Final report

Solar Combisystems

Altener Contract Number:
4.1030/C/00-002/2000

Key Issues in Solar Thermal
(Solar Thermal Technology Promotion)
Solar combisystems

Prepared by

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Content

1 Preface

The Combisystems project started in April 2001 and ended in March 2003. The project is related to the IEA task 26 collaboration about solar combisystems, and one of the aims is to convert the findings of the IEA task to information usable for the public. Another aim is to collect practical information on real installed combisystems.

The work until October 2002 has been documented in the interim report from October 2002 (see chapter 4 for references). The report describes the progress of the project after 70% of the project has been carried out.

The outcome of the combisystems project is together with the establishment of a number of combisystems in every participating country a number of documents and a PC programme.

Since the detailed project development until October 2002 has been described in the interim report this text will only summarise what has happened in the last period of the project. Furthermore the effort is put on summarising what is the content of the project deliveries, which are attached as appendices.

2 Project progress in the period from October 2002 to end of March 2003

The work of the project is organised in 7 work packages (Wp0 – Wp6).

2.1 Work package 0 - Co-ordination of the project:

After the withdrawal of The Danish Technological Institute from the project Klaus Ellehauge has from the 1st of June 2002 carried out the co-ordination.

The final project meeting has been held in Stuttgart at the ITW on March 26-27.

The project website was earlier hosted by the Technological Institute, but is now hosted on the address: http://www.elle-kilde.dk/altener-combi. The project deliveries are public available and can be downloaded from the website. Furthermore minutes and work documents can be downloaded from the password protected part of the site.

2.2 Work package 1 - Seminars and Workshops:

All participants have arranged workshops in the start and the end of the project. The second workshops have taken place in the period from February 2003 to the end of March 2003.

In general the workshops have been well attended and the interest for the project has been good.

Information of the workshops is given in appendix 2.

Deliveries WP1

- CombiSun
  As part of the WP a common PC-tool for performance estimation of the systems has been completed. The PC-programme can estimate the performance of a number of different combisystem designs, under different climates and different loads.

  The PC programme is designed so that it is very easy to compare differences in performance between different designs and to generate a report, which can be copied to i.e. a Word document. Until now the designs that have been optimised under the IEA task 26 has been added, but it is possible in the future to add further designs. The programme has been developed of the Swedish participants based on the method for combisystem comparison (the FSC method) developed by the French participant.

  The PC programme can be downloaded from the projects website.

- Presentations
  A number of presentation in national language has been elaborated. The presentations are available by contacting the national contact person.

- Solar Combisystems - European Overview of installed Systems 2001- 2003
  The brochure gives a one page information on every installed systems. The one page information gives the main data of the installation site and the system together with estimated performances and cost. The brochure also has an introduction giving an overview of the system features and markets etc.The systems are presented by a number of indicators

that makes comparison of the system features possible, and which have been elaborated in the project.

2.3 Work packages 2, 3, 4 - Grouping of potential buyers, Preparation of calls for tender, Construction of plants:

In the last period of the project the remaining number of systems have been realised and described.

The number of systems installed in every country is:

Austria:	23
Denmark:	18
France:	23
Germany:	22
Italy.	15
Sweden	29
The Netherlands:	6 datasheets representing 90 installed systems

The number of installed systems for 6 countries (the Netherlands excluded) is 117 systems while then number of systems installed included the Netherlands are more than 200 systems. In the project planning an average of 20-25 systems installed by every country was foreseen, with the most systems in the largest and strongest markets.

In Denmark the number of installed systems is less than expected because the subsidy was removed in the project period. As a result of this the solar heating market in Denmark has decreased to probably less than 700 systems a year.

The method of establishing the systems has differed from country to country and is described in the interim report

An overview of the installed systems is given in appendix 3.

Deliveries WP 2,3,4

- A number of national documents to ensure the construction (tenders, contracts etc.) have been elaborated by the national participants.

- Conditions and Problems to Be Aware of When Integrating Solar Combisystems in Buildings
  Together with the work packages WP2 and WP3 a document summarising the overall experience by the participants on practical aspects when installing combisystems has been elaborated.

