

Final report

1. Project details

Project title	IEA SHC Task 55 - Integration of Large SHC Systems into District Heating and Cooling (DHC) Networks II
File no.	64017-05145
Name of the funding scheme	EUDP (17-II)
Project managing company / institution	PlanEnergi
CVR number (central business register)	74038212
Project partners	DTU Byg, Aalborg CSP, SavoSolar
Submission date	30 December 2020

2. Summary

English version

The aim of the project is - through exchange of international knowledge - to develop and promote solar district heating plants. Denmark is in front in this field and the project gives good opportunities for promotion of Danish know how and technology. The overall objective is to increase the use of solar thermal energy throughout the world. Results are:

- fact sheets with guidelines and recommendations for solar district heating systems
- draft international standard for large scale solar fields
- conference presentations and reviewed papers
- publicly available promotional material

The project is a prolongation of: "EUDP 15-I, 64015-0063, Internationalt samarbejde om store solvarmeanlæg".

Danish version

Formålet med projektet er gennem international videndeling at udvikle og udbrede store solvarmeanlæg til fjernvarme. Danmark ligger i front på dette område, og projektet giver meget fine muligheder for udbredelse af dansk teknologi og knowhow. Overordnet set er formålet at øge anvendelsen af solvarme på verdensplan. Resultater er:

- fakta blade med guidelines og anbefalinger for dimensionering/udformning af sol-fjernvarmeanlæg
- udkast til international standard for store solfangerfelter
- konferenceindlæg og tidsskriftartikler
- offentligt tilgængelige markedsføringsmaterialer

Projektet er en forlængelse af "EUDP 15-I, 64015-0063, Internationalt samarbejde om store solvarmeanlæg".

3. Project objectives

The aim of the project was – by participating in the IEA SHC Task 55 – to further develop and promote large scale SDH plants through exchange of international experience.

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 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 was to further develop - and increase the use of - solar thermal energy in district heating networks throughout the world.

During the Task new solar district heating systems have been planned/established around the world – Danish companies have been involved in several systems; e.g in Austria, France, Germany, China, etc..

4. Project implementation

The project evolved more or less as planned – apart from ½ year extension, mainly due to:

- the Austrian operating agent had some months of illness which delayed the project progress
- the Corona pandemic made it a bit difficult to organise effective exchange of ideas and experience.

No serious risks were associated with conducting the project as it is an IEA project with exchange of international experience.

The project implementation developed as foreseen – only very insignificant changes in the original planned milestones.

Apart from the needed extension due to the operating agent illness and the Corona pandemic, no unexpected problems occurred.

5. Project results

Original project objectives have been obtained.

No specific technological results have been planned – or obtained, as it is an IEA project with exchange of international experience.

No commercial results have been planned – or obtained as it is an IEA project with exchange of international experience).

Target groups for the project

- Researchers in the field of solar district heating/cooling
- Consultants in the field of solar district heating/cooling
- District heating companies and associations
- Companies delivering components and systems for solar district heating/cooling
- National energy agencies

No specific solutions/technologies have been developed for sale, but a lot of useful information have made available and disseminated, including promotional material, reports on technology status, guidelines for dimensioning systems and components, standards development, etc.

Conferences / promoting events

- March 2019 /// SDH/Task 55 Workshop UK /// Task experts, Jan Erik Nielsen (PlanEnergi); Christian Holter (SOLID);
- December 2019 /// Solar Academy on Solar Heat Networks – organized by Richard Hall (EXCO UK) /// Task experts Magdalena Kowalska (PlanEnergi); Christian Holter (SOLID); Grant Feasey (AES Solar); Renaldi Renaldi (Univers)
- June 2020 /// European Sustainable Week Conference /// Short presentation of TASK 55 /// Christian Holter(SOLID)
- September 2020 /// EUROSUN /// OA Sabine Putz and 4 other Task 55 experts: Magdalena Berberich (SOLITES), Gunnar Lennermo (Energianalys), Jiao Qingtai (SUNRAIN) and Nicolas Lamaison (Cea Tech/ INES) have introduced their work done within Task 55.
- October 2020 /// Technology Transfer Workshop “Towards the Integration of Large SHC Systems into DHC Networks” /// Sabine Putz (SOLID), Markus Gölles (BEST), Ralf-Roman Schmidt & Hamid Aghaie (AIT), Jia Chenhui (SOLAREAST), Jan Erik Nielsen (PlanEnergi), Jianhua Fan (DTU), Magdalena Berberich (SOLITES), Daniel Tschopp (AEE INTEC), Viktor Unterberger (BEST)

Journal Articles, Conference Papers, Press Releases, etc.

Author(s)/Editor	Title	Publication / Conference (name of journal, newsletter, conference, etc.)	Bibliographic Reference (journal number, year, place, editor, etc.)
Paolo Leoni, Roman Geyer, Ralf-Roman Schmidt	Developing innovative business models for reducing return temperatures in district heating systems: Approach and first results	Energy	Vol. 195, 2020, 116963 https://doi.org/10.1016/j.energy.2020.116963
Aurelien Bres, Christian Johansson, Roman Geyer, Paolo Leoni, Johan Sjögren	Coupled Building and System Simulations for Detection and Diagnosis of High District Heating Return Temperatures	Building Simulation Conference 2019, Rome (Italy) Presentation of conference paper: poster and short presentation.	Proceedings of Building Simulation 2019: 16th Conference of IBPSA
Hamid Aghaie	The role of solar thermal in the Austrian district heating – Scenarios for 2030	Sustainable District Energy Conference, October 2019, Reykjavik, Iceland	
Abdulrahman Dahash, Fabian Ochs, Michele Bianchi Janetti, Wolfgang Streicher	Advances in seasonal thermal energy storage for solar district heating applications: A critical review on large scale hot-water tank and pit thermal energy storage systems	Applied Energy	Vol. 239, pp. 296-315, 2019
SDH Newsletter	News about SDH market, promotion of the brochure “Solar Heat for Cities”	www.solar-district-heating.eu	www.solar-district-heating.eu

