



Enlarging Solar Thermal Systems in Multi-Family-Houses,
Hotels, Public and Social Buildings in Europe

Questionnaire

Best Practice Analysis for Collective Solar Thermal Systems (CSTS)

Owner / Investor

| | | |
|----|---------------|--|
| T1 | Project title | |
| T2 | City | |
| T3 | Country | |

Interviewer

| | | |
|----|-------------------|--|
| T4 | Organisation name | |
| T5 | Contact person | |
| T6 | City | |



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Introduction

The following questionnaire is the basic instrument to analyse the key success factors for CSTS with the aid of existing best practice solutions. The evaluated projects and data will be used in the project as follows:

- Basis to create a **best practice database** within the project website www.solarge.org. This database will show comparable examples from all partner countries. The data from each project will be separated concerning the different target groups of the project. A project summary sheet will introduce every best practice project. Three special subject sheets will provide deeper information:
 1. CSTS system (technical details especially for planners, installing business, etc.)
 2. Financing (especially for the investors, the demand side)
 3. Project development and experiences
- Expert workshops to discuss and promote the deliverables
- Composing and printing of a European best practice **catalogue**
- Estimation of potentials, identification of obstacles and chances of success in the national markets; development of strategies and instruments
- Deeper evaluation of some special projects

These aims and deliverables require your agreement to use the collected data, photo material and CSTS schemes. Please print page 3 of this document and sign for your accordance. Thank you.

Structure of the document

This questionnaire is generally separated in five parts:

- **Part A: General information** (General data of the building, addresses from all responsible persons; fill in from all involved actors)
- **Part B: General description of the building services engineering and CSTS** (engineering: description of the building, the building services and the CSTS in detail; fill in mainly from technical side)
- **Part C: Operation data** (yield, heat demand, energy prices, operation costs; fill in mainly from technical side)
- **Part D: Investment costs** (costs, financing the CSTS; fill in from the owner or investor side)
- **Part E: Qualitative aspects** (stories for project development and experiences; fill in from all involved actors)

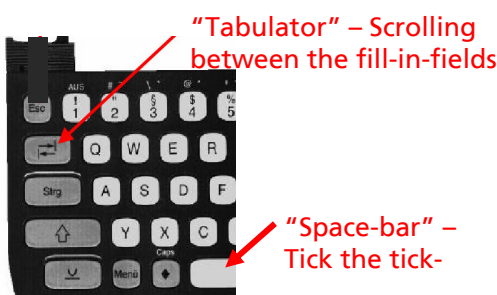
How to fill in data

We tried to create the data collection as comfortable as possible for the involved actors. Apart from Part E you should fill in data in short words into the provided spreadsheets or by using the provided tick boxes.

Part E is the only part where all involved actors should describe the project success, proceeding, experiences etc in whole sentences. This should be expressed more personal and emotional compared to the Parts A-D.

This Microsoft Word-document is generally protected. This has the advantage that you can easily find and fill in the needed data and it is not possible to make any mistakes.

You need only the “*tabulator*” on your keyboard to change between one fill-in-field to the next. If you have filled in one data or text press the tabulator to reach the next field. You have also the possibility to reach the different fields by *clicking with your mouse* on the fields.



How to tick the tick boxes

A lot of questions in the questionnaire have to be answered only by ticking a tick box. If you reach one of these questions (with the *tabulator*, as explained before) you can choose (tick) the tick boxes by using the “*space-bar*” on your keyboard or with a mouse-click with your mouse on the box, that you would like to tick. You can choose two options for the tick box: marked () or not marked ()

Part A: General Information

A1. Addresses of involved actors/interviewees to the analysed CSTS

| OWNER / INVESTOR of the building | | Also CSTS Operator? Yes <input type="checkbox"/> No <input type="checkbox"/> |
|----------------------------------|-------------------------------|--|
| A1.1 | Organisation name: | |
| A1.2 | Contact person (interviewee): | |
| A1.3 | Address: | |
| A1.4 | City, Country: | |
| A1.5 | Phone: | |
| A1.6 | Fax: | |
| A1.7 | E-mail: | |
| A1.8 | Internet: | |

