Area
Contact
Price Reduction of Solar Thermal Systems
TASK 54
Task 54's aim is the purchase price reduction of installed solar thermal systems up to 40%. Our projects investigate the complete value chain:
• We evaluate and develop sustainable means to reduce production costs on material, component and system level.
• We identify and reduce post-production cost drivers, e.g. channels of distribution, marketing, installation, O&M.
• We evaluate cost-structures of manufacturers and their cost reduction potential.
• We study socio-political boundary conditions and their effect on solar thermal prices.
• We make solar thermal more attractive by improved marketing and consumer-oriented design.
Task 54 always welcomes new members and projects. If you wish to join one of our meetings please
Task Information
DURATION
October 2015 — October 2018
OPERATING AGENT
Dr.-Ing Michael Köhl
GERMANY
+49 (761) 45885124 fax: +49 (761) 45889124
michael.koehl@ise.fraunhofer.de
Twitter Feed @IEA_SHC_Task54
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Spain leading the way for reforming
#SolarThermal - new building