IEA SHC Task 55

Towards the Integration of Large SHC Systems into DHC Networks

Workplan SHC TASK 55

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Content

1. Scope and Problem Statements

In recent years, megawatt-scale solar thermal district heating (SDH) systems have gained increasing attention globally. Several ambitious projects were successfully implemented in countries such as Austria, Germany, Italy, France, Spain, and Norway. Large scale SDH systems and their large-sized seasonal storages have become attractive options for cost effective and low carbon heat supply. In a next step, large systems will become even bigger and likely grow from MEGA to almost GIGA-sized installations. These systems will be able to meet the increasing energy demand of city districts *and* of cities. Compared to conventional heat generation systems, the effective operation of a SDH network and its seasonal storage can guarantee a primary energy consumption reduction of >70% in thermal needs. However, the actual integration of large solar thermal systems into existing and new networks faces several challenges. Expertise on the integration of large solar thermal systems into district networks is limited. A number of experts have started to discuss applicable temperature settings, technical requirements of transition phases, or optimized hydraulics. Energy prices for solar and conventional systems differ as well, solar thermal energy price is already competitive to fossils in many countries worldwide due to high gas prices and gas taxes. SHC Task 55 will figure out main parameters, which are determining investment calculations.

Additionally, components of solar thermal systems such as collector arrays and control strategies can have significant effects on the performance of networks. Whereas small performance-differences within collector fields of a view hundred square meter have only minor output or financial impacts, these differences can be huge in fields beyond 10.000m², especially if existing networks are transformed into SDH and solar district cooling (SDC) networks. The obstacles can be partly overcome with sophisticated designs and simulations beforehand.

Projects on SDC have also gained small momentum within the last years, but are in a relatively early stage compared to SDH systems. Helsinki has implemented a DC network, but the combination of large scale solar thermal installations and district cooling systems is rare, although the supply of solar energy is congruent with the demand for cooling-energy. What are main technical differences between SDC and SDH installations, and what are current benefits, risks and barriers of these systems? Are there best practice examples already in place? All these questions will be answered within SHC Task 55.

Another main component of SDH as well as SDC are large scale solar thermal and seasonal storages. Storage concepts have interesting characteristics such as scalability and transferability to other district networks, independent of their age. However, storage sizes and demands towards larger systems can differ substantially from smaller installations. What are optimal distances to DHC networks, temperatures within storages, or optimal load ratios?

Based on the identification of main technical characteristics of networks, system components and design requirements, economic considerations also become increasingly relevant for the realization of large installations. Designs and energy supply strategies which suffered from financial limitations in the past could benefit from new business models and new macroeconomic environments. Best practice examples and country strategies already in place could be crucial role models for interested stakeholders.

The new IEA SHC Task 55 is a subsequent follow up from IEA SHC Task 45.[1] In Task 45, large scale solar thermal plants were identified and a number of technical and economic questions on system parameters of solar DHC installations occurred. The new SHC Task 55 picks up past findings[2] and provides a platform for practitioners and scientists to elaborate on the benefits and challenges of SDH and SDC systems. Hence, SHC Task 55 elaborates on options and measures to realize sophisticated SDH and SDC plants by focusing on the following specifications:

1) Characteristics of solar thermal systems for DH and DC > 0.5 MW up to GW systems
2) Technical and economic specifications of district heating networks which are relevant for the integration of solar thermal systems and hybrid technologies
3) Analyses of system components and their integration: system temperature requirements, optimization of hydraulic systems, interdependences between large collector fields and seasonal storages, control strategies, self-learning controls, large collector field performances, assessment and design of large seasonal storages (>50.000 m³), system performance guarantees, system ratings and certificates
4) Modular design of large SDH/SDC systems
5) Up-scaling potential of existing medium/large SDH/SDC systems to up to GWth systems
6) Economic requirements of large SDH/SDC systems and market analyses of global and country developments

Finally, SHC Task 55 is determined to integrate efforts from international research projects with high cooperation potential. Based on this commitment, SHC Task 55 is part of a moderate cooperation with the IEA Technology Collaboration Programme on District Heating and Cooling including Combined Heat and Power (IEA DHC).