- Solar Combisystems - European Overview of installed Systems 2001-2003
  Also delivery of Wp1,4,5

2.4 Work package 5 - Costs and financial efficiency analysis:

The result of the work is summarised in the brochure elaborated together with the WP4. The brochure give one page information on all installed systems including estimated performance and cost. Furthermore the brochure gives results of comparison of the systems

Deliveries WP 5

- Brochure on installed systems
  (also delivery of WP1,4)

- Documentation of plants, Calculation of main energy data of solar combisystems
  Document defining indicators for characterisation and comparison of presented systems .

- The FSC procedure, a powerful design tool
  The document explains the FSC procedure that is the basis of the CombiSun programme and the characterisation of the systems

2.5 Work package 6 Monitoring:

At the beginning of the project, a common monitoring procedure has been elaborated, in order to be able to compare results coming from different countries, with various meteorological conditions, DHW and space heating loads, combisystem types and collector sizes. These guidelines have been developed in coherence with recommendations coming out from the work of Task 26 on solar combisystems. They are based on the FSC method.

This monitoring procedure requires equipment which should at minimum include a pyranometer, 2 to 3 heat-meters, inside and outdoor temperature sensors and a meter for final energy used by the auxiliary boiler.

Due to various situations in the different countries with regard to the financing of monitoring equipments on a national level, it has not been possible for every country to monitor plants as required in the monitoring procedure. It was for example the case in Italy, where a "lighter" equipment was used.

Minimum 3 systems in every country are monitored and monitored results are used in the evaluations.

The monitoring in every country is described in separate reports, with approaches that could differ slightly because of the various situations in each country, as explained above, while the comparison and extrapolation of results to one-year performances, based on the common monitoring procedure, are given in another report.

Deliveries WP 6

- Monitoring procedure,
  The document gives guidelines for monitoring

- Comparison of monitored results

The document gives results of monitoring and extrapolation of monitored results to one-year results.

- 7 National reports on monitoring describes the monitoring in every country:
  - Austria: Monitoring results of three Austrian plants
  - Denmark: Monitoring of Danish combisystems
  - France: Monitoring Results for 3 French Plants
  - Germany: Monitoring Results for 3 German Plants
  - Italy: 'Solar Combisystems, Work carried out by Ambiente Italia', Milan, May 2003.
  - Sweden: Monitoring report Sweden, Status April 2003
  - The Netherlands: Monitoring Results for Three Dutch Solar Combisystems

3 Project evaluation

It is the estimation that the project has fulfilled the aims that were formulated for the project.

In particular the project has strongly stimulated the focus and interest of combisystems in the involved countries. As part of this it has efficiently dispersed information about the IEA task 26 work.

Furthermore the project has developed a number of documents and a PC programme that will be central sources of information in connection with solar combisystems in the future.

The goal of the project has been obtained by installing more than the number of systems that was foreseen in the proposal.

The construction of the systems and the monitoring has in some countries been delayed mainly because the period from raising interest in the project among industry until systems are realized in general has taken longer time than foreseen. Some countries have also suffered from delays in financing and formal acceptance. However in all countries delays have been caught up and all countries are able to deliver extrapolated monitored results.

4 Overview of project deliverables

Except for Presentations (Wp1) all deliveries are downloadable from http://www.elle-kilde.dk/altener-combi

Project documentation

Wp0	Final report. May 2003 Final project report and summary
Wp0	Interim report, October 2002 The interim report document work carried out until October 2002

Project deliveries

Wp1	Presentations A number of presentations in national language has been elaborated. The presentations are available by contacting the national contact person.
Wp1, 4, 5	Solar Combisystems - European Overview of installed Systems 2001-2003 The brochure gives a one-page information on every installed systems. The one page information gives the main data of the installation site and the system together with estimated performances and cost. The brochure also has an introduction giving an overview of the system features and markets etc. The systems are presented by a number of indicators that makes comparison of the system features possible, and which have been elaborated in the project.
Wp1	CombiSun A common PC-tool for performance estimation of the systems. The PC-programme can estimate the performance of a number of different combisystem designs, under different climates and different loads.
Wp2,3,4	Conditions and Problems to Be Aware of When Integrating Solar Combisystems in Buildings The document summarises the overall experience by the participants on practical aspects when installing combisystems.
Wp5	Documentation of plants, Calculation of main energy data of solar combisystems The document defines indicators for characterisation and comparison of installed systems.
Wp5	The FSC procedure, a powerful design tool The document explains the FSC procedure that is the basis of the CombiSun programme and the characterisation of the systems
Wp6	Monitoring procedure, The document gives guidelines for monitoring
Wp6	Comparison of monitored results report The document gives results of monitoring and extrapolation of monitored results to one-year results.
Wp6	7 National reports on monitoring describes the monitoring in every country:

	• Austria: Monitoring results of three Austrian plants
	• Denmark: Monitoring of Danish combisystems
	• France: Monitoring Results for 3 French Plants
	• Germany: Monitoring Results for 3 German Plants
	• Italy: 'Solar Combisystems, Work carried out by Ambiente Italia', Milan, May 2003.
	• Sweden: Monitoring report Sweden, Status April 2003
	• The Netherlands: Monitoring Results for Three Dutch Solar Combisystems

Appendix 1 Contacts

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Sweden	Högskolan Dalarna Solar Energy Research Center - SERC EKOS	Bengt Perers	Tel. +46 - 23 - 7787 29 Fax +46 – 23 - 7787 01 E-mail bpr@du.se http://www.du.se/ekos/serc/serc.html
	Högskolan Dalarna Solar Energy Research Center - SERC EKOS S-78188 Borlänge	Chris Bales	Tel.: +46 – 23 - 7787 11 Fax: +46 – 23 - 7787 01 e-mail: cba@du.se http://www.du.se/ekos/serc/serc.html
The Netherlands	TNO Building and Construction Research Division Building & Systems P.O. Box 49 NL-2600 AA Delft Visiting address: Schoemakerstraat 97 NL-2628 VK Delft	Huib Visser	Tel.: +31 – 15-2695246 Fax. +31 – 15-2695299 e-mail: h.visser@bouw.tno.nl http://www.bouw.tno.nl

Appendix 2, Dissemination and second workshops

Austria

Final public Workshop

The national Austrian Final Workshop took place in Graz / Hotel Europa on 13th March 2003. In total 58 Persons participated in this Workshop with the following program:

8:45 h	Coffee and registration
9:15 h	**Activities and results of IEA – TASK 26 "Solar Combisystems"**
	Dipl.-Ing. Alexander Thür, AEE INTEC, Gleisdorf
9:45 h	Discussion
10:00 h	**Overview of solar combisystems realised and documented within the ALTENER-project**
	Ing. Richard Riva, AEE INTEC, Gleisdorf
10:45 h	Discussion
11:00 h	**Detailed results of three monitored solar combisystems**
	Dipl.-Ing. Alexander Thür, AEE INTEC, Gleisdorf
11:45 h	Discussion
12:00 h	**Lunch**
14:00 h	**Activities of the Soltherm Europe-project**
	Ing. Richard Riva, AEE INTEC, Gleisdorf
14:10 h	Discussion
14:20 h	**Space heating with thermal solar systems combined with tiled stoves**
	Ing. Josef Schröttner, AEE INTEC, Gleisdorf
14:50 h	Discussion
15:00 h	**Presentation of a pre-fabricated compact space heating system**
	Ing. Gerald Jungreithmayr, Solution Solartechnik GmbH, Kirchdorf
15:20 h	Discussion
15:30 h	**Coffee**
16:00 h	**Results and experiences of several monitored projects**
	Dipl.-Ing. Alexander Thür, AEE INTEC, Gleisdorf
16:45 h	Discussion
17:00 h	**End of workshop**

In the first part an overview of the activities of IEA-SHC TASK26 and the ALTENER project "Solar Combisystems" was given to the participants. Mr. Riva presented very detailed system designs and discussed advantages and disadvantages he found out during his documentation work. The results of the three monitored solar combisystems were presented by Mr. Thür. Because of additional funding two systems could be measured in detail with data logger and therefore it was possible to show in detail the behaviour of the heating systems. After lunch experiences out of further projects were presented. Also very interesting for the participants were the monitoring results of a newly developed heating concept presented by Mr. Schröttner. This concept combines a solar thermal system with a tiled stove and shows that it is possible to heat the house and prepare domestic hot water without further auxiliary heating system. The company SOLUTION as one of

the industry partners in this project presented a newly developed, pre-fabricated compact system with the main advantage, that no mistakes on the construction site are possible any more. Finally Mr. Thür showed monitoring results of the CEPHEUS-project emphasizing on solar thermal systems as parts of the energy systems.

