SDH solar district heating

SDHplus
Solar District Heating in Europe

WP3 – Case studies for changeover to SDH
Case studies on pilot plant and case studies
on integrating SDH into existing network

D3.3 – Report on know-how gained and Lessons learnt from the case studies

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Content

INTRODUCTION

This report is a synthesis of the feed-back and lessons learnt from the contributors and DH stakeholder of the case studies realized in the framework of SDHPlus project WP3.
The questions asked to the participant were divided mainly in four categories. The aim of this survey is to highlight the lessons learnt, motivation and a possible change of attitude of the stakeholders towards SDH. The questions were the following:

- **About initiating the case study**
  Who initiate the study? Had you to convince the stakeholder or did he ask you about the SDH topic? Which lessons can be learnt? What was the opinion of the stakeholder about SDH?

- **About the methodology and tools**
  For each phase of the study which lessons can be learnt?
  Who did the study? How many days did you spend on the study ? Did you use a specific methodology to contact / to convince? Which difficulties did you have to manage (missing data, no reachable objectives, …) ? About the calculation methods you used (for energetic calculation, financial ones, etc...): Which were the most valuable aspect of the tools?

- **About solar, DH and SDH**
  Concerning the integration of solar into a DH or new SDH plants… what are the most valuable aspect of the case you studied ? Is it a realistic option in the case you studied? Why?

- **Decision of the owner**
  Will the study lead to a realization of the SDH plant ? What are the main motivations of the stakeholder?

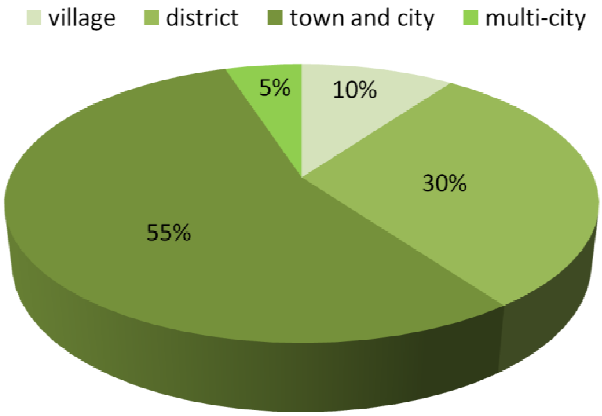
The case study factsheet are available in national language and english on the SDH website http://www.solar-district-heating.eu/ (Documents/SDH case studies)

1. CONTEXT

This report hase been written by taking into consideration 40 case studies, which have been implemented in the framework of the WP3 of the SDHPlus project.

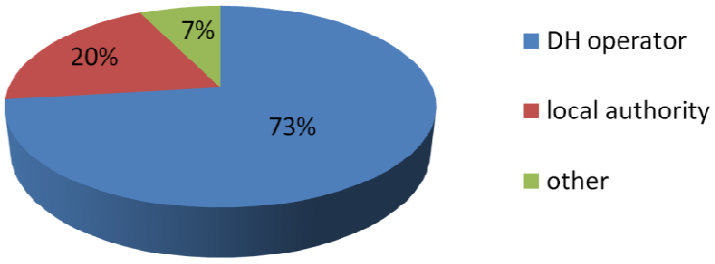
The following map presents the distribution of the case studies in Europe.

Most of the case studies (34) were realized for DH located in towns, cities and districts. Only a few projects (6) were planned in villages. “Multi-city” case studies represent network to be created between villages.



The analysis shows that the case studies were ordered by:

- Local authority
- **DH operator (public or private)**
- Other : Technical consultant, user association, renewable energy association



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The industry part, i.e collector manufacturers, showed interest about the topic and the results of the study but did not initiate any study.

The grant context of each country is described in the following table (source WP2):

	Subsidies and incentives for SDH
AT	2012 : Local and district heating networks get subsidies based on the nature of the fuel provided and heating/cooling capacity. **2015 : National subsidies for large scale solar thermal plants from 100 m² to 2000 m² collector area** The program is called “Solar Thermal – Large-scale solar plants” and is from the Austrian climate fund: It promotes the design and construction of innovative solar systems.
CZ	2012 : “Green bonus” for district heat produced in some RES (**solar is not included).** Subsidy on renovation of some DH systems from The Operational Programme Environment (program ends in 2013).

