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# Challenges for Price Reduction of Solar Thermal Systems



**TASK 54**

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ESTTP-ESTIF-workshop

Brussels, April 25, 2016

<http://task54.iea-shc.org/>

# How to reanimate the solar thermal market?



# How to reanimate the solar thermal market?

Improve Image

Improve Political Framework Conditions

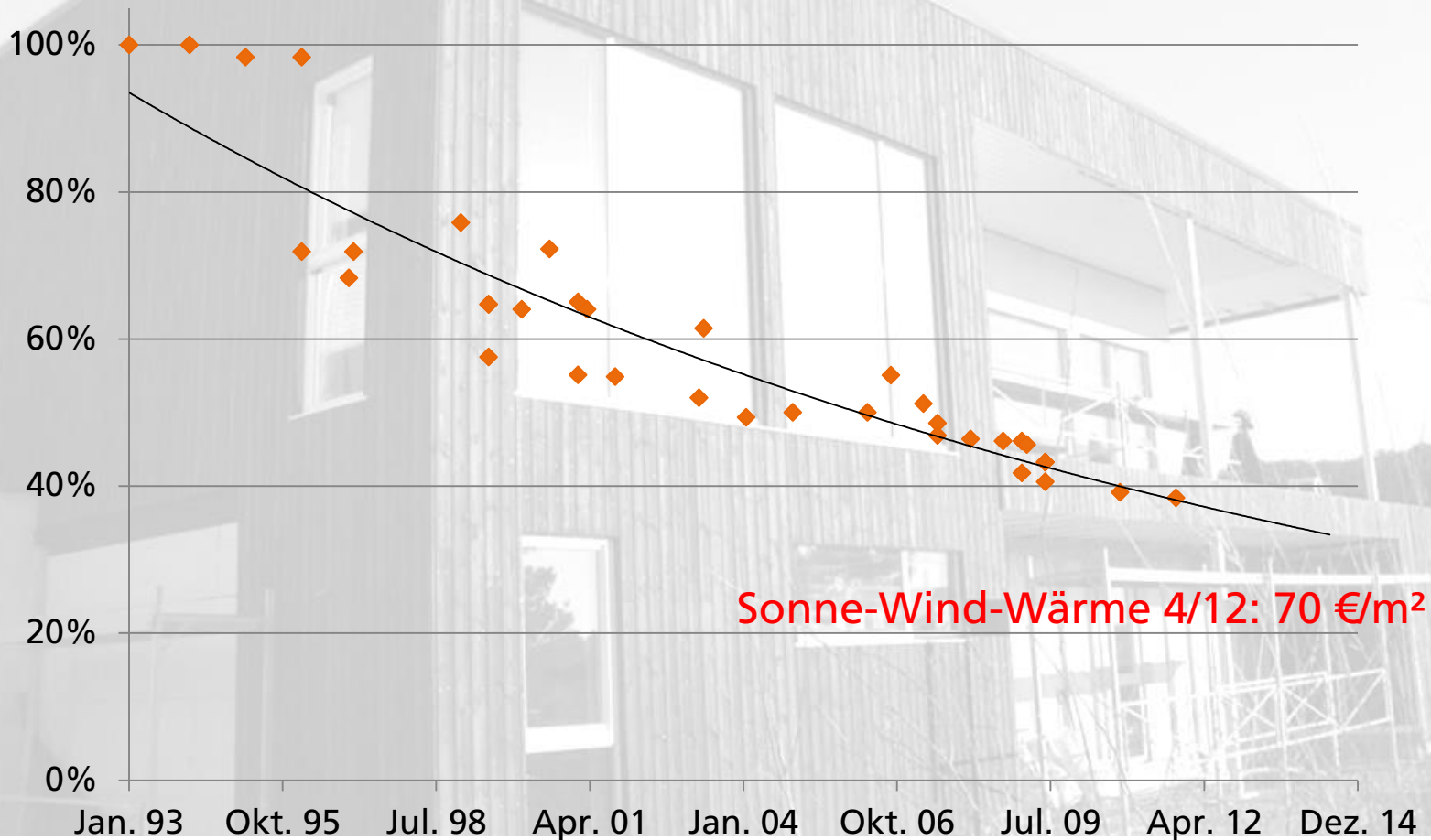
Improve Economical Feasibility

Become Cost-competitive

# Past Cost Development

Development of production costs of collectors since 1993:

Decrease about 4%/year



# Current Cost Structures

Typical German solar DHW system (installed) : 5 m<sup>2</sup> collector, 300 l DHW tank