Time for discussion was scheduled after each presentation which was very well used by the participants. Concluding it was a very technical workshop with very interesting discussions and a lot of good inputs every participant could learn from.

A seminar book was produced and handed out to the participants directly at the workshop. For further dissemination the documents of the seminar book were sent out to the participants as pdf-files on a CD.

Industry Workshop

In addition to the final public workshop, AEE INTEC and the industry partner SOLUTION organised a workshop for professionals on 3rd Feb 2003. This workshop was part of a specific training course for technicians in the field of solar thermal. The main topics of this course were similar to the public workshop but much more technical:

- Activities and results of IEA – TASK 26 "Solar Combisystems"
- Overview of solar combisystems realised and documented within the ALTENER-project
- Detailed results of three monitored solar combisystems
- solar combisystems in multiple family houses - simulation analysis of several systems
- Results and experiences of several monitored projects

After these presentations and discussions standard hydraulic schemes of SOLUTION systems were presented and discussed to find optimised schemes with a maximum of flexibility for integration of various auxiliary boilers.
In total, 15 experts took part in this training course.

Denmark

The second seminar in Denmark of the Altener Combisystems project took place on March the 6th 2003 between 13:00 and 17:00 at the Technical University of Denmark situated in Lyngby near Copenhagen.

The seminar was arranged together with Danvak, which are the Danish Society of Heating, ventilation and air-conditioning engineers, and which hosts the Danish solar Energy Group.

On the agenda were the following items:

- Introduction of the projects IEA SHC task 26 and Altener Solar Combisystems
- Results from IEA SHC task 26 solar combisystems
- European Combisystem designs

- Methods for comparison and results.
- Optimisation of IEA task 26 system #2
- Optimisation of IEA task 26 system #4
- Results and materials from the project Altener Solar Combisystems
- PC program CombiSun
- The combisystems test facility at The Technical University of Denmark
- Related Danish R&D projects

It was attempted to arrange a computer workshop introducing CombiSun, however there were not enough people signing up for this.

At the meeting 19 persons participated. The attendance was less than at the first seminar which had 40 attendants. This probably reflects that the activity in the Danish Solar Energy Branch has decreased after subsidy was removed in 2002

France

The French final workshop was organised with support of ADEME (French Agency for Environment and Energy Management) in Lyon on March 2003 the 19th.

20 persons attended the meeting. Among them:

- 3 representatives of ADEME
- 5 of the 6 manufacturers or sellers of SCS that are subsidized by the French state. The 6th would have liked to come, but had a hitch at the last moment
- 2 of the 3 companies involved in monitoring French SCS in the national evaluation program. The 3rd should come, but had a hitch at the last moment
- a representative of the manufacturers trade union "Enerplan"
- 4 installers, members of the trade union of installers "Technosolar"

In the morning, a presentation of the main results of task 26 was made by Thomas Letz, with following topics:

- hydraulic diagrams of main European SCS
- architectural integration of systems (floor space requirements)
- used indicators (fractional thermal energy savings, fractional extended energy savings, FSC method, Cost Performance Indicators, durability and reliability indicator, ,...)
- results of intercomparison of simulated results

Then a presentation of the first results of the Altener project was made by Thomas Letz, with following topics:

- French documented systems
- Austrian monitored systems
- First results of monitoring of 3 French SCS
- Combisun presentation

Other issues were discussed in the afternoon:

- Discussion and milestones about the French national evaluation program:
  During the year 2001, discussions began with manufacturers to have other systems subsidized and sold in France. A "dissemination" program was elaborated by Ademe (French Agency for Environment and Energy Management), that allows new manufacturers to distribute SCS in the condition that they agree to participate to a parallel "evaluation" program:
    - Each manufacturer proposes a list of 10 to 30 individual projects that will be documented in details.
    - Among this list, up to 8 SCS will be monitored. Monitoring will be performed by independent companies, chosen by the manufacturer in a list.
    - Members of this list, with leadership of ASDER, have elaborated monitoring guidelines that will be applied for the evaluation process.
    - ASDER has been asked to coordinate the monitoring phase in this project, and is therefore not allowed to perform monitoring by itself.

- Discussion about design methods used by the sellers, results and indicators calculated. Each sellers was asked to give a short presentation on the design tool he uses
- It came out that there is a need of evaluation of the design tools used for dimensioning, in order to get comparable results. A specific work on this topic will be made.