DE	2012 : law in favor of CHP with feed-in tariff, **support for investment** for DH and DC, **thermal storages** (heating and/or cooling) used for CHP with other renewable energy sources in the energy system (**solar included**).
DK	2012 : ST counts as fuel saving and the first year production has a value of 35÷45 €/MWh. **SDH are cheaper than fossil fuel DH.**
ES	2012: No subsidies for DH but regional and state support scheme for ST. National funding: 1000 €/kW with a maximum of 250,000 €/project and a minimum of 20,000 €/project and maximum of 1,000,000 € per ESCO. Moreover, regional support is available in Andalucia.
FR	2012: The main subsidy is the Heat Fund (*Fonds Chaleur*) managed by ADEME (French national agency). This fund **finances RES for heat and DH project investments** and has a 200 million € budget per year. There is a tax credit for ST in households (32% of the investment). 2014: specific call of the *Fonds Chaleur* for new emerging ST technology from ADEME **include explicitly SDH.** 2015-2016: specific call of the *Fonds Chaleur* for **large ST installation including SDH application** has been launched from the ADEME. It is funded with # 2 M°€/year. Furthermore, there is a **reduced VAT** (5.5% instead of 19.6%) for heat sold by DH using more than 50% of RES.
HR	2012: No incentives are available for district heating or for RES / solar district heating. 2015: **The new Act on Renewable Energy Sources is at the moment under public consultation and it includes DH**. The only support schemes are the occasional tenders from the Fund for Environmental protection and Energy Efficiency. They are addressing solar equipment for preparation of domestic hot water and heating, usually for private households.
IT	2012: A guarantee fund for new DH networks operated with RES has been created ; part of the amount of this fund has been redirected for public building energy efficiency measures. 2012: ST and other RES, as well as energy efficiency measures, are subsidised via tax credit. Another mechanism is available, valid for **ST plants up to 1.000 m^2 and giving an incentive per m^2 installed (up to 65% of investment cost)**. 2015: **This mechanism is now under revision in order to have incentives per produced kWh (certified by Solar Keymark) for ST plants up to 2.500 m^2**.
LT	2012: The Lithuanian Government using EU support sponsored penetration of renewable energy technologies into the market. Biomass boiler-houses, CHP units, solar PV and wind plants received support for investments during the first support period (2007-2014). 2015: Support was continued for biomass plants only during the second period (2014-2020). **Other RES were not supported by the Government of Lithuania.**

PL	2012: The National Fund of Environmental Protection and Water Management supports ST in two programs. - Programme Prosumer, years 2015-2022 supports ST among other RES heat technologies in hybrid installations (producing heat and electricity is a must) and is addressed for individuals and housing associations. - The Stork Programme, years 2014-2023, for entrepreneurs, supports large ST in larger scale installations. 2012: European founds are available under Regional Operational Founds (2014-2020) and Rural Development Program. **ST is an eligible RES technology** supported on a general basis and has to be combined with energy efficiency actions.
SE	2012: From 2000 to 2012 there were grants for supporting ST installations. Investment support is given from 2.50 SEK/kWh annual collector output up to 3 million SEK per project. This support was used in a number of projects based on net-metering model. With the new regulation SFS 2011:1105, the **support has been cancelled, due to the opinion on the governmental level that solar heat is profitable anyway**.
SI	2012: There exist **subsidies for solar thermal energy**. Maximum co-financing 200-300 k€. - 10% of total costs for public companies - 30% of total costs for large companies - 40 % of total costs for medium size companies - 50% of total costs for small size companies For individual owners the subsidies for solar thermal do not exist anymore. There existed also subsidies for biomass DH systems, which ended in 2011.

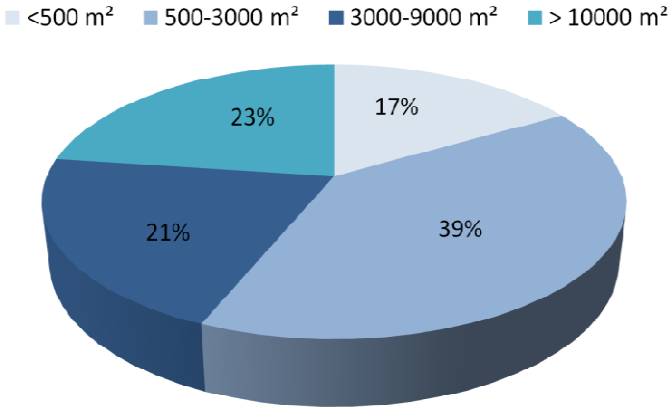
2. RESULTS

Most of the case studies present solution to integrate solar plant into existing DH with centralized solar plant:

existing DH	30	75%
new SDH	10	25%

centralized	29	72%
decentralized	11	28%

The solar plant collector area varies from 100 to more than 40 000 m² with the following proportions. Some studies propose different collector area and evaluate the energetic and economical potential of various sizing.