[1] The IEA SHC Task 45 focused on components and collector performances of large scale (>0.5 MW) solar thermal systems.
[2] http://task45.iea-shc.org/

1.1. Specific Task Objectives

International experts participate in SHC Task 55 and have a rich, scientific and industry background within the field of solar thermal energy. It is the partners´ objective to answer pressing questions within the industry from a network, components, design, and economic perspective. Solar DH and DC systems are based on the same technology to yield energy, but the distribution and usage of the energy serves opposite temperature purposes. SDC systems are by far less explored, and the Task aims to identify current systems already in place, technical characteristics of the systems and also economic pros and cons for the selection and integration of the technology into district networks. The main objectives of SHC Task 55 are:

1) Description of low cost and high performance large-sized SDH/SDC systems, their main components and guidelines for their construction
2) Simulation of the integration of large seasonal storages, hybrid technologies and large collector arrays into different district heating networks
3) Description of crucial components of modular conception and construction of SDH/SDC systems
4) Elaboration of business and financing calculation models
5) Validation of measurement methods of tests on field collector performances and singular collector tests in the laboratory
6) Country reports, license requirements, feasibility studies and a database on large SDH/SDC systems in established and new markets
7) Expert and industry workshops and presentations to communicate task findings
8) Cooperation on a moderate level with the IEA Technology Collaboration Programme on District Heating and Cooling including Combined Heat and Power (IEA DHC), focusing SDH/SDC network designs and analyses

The Task looks at fundamentals behind the objectives above to serve both, solar thermal DH and DC, including network requirements, system components, and system designs.
Technical optimization, economic feasibility and the promotion of solar thermal energy are at the heart of the efforts of the participants, motivated by the benefits that solar district energy can bring to building owners, municipalities, and the public.

1.2. Roots in IEA-SHC Vision and Strategies

An increasing number of the global population lives in cities, where district heating systems are one possibility for centralized, efficient energy systems which mitigate uncontrolled carbon emissions. The integration of solar thermal installations into district heating systems contributes significantly to the increase of solar thermal energy to meet heating and cooling demands. The promotion of solar thermal energy in DH and DC systems therefore directly supports the IEA SHC 2014 - 2018 long term vision: “solar thermal energy meeting 50% of low temperature heating and cooling demand”.[3]

The objectives of the new IEA SHC Task 55 are aligned to several of the most important targets of the Solar Heating and Cooling Programme “Strategic Plan 2014 - 2018”. The Task will elaborate on design requirements for the implementation of solar heating and cooling installations into district networks. Technical improvements and standardized business models will stimulate higher solar factions within district heating and combi-systems (domestic hot water and space heating). Research on advanced and cost effective large scale heat storages such as pit storages, borehole storages and aquifer storages for applications in district heating systems and industries will be extended to identify technical and economic scenarios. New business models addressing the financial, operational and legal challenges of medium to large scale solar heating and cooling systems in the district heating industry will be developed as well as test methods for components and tools for urban planners.

SHC Task 55 further complies with IEA SHC objectives to raise awareness for the importance of education and training on sophisticated SDH and SDC systems, to involve strategic players and key personalities (solar thermal pioneers, public policy actors, architects, city planners, and energy consultants), to reduce primary energy demand, and, to reduce prices for solar thermal heat and cold.

The project team is convinced that the vision of the IEA SHC strategic plan for a worldwide capacity of 5 kW_{th} per capita of solar thermal systems installed can only be achieved by the rapid implementation of large scaled solar heating and cooling systems and large scaled seasonal heat storages into existing and also new district heating and cooling networks.

The Task also complies with efforts of the European Commission to ensure the “EU’s collective 2030 targets of 40% reduction in greenhouse gas emissions, at least 27% renewables in energy consumption, and an indicative target of at least 27% improvement in energy efficiency. “[4] Increasing the share of solar heating and cooling energy in district heating networks as well as increasing the efficiency of the systems and components are all core objectives of SHC Task 55.

The European Technology Platform on Renewable Heating and Cooling identifies “Strategic Research Priorities for Solar Thermal Technology“ as one of the most promising future markets for large-scale solar thermal systems and SDH. The platform further expects that SDH „systems will be used more often since they result in an increased share of renewable energies for heating purposes also in high density urban areas“, and the systems have to be optimized

[3] http://www.nachhaltigwirtschaften.at/iea_pdf/iea_shc_strategic_plan_2014_2018.pdf
[4] http://estif.org/fileadmin/estif/content/policies/downloads/151118_RES_statement_-State_of_the_Energy_Union.pdf

for this purpose. It also states that up to now, SDH is non-existent in most European countries and an undeveloped niche market. Only 1% of the solar collector area in Europe is currently connected to SDH systems[5].