DE 2012: 4.900 €  
DE 2015: 4.700 €

Price per m<sup>2</sup>:

DE 2012: 98 €

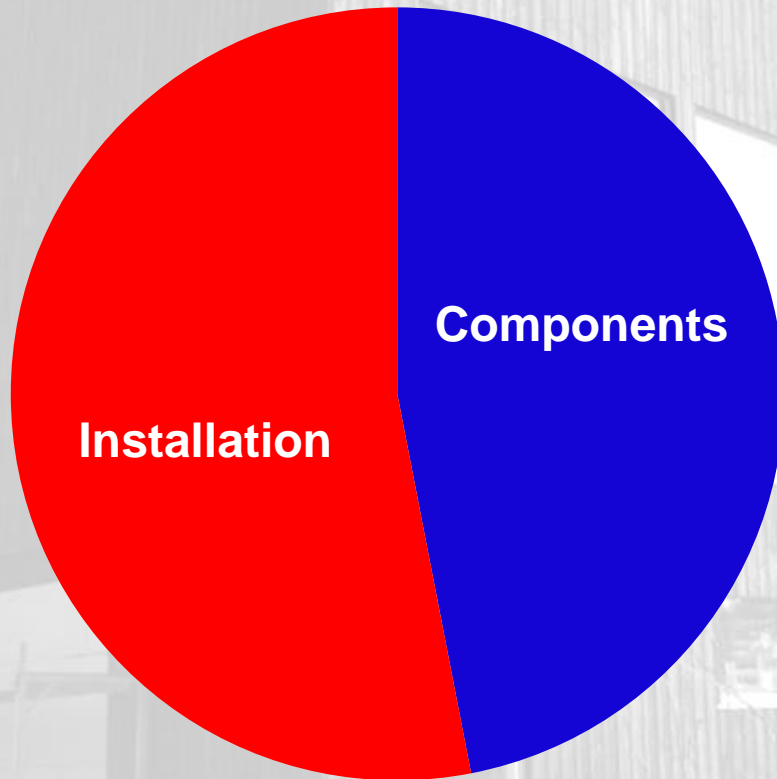
DE 2015: 94 €

**No more production cost  
reduction?**



# Current Cost Structures

Typical solar DHW system (installed) : 5 m<sup>2</sup> collector, 300 l DHW tank



DE 2012: 2.300 €

DE 2015: 2.100 €

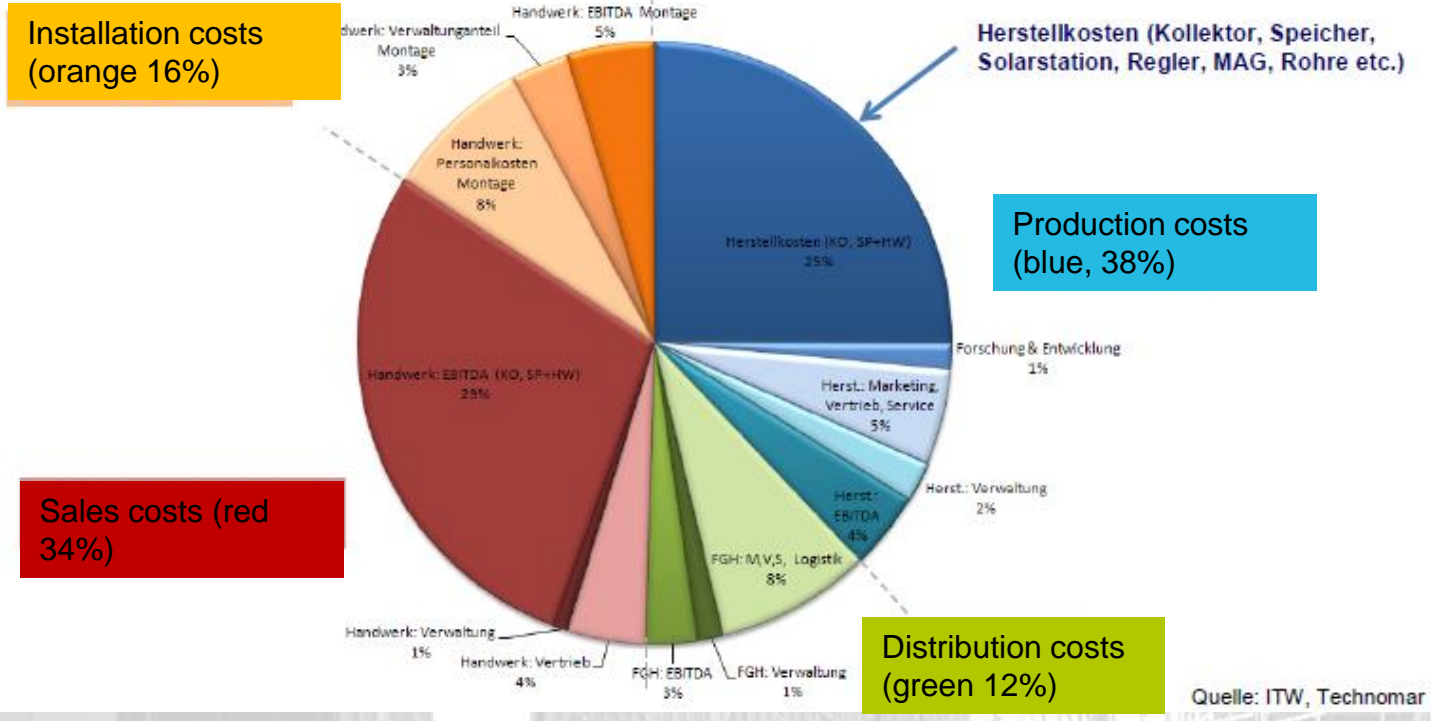
**Decrease about 0.3%  
per year**

# Cost Structures

Combi-system (11 m<sup>2</sup>) price in 2011

## System costs 2011

[combi system 11m<sup>2</sup>, net purchase price end-customer]



# Price reduction of solar thermal systems

## The Task 54 Approach

- Start in October 2015
- Duration: 3 years
- Objectives:

**40%  
reduction  
of  
purchase  
price**

by

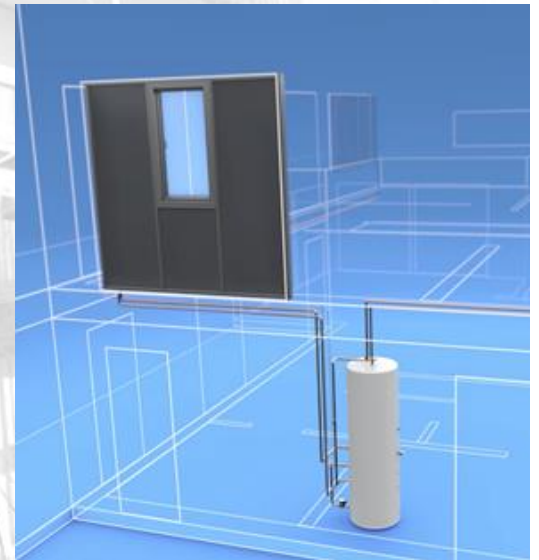




# Price reduction of solar thermal systems

Special emphasis on

- Simplified component design
- Simplified system designs
- Standardized sub-components
- Innovative cost-efficient materials
- Low production costs
- Identification of post-production cost drivers
- Reduced maintenance and operation costs
- Consumer-oriented design
- Improved marketing measures
- Active stakeholder involvement



# Price reduction of solar thermal systems

## Task 54 Structure

Operating Agent: Michael Köhl, Germany

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

# Actual costs and prices

Reference systems

Benchmark for application and verification of cost reduction measures

## Systems of interest:

- Thermosiphon for the sunbelt
- DHW for single family houses
- DHW for multi-family houses
- Combi-systems
- .....

