

Challenges for Price Reduction of Solar Thermal Systems



TΛ\$K 54

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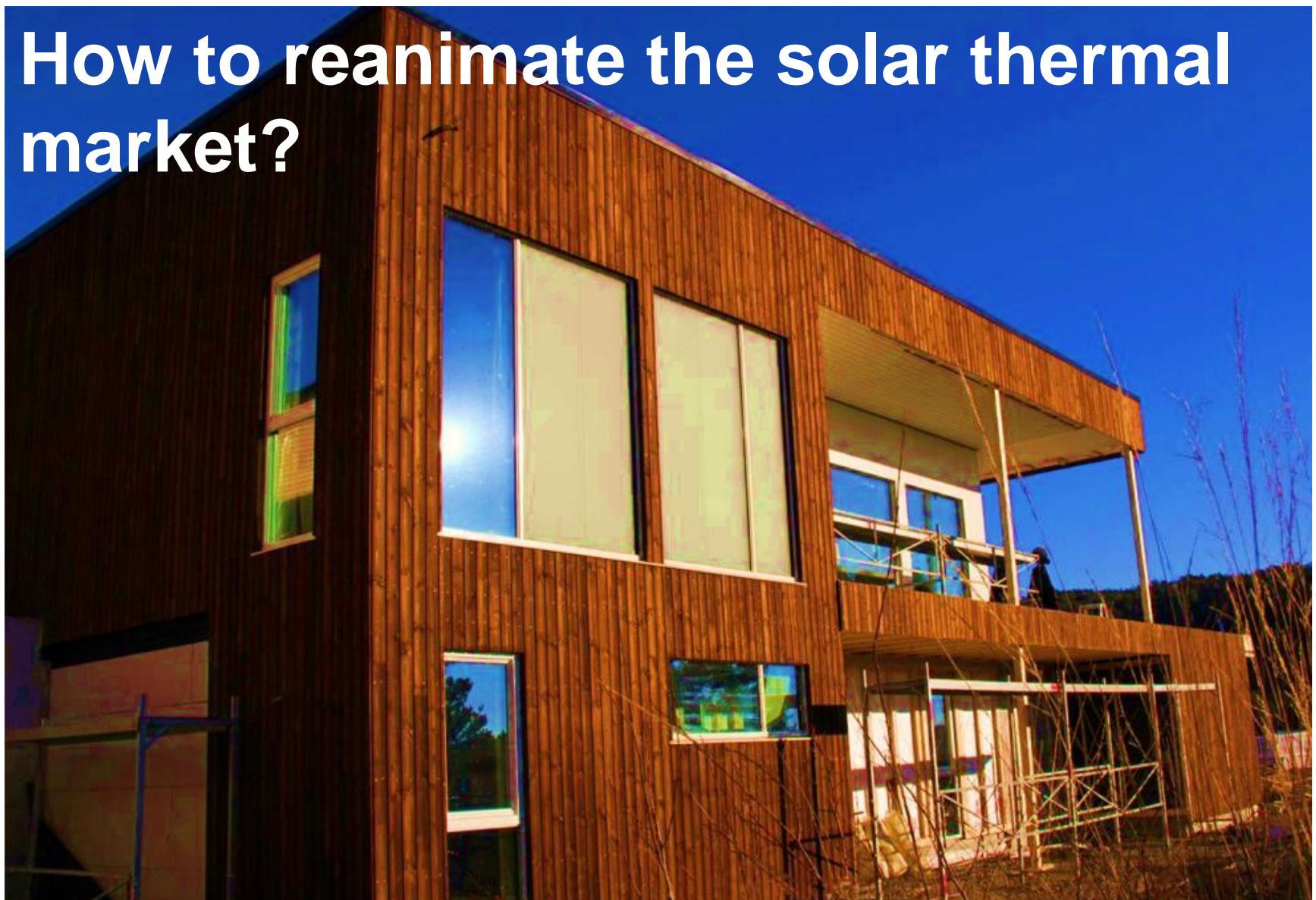
²University of Stuttgart, ITW

