

# Final report

## 1. Project details

<b>Project title</b>	Internationalt samarbejde om store solvarmeanlæg
<b>Project identification (program abbrev. and file)</b>	EUDP-15-I 64015-0063
<b>Name of the programme which has funded the project</b>	EUDP, Teknologiområde: Solenergi
<b>Project managing company/institution (name and address)</b>	PlanEnergi
<b>Project partners</b>	DTU Byg, Aalborg CSP
<b>CVR</b> (central business register)	74038212
<b>Date for submission</b>	2015-03-03

## 2. Short description of project objective and results

The aim of the project is – by participating in the [IEA SHC Task 55](#) “Towards the Integration of Large SHC Systems into District Heating and Cooling (DHC) Networks”<sup>1</sup> – to further develop and promote large scale solar district heating plants. The overall objective is to increase the use of solar thermal energy throughout the world.

This EUDP project has covered participation in the Task 55 start-up activities and the participation in the Task 55 from September 2016 to December 2018. The Task 55 is a follow-up to the [IEA SHC Task 45](#) – which was led by Denmark.

Task 55 will run until August 2020, the Danish participation in the period 1/1 2019 to 31/8 2020 is covered by another EUDP project (64017-05145).

Denmark is a front-runner in the field of Solar District Heating (SDH) and participation in IEA SHC Task 45 and 55 has given good opportunities for promotion of Danish know-how and technology – and to follow development and opportunities throughout the world.

The main outcomes of Task 55 are so far:

- very good positioning of Danish SDH technology and know-how
- very good connections to the international professional SDH network
- a specific proposal for checking performance of large collector fields (now proposed to ISO with Danish – Chinese co-lead)

## 3. Executive summary

The companies PlanEnergi and Aalborg CSP and the DTU Byg has been involved in defining the IEA SHC Task 55 “Towards the Integration of Large SHC Systems into District Heating and Cooling (DHC) Networks” and has participated in the Task until end 2018.

<sup>1</sup> In short “Task 55” or “the Task”.

The Task aims to develop technical and economic requirements for the commercial market introduction of solar district heating and cooling (DHC) for a broad range of countries. The activities aim to improve technological know-how, market know-how and understanding of the boundary conditions as well as to provide expert know-how for project initiation and implementation and for training. A key element will be the direct cooperation of SDH experts with associations and companies in the district heating sector as a means to bridge the gap between these sectors.

Task 55 started a bit later than expected but is now on a good track. Danish participation in the Task makes it possible to maintain the Danish front-runner position in the SDH field.

Some very interesting perspectives for the Danish participants are co-operation with Chinese partners on SDH projects in China. Danish participants gave already two courses in SDH in China – and made feasibility studies for several sites in Tibet.

In March 2019 Danish and Austrian Task 55 participants will give SDH presentations in London; this may lead to co-operation with English partners on potential projects in UK.

More and more interest is seen globally for renewable district heating, and the Task 55 deliverables (fact sheets) are expected to be very useful for the future SDH development worldwide. Denmark has very good opportunities for participating in this development, delivering know-how and technology.

#### **4. Project objectives**

The aim of the project is – by participating in the [IEA SHC Task 55](#) – to further develop and promote large scale SDH plants.

Denmark is a front runner in this field and the project gives good opportunities for promotion of Danish know-how and technology.

The specific [objectives of the Task 55](#) are:

- Description of low cost and high performance large-sized SDH/SDC<sup>2</sup> systems, their main components, hybrid technologies (large scale storages, industrial waste heat, heat pumps, etc.) and guidelines for their construction
- Simulation of the integration of large seasonal storages, hybrid technologies and large collector arrays into different district heating networks
- Description of crucial components of modular conception and construction of SDH/SDC systems
- Elaboration of business and financing calculation models
- Validation of measurement methods of tests on field collector performances and singular collector tests in the laboratory
- Country reports, license requirements, feasibility studies and a database on large SDH/SDC systems in established and new markets
- Expert and industry workshops and presentations to communicate task findings
- 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 overall objective is to increase the use of solar thermal energy throughout the world.