## Out of scope:

SHIP

District heating



# Subtask A : Market success factors and cost analysis

## Michaela Meir, Norway

- Project A.1: Definition of solar thermal and conventional reference systems
- Project A.2: Cost tool definition, life cycle costs of reference and optimized systems
- Project A 3: Political, legal and social boundary conditions
- Project A.4: Market success factors

# Subtask B : System design, installation, operation and maintenance

**Stephan Fischer, Germany**

- Project B.1: Definition of standardised components
- Project B.2: Manufacturing costs
- Project B.3: Technical after sales costs
- Project B.4: Cost optimization of reference systems
- Project B.5: New proposals for a 40% price reduction



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

## Gernot Wallner, Austria

- Project C.1: Identification of major cost drivers
- Project C.2: Material substitution and functional integration
- Project C.3: Innovative, cost-efficient processes and components



# Subtask D : Information, dissemination and stakeholder involvement

## Sandrin Saile, Germany

- Project D.1: Industry liaison
- Project D.2: Dissemination and information



# Task 54 Participants so far

- Advanced Polymer Compounds (Austria)
- AEE INTEC (Austria)
- Aventa AS (Norway)
- Conico Valves (Netherlands)
- DTU & Solar Key Int. (Denmark)
- Fraunhofer ISE (Germany)
- GreenOneTec (Austria)
- Grundfos (Denmark)
- HSR SPF (Switzerland)
- 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)
- University of Kassel (Germany)
- University of Stuttgart ITW/TZS (Germany)