ESTTP-ESTIF-workshop

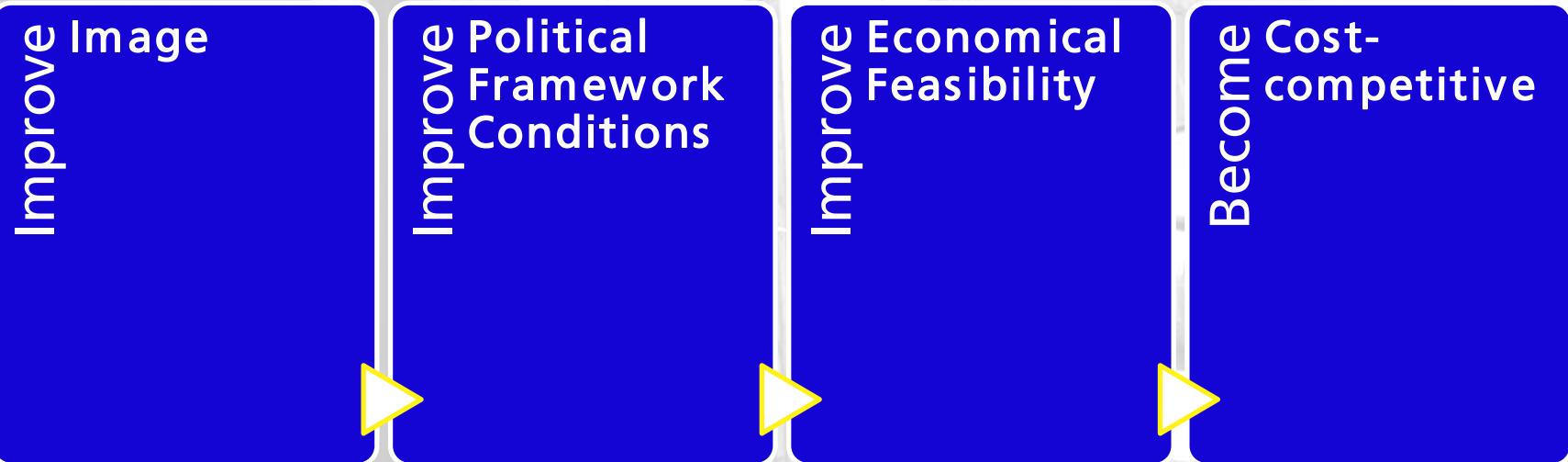
Brussels, April 25, 2016

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

How to reanimate the solar thermal market?



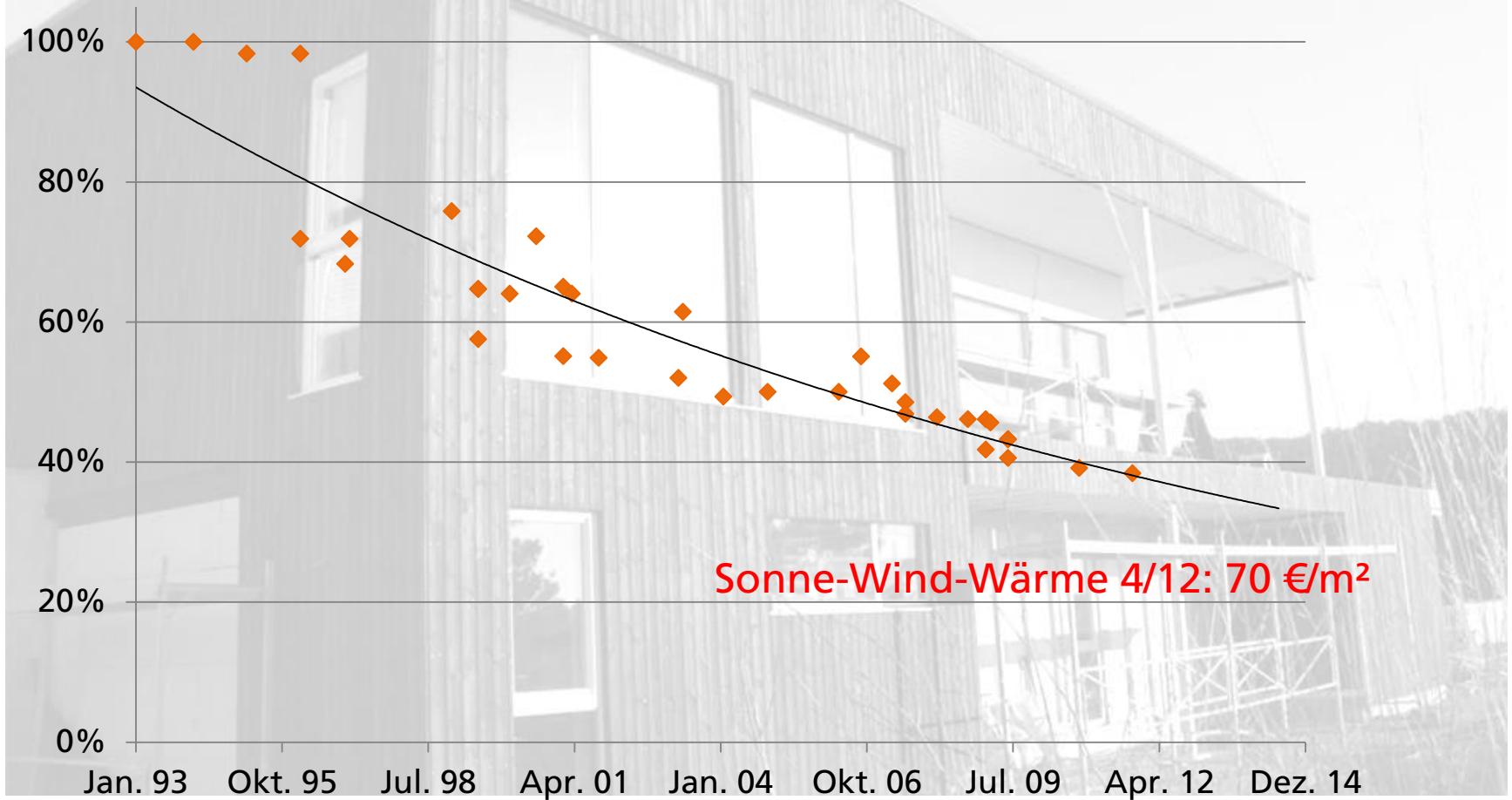
How to reanimate the solar thermal market?