<sup>2</sup> SDH : Solar District Heating. SDC: Solar District Cooling

## 5. Project results and dissemination of results<sup>3</sup>

### 5.1 Main Results

#### 5.1.1 Subtask A: Network Analyses and Integration

17 partners and about 27 projects are contributing to Subtask A. Following general achievements can be noted:

- ❑ A SWOT analyses has been continued and extended as well as discussed internally.
- ❑ Transformation strategies for Graz (SOLID), a general methodology for developing transformation strategies (AIT), the installation in Brühl (TU Chemnitz, ongoing), and multi-criteria optimization of trigeneration from hybrid technologies (University of Zaragoza) were elaborated.
- ❑ A literature review on hydraulic integration concepts was done, including SDH EU Project, DEZENTRAL from Solites and further Input from task partners (AIT, PlanEnergi).
- ❑ A study for storage designing and sizing as well as decentral integration (AIT), including a configuration study for hybrid technologies (University of Zaragoza, network excluded) was elaborated.
- ❑ Results in A-D3 show that heat pumps can be integrated in SDH systems with the aim of achieving higher share of REs and thus reducing/replacing use of fossil fuels.
- ❑ Feasibility analyses for long term storage integration and control strategies were developed and simulated (AIT).
- ❑ Feasibility study of high-share integration of solar thermal systems into typical Austrian rural district heating systems is available.

#### 5.1.2 Subtask B: Components Testing, System Monitoring, and Quality Assurance

Following general achievements can be noted:

- ❑ The project "MeQuSo" presented results on the quality assurance of large-scale solar thermal plants.
- ❑ Draft proposal for ISO standard on "Performance check of large collector fields"
- ❑ International stakeholders with large scale solar heating systems are invited to connect their system to the website [SolarHeatData.EU](http://SolarHeatData.EU)

#### 5.1.3 Subtask C: Design of the Solar Thermal System and of Hybrid Technologies

Following general achievements can be noted:

- ❑ The thermal performance of a system with large seasonal storage has been investigated and reported
- ❑ ITW presented status on Convection in insulation materials: CFD based evaluation of heat transfer processes in bulk insulation materials (Dominik Bestenlehner)
- ❑ A literature review on all publications available on modelling of large-scale storages had been undertaken and presented at the last Task 55 Expert Meeting
- ❑ First draft report on CSP system in Tårs, DK

<sup>3</sup> Taken from Task 55 Status Report 2018

- ❑ Paper from Chemnitz: Thermal and hydraulic investigation of large-scale solar collector field; Nirendra Lal Shrestha, Ophelia Frotscher, Thorsten Urbaneck, Thomas Opelt, Thomas Göschel, Ulf Uhlig, Holger Frey

#### 5.1.4 Subtask D: Promotion and dissemination of SDH/SDC and hybrid technologies in new markets

Following general achievements can be noted:

- ❑ Presentation on dynamic financial appraisal method of SOLID. First descriptions of business models almost finalized and will be published in spring 2019.
- ❑ A SDH plant in Dresden in a protected area was investigated.
- ❑ The draft of the template was developed further and finalized.
- ❑ Description of diverse global market developments
- ❑ A number of new country reports (Austria, China, Denmark, Germany, France, Sweden)
- ❑ CEA Ines is developing a calculation tool for renewable heat production installations. A first version is almost finished and a final version in English is expected in 2019.

## 5.2 Dissemination

Author(s)	Title	Publication / Conference	Bibliographic Reference
Ralf-Roman Schmidt, Paolo Leonie, Markus Gölles, Sabine Putz, Anna Katharina Provasnek	Measures and enablers for integrating significant shares of solar thermal energy into urban district heating networks – preliminary results from SHC Task 55, Subtask A	SDH Conference 2018 April 2018, Graz, Austria	
Putz, Sabine, Provasnek, Anna Katharina	Towards the Integration of Large SHC Systems into DHC Networks - Contributing Projects and Results	SDH Conference 2018 April 2018, Graz, Austria	
Anna Katharina Provasnek, Sabine Putz	Towards the Integration of Large SHC Systems into DHC Networks	SHC 2017 / SWC 2017 Conference October 2017, Abu Dhabi, UAE	
Ralf-Roman Schmidt, Markus Gölles, Anna Katharina Provasnek, Paolo Leoni, Sabine Putz	Barriers and opportunities to maximize the share of solar thermal energy in district heating networks – approaches within the IEA SHC Task 55, Subtask A and selected preliminary results	SHC 2017 / SWC 2017 Conference October 2017, Abu Dhabi, UAE	
Anna K. Provasnek, Sabine Putz	2nd SHC Task 55 Expert Meeting in Aalborg, Denmark	Task 55 Newsletter	30 March 2017