# Economical aspects, reference systems and cost calculation

## How to measure costs and cost reduction?

**Calculation of the energy costs in €/kWh generated by solar thermal**

using the so-called

**Levelised Cost Of Energy (LCOE)**

# Economical aspects, reference systems and cost calculation

## LCOE – Definition Task 52

$$LCOE = \frac{I_0 + \sum_{t=1}^n \frac{A_t}{(1+i)^t}}{\sum_{t=1}^n \frac{E_{solar}}{(1+i)^t}}$$

$LCOE$	levelized cost of solar thermal generated heat [€/kWh]
$I_0$	investment expenditures in the year of installation [€] <sup>[1]</sup>
$A_t$	fixed and variable O&M expenditures in the year $t$ [€]
$E_{solar}$	(useful) solar thermal heat generation in the year $t$ [kWh]
$i$	discount rate (Weighted Average Cost Of Capital) [%]
$n$	period of use (solar thermal collector life time) [yr]
$t$	year within the period of use (1,2,... n)

<sup>[1]</sup> Spec. turnkey solar thermal system costs incl. storage [€/m<sup>2</sup>gross] (excl. VAT)

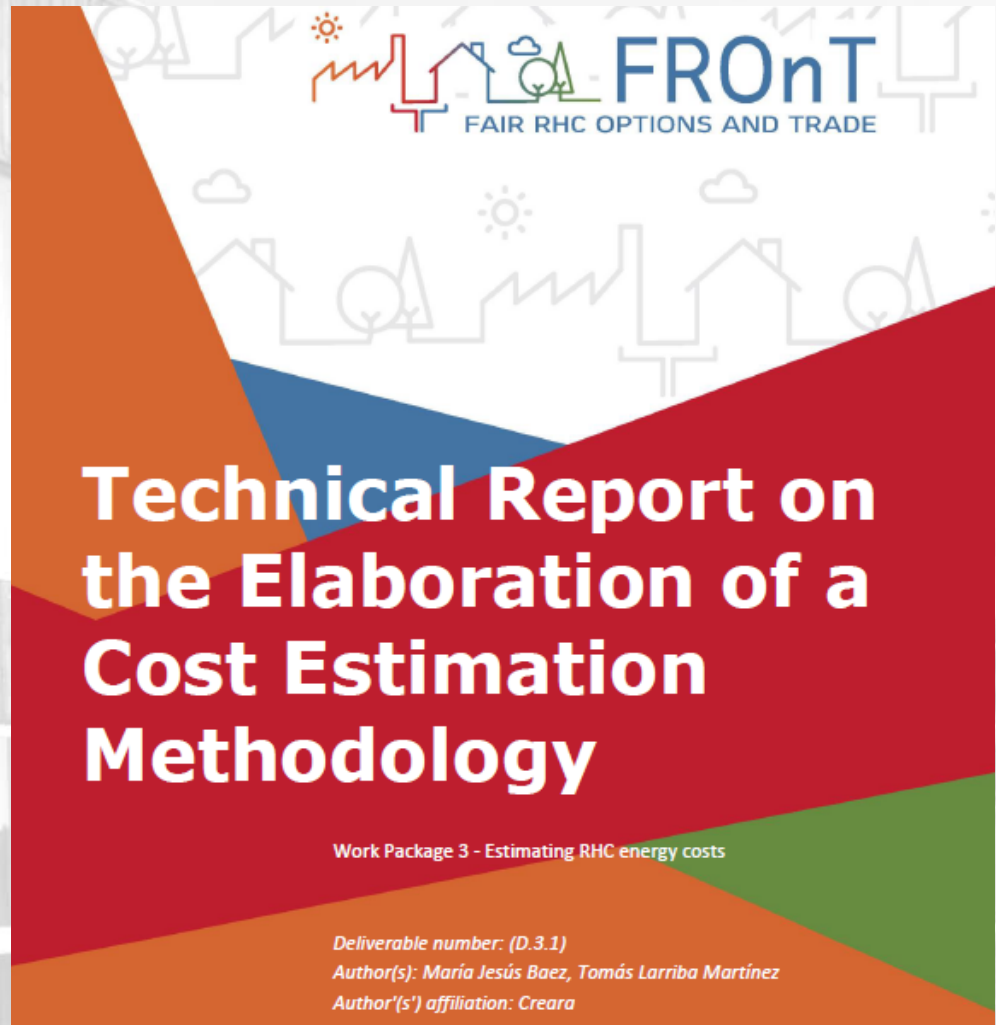
<https://www.ise.fraunhofer.de/de/veroeffentlichungen/veroeffentlichungen-pdf-dateien/studien-und-konzeptpapiere/studie-stromgestehungskosten-erneuerbare-energien.pdf>