A2. Data of the building

| Analysed building | | |
|-------------------|-----------|--|
| A2.1 | Address: | |
| A2.2 | City: | |
| A2.3 | Province: | |
| A2.4 | Country: | |

| Type of building | | Tick |
|------------------|-------------------------|--------------------------|
| A2.5.1 | Multi Family House | <input type="checkbox"/> |
| A2.5.2 | Hotel | <input type="checkbox"/> |
| A2.5.3 | Pension House | <input type="checkbox"/> |
| A2.5.4 | Hospital | <input type="checkbox"/> |
| A2.5.5 | School | <input type="checkbox"/> |
| A2.5.6 | Sport Centre | <input type="checkbox"/> |
| A2.5.7 | Other (please specify): | <input type="checkbox"/> |

Declaration of Consent

We comply with your request as regards the right to use all evaluated data and photo material in the frame of the SOLARGE project.

date,city

Signature OWNER / INVESTOR of the building

A3. Further Addresses of involved actors to the analysed CSTS

Please fill in a declaration of consent for every involved actors (e.g. investor, CSTS operator, planning/engineering company, architect, installer, operating company) who as been interviewed for this questionnaire. If necessary, multiply the table below.

| | | |
|------|--|--|
| A3.1 | Involved actors (e.g. CSTS Operator, Planning/Engineering company, etc.) | |
| A3.2 | Organisation name: | |
| A3.3 | Contact person (interviewee): | |
| A3.4 | Address: | |
| A3.5 | City, Country: | |
| A3.6 | Phone: | |
| A3.7 | Fax: | |
| A3.8 | E-mail: | |
| A3.9 | Internet: | |

Declaration of Consent

We comply with your request as regards the right to use all evaluated data and photo material in the frame of the SOLARGE project.

Date, city

Signature OWNER / INVESTOR of the building

Part B: General description of the building services engineering and CSTS

B1. Description of the building

| Criteria | | Unit | Answer / Value |
|----------|----------------------------------|----------------|--|
| B1.1 | Year of construction: | Year (a) | |
| B1.2 | Number of users: | Number | |
| B1.3 | Number of dwellings: | Number | |
| B1.4 | Number of floors: | Number | |
| B1.5 | Ground area of building: | m ² | |
| B1.6 | Total effective area (heated): | m ² | |
| B1.7 | Insulation standard of building: | Tick box | <input type="checkbox"/> Low <input type="checkbox"/> Middle <input type="checkbox"/> High |
| B1.8 | Roof type: | Tick box | <input type="checkbox"/> Flat roof <input type="checkbox"/> Inclined roof |

B1.1 Project summary

Please explain briefly:

- Cause of installation of CSTS and description of the project
- Condition/state of the building
- What do you use your CSTC for?
- General information and exceptional features of the CSTC

(700 characters maximum)

B2. Description of the CSTS

| Criteria | | Unit | Answer/Value |
|----------|-------------------------------|--|---|
| B2.1 | Year of construction of CSTS: | Year (a) | |
| B2.2 | Gross area of collectors: | m ² | |
| B2.3 | Aperture area of collectors | m ² | |
| B2.4 | Type of collectors: | Tick box | <input type="checkbox"/> Flat plate collector <input type="checkbox"/> Vacuum tube collector <input type="checkbox"/> Uncovered collector |
| B2.5 | Type of assembly: | Tick box | <input type="checkbox"/> Roof top <input type="checkbox"/> Roof-integration <input type="checkbox"/> Solar roof <input type="checkbox"/> On flat roof <input type="checkbox"/> Others, specify: |
| B2.6 | Orientation of collectors: | Tick box / degree (°) | <input type="checkbox"/> East (-90°) <input type="checkbox"/> South-East: ° <input type="checkbox"/> South (0°) <input type="checkbox"/> South-West: ° <input type="checkbox"/> West (+90°) |
| B2.7 | Inclination angle to horizon: | Degree | |
| B2.8 | Freezing protection: | Tick box | <input type="checkbox"/> Glycol <input type="checkbox"/> Drain-back <input type="checkbox"/> Others, specify: |
| B2.9 | Overheating protection | Tick box | <input type="checkbox"/> Expansion vessel <input type="checkbox"/> Drain-back <input type="checkbox"/> Fan-coil <input type="checkbox"/> Others, specify: |
| B2.10 | Operation mode: | Tick box | <input type="checkbox"/> High flow <input type="checkbox"/> Low flow <input type="checkbox"/> Variable |
| B2.11 | Use of CSTS for: | Tick box (Multiple choice possible) | <input type="checkbox"/> Hot tap water heating <input type="checkbox"/> Space heating <input type="checkbox"/> Swimming pool heating <input type="checkbox"/> Others, specify: |

| | | | |
|-------|----------------------------------|----------|--|
| B2.12 | Buffer storage | | Total volume m ³ number of storages: volume per storage please explain: |
| B2.13 | Hot tap water storage | | Total volume m ³ number of storages: volume per storage please explain: |
| B2.14 | Control of backup-system / CSTS: | Tick box | <input type="checkbox"/> Separated control <input type="checkbox"/> Shared control, if possible, explain the control |