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 m² collector, 300 l DHW tank



DE 2012: 4.900 €
DE 2015: 4.700 €

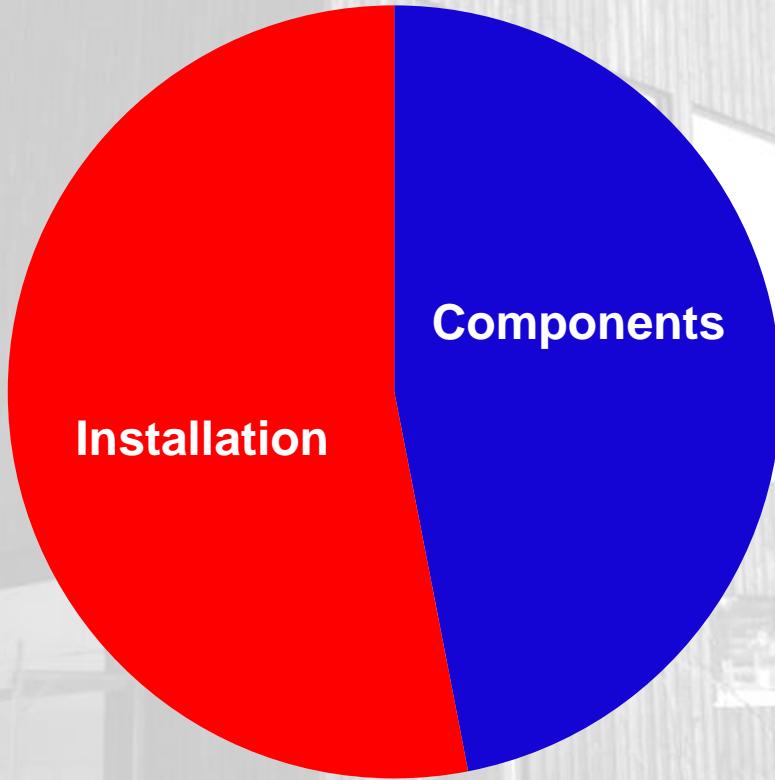
Price per m²:

DE 2012: 98 €
DE 2015: 94 €

No more production cost reduction?