# Economical aspects, reference systems and cost calculation

Same calculation can be found within:

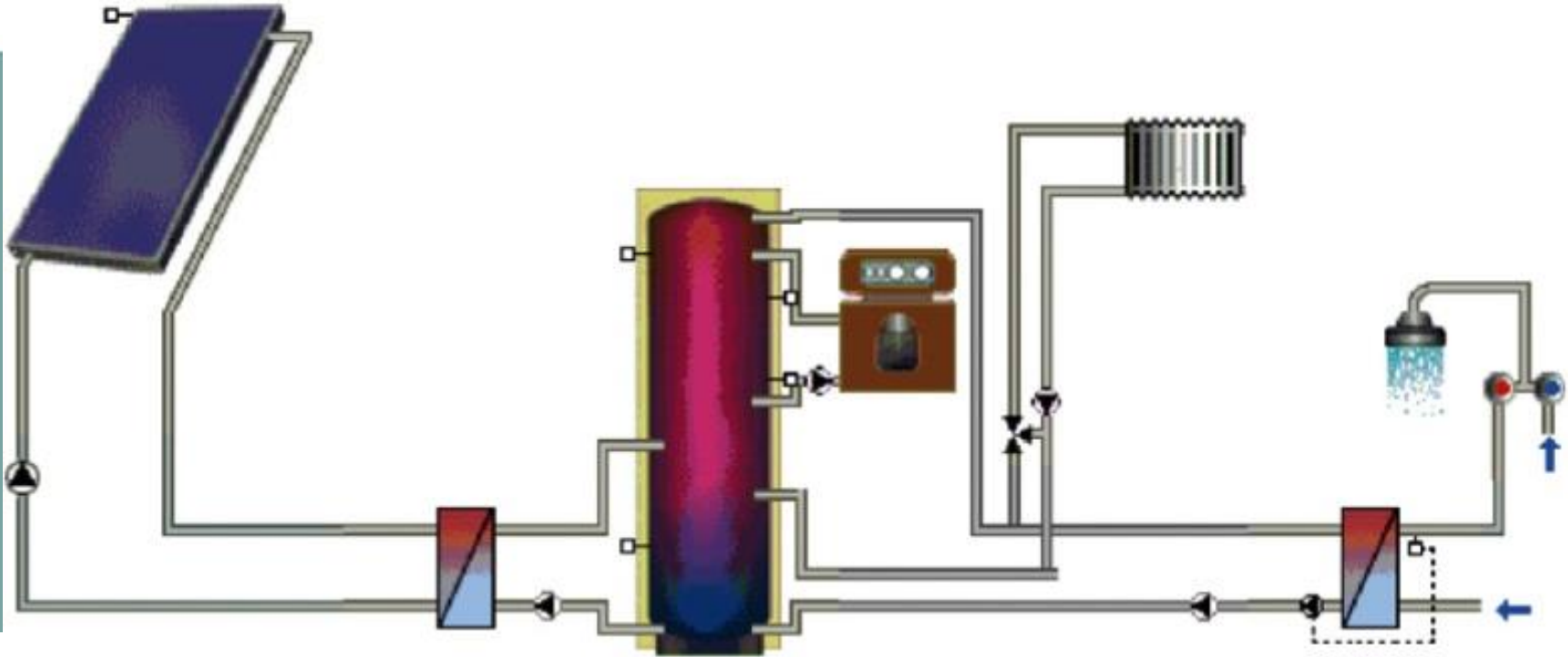
FROnT  
Fair RHC Options and Trade

Technical report on the  
Elaboration of a Cost  
Estimation Methodology



# Economical aspects, reference systems and cost calculation

Reference systems according





# Economical aspects, reference systems and cost calculation

## How to reduce costs (LCOE)?

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

# Economical aspects, reference systems and cost calculation

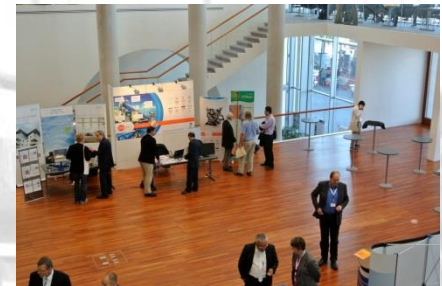
## How to reduce costs (LCOE)?

