SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

PRICE REDUCTION OF SOLAR THERMAL SYSTEMS

Work Plan 2015 -2018

May 2016 (rev. 2)

History of changes

Page	Section	Changes / Remarks
4	Project A.1, activities	Term "7-10 reference systems" changed to "minimum five reference systems"
4-5	Project A.2 - A.5, activities	Project A.2 - A.5 are merged, named A.2.
4	Project A.2, deliverables	Deliverables reduced from 4 to 2 (now A.3, A.4)
4	Project A.2, new activity and deliverable	Definition of "cost tool" and deliverable added.
5	Timescale / Milestones	Updated according to changes above.
Approved earlier:		
4	Project overview, projects A.2 and A.4	Term “non-technical” deleted
4	Project A.2, title, text and name of deliverable	Term “non-technical” deleted
5	Project A.4, title, text and name of deliverable	Term “non-technical” deleted
5	Project A.5, D. A.5	Change reference syst. to “optimized systems”
6	Timescale / Milestone	Quarter 4, / year 1; DA.2 changed to D A.1

Objectives

This Task aims at the purchase price reduction for end-users of installed solar thermal systems by evaluating and developing sustainable means to reduce production and/or installation costs on material, sub-component, system-component and system level. Special emphasis is placed on the identification and reduction of post-production cost drivers, e.g. channels of distribution. An extensive market research and the definition of reference systems, cost analyses, and the study of socio-political boundary conditions for solar thermal prices in selected regions will provide the basis for the evaluation of cost-structures and the cost reduction potential.

A reduction of the purchase price up to 40% contrasted to the applied reference systems shall be achieved by:

- Simplified system designs
- Less but innovative and cost-efficient materials
- Standardized components (e.g. collector, storage tank), subcomponents (e.g. connectors, casing parts) and installation
- Low production costs
- Plug & play systems for a simplified installation
- Reduced maintenance and operation costs

Additionally, ways to make solar thermal more attractive by improved marketing and consumer-oriented design will be explored. The research activities shall be specifically targeted at the needs and potentials of different markets and offer tailored solutions for affordable solar thermal systems at a competitive price.

Means

The objectives shall be achieved in the following subtasks:

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)

Operating Agent: Germany (Michael Köhl)

Subtask A: Market success factors and cost analysis

Objectives

Subtask A contains the investigation of regionally typical solar thermal applications and system designs and definition as reference systems for the investigation of the cost reduction potential in all subtasks. Their entire aim is to arrive at a purchase price reduction of up to 40%. To this end, Subtask A shall initially focus on all cost factors beyond technical process steps such as channels of distribution and installation. The objective is to develop an understanding of the post-production cost drivers in selected markets that should be taken into account alongside the technical developments carried out in Subtask B and C. Therefore, part of this Subtask will additionally be dedicated to an investigation of the political and legal boundary conditions that support or hinder the use of solar thermal systems in selected markets. Market success factors such as marketing and awareness raising activities, aspects of branding and consumer friendly design will be researched as additional tools to boost the market penetration of solar thermal applications.

The most relevant systems per geographic region will be defined in close cooperation with the involved industry in the frame of an issue-specific expert round at the beginning of the Task in combination with the 2nd Task meeting. The expert rounds are organized by Subtask D. They will be followed by LCA and LCC analyses, laying the groundwork for the material and process related cost analyses and work on optimized systems in Subtask B and C.

The main results of this subtask are:

- Definition of reference systems
- Performance of LCA as a basis for LCC of reference systems and optimized systems
- Comprehensive cost category analyses with regard to production, installation, maintenance, and distribution channels
- Identification of the cost reduction potential at the investigated markets
- Identification of the most promising cost reduction measures
- Identification of non-technical success factors such as global mega trends, branding, industrial design, quality, and customer needs
- Identification of political and legal boundary conditions supporting or hindering the market penetration of solar thermal systems (subsidy mechanisms, legal requirements, standardisation, certification, energy labelling, etc.)