A copy of the slides presented during the workshop has been distributed to each participant.

Germany

A second workshop for the industry participants of the project was
Scheduled for March 19th, 2003 at Stuttgart.

However, due to the weak interest the meeting was quite small and less formal. The current status of the project, the measurement equipment used and the future steps necessary to complete the work programme were discussed.

Furthermore, an overview on the results of IEA SH&C Task 26 was given.

Italy

The final Solar Combisystems workshop was held in frame of the Italian congress and trade fair 'Solarexpo 2003' at Verona (www.solarexpo.com) in March 2003. During the workshop the research results of IEA SH&C, Task 26 were presented by a representative of the IEA Task. The results of the Altener Solar Combisystems project in Italy were shown by the national participants. Furthermore seven manufacturers presented their products available on the Italian market. The workshop was booked out and attended by more than 300 visitors.

Sweden

Instead of one final seminar dispersion of results has in Sweden taken place by several means:

1) Since the start of March 2003 Internet, email and phone has been used to disseminate results/data/CombiSun.

2) The final seminar was planned at the 19th March 2003. Because of too little people signing up a later seminar with the largest federation of solar companies Svenska Solgruppen was planned. 12 persons attended it. The interest for IEA and Altener results was great.

3) Furthermore Combisystem seminars at SERC (one in January) have been held. They were very well attended and got good critics.

The Netherlands

Last seminar was held on 20 February 2003 at Novem in Utrecht. Subject was "Verwarming en koeling met zonne-energie" (Heating and cooling with solar thermal energy). Aim of the meeting was twofold:

(1) Knowledge transfer through presentation of just finished and ongoing projects and of new initiatives.
(2) Exchange of thoughts on the future of solar heating and solar cooling and on spearhead for further development of thermal solar in general.

Presentations (translated into English) were as follows:

- Present solar combisystems (Huib Visser - TNO) - on the end result of Task 26 of the IEA Solar Heating and Cooling programme and on test procedure development.
- Performance of solar combisystems in practice (Bert Brouwer - BEC) - on the figures and experiences.
- Set off for 100% solar fraction (Klaas Visscher - ECN) - on the future for solar combisystems on the short and long term.
- Further development of storage for solar heat (Jacob van Berkel - Entry Technology) - on the initiatives of the new Task 32 of the IEA Solar Heating and Cooling programme on solar heat storage.
- Solar driven cooling (Daniël Naron - TNO) - on the state-of-the-art in Task 25 of the IEA Solar Heating and Cooling programme and initiatives for the future.
- Spearheads for further development of solar thermal - exchange of thoughts based on advanced theses.

About 20 people attended the seminar. The character was lively also through the advanced theses at the end of all presentations. The presentations are put on CD.

Appendix 3, Overview of installed systems

No	Site	Heated Area [m²]	Inhabitants	additional heat demand	Producer	Collector Area [m²]	Store size [ltr]	Patricularities	Status	Measur-ments	Generic system type (short characterisation and/or IEA26 generic system #
Austria - Installed and planned systems											
AUT_01	Sappl (carinthia)	214	5		Sonnenkraft	20	2000		operating	detail	15
AUT_02	Villach (carinthia)		4		Sonnenkraft	30	2400		operating	no	19
AUT_03	St. Paul im Lavanttal (carinthia)		2		Sonnenkraft	32	1500		operating	no	15
AUT_04	St. Paul im Lavanttal (carinthia)	560	4 (5)	heat demand for swimming pool	Sonnenkraft	40	3000		operating	no	
AUT_05	Rotenturm (Burgenland)	95	2		Sonnenkraft	14	1000		operating	no	nearly the same as Nr. 15
AUT_06	Bad Gleichenberg (styria)	210	5		Sonnenkraft	16	800		operating	no	9
AUT_07	Neckenmarkt (Burgenland)	135	4		Sonnenkraft	22	1000	nearly everytime gas burner, sometimes wood burner	operating	no	13
AUT_08	Polsing (upper austria)	150	5		Solution	16	1000		operating	detail	10
AUT_09	Ohlsdorf (upper austria)	150	5		Solution	15	1000		operating	no	10
AUT_10	Schwand im Innkreis (upper austria)	150 (+ 500 factory)	4 (+ 4 persons staff)		Solution	20	1500		operating	no	10
AUT_11	Pürgg Trautenfels (styria)	150	only restaurant guest	much water for kitchen in restaurant	Solution	13.5	1000	wood burner for winter, gas burner during summer	operating	no	nearly the same as Nr. 13
AUT_12	Bad Gleichenberg (styria)	280	3 (+ 7 persons in summer for bed and breakfest)	during summer more hot water demand for showers	Solution	10.8	480		operating	no	8
AUT_13	Geinberg (upper austria)	180	2		Solution	15.5	1000		operating	no	10
AUT_14	Neunkirchen (upper austria)	250	5		Solution	20	1000		operating	no	10
AUT_15	Wolfsberg (carinthia)	200	5		Solution	16	800		operating	no	
AUT_16	Fischlham (upper austria)	150	4		Xolar	12	750		operating	detail	
AUT_17	Bettenbach (upper austria)	218	4		Xolar	20	750		operating	no	
AUT_18	Steinbach am Ziehberg (upper austria)	200	5		Xolar	15	1000		operating	no	9
AUT_19	Rosenau am Hengstpaß (upper austria)	150	4		Xolar	20	3000		operating	no	15
AUT_20	Ulmerfeld (lower austria)	150	4		Xolar	20	3000		operating since 1997	no	15
AUT_21	Seitenstetten (lower austria)	150	3		Xolar	10	1000		operating since 2000	no	9
AUT_22	St. Johann (lower austria)	170	2 (+4 persons on weekend)		Xolar	10	1000		operating since 2000	no	
AUT_23	Weyer (lower austria)	300	6		Xolar	20	2000		operating	no	9