However, in some countries, especially in Denmark, this market is buoyant as district heating systems are widespread there and solar thermal energy is cost-competitive (e.g. high prices for fossil fuels). In other countries, such as Germany, the number of buildings connected to district heating systems is also increasing. The government and leading experts state, that solar thermal energy will play a major part in the future of district heating energy sources, and that a lot of research is needed to realize evaluated potential for the so-called “Wärmewende”-strategies (exit from nuclear and fossil energy). [6]

It is expected that the number of district heating systems could grow in other countries as well, since the networks make it possible to use renewable energies for heating in high density urban areas. Therefore, several strategies ask for adapted components and concepts for large-scale solar thermal systems, especially for district heating systems, which have to increase their efficiency, improve reliability, durability and reduce costs. The SHC Task 55 is one major instrument to realize these strategies, e.g. for the European Technology Platform on Renewable Heating and Cooling[7].

5 http://www.rhc-platform.org/fileadmin/Publications/Solar_thermal_SRP.pdf

6 „Innovation durch Forschung“, Bundesministerium für Wirtschaft und Energie, April 2016, p. 90 - 91.
„Transformationsstrategien Fernwärme“, AGFW, April 2014, p. 18 – 19.

7 http://www.rhc-platform.org/fileadmin/Publications/Solar_thermal_SRP.pdf

2. Subtask definitions

2.1. Subtask A: Network analyses and integration

LEAD: AIT – Austrian Institute of Technologies (Ralf-Roman Schmidt, Austria)

Subtask A focuses on the operation of district heating networks and the integration of solar thermal technologies. It analyses DHC network supply strategies, including: transition strategies from no to 100% solar thermal supply, hydraulics within networks and at transmission stations, heat demand management, storage charging/discharging, control strategies and energy price scenarios as well as potentials and barriers for the integration of solar thermal systems. A main focus of the analyses will further be on return temperatures and their reduction within the district heating network. Technical characteristics of existing, newly integrated and planned SDH and SDC systems of > 0,5MWth up to GWth will be assessed (typical network temperatures, summer/winter load ratio, pressure level, collector fields, seasonal storages, hybrid-technology implementation, hydraulics, control strategies).

Activities in this subtask will be performed in collaboration with other SHC Tasks and Implementing Agreements such as the DHC Implementing Agreement. The IEA DHC will give expert input in Subtask A and reviews publications and major outputs. Also interactions with Subtask B, C and D are given.

2.1.1. Deliverables

A-D1	Economic analyses of overall DHC networks, their supply strategies, transition strategies, heat demand and energy price scenarios
A-D2	Assessment of technical requirements of existing and newly integrated large scale SDH/SDC
A-D3	Analyses of DHC network hydraulics, evaluation of hybrid technologies and possible supply points for large solar thermal installations
A-D4	Overall DHC network control strategies and algorithms for increasing solar thermal fractions

2.1.2. Activities description

Activity 1	Assessment of technical characteristics of district heating networks
Output:	Delivery report for Deliverables A-D2, A-D3
Activity 2	Assessment of technical characteristics of district cooling networks
Output:	Delivery report for Deliverables A-D2, A-D3
Activity 3	Economic analysis of district heating networks
Output:	Delivery report for Deliverables A-D1
Activity 4	Economic analysis of district cooling networks

Output: Delivery report for Deliverables A-D1

Activity 5 Identification of control strategies for district heating networks

Output: List and description of control parameters A-D4

Activity 6 Identification of control strategies for district cooling networks

Output: List and description of control parameters A-D4

Activity 7 Providing information material and results to IEA DHC (reports, publications, etc.)

Output: Living cooperation and reviewed material from IEA SHC

2.1.3. Milestones

M A-D1 Economic analyses finished (Interim Report, Final Deliverable Report)

M A-D2 Technical Requirements are elaborated (Final Deliverable Report)

M A-D3 Parameters for optimized hybrid hydraulics and control strategies, including algorithms, are defined (Interim Report, Final Deliverable Report)

2.1.4. Timescale / Deliverables and Milestones (semesters)

	Year 1		Year 2		Year 3		Year 4	
	1	2	3	4	5	6	7	8
A-D1		A-D1 M A-D1						
A-D2		A-D2 M A-D2						
A-D3			A-D3					
A-D4						A-D4	M A-D4	