B2.15 Short summary / introduction of the general system

(300 characters maximum)

B3. Hot tap water system

| Criteria | | Unit | Answer / Value |
|----------|--|----------------|---|
| B3.1 | Type of hot tap water heating: | Tick box | <input type="checkbox"/> Centralised <input type="checkbox"/> Decentralised |
| B3.2 | Recirculation System: | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| B3.3 | If decentralised system, then: What is installed on the consumer side?*: *) This questions corresponds to Danish and French system configurations | Tick box | <input type="checkbox"/> Heat exchangers <input type="checkbox"/> Hot water tanks <input type="checkbox"/> Individual gas boilers <input type="checkbox"/> Others, specify: |
| B3.4 | Size and type of storage for hot tap water: (central / decentral storage?) <u>Remark:</u> In case the solar storage and hot tap water storage are combined in one tank please mark this and specify the volume of hot water heating part only | m ³ | <input type="checkbox"/> Central: <input type="checkbox"/> Per dwelling: <input type="checkbox"/> Combined solar and hot water back-up heating storage tank: |
| B3.5. | Separated back-up heater/boiler for hot tap water heating only: | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No (via space heating system) |
| B3.5.1 | If yes, then specify: 1) Total capacity (of separated back-up heater/boiler for hot water heating only) | kW | |
| B3.5.2 | 2) Year of construction of the boiler system | Year (a) | |
| B3.5.3 | 3) Auxiliary energy source: | Tick box | <input type="checkbox"/> Natural gas <input type="checkbox"/> Heating oil <input type="checkbox"/> Electricity <input type="checkbox"/> District heat <input type="checkbox"/> Others, specify: |
| B3.5.4 | 4) Type of the boiler system: | Tick box | <input type="checkbox"/> Standard <input type="checkbox"/> Low temperature <input type="checkbox"/> Condensing |

B4. Space heating system

| Criteria | | Unit | Answer/Value |
|----------|---|-------------------------------------|--|
| B4.1 | Type of heating system: | Tick box | <input type="checkbox"/> Centralised <input type="checkbox"/> Decentralised |
| B4.2 | Number of boilers: | Number | |
| B4.3 | Total capacity (power output) of boilers: | kW | |
| B4.4 | Capacity of each boiler and the year of construction: | kW and Year (a) | No. 1: kW, Year No. 2: kW, Year No. 3: kW, Year |
| B4.5 | Energy source: | Tick box | <input type="checkbox"/> Natural gas <input type="checkbox"/> Heating oil <input type="checkbox"/> Electricity <input type="checkbox"/> District heating <input type="checkbox"/> Others, specify: |
| B4.6 | Type of boiler system: | Tick box (Multiple choice possible) | <input type="checkbox"/> Standard <input type="checkbox"/> Low temperature <input type="checkbox"/> Condensing |

B5. Type of operation

| Criteria | | Unit | Answer/Value |
|----------|-----------------------------------|-------------------------------------|--|
| B5.1 | Who is operating the CSTS system? | Tick box | <input type="checkbox"/> Self-operation <input type="checkbox"/> ESCO* <input type="checkbox"/> BOOT** <input type="checkbox"/> Others, specify: |
| B5.2 | CSTS monitoring: | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| B5.2.1 | If yes, then specify: | Tick box (Multiple choice possible) | <input type="checkbox"/> Solar radiation <input type="checkbox"/> Output of solar heat <input type="checkbox"/> Total water consumption <input type="checkbox"/> Others, specify: |

| | | | |
|--------|--|----------|---|
| B5.2.2 | Please describe briefly the TYPE of data observation (monitoring) and specify WHO is supervising these data. | | |
| B5.3 | Are the data accessible via internet? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| B5.4 | Is there a scientific monitoring / follow up? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| B5.5 | Is there a maintenance contract? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| B5.5.1 | If yes, how many times a year maintenance occurs? | | |
| B5.6 | Is there a visualisation of the solar heat output (e.g. by adisplay)? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| B5.6.1 | If yes, please describe (type and place): | | |