- **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
  - ...

# Data collection on installation

## Subtask D – Information, dissemination and stakeholder involvement

- Active involvement of industry partners outside the task for input and support
- Publications in reviewed journals, magazines and conference proceedings
- Public website and online information
- Networking and dissemination events [in close cooperation with Subtask A]

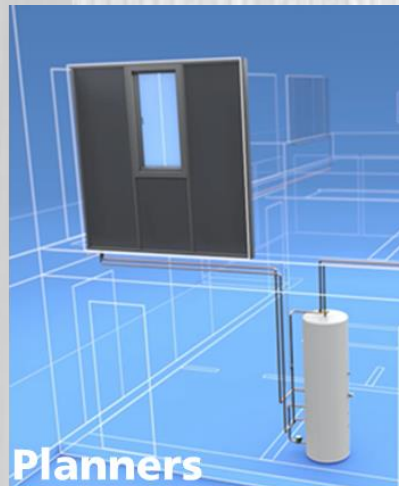


**Project D.1:** | Industry liaison

**Project D.2:** | Dissemination and information

# Data collection on installation

## Subtask D – Stakeholder groups





# Data collection on installation

## Subtask D – Stakeholder groups



# Data collection on installation

## Task 54 Questionnaire

### Task:

- Gain first-hand field experience
- Gain thorough understanding of post-production cost drivers, e.g. installation

### Approach:

Get input and feed back from installers themselves

- Make installation cost structures more transparent
- Understand obstacles for more cost-efficient installation
- Find simplifications, ways to make installation more efficient

**SHC**  
SOLAR HEATING & COOLING PROGRAMME  
INTERNATIONAL ENERGY AGENCY

**TASK 54**

Please return to: *[insert email address]*

**SHC Task 54 Data Collection on Installation**

**General remarks**  
In order to facilitate the completion of this questionnaire, the survey is limited to three most dominant system types in the investigated regions:  
1) Domestic hot water (DHW) systems  
2) Combined Systems  
3) Thermosiphon Systems  
with the possibility to give more details on these types in the optional section at the end of the questionnaire. Please try to answer as many questions as you can. If there are questions you cannot answer, leave them blank and continue to the next.  
**Task 54 declares that all answers will be treated confidentially and will only be used for research purposes.** No names or organizations will be published.

**Manufacturers**

1. Which manufacturers are predominantly chosen for your installations? Please indicate the top 3 for each of the three systems specified above [in the same order].

	Manufacturer 1	Manufacturer 2	Manufacturer 3
DHW system:			
Combined System:			
Thermosiphon System:			

2. Why are they chosen? Please tick one of the listed options and add further reasons if necessary [multiple answers possible].

Customer wishes	<input type="checkbox"/>
Framework contracts	<input type="checkbox"/>
Easy installation, convenient installation	<input type="checkbox"/>
Other (please specify)	

**Resources**

3. Please specify the expenditure of time for the installation (incl. travel and preparation time) by indicating the **total number of man hours** needed for the installation of each of the systems defined above [in the same order].

DHW System:	
Combined System:	
Thermosiphon System:	

4. How much personnel is involved? Please insert **number of installer(s)** per system specified above [in the same order].

DHW System:	
Combined System:	
Thermosiphon System:	

5. How much does one man hour cost? Please indicate **average personnel costs in 1 hour**.

Man hour in 1 hour:	
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# Data collection on installation

## Task 54 Questionnaire – Trial version

Designed by TECSOL, ISE, ITW, SPF

Limited to 3 most dominant system types in the investigated regions:

1. Domestic hot water (DHW) systems
2. Combined systems
3. Thermosiphon Systems

Possibility to provide more details at the end of the survey (collector technology, collector area, storage size, refurbishments / new installations, total costs for installation).

Available languages: English, German, French (more to be added)

The image shows a tilted screenshot of a questionnaire form titled "SHC Task 54 Data Collection on Installation". The form is in German and contains several sections with tables for data entry. The sections are: "System", "Kollektorsystem", "Speicher", "Wärmepumpe", "Wärmehaube", "Wärmehaube", "Wärmehaube", "Wärmehaube", "Wärmehaube", "Wärmehaube". Each section has a table with columns for "System", "Kollektorsystem", "Speicher", "Wärmepumpe", "Wärmehaube", "Wärmehaube", "Wärmehaube", "Wärmehaube". The form is partially filled out with yellow highlights.