2.2. Subtask B: Components testing, system monitoring and quality assurance

LEAD pending: Fraunhofer ISE, (Korbinian Kramer, Germany) *or* SOLID (Stefan Krammer, Austria)

Subtask B focuses on system components. It targets tests, performance guarantees, monitoring, and control strategies of main solar thermal system elements. Methods for hybrid elements in in-situ collector tests at existing installations (6 different collector types approx. 2.500m²) as well as methods for simple thermal power and energy performance proofs will be elaborated. Of interest are also validated performance guarantees for key components such as collectors, storages, piping, heat exchangers, etc. The subtask will also provide data on automated monitoring and failure detection software for key components. In a next step, control strategies and self-learning controls will be developed and described. Finally, results from IEA SHC Task 43 on solar ratings and certification procedures will be implemented in Subtask B as well.

2.2.1. Deliverables

B-D1	In-situ collector tests
B-D2	Further development of validated performance guarantees for key components
B-D3	Automated monitoring and failure detection of key components
B-D4	Control strategies and self-learning controls of key components
B-D5	Integration of solar ratings and certification procedures

2.2.2. Activities description

Activity 1	Development of methods for the efficient measurement of outputs at in-situ collector fields
Output:	Results of in-situ collector tests are available
Activity 2	Evaluation of existing performance guarantees for components and further development of existing measurement standards (methodology for describing performance guarantees have been elaborated within IEA SHC Task 45)
Output:	Validated methods for the assessment of the yearly collector outputs
Activity 3	Development of a software on automated monitoring and failure detection
Output:	Software codes and algorithms are developed, tested, validated and documented (tested at an existing installation)
Activity 4	Design of control strategies and self-learning controls of key components
Output:	Designed and documented controls of key components
Activity 5	Implementation of IEA SHC Task 43 work results
Output:	Solar rating and certification standards for large scale SDH and SDC

2.2.3. Milestones

M B-D1	Methodology for collector output forecasts is developed and proven (Interim Report on measurements, Final Deliverable Report on methodology)	
M B-D2	Validated performance guarantees (Final Deliverable Report)	
M B-D3	M B-D3.1	Algorithms are developed
	M B-D3.2	Software codes developed and tested
M B-D4	Control strategies are designed and documented (Interim Report, Final Deliverable Report)	

2.2.4. Timescale / Deliverables and Milestones (semesters)

	Year 1		Year 2		Year 3		Year 4	
	1	2	3	4	5	6	7	8
B-D1				M B-D1		B-D1		
B-D2						B-D2 M B-D2		
B-D3				M B-D3.1		M B-D3.2	B-D3	
B-D4							B-D4 M B-D4	
B-D5						B-D5		

2.3. Subtask C: Design of solar thermal systems and of hybrid components

LEAD: PlanEnergi (Jan-Erik Nielsen, Denmark)

Subtask C focuses on the design of solar thermal systems and the integration of hybrid technologies. The subtask elaborates on characteristics of collector array units, large and seasonal storages, hydraulics, and heat pumps within system operations. Large scale collector fields will be simulated and compared to the measurements in Subtask B. If needed, the simulation tool will be corrected. Parameters of seasonal storages will be calculated and guidelines for the design and construction of different storage types elaborated. Hydraulics within systems are sensitive to a variety of parameters. These parameters will be optimized. Piping within large systems will be investigated as well and options for a modular conception and construction for the system.

2.3.1. Deliverables

C-D1 Simulation and design of collector array units within large systems

C-D2 Assessment and design of large scale seasonal storages

C-D3 Optimized hydraulics and piping in large solar systems

C-D4 Modular conception and construction

2.3.2. Activities description

Activity 1 Trnsys Simulation of an existing SDH installation

Output: Documented Simulation, Simulation Guidelines

Activity 2 Assessment and design of large scale seasonal storages

Output: Design guideline for seasonal storages of large systems

Activity 3 Simulation and verification of hydraulics and piping via an existing installation for modular concerted system units

Output: Report on the optimal design of hydraulics and piping for modular systems

2.3.3. Milestones

M C-D1	M C-D1.1	Interim report on data for simulation
	M C-D1.2	Final report on simulations and results validated
M C-D2	M C-D2.1	Interim report on seasonal storage requirements finished
	M C-D2.2	Final report on design guidelines for seasonal storages
M C-D3	M C-D3	Final Deliverable Report on recommendations for hydraulic design and piping