Dissemination material produced

Solar Heat for Cities – The sustainable solution for district heating

<https://task55.iea-shc.org/Data/Sites/1/publications/Solar-Heat-for-Cities--The-Sustainable-Solution-for-District-Heating.pdf>

UK 2019 Solar Academy, Solar Heat Networks

<https://task55.iea-shc.org/Data/Sites/1/publications/IEA-SHC-UK-2019-Solar-Academy-Solar-Heat-Networks-Report.pdf>

Specific Danish deliverables

Fact sheets:

- B-D2 Solar energy - collector fields - check of performance, PlanEnergi
- C-D1.1 Long-term thermal performances of solar collector fields, DTU
- C-D1.1 Long-term thermal performances of solar collector fields, DTU
- C-D1.2 Solar radiation modelling on tilted surfaces based on global radiation, DTU
- C-D1.3 Collector types for large collector fields thermal performance, DTU
- C-D1.4 CFD Models of different collector types, DTU
- C-D2 Seasonal pit heat storages - guidelines for material and construction, PlanEnergi

Task 55 fact sheets can be downloaded from: <https://task55.iea-shc.org/fact-sheets>

International standard for large scale collector fields

A draft ISO standard has been developed in ISO TC180 under Danish lead (PlanEnergi) for checking the performance of large solar collector fields:

- ISO/CD 24194 Solar energy — Collector fields — Check of performance

It has reached the stage 30.99: CD approved for registration as DIS (Draft International Standard).

It has been accepted by CEN TC312, so it will end up as an EN/ISO standard.

Final IEA SHC Task 55 report

A final IEA SHC Task 55 report will be produced for the IEA SHC ExCo during first half of 2021, and presented at the ExCo meeting in June 2021.

6. Utilisation of project results

Results from the project (reports, dissemination material, guidelines, recommendations) are available for everybody at <https://task55.iea-shc.org/>.

No commercial results planned or obtained, as it is an IEA project with exchange of international experience.

Concentrating/focusing solar collectors are becoming more and more cost effective, so it is expected that systems with these collectors will be more popular in the near future. This is very interesting in many district heating systems which are running with high temperatures (90 – 120°C). A follow-up task is planned, which will have focus high temperature collectors use of digitalisation in operating the systems).

Dissemination/promotion material has been made for distribution to district heating companies and associations, relevant consultant companies and energy authorities.

The project will lead to more (very good performing) large solar thermal systems - producing energy for heating (and cooling) houses, which will reduce the CO₂ emission significantly.

7. Project conclusion and perspective

More and more interest is seen globally for renewable district heating, and the Task 55 deliverables (fact sheets and standards) 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.

A follow-up task is planned: *“Large-scale Solar District Heating Systems efficiently providing medium-high temperature heat and incorporating digitalization measures”*. The proposal was approved by the IEA SHC ExCo Committee, and will start during 2021. The Danish Task 55 participants hope to be able to participate in this new related task too.

8. Appendices

Official IEA web sites

- ❑ IEA SHC Task 55 homepage: <http://task55.iea-shc.org> (all Task 55 results/deliverables are/will be available from this web site):
 - Publications: <https://task55.iea-shc.org/publications>
 - Highlights: <https://task55.iea-shc.org/highlights>
 - Fact Sheets: <https://task55.iea-shc.org/fact-sheets>
 - Participants: <https://task55.iea-shc.org/participants>
 - Organization of task / subtasks: <https://task55.iea-shc.org/subtasks>

- ❑ Main IEA SHC homepage: <http://www.iea-shc.org/>

- ❑ IEA DHC homepage: <https://www.iea-dhc.org>

Other relevant web sites on Solar District heating

- ❑ Solar District Heating on www.solarthermalworld.org
- ❑ European Solar District Heating projects: www.solar-district-heating.eu

Attachments

Attached in Zip file: <64017-05145_attachments.zip> are the Danish produced fact sheets

- B-D2 Solar energy - collector fields - check of performance, PlanEnergi
- C-D1.1 Long-term thermal performances of solar collector fields, DTU
- C-D1.1 Long-term thermal performances of solar collector fields, DTU
- C-D1.2 Solar radiation modelling on tilted surfaces based on global radiation, DTU
- C-D1.3 Collector types for large collector fields thermal performance, DTU
- C-D1.4 CFD Models of different collector types, DTU
- C-D2 Seasonal pit heat storages - guidelines for material and construction, PlanEnergi

B-D2 and C-D2 are still being reviewed (30/12 2020), so the versions in the Zip-file attachment might not be the final versions. Final versions will soon be available at: <https://task55.iea-shc.org/fact-sheets>.

Other

The standard developed under Danish lead:

- ISO/CD 24194 Solar energy — Collector fields — Check of performance

The draft standard is not for distribution, as it is owned by the international standards organizations – and not published yet. But a copy can be delivered on request from PlanEnergi (Jan Erik Nielsen) if a confidential agreement is signed.