They will be achieved in the frame of different projects:

Projects

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

Project A.1: Definition of solar thermal and conventional reference systems

Activities:

Project A1, Definition of minimum five reference systems[1] as basis for a cost / performance comparison and definition of non-variables: application (e.g. DHW, space heating in single and multi-family houses), location and system design in the frame of an expert round with industrial partners in combination with the 2nd task experts meeting.

Deliverables:

No.	Deliverable	Month
D A.1	List of reference systems and their specifications	12

Project A.2: Cost tool definition, life cycle costs of reference and optimized systems

Activities:

In this project, a tool will be defined, which allows to quantify and compare costs (cost reduction) of solar thermal systems.

Cost and life cycle analyses (LCC / LCA) for reference systems will be carried out with focus on post-production costs (distribution channels, installation, warranty costs, etc.). For selected reference the focus will be on aspects along the complete value creation chain with the aim of a complete cost breakdown as basis for optimization in Subtask B and C. As next step cost and life cycle analyses (LCC / LCA) for the optimized systems will be carried out in the same line and for comparison with the reference systems.

Deliverables:

No.	Deliverable	Month
D A.2	Report on selected tool for quantifying and comparing costs	16
D A.3	Report on cost structure for reference systems	26
D A.4	Report on cost structure for optimized systems	36

[1] In the framework of this task a reference system is a system typical for one purpose (e.g. domestic hot water preparation) and one country. These reference systems serve as reference for all cost improvements. However cost improvements are not limited to reducing the costs of parts of the reference system or its installation but include also alternative system designs with the same or higher solar yields.

Project A.3: Political, legal and social boundary conditions

Activities:

This project deals with aspects that have the power to either support or hinder the market penetration of solar thermal systems. Factors such as e.g. subsidy mechanisms, legal requirements, standardisation, certification, etc. will be identified and analysed in detail.

Deliverables:

No.	Deliverable	Month
D A.5	Report on impact of political, legal and social boundary conditions	24

Project A.4: Market success factors

Activities:

Investigation of market success factors with the potential to additionally support the market penetration of investigated solar thermal applications. In the centre of interest are beneficial marketing activities and mechanisms, awareness raising activities, aspects of branding, consumer-oriented industrial design. Marketing specialists of the involved industry partners will be invited to a workshop on marketing strategies. The workshop will be organized in close cooperation with Subtask D.

No.	Deliverable	Month
D A.6	Catalogue of best practices for marketing solar thermal	36

Timescale / Milestones (quarters)

Project	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
A.1				D A.1								
A.2					D A.2			D A.3				D A.4
A.3								D A.5				
A.4												D A.6

Subtask B: System design, installation, operation and maintenance

Objectives

In the frame of Subtask B, cost reduction shall be achieved by the optimization of system designs and the use of standardized, prefabricated components and sub-components as well as standardized installation based on a critical evaluation of the involved costs. The aim is to reduce the costs for the kWh heat produced by solar thermal of the investigated reference systems up to 40%. This shall be achieved by a standardisation of components e. g. collectors, stores, controllers and mounting devices and an optimization of the reference systems with regard to simple installation, operation and maintenance of established systems or the development of innovative new system concepts in accordance with the selected markets and approaches developed in Subtask A. Investigated are systems with low production costs (recommended by Subtask C) or systems promising easy installation, commissioning, operation and maintenance (e.g. by means of pre-fabricated, standardized components, plug & play systems, etc.). The aim is to arrive at optimized and standardised systems, which are

- easy to produce
- easy to install (e.g. less fastening points, standardized mounting, easy to assemble components)
- easy to control (e.g. by simplified controllers)
- easy to maintain
- easy to recycle

The main results of this subtask are:

- New component proposals for a 40% price reduction
- Proposals for optimized system concepts
- Proposals for innovative, new system concepts
- Proposals for standardization of components and installation

They will be achieved in the frame of different projects:

Projects

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

Project B. 1: Definition of standardised system components

Activities:

- Identification of possibilities to standardize the system components (collector, storage tank, etc.) with respect to size, hydraulic connections, position of temperature sensors, etc. to enable cheaper procurement of sub-components and standardised installation of the systems.
- Identification of cost savings by the use of the standardised system components for solar thermal systems.