Current Cost Structures

Typical solar DHW system (installed) : 5 m² collector, 300 l DHW tank



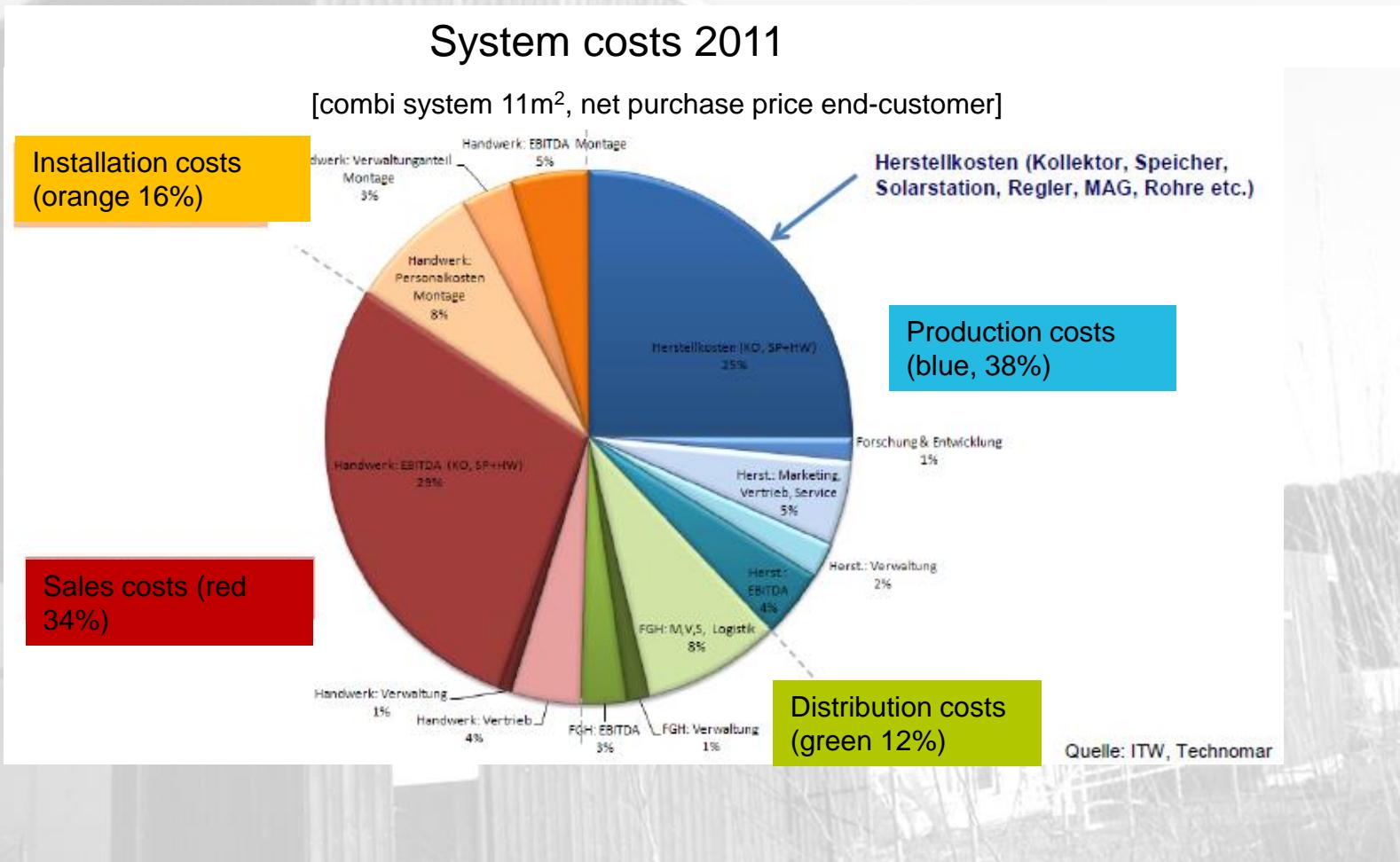
DE 2012: 2.300 €

DE 2015: 2.100 €

Decrease about 0.3% per year

Cost Structures

Combi-system (11 m²) price in 2011



Price reduction of solar thermal systems

The Task 54 Approach

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

40%
reduction
of
purchase
price

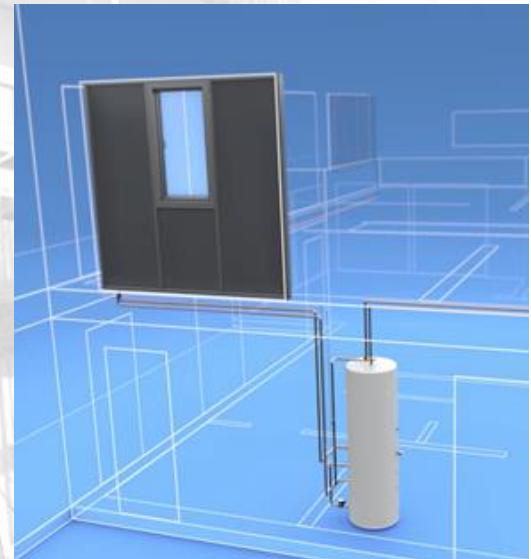
by



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

Subtask A	Market success factors and cost analysis	<i>Norway, Michaela Meir</i>
Subtask B	System design, installation, operation and maintenance	<i>Germany, Stephan Fischer</i>
Subtask C	Cost-efficient materials, production processes and components	<i>Austria, Gernot Wallner</i>
Subtask D	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 [€] ^[1]
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)