Baerbel Epp	IEA SHC Task 55	Solarthermal-world.org	<a href="http://www.solarthermalworld.org/keyword/iea-shc-task-55">http://www.solarthermalworld.org/keyword/iea-shc-task-55</a>
Anna K. Provasnek, Sabine Putz	Large Scale Solar Installations – The Actors & Activities	Solar Update Newsletter	December 2017, Vol. 66
Sabine Putz Anna K. Provasnek	Towards the Integration of Large SHC Systems into DHC Networks	OTTI Symposium, Thermische Solar-energie	Poster presented (short oral presentation) in May 2017
Sabine Putz	IEA SHC Task 55 – Akteure und Aktivitäten	Presentation at Dresder Fernwärme Kolloquium	Presentation, September 2017
Sabine Putz, Patrick Reiter	IEA SHC Task 55	4th Generation District Heating Conference	Presentation, September 2017

Task 55 is collaboration with IEA DHC (District Heating and Cooling) and a joined Workshop of Task 55 and DHC Annex TS2 was organised in 2018.

The Task has very good industry participation: Sixteen companies are participating in SHC Task 55.

## 6. Utilization of project results

Task is still running – ending in mid-2020; but already now the Danish participants have benefits from participation in the task.

The industry participant [Aalborg CSP](#) organised one the task expert meetings at own premises and is now well recognised in the international DHC environment.

The university [DTU Byg](#) has been able to expand their activities in the field of DHC and give support / know-how to Danish industry – and to make several papers for international magazines and conferences.

Participation in Task 55 (and leading the former Task 45) is one of the main reasons that the consulting company [PlanEnergi](#) has established itself internationally as one of the main know-how bases in the field designing SDH systems.

The Danish practise for checking performance of large collector fields is now the basis for a draft standard proposed to ISO.

## 7. Project conclusion and perspective

Task 55 started a bit later than expected but is now on a good track. Danish participation in the Task makes it possible to maintain the Danish front-runner position in the SDH field.

Some very interesting perspectives for the Danish participants are co-operation with Chinese partners on SDH projects in China – so Danish participants gave two courses in SDH in China – and made feasibility studies for several sites in Tibet.

In March 2019 Danish and Austrian Task 55 participants will give SDH presentations in London; this may lead to co-operation with English partners on potential projects in UK.

More and more interest is seen globally for renewable district heating, and the Task 55 deliverables (fact sheets) will be very useful for the future SDH development worldwide. Denmark

has very good opportunities for participating in this development, delivering know-how and technology.

The present EUDP project (64015-0063) ends by 2018, but the Task 55 will run until August 2020. The Danish participation in the period 1/1 2019 to 31/8 2020 is covered by another EUDP project (64017-05145). In this new project [Savosolar](#) is entering as a new Danish partner.

## **8. Annex**

### **8.1 Web sites**

#### *8.1.1 Official IEA web sites*

- IEA SHC Task 55 homepage is: <http://task55.iea-shc.org>
- Main IEA SHC homepage: <http://www.iea-shc.org/>
- IEA DHC homepage: <https://www.iea-dhc.org>

#### *8.1.2 Other relevant web sites on Solar District heating*

- Solar District Heating on [www.solarthermalworld.org](http://www.solarthermalworld.org)
- European Solar District Heating projects: [www.solar-district-heating.eu](http://www.solar-district-heating.eu)

### **8.2 Attachments**

Zip file "Task55-ReportsEtc" with:

- Task description: Annex and Work Plan
- Highlights 2016, 2017, 2018
- Annual reports 2016, 2017 2018