2.3.4. Timescale / Deliverables and Milestones (semesters)

	Year 1		Year 2		Year 3		Year 4	
	1	2	3	4	5	6	7	8
C-D1		M C-D1.1		C-D1				
C-D2				C-D2			M C-D1.2	
C-D3		M C-D2.1				C-D3 M C-D2.2		
C-D4					C-D4		M C-D3	

2.4. Subtask D: Economic Aspects and Promotion of Solar Thermal and Hybrid Technologies

LEAD: Tecnalia (Patricio Aguirre Múgica, Spain)

Subtask D elaborates on economic aspects and the promotion of results from SHC Task 55. Large scale solar thermal systems require sophisticated financing models due to high initial investment costs. Different business models are already in place and facilitate the realization of large systems. The subtask will assist practitioners, architects, system designers and district heating providers in their efforts for the integration of DHC applications. Stakeholders face several economic challenges and risks and will benefit at large from the deliverables of this Subtask. A database will collect information on different system types already in place and their global distribution. Country regulations such as licenses and permissions are also central for business cases of different markets. Moreover, the subtask will assist the other subtasks in the promotion and dissemination of project results, the organization and execution of events, workshops, and trainings.

2.4.1. Deliverables

D-D1 Business Models

D-D2 Beneficial and challenging macroeconomic environments for SDH/SDC systems in new and existing markets

D-D3 Identification and preparation of large SDH/SDC systems in a database

D-D4 Promotion and dissemination of SDH/SDC technologies in new markets

D-D5 Evaluation of divers global market development and country reports

D-D6 Dissemination of expertise through education and training

2.4.2. Activities description

Activity 1	Collection of currently applied financing models of SDH and SDC systems
Output:	Report on different schemes and contracts
Activity 2	Creation of a reference calculation tool on solar thermal district heat and cold price scenarios
Output:	Tool
Activity 3	Compilation of favorable and challenging macroeconomic conditions for solar DHC systems in existing and new markets
Output:	Reports on risks and barriers in different macroeconomic regions and their potentials for the technologies
Activity 4	Accumulation of data on existing and new global large scale solar DHC systems in a database (based on Task 45 Subtask C database)
Output:	Database including evaluations of global and country technology spreads and developments
Activity 5	Promotion of solar DHC systems in different cities, countries, regions
Output:	Feasibility studies and brochures on large SDH/SDC systems
Activity 6	Assessment of developments within the solar DHC technology on a global scale in different regions and countries
Output:	Country reports and market reports
Activity 7	Organization and execution of expert and training events, workshops and presentations
Output:	Shared knowledge based on events, presentation material, workshop material

2.4.3. Milestones

M D-D1	Schemes and contracts available for Task participants	
M D-D2	Report on macroeconomic conditions finished	
M D-D3	M D3.1	Data base template available
	M D3.2	Database completed
M D-D4	M D4.1	Dissimination completed (articles, leaflet…)

M D4.2 Feasibility studies and brochures sent to all interested stakeholders

M D-D5 Country reports and market reports available to Task participants

2.4.4. Timescale / Deliverables and Milestones (semesters)

	Year 1		Year 2		Year 3		Year 4	
	1	2	3	4	5	6	7	8
D-D1		M D-D1		D-D1				
D-D2				M D-D2		D-D2		
D-D3	M D-D3.1						D-D3	M D-D3.2
D-D4							D-D4 M D-D4.2	M D-D4.1
D-D5								M D-D5
D-D6						D-D5	D-D6	

3. Target groups

The Subtask partners have heterogeneous scientific and industry backgrounds. Results of SHC Task 55 projects will be provided to the cooperation partner IEA SHC, all partner institutions, and the international IEA community. Several stakeholders are crucial to work with the findings at different levels, from system components to installations to district heating and cooling networks. Target groups are decision-makers, local and regional politicians, leading international scientists, and industry experts.

Following stakeholders are of specific interest:

- Researchers (simulations, measurement methods, evaluations, validations…)
- District heating & cooling planners and experts
- Urban planners
- Politicians
- Architects
- Geologists for seasonal storages
- Solar thermal plant constructors
- Seasonal storage constructors
- Experienced pioneers and visionaries
- Civil and structural engineers
- Promotors
- Trainers
- Individual business experts
- Investors
- Funding experts

4. Collaborations

SHC Task 55 benefits from previous work within IEA SHC Tasks and Implementing Agreements. It integrates them into its own work as the starting point for next-generation research. The Task addresses challenges previously identified such as solar thermal heat price reductions, risks of network integrations and system efficiency challenges.