No	Site	Heated Area [m²]	Inhabitants	additional heat demand	Producer	Collector Area [m²]	Store size [ltr]	Patricularities	Status	Measur-ments	Generic system type (short characterisation and/or IEA26 generic system #
Denmark - Installed and planned systems											
DK_01	9381 Sulsted	300	4		Sol & Træ	12.5	500		operating	Energy meters	Drain Back Storage in Existing Space Heating Loop
DK_02	9541 Suldrup	265	3		Sol & Træ	15.0	500		operating	no	Drain Back Storage in Existing Space Heating Loop
DK_03	9280 Stovorde	225	4		Sol & Træ	15.0	500		operating	no	Drain Back Storage in Existing Space Heating Loop
DK_04	9260 Gistrup	125	3		Sol & Træ	10.0	500		operating	no	Drain Back Storage in Existing Space Heating Loop
DK_05	9293 Kongerslev	190	2		Sol & Træ	10.0	500		operating	no	Drain Back Storage in Existing Space Heating Loop
DK_06	8305 Samsø	170	2		Brdr. Stjerne	12.0	800		operating	no	Strat. Store/ext heat exch.
DK_07	7790 Thyholm	160	4		Brdr. Stjerne	15.0	700		operating	no	Strat. Store/ext heat exch.
DK_08	7500 Holstebro	420	10		Brdr. Stjerne	20.0	1000		operating	no	Strat. Store/ext heat exch.
DK_09	7760 Hurup Thy	200	4		Brdr. Stjerne	18.0	1000			no	Strat. Store/ext heat exch.
DK_10	4100 Ringsted	350	10		Batec A/S	12.6	900		operating	no	#9 Tank in tank
DK_11	4480 Store Fuglede.	175	3		Batec A/S	9.0	900		operating	no	#9 Tank in tank
DK_12	3300 Frederiksværk	140	2		Batec A/S	11.0	750		operating	no	#9 Tank in tank
DK_13	3330 Gørløse				Batec A/S	9.0	500		operating	no	#9 Tank in tank
DK_14	8400 Æbeltoft	348	3		Batec A/S	12.0	900		operating	Energy meters	#9 Tank in tank
DK_15	5560 Aarup	156	4		Batec A/S	9.0	280		operating	no	#2 Heat Exchanger between Collector Loop and Space Heating Loop
DK_16	4241 Vemmelev	180	2		Batec A/S	15.0	280		operating	no	#2 Heat Exchanger between Collector Loop and Space Heating Loop
DK_17	4671 Strøby		5		Batec A/S	9.0	280		operating	Energy meters	#2 Heat Exchanger between Collector Loop and Space Heating Loop
DK_18	3460 Birkerød	160	4		Batec A/S	6.0	280		operating	no	#2 Heat Exchanger between Collector Loop and Space Heating Loop
DK_19	Østerbyvej 13, 6980 Tim				Batec A/S	12.0	280		operating	no	#2 Heat Exchanger between Collector Loop and Space Heating Loop