# Data collection on installation

## Task 54 Questionnaire – Trial version

### ➤ Manufacturers:

Which ones are chosen?

Why are they chosen?

### ➤ Resources:

Expenditure of time

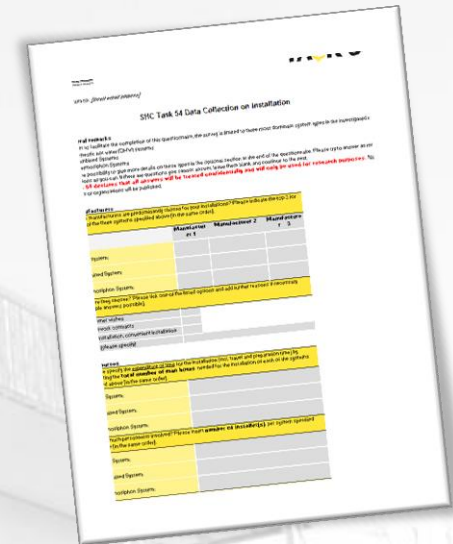
Number of personnel

Costs of one man hour

Most time consuming factors (e.g. preparation, roof installation, piping, number of tools, etc.

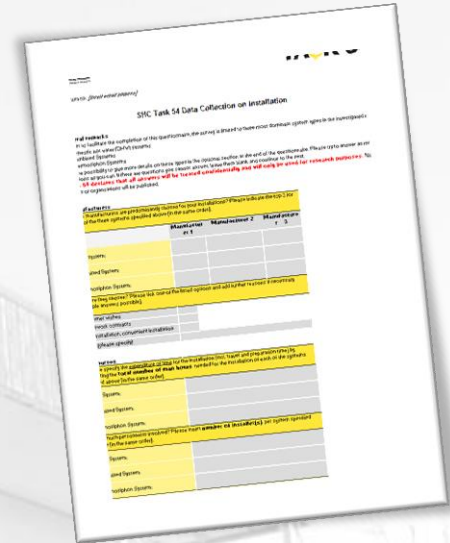
### ➤ Maintenance:

Expenditure of time, planned vs. actual



# Data collection on installation

## Task 54 Questionnaire – Trial version



Open questions:

➤ Improvements:

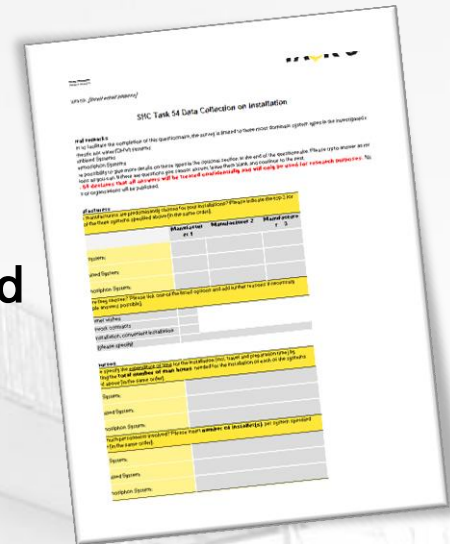
How can the installation process be facilitated?

How could maintenance be reduced?

# Data collection on installation

Experiences so far...

- Interesting replies
- BUT: Great variances per country, system and providers stress the complexity at hand
- e.g. Choice of manufactures based on “easy installation, convenient installation sets”
- “building owner requirements (specs in call for tenders)”
- “best and long term quality (even if more expensive.”
- Time consuming parts during installation vary from piping to preparation



# Data collection on installation

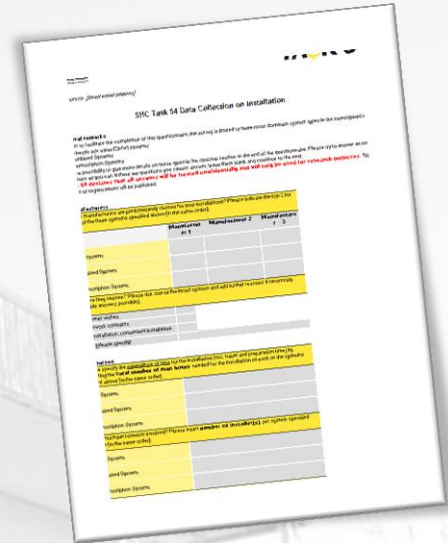
Experiences so far...

## Suggestions for improvement:

- Standardized montage
- Open and clear communication with stakeholders
- Detailed mounting video
- Wireless sensors and increase the electrical wiring efficiency
- Finding efficient plumbing and heating installers
- Etc.