* ESCO = Energy Service Company

** BOOT = Build, Own, Operate & Transfer

B6. Additional material

| Criteria | | Unit | Answer/Value |
|----------|--|----------|--|
| B6.1 | Hydraulic scheme (principal diagram) of CSTS: | Tick box | <input type="checkbox"/> Paper copy attached <input type="checkbox"/> Digital picture sent via mail |
| B6.2 | Pictures of the CSTS and heating system and building | Tick box | <input type="checkbox"/> Paper copy attached <input type="checkbox"/> Digital picture sent via mail |

Part C: Operation Data

C1. Yield of CSTS plant

| Criteria | Unit | Answer/Value |
|---|-----------|---|
| C1.1 Output of solar heat: (estimated data: solar system output, see C1.3) (Make sure that energy from back-up heater is not included) | kWh/a (!) | |
| C1.2 Origin of data: | Tick box | <input type="checkbox"/> Measured <input type="checkbox"/> Design (Calculated) |
| C1.3 Where does the measurement happen? (please indicate the measuring points in the Hydraulic scheme) | Tick box | <input type="checkbox"/> Between collector and storage (collector output) <input type="checkbox"/> Between storage and piping to taps (solar system output) <input type="checkbox"/> Others, specify: |
| C1.4 Reduction of final energy (Natural gas, Heating oil, Electricity, District heating see the question B3.5.3 and B4.5)* | kWh/a (!) | |
| C1.5 Origin of data, please explain: | | |
| C1.6 Solar performance guarantee: | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| C1.61 If yes, did the system achieve the Solar performance guarantee | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |

* related to C1.1: and C1.3, solar system output

C2. Heat consumption

| Criteria | Unit | Answer/Value |
|---|--|---|
| C2.1 Whole energy consumption for heating purposes after CSTS implementation: | kWh/a | |
| C2.2 Origin of data: | Tick box | <input type="checkbox"/> Measured <input type="checkbox"/> Estimated from |
| C2.3 Energy used for heating of: | Tick box (Multiple choice possible) | <input type="checkbox"/> Hot tap water heating <input type="checkbox"/> Space heating <input type="checkbox"/> Swimming pool heating <input type="checkbox"/> Others, specify: |
| C2.4 Whole Energy consumption for heating purposes before CSTS implementation: | kWh/a | |

| | | | |
|------|--|-------------------|--|
| C2.5 | Total tap water consumption: | m ³ /a | |
| C2.6 | Hot tap water consumption: (Please indicate whether measured or calculated) | m ³ /a | <input type="checkbox"/> Measured <input type="checkbox"/> Calculated |
| C2.7 | Hot tap water temperature: | °C | |
| C2.8 | Cold water temperature: | °C | |

C3. Energy prices for back-up heater (including VAT)

| Criteria | | Unit | Answer/Value |
|----------|----------------|---|--|
| C3.1 | Energy rate: | Euro/kWh or Euro/l or Euro/m ³ | €/kWh or €/l (heating oil) or €/m ³ (natural gas) |
| C3.2 | Demand charge: | Euro/kW *a | |

C4. Operation cost of heating system (including VAT)

| Criteria | | Unit | Before CSTS installation | With CSTS |
|----------|---|--------|--------------------------|-----------|
| C4.1 | Power costs for pumping: | Euro/a | | |
| C4.2 | Maintenance costs: | Euro/a | | |
| C4.3 | Monitoring costs: | Euro/a | | |
| C4.4 | Other operation costs: | Euro/a | | |
| C4.5 | Total operation costs: | Euro/a | | |
| C4.6 | or: Increase of the operating costs after CSTS implementation: | Euro/a | | |

Part D: Investment Costs

D1. Cost of solar materials

| Criteria | | Unit | Answer/Value |
|----------|--|----------|---|
| D1.1 | Total costs solar system: | Euro | |
| D1.2 | Total costs include: | Tick box | <input type="checkbox"/> Collectors <input type="checkbox"/> Mounting structure <input type="checkbox"/> Heat exchanger <input type="checkbox"/> Storage <input type="checkbox"/> Back-up heater <input type="checkbox"/> Control <input type="checkbox"/> Installation <input type="checkbox"/> Planning/Engineering <input type="checkbox"/> VAT: % |
| D1.3.1 | If possible provide detailed costs for: Costs including / exclusive VAT | Tick box | <input type="checkbox"/> including VAT <input type="checkbox"/> exclusive VAT |
| D1.3.2 | Collectors | Euro | |
| D1.3.3 | Elevation / mounting structure | Euro | |
| D1.3.4 | Storage, heat exchanger | Euro | |
| D1.3.5 | Back-up heater | Euro | |
| D1.3.6 | Control | Euro | |
| D1.3.7 | Installation (collectors, piping) | Euro | |
| D1.3.8 | Planning/Engineering | Euro | |
| D1.3.9 | Other costs (please specify): | Euro | |