No	Site	Heated Area [m²]	Inhabitants	additional heat demand	Producer	Collector Area [m²]	Store size [ltr]	Patricularities	Status	Measur-ments	Generic system type (short characterisation and/or IEA26 generic system #
France - Installed and planned systems											
F_01	74 750 THORENS-GLIERES	200	2	oil	CLIPSOL	26.6	530.0		operating		#3a modified
F_02	05600 EYGLIERS	190	5	electricity	CLIPSOL	28.0	500.0		operating		#3a
F_03	73540 ESSERTS BLAY	91	3	electricity	CLIPSOL	10.8	330.0		operating		#3a
F_04	38350 MARCIEU	200	4 to 20	electricity	CLIPSOL	20.8	1000.0	antifreezing for holiday house	operating		#3a
F_05	74250 BOGEVE	100	4	electricity	CLIPSOL	15.7	500.0		operating	detailed since september 2002	#3a
F_06	43 CHAMBON SUR LIGNON	220	4 to 20	wood chimney	CLIPSOL	23.6	500.0	antifreezing for holiday house	operating		#1
F_07	73230 ST ALBAN LEYSSE	190	1	oil	CLIPSOL	20.4	330.0	won a national solar award in 2002	operating	detailed since september 2002	#3a
F_08	73 ST OFFENGE	100	4	wood pellet stove	CLIPSOL	10.8	330.0		operating		#1
F_09	35160 BRETEIL	160	4	propane gas	CLIPSOL	14.7	330.0		operating		#3a
F_10	42260 CREMEAUX	104	5	wood	CLIPSOL	15.8	330.0		operating		#1
F_11	73720 QUEIGE	150	4	wood log	CLIPSOL	16.1	830.0		operating		#3a modified
F_12	74 750 THORENS-GLIERES	220	4	oil	CLIPSOL	32.5	330.0		operating		#3a
F_13	73 270 VILLARD SUR DORON	100	4	propane gas	CLIPSOL	17.4	330.0		operating		#3a
F_14	38350 LA SALLE EN BEAUMONT	120	5	oil	CLIPSOL	18.8	330.0		operating		#3a
F_15	05100 BRIANCON	180	2	oil	CLIPSOL	18.8	330.0		operating		#3a
F_16	05000 GAP	130	5	electricity	CLIPSOL	18.3	330.0		operating		#3a
F_17	84140 MONTFAVET	150	4	natural gas	CLIPSOL	19.3	330.0		operating	detailed since october 2002	#3a
F_18	84490 ST SATURNIN LES APT	140	5	oil	CLIPSOL	17.4	330.0		operating		#3a
F_19	35660 LANGON	126	2	propane gas	CLIPSOL	13.1	330.0		operating		#3a
F_20	22120 QUESSOY	160	4	wood log	CLIPSOL	18.1	330.0		operating		#3a
F_21	73190 CHALLES LES EAUX	112	2	natural gas	CLIPSOL	14.7	330.0		operating		#3a modified
F_22	26110 CONDORCET	140	3	wood log	SONNENKRAFT	15.4	830.0		operating		#9 modified
F_23	30130 PUJAUT	120	2	propane gas	SONNENKRAFT	15.4	1000.0		operating		#9 modified