[1] Spec. turnkey solar thermal system costs incl. storage [€/m²gross] (excl. VAT)

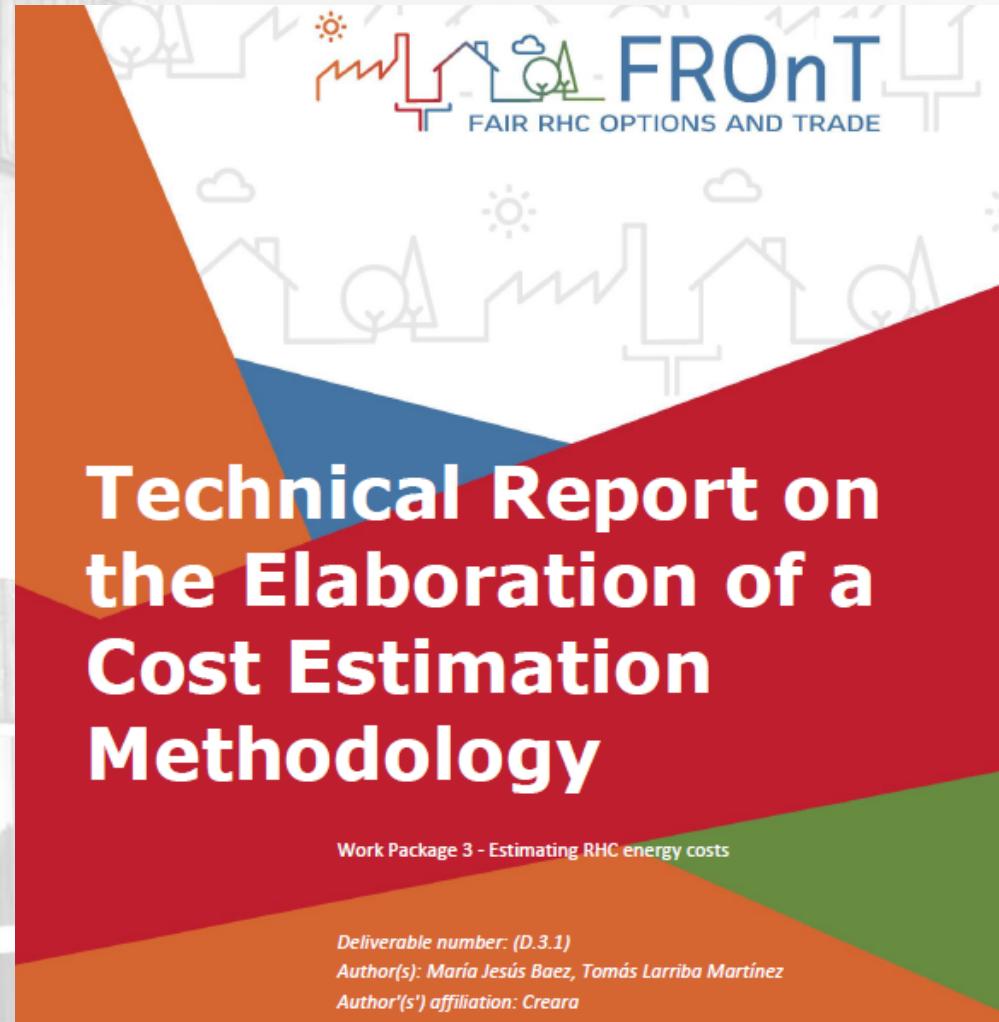
<https://www.ise.fraunhofer.de/de/veroeffentlichungen/veroeffentlichungen-pdf-dateien/studien-und-konzeptpapiere/studie-stromgestehungskosten-erneuerbare-energien.pdf>

Economical aspects, reference systems and cost calculation

Same calculation can be found within:

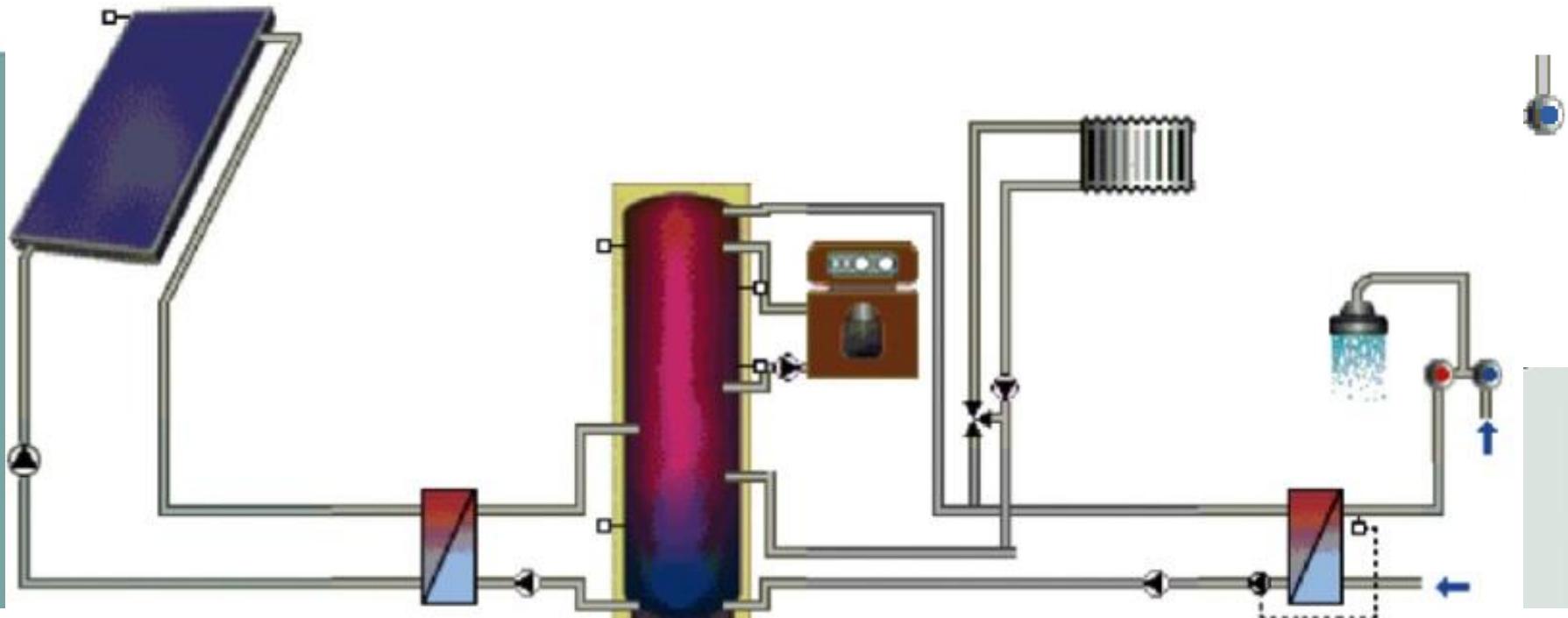
FROnT
Fair RHC Options and Trade

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

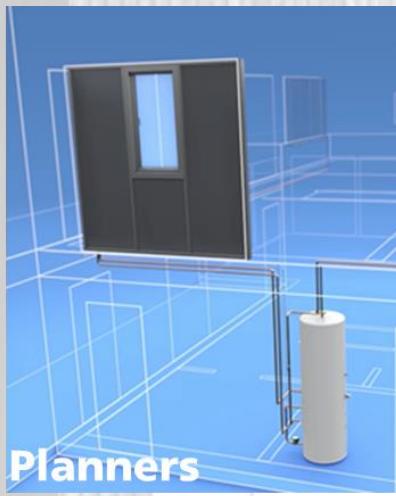
Project D.2: Dissemination and information

