

TASK NAME: Large Scale Solar District Heating and Cooling Systems

Task Duration: 4 Years, earliest start of the Task: 07/2016

Solar Thermal System characteristics of very large SDH (solar district heating) and SDC (solar district cooling) installations (>3.5 MW up to GW systems):

- **Modular design principles** of large solar thermal district heating and cooling systems:
It will focus on the **optimization of SDH/SDC systems**, their modular units and the units' sizes. Optimizations of hydraulic systems in existing and new SDH/SDC systems are at the core of investigation, since these connect the different components and modular units. The **interdependences** between large collector fields' **seasonal storages, control strategies** and the main **thermal grids** are investigated.
- The Task will focus on technical possibilities to reduce **return temperatures** of district heating grids.
- **Large collector field performances:**
The performance of large collector fields is of higher significance than the performance of singular collectors (e.g. Solar Keymark certified collectors). The evaluation of performance results will lead to collector fields' standardized field measurements, the optimization of collector fields' hydraulic concepts and the minimization of the fields' heat losses.
- **Large seasonal storages (>50.000 m³):**
The Task will evaluate system integration requirements, the durability of large storages, possibilities to optimize current materials, and storages' control strategies. Furthermore, strategies to lower operation, and maintenance costs of large storages will be elaborated.
- Evaluation of state-of-the art **SDH/SDC system performance guarantees** (based on Task 45 performance guarantee sheets). Data will be accumulated from launched Danish and Austrian district heating systems.
- Development of **automated monitoring systems**. The task focuses on monitoring systems' automated failure detection and self-learning control functions for automated large SDH/SDC system surveillance.
- Evaluation and further development of SDH/SDC **system ratings and system certificates** (out of Task 43).
- Analysis of large solar thermal systems' **economic requirements:**
The Task will provide cost-effective business models and investment projections for large solar thermal systems as well as for centralized and decentralized SDH/SDC systems. Furthermore, pricing frameworks for the prediction of district heat and cold prices will be elaborated.
- Development of **standard technical criteria** of large solar systems for policy makers from diverse industries: Decision makers, city planners, architects and municipal utilities will be able to evaluate the relevance of specific large SDH and SDC projects.
- **Promotion** of large solar thermal systems through the continuation of a database, developed within the Tasks 45, 48 and 49.
- Market analyses on global and country specific **developments within the SDH market**, based on the existing SDH database of large solar thermal systems.
- Evaluation of the potential to integrate hybrid **technologies** (biomass and solar) in existing SDH/SDC systems.
- The task uncovers the up-scaling potential of existing medium/large SDH systems, and the requirements for the installation of SDH systems with more than 1 GW_{th} in large communities and cities.

Preliminary Subtask Definition and Description:

The preliminary Subtask Description will be discussed and sharpened in the task definition meeting(s):

A Economic aspects

- D-A1 Reference calculation tool on solar thermal district heat and cold price
- D-A2 Financing and investment schemes for large SDH and SDC systems
- D-A2.1 Business Models (financing models, risks and barriers, systems' maintenance costs)
- D-A3 Beneficial and challenging economic environments for SDH/SDC systems in new markets
- D-A4 Business requirements for large systems

B Components testing, system monitoring and quality assurance

- D-B1 In-situ collector tests (Method development and demonstration at existing installations; Methods for simple thermal power and energy performance proofs)
- D-B3 Further development of validated performance guarantees
- D-B4 Automated monitoring and failure detection
- D-B5 Control strategies and self-learning controls
- D-B6 Integration of solar ratings and certification procedures

C System Design

- D-C1 Technical requirements of existing and newly integrated SDH/SDC systems >3,5MW up to GW systems (Collectors, seasonal storages, hybrid technologies)
- D-C2 Simulation and design of large collector array units
- D-C3 Large scale seasonal storages (>50.000m³)
- D-C4 Optimized hydraulics and piping of large solar systems
- D-C5 Integration and management of hybrid technologies
- D-C6 Modular conception and construction
- D-C7 Intelligent control systems for SDH, SDC as well as hybrid systems

D Promotion, Dissemination, Database

- D-D1 Identification and preparation of large SDH/SDC systems in a database
- D-D2 Promotion and dissemination of SDH/SDC technologies in new markets
- D-D3 Evaluation of the divers global market development
- D-D4 Feasibility studies and brochures on large SDH/SDC systems
- D-D5 Dissemination of expertise through education and training