Deliverables:

No.	Deliverable	Month
D B.1	Potential cost savings by use of standardised. components	24

Project B.2: Production costs

Activities:

Detailed cost analysis with regard to purchasing costs of subcomponents and the costs during the manufacturing process for the reference systems. Results will contribute to the total cost breakdown elaborated Subtask A.

Deliverables:

No.	Deliverable	Month
D B.2	Report on the cost analysis for purchase and manufacturing costs for the reference systems	27

Project B.3: Installation and operation costs

Activities:

This project is dedicated to costs pertaining to installation, operation and maintenance for the reference systems. Results will contribute to the total cost breakdown elaborated in Subtask A 3.

Deliverables:

No.	Deliverable	Month
D B.3	Report on cost analysis for installation, operation and maintenance for the reference systems.	27

Project B.4: Cost optimization of reference systems

Activities:

Proposals for a cost optimization of the reference systems and the reduction of overall costs shall be elaborated and contribute to the comprehensive cost analysis of optimized systems in Subtask A 5.

Deliverables:

No.	Deliverable	Month
D B.4	Report on cost optimization of reference systems and technical after sales costs	36

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

Activities:

Developments of new proposals for up to 40% price reduction of selected applications (e.g. building integrated, HVAC, control systems). The price reduction shall be tackled from different sides; aspects to be considered are system design, control systems, installation / commission as well as operation and maintenance.

Deliverables:

No.	Deliverable	Month
D B.5	Report on new proposals for a 40% price reduction	36

Timescale / Milestones (quarters)

Project	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
B.1								D B1				
B.2									D B2			
B.3									D B3			
B.4												D B4
B.5												D B5

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

Objectives

The aim of this subtask is to develop and evaluate cost-efficient and reliable materials and components for solar thermal systems. The work will be based on the needs defined in Subtask A and is conducted in close cooperation and interaction with Subtask B. In order to achieve these goals, the activities in Subtask C will be:

- Development, characterization and evaluation of plastics and hybrid (organic/inorganic) materials, thermo tropic overheating protection, cheap solutions based on thermoplastics
- Development, characterization and evaluation of other materials with cost-reduction potential (e.g. metal light weight constructions, composites, etc.)
- Identification of possibilities for reduced material usage, e.g. through assessment of the need for high efficient materials
- Identification of new production processes linked with innovative materials and new approaches in terms of collector components (e.g. adhesive bonding instead of mechanic bonding; fully adhesive edge bond; polymeric collector components; roll-bond absorber technology)
- Development of innovative, cost-efficient components
- Development of new test methods for component testing (failure testing, impact testing, media resistance)

Projects

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

Project C.1: Identification of major cost drivers and saving potentials

Activities:

In order to gain knowledge on savings potential on material and component level, respective methods of other industry sectors shall be researched. Based on the results of the costs analysis in Subtask B, the major cost drivers of the reference systems (component and material level) shall then be identified and selected for optimization in projects C 2 to C 4. Project C1 further includes a critical cost assessment for the optimized materials that will be used as input for the comprehensive cost analyses of optimized components and systems in Subtask A 5.

Deliverables:

No.	Deliverable	Month
D C.1	Report on cost reduction methods in other industries	9
D C.2	Report on cost drivers and selected components and materials for optimization	27
D C.3	Cost assessment for optimized components and materials	36

Project C.2: Material substitution and functional integration

Activities:

The aim of this project is to have a look at alternatives to the major cost drivers identified in C 1. Ways of material reduction or substitution and functional integration, either by the formulation and development of plastics or hybrid materials or the evaluation of other materials with cost reduction potential (e.g. metal, composites, etc.) will be investigated. Appropriate testing methods will be established in order to qualify alternative materials for their use in solar systems.