Neither (a) efforts to decrease solar thermal heat prices in comparison to fossil energy prices, nor (b) evaluations of system losses due to the interaction of the district heating network with large scaled solar thermal plants are central parts of current or previous SHC Tasks. Furthermore, the minimization of hydraulic dead volumes in transition periods, safety reserves during planning and engineering stages to avoid system losses, or, automated operational surveillance and control strategy optimization are not met in other current or previous IEA SHC Tasks.

4.1. DHC Collaboration

The IEA Technology Collaboration Programme on District Heating and Cooling including Combined Heat and Power (IEA DHC) is the most relevant cooperating program of the SHC Task 55. Both parties declare their endorsement for a moderate cooperation with SHC Task 55 of the IEA Technology Collaboration Programme on Solar Heating and Cooling (IEA SHC). In the moderate cooperation, Task work is jointly discussed. The SHC Task 55 operating Agent will manage the cooperation, and the IEA DHC will provide its expertise and feedback.

In the course of the moderate collaboration, the Operating Agent of SHC Task 55 will send in a progress report (MS PowerPoint presentation, Subtask A report) for every meeting of the IEA DHC Executive Committee (ExCo meeting) at least one month in advance of the Executive Committee meeting. Furthermore, the IEA SHC Task 55 will integrate input provided by the IEA DHC in its publications and communication in order to ensure messages are in line with IEA DHC views. Especially Subtask A is affected by the cooperation, and will use the IEA DHC logo on its publications that have been reviewed and endorsed on behalf of IEA DHC. Additionally, the IEA DHC will ensure the review of major outputs of IEA SHC Task 55 Subtask A, which includes all DHC aspects of IEA SHC Task 55, and will keep the SHC Task 55 informed of its activities and give expert inputs. Overall, the IEA DHC will ensure that its projects do not cover significant research that will be performed under the IEA SHC Task 55. The project groups of the IEA DHC, the Operating Agent and the SHC Task 55 Subtask A leaders will meet once a year, and also exchange their project status online via a “Collaboration Platform” of the IEA SHC during the 4 year SHC Task 55 work. The Operating Agent of SHC Task 55 and the Subtask A leader are responsible to keep contact with the IEA DHC project partners.

4.2. Past Tasks

Several past Tasks focused on solar thermal systems, components, and performance measures:

- Task 48 - Quality Assurance and Support Measures for Solar Cooling Systems
- Task 45 - Large Scale Solar Heating and Cooling Systems
- Task 7 - Central Solar Heating Plants with Seasonal Storage
- Task 3 - Performance Testing of Solar Collectors
- Task 1 - Investigation of the Performance of Solar Heating and Cooling Systems

The most connected Task is the previous Task 45: “Large Scale Solar Thermal Heating and Cooling systems.” SHC Task 55 will use the developed database on large scale solar thermal installations (category SDH, SDC), the performance guarantee sheets and the ESCo compendium, develop them further and inform Task 45 participants of new findings within SHC Task 55.

4.3. Ongoing Tasks/Implementing Agreements

Several ongoing Tasks are also interesting for work within the current project. Despite the close collaboration with the IEA DHC, the IEA SHC Task 55 will also collaborate with:

HPP Annex 47 “Heat pumps in District Heating and Cooling systems”:

The objective of this annex is to gather information and ideas for policy makers and planners of energy systems in urban areas concerning the possibilities and barriers related to the implementation of heat pumps in DHC systems.

Task 51 “Solar Energy in Urban Planning”:

Findings on legal frameworks and barriers for solar thermal energy in urban planning will be transferred to the new Task.

Task 52 “Solar Heat and Energy Economics in Urban Environments”:

This Task focuses on the analysis of the future role of solar thermal in energy supply systems in urban environments. Based on an energy economic analysis - reflecting future changes in the whole energy system - strategies and technical solutions as well as associated tools will be developed.

Task 53 “New Generation Solar Cooling and Heating Systems (PV or Solar Thermally Driven Systems)”:

Investigations on LCA of solar thermal installations and analysis on component level can be delivered to the new Task.

Task 57 “Solar Standards and Certification”:

The scope of the task is test procedures, standardization and certification at international level of solar thermal systems and components.