☺...Task 54 on the right track

☹...more data needed for validation of trial results





# Data collection on installation

## Next steps

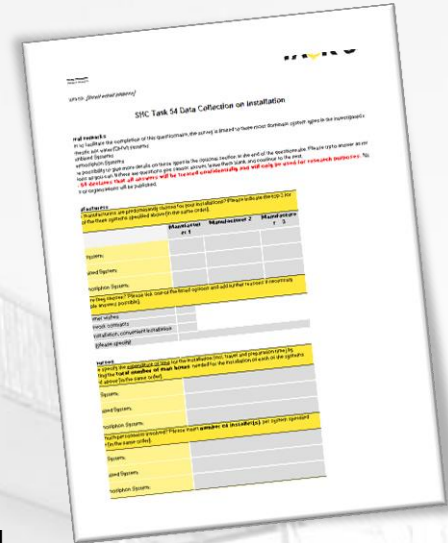
Final version conceptualized by

Daniel Mugnier, TECSOL

Sandrin Saile , Wolfgang Kramer, ISE,

Stephan Fischer, ITW in close cooperation with

Bernd Hafner, RHC Solar Thermal Technology Panel



**We need you!**

Task 54 seeks contact with installers and their associations for distribution of Task 54 questionnaire. Contact details can be sent to [sandrin.saile@ise.fraunhofer.de](mailto:sandrin.saile@ise.fraunhofer.de).



# Discussion

**How can we actually reduce costs (LCOE)?**

**What are other possibilities not mentioned?**

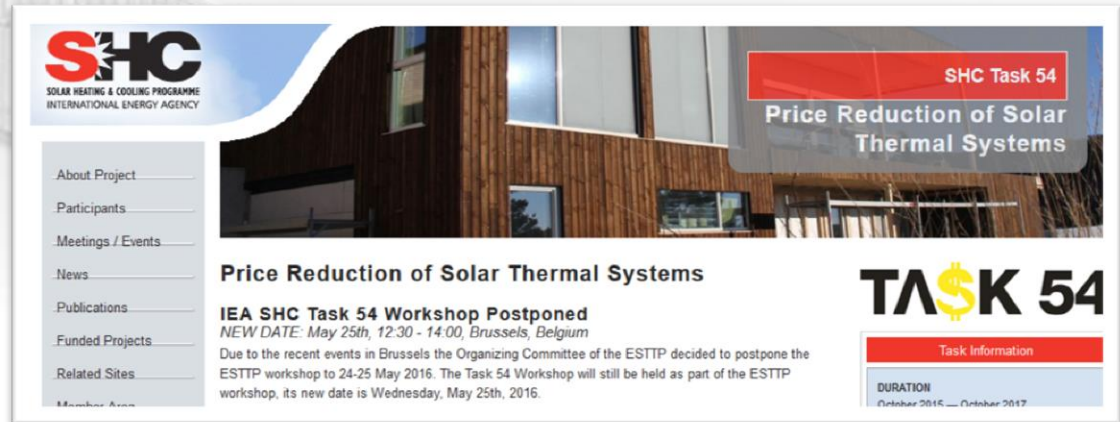
**Which are the measures you are working on?**

**Which are the most promising approaches?**

# Possibilities for participation

For contact and info  
visit us at:

[task54.iea-shc.org](http://task54.iea-shc.org)



The screenshot shows the SHC Task 54 website. On the left is a navigation menu with links for About Project, Participants, Meetings / Events, News, Publications, Funded Projects, Related Sites, and Member Area. The main content area features a news article titled "Price Reduction of Solar Thermal Systems" with a sub-headline "IEA SHC Task 54 Workshop Postponed". The article text states: "NEW DATE: May 25th, 12:30 - 14:00, Brussels, Belgium. Due to the recent events in Brussels the Organizing Committee of the ESTTP decided to postpone the ESTTP workshop to 24-25 May 2016. The Task 54 Workshop will still be held as part of the ESTTP workshop, its new date is Wednesday, May 25th, 2016." To the right of the article is a "TASK 54" logo and a "Task Information" box indicating a duration from October 2015 to October 2017.

## ➤ Regular participation

*Join meetings, get full access to database and results, benefit from international network.*

## ➤ Join workshops

*Contribute with your expertise, network, stay in touch.*

## ➤ Observe

*Be part of our email list, get the latest news, stay informed of Task 54 activities.*

**Save the date!**

**Next meeting:**

**Stuttgart, October, 6 – 7, 2016**

# Thank you for your attention!



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Fischer@itw.uni-stuttgart.de