D2. Financing of the CSTS

| Criteria | | Unit | Answer/Value |
|----------|----------------------------|----------|--|
| D2.1 | How was the CSTS financed? | Tick box | <input type="checkbox"/> purchase % self financing % loans % subsidies <input type="checkbox"/> Contracting <input type="checkbox"/> Leasing <input type="checkbox"/> Others, specify: |
| D2.2 | Please explain: | | |

D3. Obtained subsidies for the CSTS (including VAT)

| Criteria | | Unit | Answer/Value |
|----------|---|-----------|--------------|
| D3.1 | Grants: | Euro | |
| D3.2 | If low interest loans, then specify: <ul style="list-style-type: none"> • nominal interest reduction: • amount of the loan: | % Euro | |
| D3.3 | Tax credits: | Euro | |
| D3.4 | Others, please specify: | Euro | |
| D3.5 | Please explain: | | |

D4. Short summary / introduction of the cost and financing details

(200 characters maximum)

E3. Financial effects / project performance

| Criteria | | Unit | Answer |
|----------|--|----------|---|
| E3.1 | Is the project economically efficient? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| E3.2 | Are there fiscal or other financial effects? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| E3.3 | If yes, please explain shortly: | | |
| E3.4 | Is there an effect on rental fees? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| E3.5 | If yes, please explain shortly: | | |

E4. Economic assessment

Is the investment profitable?

Please explain briefly:

Questionnaire for technical staff

E5. Motivation

| Criteria | | Unit | Answer |
|----------|---|----------|---|
| E5.1 | Ecological image | Tick box | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> high low |
| E5.2 | Economical issues | Tick box | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> high low |
| E5.3 | Interest in new technology | Tick box | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> high low |
| E5.4 | Additional values of project according to national framework (f.i. EnEV in Germany) | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| E5.5 | If yes, please explain briefly: | | |

E6. Experiences

| Criteria | | Unit | Answer |
|----------|--|----------|---|
| E6.1 | Satisfied with performance of project/solar system? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| E6.2 | Did you experience problems or failures? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| E6.3 | If yes, please explain briefly: | | |
| E6.4 | Did you find solutions to these problems or failures? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| E6.5 | If yes, please explain briefly: | | |
| E6.6 | Did you experience fully integrated support by planners / suppliers? | Tick box | <input type="checkbox"/> Yes <input type="checkbox"/> No |

E7. Technical assessment

Does the realised solution accurately serve the demand?

Please explain briefly:

E8. Ecological assessment

| Criteria | | Unit | Answer/Value |
|----------|-----------------------------------|----------------------|--------------|
| E8.1 | Fossil energy savings by the CSTS | kWh/a | |
| E8.2 | CO ₂ emissions avoided | t CO ₂ /a | |

Questionnaire for all actors involved

Please describe the story of success of the CSTS plant.

Remark: It would be desirable, if **all** participants would answer these questions.

E9 What initiated the installation of the CSTS?

E10 Please describe the course of planning and installing of the CSTS.

E11 How is he CSTS running? What experiences did you gain?

E12 Please assess the performance of the CSTS and indicate possible amelioration concerning installation and running (of the system).

E13 What kind of recommendation do you have for the realisation of future projects (planning, installation, running)?

E14 How does the project influence your future activities in the solar sector?

E15 Special explanatory notes?

E16 Success story for the project summary sheet

Remark: The Responsible contact person (interviewer) will choose one of the relevant actors from every project for the we called “Success story” within the “summary sheet” of the project (see “Introduction and Advice”).

This person will be involved with his photograph, name, statement and the success story.

| | | | |
|-------|----------------------------|----------|--|
| E16.1 | Name of the chosen person: | | |
| E16.2 | Institution / position | | |
| E16.3 | Photograph | Tick box | <input type="checkbox"/> Paper copy attached <input type="checkbox"/> Digital picture sent via mail |

E16.4 Statement, excerpt:

(200 characters maximum)

E17. Short summary of experiences / notices to the project performance (E9 to E15)

(400 characters maximum)