4.4. Collaborating Research Projects

Some information will also be provided from projects of SHC Task 55 participants such as:

- MeQuSo: Precise measurement technology at each collector field
- SPC: Development of a model predictive control for solar systems
- store4grid: Optimized pit heat stores for block heating
- SHINE: Flexible Hydraulic Concepts and Stagnation Prevention

- Project of “INTEGRATION OF THERMAL ENERGY STORAGE (TES) INTO DISTRICT HEATING AND COOLING SYSTEMS TO INCREASE THE SOLAR FRACTION AND RENEWABLE ENERGY SOURCES” 2015 – 2017
- BIG SOLAR GRAZ
- Tbc.

4.5. Information Measures: Internal and External

The SHC Task 55 starts on the 1st of September 2016. Findings will be presented at conferences, in publications, seminars, trainings, journals, and magazines. Information materials will help interested parties to assess results of the SHC Task 55, link them with their business and scientific activities for further achievements of their own goals, and enhance the impact of SHC Task 55 findings.

Future Task projects should be enabled to set new objectives, develop further strategies and employ new compelling and engaging work.

Within SHC Task 55, regular meetings will be held to make midcourse program adjustments and corrections, adapt approaches over time in light of changing objectives, new opportunities and emerging best practices.

Information tools are workshops (e.g. industry workshops), websites, newsletters, guidelines, reports or articles.

There will be 1 kick-off meeting past the SHC Task 55 start of the 1st of September 2016, half year IEA SHC Task 55 meetings including at least 2 industrial workshops during 4 years task period:

- September/October 2016: SHC Task 55 Kick-off Meeting in Austria
- March/April 2017
- September/October 2017
- March/April 2018
- September/October 2018
- March/April 2019
- September/October 2019
- 2020: SHC Task 55 Final Meeting

Collaboration meetings with the IEA DHC will be organized by the OA and the Subtask A leader. SHC Task 55 Subtask A Expert/Subtask Leader Ralf-Roman Schmidt and/or OA Sabine Putz will attend DHC EXCo meetings and workshops within SHC Task 55 execution.

Finally, findings from SHC Task 55 and results from the cooperation between the IEA DHC and SHC Task 55 will be disseminated on the IEA SHC Task 55 homepage in the form of Fact Sheets:

[1] Fact Sheet on Economic analyses of SDH networks
[2] Fact Sheet on Economic analyses of SDC networks
[3] Fact Sheet on Technical analyses of SDH networks
[4] Fact Sheet on Technical analyses of SDC networks
[5] Fact Sheet on Network hydraulics
[6] Fact Sheet on Networks and hybrid systems
[7] Fact Sheets on Network transition strategies
[8] Fact Sheet on Control parameters
[9] Fact Sheet on In-situ collector tests
[10] Fact Sheet on Methods for the assessment of collector outputs
[11] Fact Sheet on Software codes and algorithms for system simulations
[12] Fact Sheet on Control strategies of key components
[13] Fact Sheet on Solar rating and certification standards
[14] Fact Sheet on Simulation Guidelines
[15] Fact Sheet on Design guideline for seasonal storages of large systems
[16] Fact Sheets on Optimal design of hydraulics and piping for modular systems
[17] Fact Sheets on Investment schemes and contracts
[18] Fact Sheet on Risks and barriers in different macroeconomic regions and their potentials for the technologies
[19] Fact Sheet on Database including evaluations of global and country technology spreads and developments
[20] Fact Sheet on Feasibility studies
[21] Fact Sheet on Country reports and market reports

5. List of participants and contributions

(to be amended/completed at the kick-off meeting with specific contributions)

Country	Partner agreed
Austria	SOLID; AEE INTEC; University of Innsbruck; AIT; Thermaflex Group; BIOENERGY2020+;
China	Sunrain; Tsinghua Solar Systems;
Denmark	PlanEnergi; SolarKey; DTU; Aalborg CSP A/S (Solar district heating); Logstor; PURIX;
Finland	SAVO-SOLAR Oy;
Italy	Dipartimento di Energia - Politecnico di Milano;
Spain	TECNALIA; University of Zaragoza;
	IEA DHC IA
Country	**Partner pending**
Sweden	Dalarna University, Absolicon
Switzerland	EPFL; IPESE; ETH Zürich
Canada	NRCan
Australia	SCIRO
Germany	Frauenhofer Institute for Solar Energy Systems ISE (funding pending); KBB Kollektorbau GmbH; Uni Kassel (pending); ITW Stuttgart (pending); HS-Bremerhafen Dr. Gottschalk or SUPREN GmbH, Dortmund; UNI KASSEL; HFT Stuttgart; TU Chemnitz; TU Dresden; SOLRICO;
Israel	Membership SHC pending – TIGI Solar