Data collection on installation

Subtask D – Stakeholder groups



Research



Planners



Installers



Users



Industry

Data collection on installation

Subtask D – Stakeholder groups



Data collection on installation

Task 54 Questionnaire

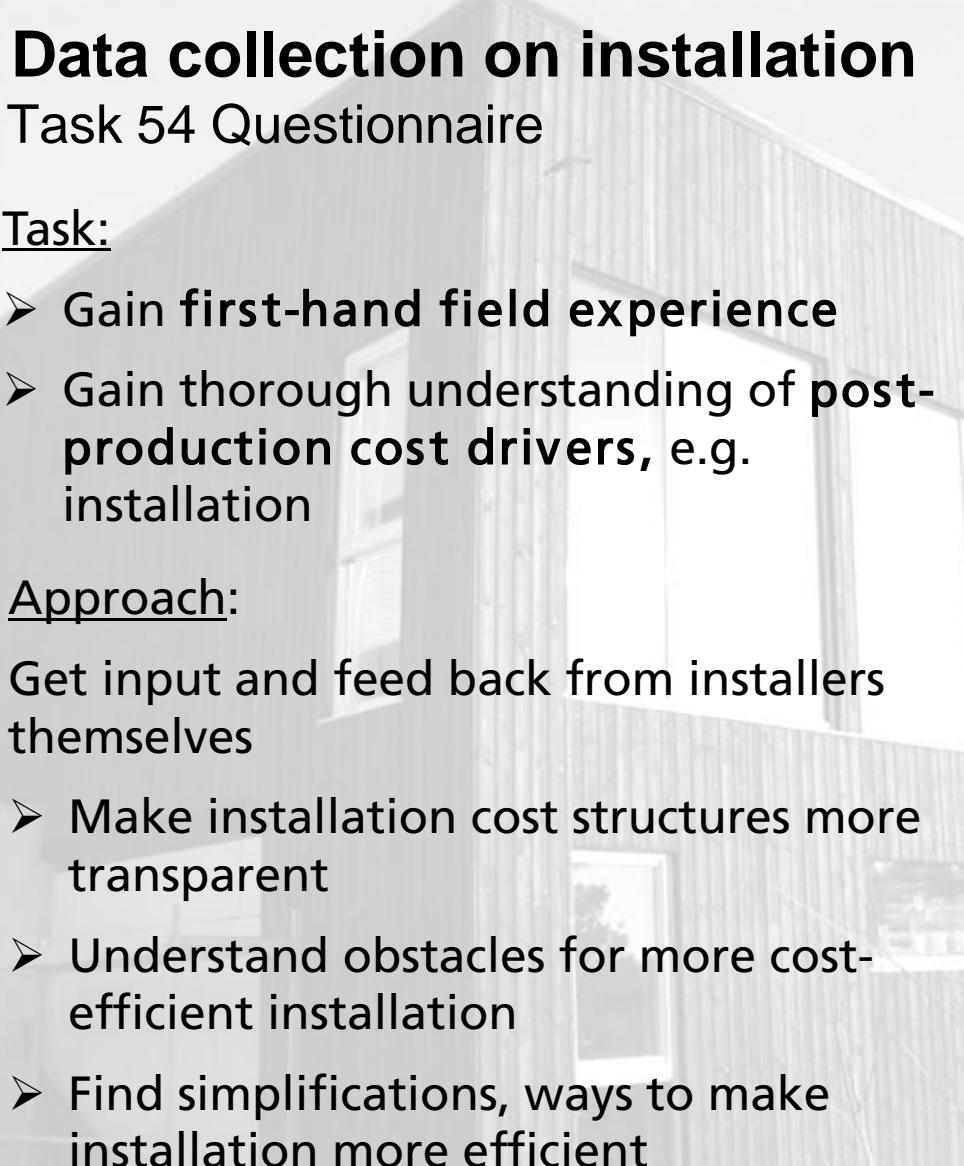
Task:

- 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 organisations 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	
Framework contracts	
Easy installation, convenient installation	
Other (please specify)	

I. 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 € / hour**.

Man hour in € / hour:

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

STC Task 54 Data Collection on Installation

If all installed systems are of the same type, the survey is limited to one model. Otherwise, please specify the manufacturer, model and year for each system.

If you have more than one system, please indicate the distinct model or part of the equipment. Please only answer once.

Please provide your name and address for the survey results, however, we will not publish your name or address. We will only use your name for research purposes. No other organisations will receive your data.

If different DHW systems are predominantly heated by the installation (Please tick the boxes):

Manufacturer	Model/Version	Manufacture Year
None		
System 1		
System 2		
System 3		

If there are more than three DHW systems, please list the latest system and add further in the free text field.

If there are more than three combined systems, please list the latest system and add further in the free text field.

If there are more than three thermosiphon systems, please list the latest system and add further in the free text field.

If there are more than three solar powered DHW systems, please list the latest system and add further in the free text field.