In one third of the cases, the solar plant covers the loads with the following share:

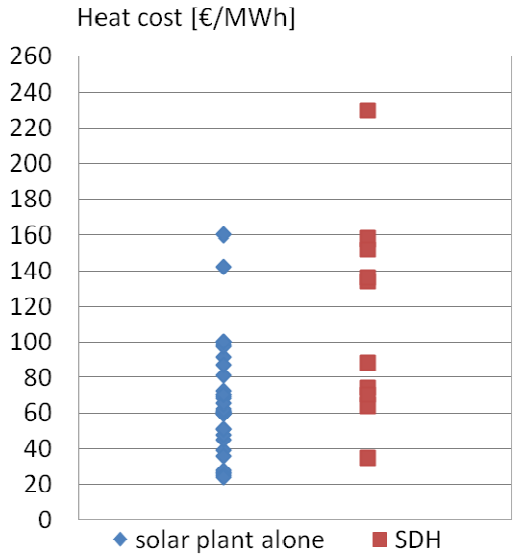
<5%	5-15%	>15%
12 cases	18 cases	16 cases

The cost of heat is defined as :

Global cost of the SDH / Production on the lifespan

The global cost is calculated without grants, without VAT. Some of the case studies include the discount rate.

The heat cost of a solar plant connected to a DH in Europe is about 30 and 100 €/kWh. The cost of overall SDH (including network, substations, solar and other mean of production investment and explotation cost) have a wider distribution between 40 and 230 €/MWh.



3. LESSONS LEARNT

In each country the political and economical context varies, as well as the interest for district heating for one side, for solar energy to the other side.

The general lessons we have can learnt, whatever the country, are summarized in the following sub-chapters.

3.1 INITIAL INTEREST OF DH STAKEHOLDER

The initial knowledge about SDH varies from a country to another; most of the SDHTake-Off participating countries have people aware of the technology in their country. Spontaneous interest is rare, most of the time some initial work was done by the SDHPlus project partner to inform them about SDH, using the SDHPlus project tools and other like:

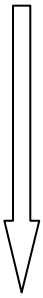
- Call for interest published to specific public of DH stakeholder (newsletter, emailing, …)
- National workshop organized in the framework of SDHPlus WP5
- National conference about DH
- Direct contact by email or phone

After this first contact, the identified initial motivations are the following:

Local authority	**DH operator**	**Other**
Increase RES share and decrease CO2 emission of the DH in their city/zone Other source of the energetic mix of the DH	Improve image Get a label Possibility to improve the energy mix Optimization of the DH Develop an ecodistrict Obligation for the municipality Increase public acceptance for future extension of the DH Anticipate future regulation	Improve knowledge about SDH

In some case, they were granted for the study. The grants do not consist in a first motivation, but they help to go through the realization of the study. In some case, the DH stakeholders are so poorly motivated that they expect free studies and are not ready to pay for it.

The involvement of the DH stakeholder in the topic of SDH can be described as:



Informed about SDH project

Visit SDH plant locally (DK, DE, AUS, SE mainly)

Visit SDH plant abroad

Participate to SDH conference

Involved in R&D project about SDH

Manage a master thesis on the topic of SDH

Realize a SDH

3.2 METHODOLOGY AND TOOLS

According the feedback of the partners and DH stakeholders concerned by the case studies, the main lessons learnt about the tools and methodology are the following:

- The work should start by defining scope and limitations, as well as define key values, in the interest of the DH stakeholder.
- Engineering skills are required to run the calculations required for a case study. Moreover, some experience on the topic is necessary because many assumptions and considerations have to be made.
- Hourly calculations have to be made, using tools like TRNSYS, Polysun, EnergyPro. They are particularly recommended to provide detailed thermal energy balance and compare specific solutions (control, specific hydraulic scheme, multi-energy DH, …).
- A very few basic and simple tools exist to predict the energetic performance of a solar plant connected to a DH at an early stage.
- The economical balance requires the knowledge of key financials values adapted to the DH operator/stakeholder (actualization rate, interest rate, price of the main component, price of the installation, etc).
- The loads of the DH should in most of the cases be set up in an hourly basis, for a whole year:
    - Existing DH : gather the monitoring data or propose monitoring in the framework of the study
    - New DH : run or gather results of building simulation

The feedback also showed that some data may be difficult to gather or are missing. The designer has to be able to make assumption according his experience OR have to fix the values in accordance with the DH stakeholder/DH operator.

An important lessons learnt about the methodology is the following: ”It is sometimes important to not only calculate the performance of the plant as the initiator of the study wishes, but to go beyond and look into further options to find the best solution (energetically and economically) taking into account his framework. Experience shows that the discussion is often open if another solution proves feasible too. However, the "best" solution must not be imposed and the dimensioning must remain flexible according to the initiator's needs.”