Further contributions from countries/partners are currently in request and evaluation

6. List of Deliverables

A-D1	Economic analyses of overall DHC networks, their supply strategies, transition strategies, heat demand and energy price scenarios
A-D2	Assessment of technical requirements of existing and newly integrated large scale SDH/SDC
A-D3	Analyses of DHC network hydraulics, evaluation of hybrid technologies and possible supply points for large solar thermal installations
A-D4	Overall DHC network control strategies and algorithms for increasing solar thermal fractions
B-D1	In-situ collector tests
B-D2	Further development of validated performance guarantees for key components
B-D3	Automated monitoring and failure detection of key components
B-D4	Control strategies and self-learning controls of key components
B-D5	Integration of solar ratings and certification procedures
C-D1	Simulation and design of collector array units within large systems
C-D2	Assessment and design of large scale seasonal storages
C-D3	Optimized hydraulics and piping in large solar systems
C-D4	Modular conception and construction
D-D1	Business Models
D-D2	Beneficial and challenging macroeconomic environments for SDH/SDC systems in new and existing markets
D-D3	Identification and preparation of large SDH/SDC systems in a database
D-D4	Promotion and dissemination of SDH/SDC technologies in new markets
D-D5	Evaluation of divers global market development and country reports
D-D6	Dissemination of expertise through education and training

7. Gantt chart

IEA SHC Task 55 Start: 01.09.2016

	Year 1		Year 2		Year 3		Year 4	
	1	2	3	4	5	6	7	8
A-D1		A-D1 M A-D1						
A-D2		A-D2 M A-D2						
A-D3			A-D3					
A-D4						A-D4	M A-D4	
B-D1				M B-D1		B-D1		
B-D2						B-D2 M B-D2		
B-D3				M B- D3.1		M B- D3.2	B-D3	
B-D4							B-D4 M B-D4	
B-D5						B-D5		
C-D1		M C- D1.1		C-D1				
C-D2				C-D2			M C- D1.2	
C-D3		MC-D2.1				C-D3 M C- D2.2		
C-D4					C-D4		M C-D3	
D-D1		M D-D1		D-D1				
D-D2				M D-D2		D-D2		
D-D3	M D- D3.1						D-D3	M D- D3.2
D-D4							D-D4 M D- D4.2	M D- D4.1
D-D5						D-D5		M D- D5
D-D6							D-D6	

8. Letter of Cooperation

IEA Technology Collaboration Programme on
District Heating and Cooling including Combined Heat and Power

Letter of cooperation

With this letter the Executive Committee of the IEA Technology Collaboration Programme on District Heating and Cooling including Combined Heat and Power (IEA DHC) officially declares its endorsement for cooperation with Task 55 of the IEA Technology Collaboration Programme on Solar Heating and Cooling (IEA SHC).

IEA SHC agrees to the following provisions as its part of the moderate level cooperation between IEA DHC and IEA SHC Task 55:

1. SHC Task 55 will send in a progress report (MS PowerPoint presentation) for every meeting of the IEA DHC Executive Committee (ExCo meeting) at least one month in advance of the Executive Committee meeting.
2. IEA SHC Task 55 will integrate the input provided by IEA DHC in its publications and communication in order to ensure messages that are in line with IEA DHC views.
3. IEA SHC Task 55 Subtask A will use the IEA DHC logo on its publications that have been reviewed and endorsed on behalf of IEA DHC.

IEA DHC agrees to the following provisions as its part of the moderate cooperation between IEA DHC and IEA SHC Task 55:

1. IEA DHC will ensure the review of major outputs of IEA SHC Task 55 Subtask A, which includes all DHC aspects of IEA SHC Task 55.
2. IEA DHC keeps IEA SHC Task 55 informed of the dates of its ExCo meetings.
3. IEA DHC provides expert input into SHC Task 55 if practicable.
4. IEA DHC will ensure that its projects do not cover significant research that is already performed under IEA SHC Annex 55 Subtask A.

The main contact between both TCPs is organized by the Operating Agents of the respective TCPs.

Dr. Robin Wiltshire
The chair of IEA DHC on behalf of the IEA DHC ExCo

May, 17th 2016

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