Deliverables:

No.	Deliverable	Month
D C.4	Report on testing and qualification methods (material level)	27
D C.5	Report on multifunctional hybrid materials	36

Project C.3: Innovative, cost efficient processes and components

Activities:
This project will research and transfer best practice examples from other industry branches that successfully introduced cost-efficient, highly prefabricated components or sub-components by innovative and fully automated processes. Its aim is the modelling and testing of innovative, cost efficient components for solar thermal systems which can be transferred to the research activities in Subtask B.

- Transfer of knowledge and expertise from component manufacturers
- Modelling and design of components
- Methods for pre-qualification, optimization and scale-up of components

No.	Deliverable	Month
D C.6	Report on testing and pre-qualification methods for components of solar-thermal systems	27
D C.7	Report on the potential of design of less expensive components	36

Time-scale / Milestones (quarters)

Project	1	2	3	4	5	6	7	8	9	10	11	12
C.1			D C1						D C2			D C3
C.2									D C4			D C5
C.3									D C6			D C.7

Subtask D: Information, dissemination and stakeholder involvement

Objectives:

As interface to stakeholders outside the Task, Subtask D will involve the relevant industry to support the Task activities and make use of its accomplishments. It will also address the end-users and consumers of solar thermal systems, inform them about innovative possibilities created by the Task and thus provide a gateway to important stakeholder groups inside and outside industrial and academic circles. In order to achieve this goal, this subtask will conceptualize and implement networking events to bring industry, research, end-users and installers together. It will support and promote the results of the entire Task, in particularly those of Subtask A, where a synergetic collaboration is envisaged. Activities involve the organization of workshops to provide input for Subtask A as well as PR activities that are specifically tailored to fit the needs of the marketing measures developed in Subtask A. Dissemination is further ensured by the organization of national or international dissemination workshop(s), scientific publications, presentations on conferences and trade fairs and other PR and marketing activities.

The main results of this subtask are:

- Input and support from industrial companies.
- Publications in reviewed journals, magazines and conference proceedings.
- Public website and online information.
- Networking and dissemination events.

Project D.1: Industry liaison

Activities:

Project D.1 will serve as a gateway to the interested solar thermal community, industry and research, to political decision makers as well as installers and end-users of solar thermal systems. To ensure a routinely and active exchange and to provide input to the ongoing research, especially the topics dealt with in Subtask A, issue-specific workshops and expert rounds will be organized. Further national and international dissemination and networking activities can be planned and implemented in accordance with the specific needs and wishes of the Task participants.

Deliverable:

No.	Deliverable	Month
D D.1	Workshop with invited industrial partners to assess the needs of the involved industry and to identify reference systems in Subtask A (gain and select input for Subtask A)	9
D. D.2	National dissemination workshop by Task partner(s)	24
D D.3	Marketing workshop (in collaboration with Subtask A)	27
D D.4	Workshop for exploitation and dissemination	33

Project D2: Dissemination and information

Activities:

This project will make use of various publication and dissemination measures such as a public website, regular newsletters, scientific publications and presentations on conferences. To ensure that the findings will be distributed in the most appropriate channels, online publication as well as a close cooperation with solarthermalworld.org is envisaged.

Deliverables:

No.	Deliverable	Month
D D.5	Public website and press release	1
D D.6	e-Newsletter	12, 24, 36
D D.7	Publications (reviewed journals, online, conferences, etc.)	div.
D D.8	Final publication	36

Time-scale / Milestones (quarters)

Project	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
D.1			DD 1					DD2	DD3			DD4
D.2	DD5			DD6				DD6				DD 6 DD8