If there are more than three solar powered combined systems, please list the latest system and add further in the free text field.

Note: This survey is intended for installations from 1990 and provides general information. If you have specific questions about your system, please contact the manufacturer or your supplier.

Systems

Manufacturer	Model/Version	Manufacture Year
None		
System 1		
System 2		
System 3		

combined Systems

Manufacturer	Model/Version	Manufacture Year
None		
System 1		
System 2		
System 3		

Solar powered DHW

Manufacturer	Model/Version	Manufacture Year
None		
System 1		
System 2		
System 3		

Solar powered combined

Manufacturer	Model/Version	Manufacture Year
None		
System 1		
System 2		
System 3		

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)

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

The screenshot shows a questionnaire titled "SHC Task 54 Data Collection on Installation". It includes sections for "Manufacturers", "Resources", and "Maintenance". The "Manufacturers" section has three rows for "Manufacturer 1", "Manufacturer 2", and "Manufacturer 3", each with dropdown menus for "System" and "Type Options". The "Resources" section has two rows for "Planned" and "Actual" values, with dropdown menus for "Expenditure of time", "Number of personnel", and "Costs of one man hour". The "Maintenance" section has two rows for "Planned" and "Actual" values, with dropdown menus for "Expenditure of time" and "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?

The screenshot shows a questionnaire titled "SHC Task 54 Data Collection on Installation". It includes a header with instructions and a note about the survey being used to improve the questionnaire. The main part of the form contains several tables for data entry.

Maintenance Requirements		
System	Maintenance 1	Maintenance 2
Solar Systems	At least once a year	At least once every 2 years
Boiler Systems	At least once a year	At least once every 2 years
Heating Systems	At least once a year	At least once every 2 years
Water Heating Systems	At least once a year	At least once every 2 years
Electrical Systems	At least once a year	At least once every 2 years

Below this table, there is a note: "Maintenance is considered to be the installation (or repair and replacement) of parts which are not part of the production of heat or cooling if either the cost is high or the system is not fit for the production of heat or cooling".

Maintenance Intervals		
System	Maintenance 1	Maintenance 2
Solar Systems	At least once a year	At least once every 2 years
Boiler Systems	At least once a year	At least once every 2 years
Heating Systems	At least once a year	At least once every 2 years
Water Heating Systems	At least once a year	At least once every 2 years
Electrical Systems	At least once a year	At least once every 2 years

Below this table, there is a note: "Maintenance is considered to be the installation (or repair and replacement) of parts which are not part of the production of heat or cooling if either the cost is high or the system is not fit for the production of heat or cooling".

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

The screenshot shows a survey titled "STC Task 54 Data Collection on Installation". The survey asks respondents to compare three manufacturers (Manufacturer 1, Manufacturer 2, Manufacturer 3) across various system components. The components listed are:

- Boiler Systems
- Heat Exchangers
- Control Systems
- Storage Systems
- Piping Systems
- Accessories
- Other

For each component, there are three columns corresponding to the manufacturers. The survey also includes a section for comments.

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

The screenshot shows a Microsoft Word document titled "SHC Task 54 Data Collection on Installation". The form includes several sections with tables and checkboxes. One section asks if all measures have been implemented, with options "Yes" and "No". Another section asks if the system is operational, with options "Yes" and "No". There are also sections for "System Components" and "System Options", each containing a table with three rows labeled "Manufacturer", "Model/Version", and "Manufacturer". The "System Components" table has columns for "Boiler", "Heat Exchanger", "Pump", "Valve", "Control System", and "Accessories". The "System Options" table has columns for "Boiler", "Heat Exchanger", "Pump", "Valve", "Control System", and "Accessories".

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.

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

The screenshot shows the homepage of the IEA SHC Task 54 website. At the top left is the SHC logo. To the right is a large image of a modern building with wooden cladding and large windows. In the top right corner, a red box contains the text "SHC Task 54" and "Price Reduction of Solar Thermal Systems". On the left side, there is a vertical navigation menu with links: About Project, Participants, Meetings / Events, News, Publications, Funded Projects, Related Sites, and Member Area. The main content area features the title "Price Reduction of Solar Thermal Systems" and a sub-section titled "IEA SHC Task 54 Workshop Postponed" with the text: "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." On the right side, there is a large "TASK 54" logo with a yellow dollar sign symbol, and below it, a "Task Information" section with the word "DURATION" and the text "October 2015 — 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