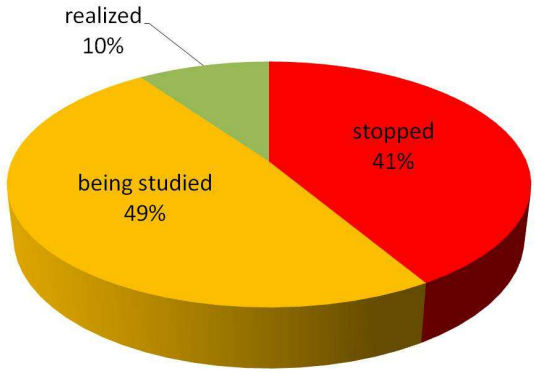
3.3 SWOT ANALYSIS

The following SWOT analysis has been made with the feedback of all partners and stakeholder when answering the question *"Concerning the integration of solar into DH or new SDH plant, what are the most valuable aspects of the case you studied? Is it a realistic option? Why?".* The question was also understood as *"what are the general lessons learnt about SDH ?"*.

Strenght	**Weakness**
<u>No technical barrier for SDH integration</u> SDH is a realistic option SDH has a higher solar fraction than solar DHW production SDH price is lower than fossil fuel price (DK) There are SDH operators motivated to build, operate and share their experience	High initial investment Low capacity of investment of local DH operator Legislation in favor of solar DHW production make this solution a competitor of SDH Private investment VS local and public investment may increase the SDH price of about 20% Missing grants for SDH Lack of awareness and knowledge of local DH operator – solar evaluated as a high risk project Limited space available in urban area limiting the solar plant size and solar fraction.
Opportunities	**Threats**
High fossil fuel price of the DH production High fossil fuel CO2 emission of the DH production Solar increasing CHP electricity production DH not connected to natural gas network High level of incentives, grants High summer loads Increase of energy price (biomass, natural gas) Decrease of solar thermal installation costs	<u>Solar has no competitive economical figures compared to traditional fossil fuel and biomass solutions</u> No capacity of investment of local authorities

3.4 PRESENT SITUATION

At this time (June 2015), the feedbacks we have from the partners and stakeholder show that very lower than half of the projects were rejected. Most of the case studies (about 50%) are under discussion internally by the stakeholder and some of them are under construction (4).



The various arguments collected when we asked about the main motivation of the stakeholder after the studies are the following:

+ positive	- negative
Good image	
Low electricity cost in summer => CHP not economically viable => solar heat feasible	
Economy	Other solution more feasible for the case
Change fossil fuel to RES	SDH solution is not financially competitive compared to the more traditional solutions (natural gas, biomass, waste heat)
Political argument of local authority	No investment capacity
SDH is a variante which can lead to new contract for a DH operator	Take a risk and no place available for seasonal storage
Set up new grant program	
Solar thermal energy stored in summer become a serious competitor of waste heat	
New solution, innovation, originality	
Require DH temperature decrease	

Despite the fact that a few study lead to plant realization (only 4), it has to be underline that in learning countries (FR, HR, LT, PL mainly) the studies are “a first time”. Most of the feedback indicates that the DH stakeholders are **more aware of this application** of solar thermal and **should integrate evaluation about this solution in their future activities**. The work to be done is then to continue to disseminate main results of the studies and information to help DH stakeholder to integrate solar in their future project.

One major information provided by the studies and who interests very much the DH stakeholder and solar thermal industry is the **relations between costs and energy yields**. To fulfill DH stakeholder expectation, further studies should present results about the profitability and customer needs.

Because this aspect appears to be a key point to go through realization, the research of **potential investors** and **adapted business and financing models** should be continued.

CONCLUSION

According to the feedback, the activities realized in the framework of WP3 have been very profitable to all partners and stakeholder.

The new-comers countries increased their knowledge and skills about the main figures of SDH, and gain know-how and experience, which is absolutely necessary to continue the promotion of SDH in each country.

Moreover, stakeholders had the opportunities to evaluate the real aspect of SDH: technical as well as financial ones. The case studies generally demonstrate that there are no major technical barriers for SDH, even when integrating solar plant into existing DH.

Finally, the case studies factsheet seems to be useful documents to communicate to DH stakeholder and show real example.

All the activities of the SDHPlus project have been useful to help the partners to realize the case studies and should be maintained in each country to permit a larger diffusion of SDH applications:

- Coaching and help-desk from expert (mainly for technical aspect: sizing, calculations, design) or training
- Knowledge about the national and European grant context
- Dynamic national and international professional network activities
- Disseminations activities with national fixed and updated point for dissemination (website, …).

For next step and futures years, it is highly recommended to continue this activity in each country, even without any SDHplus project support.