No	Site	Heated Area [m²]	Inhabitants	additional heat demand	Producer	Collector Area [m²]	Store size [ltr]	Patricularities	Status	Measur-ments	Generic system type (short characterisation and/or IEA26 generic system #
Germany - Installed and planned systems											
GER_01	Binzen	140	2	oil	Solvis GmbH & Co KG	8.70	650.00		operating	detailed	#15, integrated auxiliary burner (oil)
GER_02	Königslutter	113	3	oil	Solvis GmbH & Co KG	9.40	450.00		operating	none	#15, integrated auxiliary burner (oil)
GER_03	Wendhausen	120	5	oil	Solvis GmbH & Co KG	8.40	450.00		operating	none	#15, integrated auxiliary burner (oil)
GER_04	Königslutter	100	2	gas	Solvis GmbH & Co KG	11.20	500.00		operating	none	#15, integrated auxiliary burner (gas)
GER_05	Adensen	150	2	gas	Solvis GmbH & Co KG	9.00	650.00		operating	none	#15, integrated auxiliary burner (gas)
GER_06	Königslutter	115	3	gas	Solvis GmbH & Co KG	8.40	400.00		operating	none	#15, integrated auxiliary burner (gas)
GER_07	Wittmar	120	3	gas	Solvis GmbH & Co KG	8.40	400.00		operating	detailed	#15, integrated auxiliary burner (gas)
GER_08	Evessen	386	10	gas	Solvis GmbH & Co KG	10.00	750.00		operating	detailed	#15, integrated auxiliary burner (gas)
GER_09	Erkerode	120	2	gas	Solvis GmbH & Co KG	6.90	500.00		operating	none	#15, integrated auxiliary burner (gas)
GER_10	Bergisch-Gladbach	105	2	gas	Solvis GmbH & Co KG	6.90	400.00		operating	none	#15, integrated auxiliary burner (gas)
GER_11	Evessen	120	3	gas	Solvis GmbH & Co KG	11.20	500.00		operating	none	#15, integrated auxiliary burner (gas)
GER_12	Wolfenbüttel	120	2	gas	Solvis GmbH & Co KG	6.90	500.00		operating	none	#15, integrated auxiliary burner (gas)
GER_13	Wolfenbüttel	130	4	gas	Solvis GmbH & Co KG	6.90	500.00		operating	none	#15, integrated auxiliary burner (gas)
GER_14	Wolfenbüttel	110	3	gas	Solvis GmbH & Co KG	6.90	500.00		operating	none	#15, integrated auxiliary burner (gas)
GER_15	Braunschweig	80	2	gas	Solvis GmbH & Co KG	5.50	500.00		operating	none	#15, integrated auxiliary burner (gas)
GER_16	Braunschweig	120	4	gas	Solvis GmbH & Co KG	6.90	400.00		operating	none	#15, integrated auxiliary burner (gas)
GER_17	Evessen	115	3	gas	Solvis GmbH & Co KG	5.50	400.00		operating	none	#15, integrated auxiliary burner (gas)
GER_18	Völkenrode	150	3	gas	Solvis GmbH & Co KG	8.40	500.00		operating	none	#15, integrated auxiliary burner (gas)
GER_19	Cremlingen	145	2	gas	Solvis GmbH & Co KG	5.50	500.00		operating	none	#15, integrated auxiliary burner (gas)
GER_20	Ansgar	160	5	gas	Solvis GmbH & Co KG	10.80	950.00		operating	detailed	#15, integrated auxiliary burner (gas)
GER_21	Stuttgart	130	4	gas	Paradigma	8.50	550.00		operating since Dec 2001	detailed	Stratified Storage System
GER_22	Meßstetten	130	3	oil	Auriga	11.20	750.00		operating	detailed	Tank-in-Tank
GER_23	Hechau	250 m²	6	gas	Solvis GmbH & Co KG	11	655 l		operating	none	#15, integrated auxiliary burner (gas)

No	Site	Heated Area [m²]	Inhabitants	additional heat demand	Producer	Collector Area [m²]	Store size [ltr]	Patricularities	Status	Measur-ments	Generic system type (short characterisation and/or IEA26 generic system #
Sweden - Installed and planned systems											
SWE_01	Örebro	*150*	4	electricity,and wood	Aquasol	17	1500	Electric "after heater" on DHW	Operting since about one year	since september 2002	
SWE_02	Falun	*150*	2		Energiverkstan i Dalarna AB	8	620	Pellets burner instegrated in the tank	Operating since about one year	since october 2002	
SWE_03	Uppsala	*180*	6		STT /heat pump company	13	300	Heat pump and sesonal borehole storage Advanced control	Operting since January 2002	since June 2002	
SWE_04	Köping	*120*	4		NILA energi	9.6	750		Operating aug 2002		
SWE_05	Falun	*140*	4		Energiverkstan i Dalarna AB	9.6	750		Operating mars 2003		
SWE_06	Falun	*130*	6		Energiverkstan i Dalarna AB	9.6	1400		Operating sept 2002		
SWE_07	Falun	*180*	4		Energiverkstan i Dalarna AB	9.6	1700		Operating april 2003		
SWE_08	Falun	*160*	2		Energiverkstan i Dalarna AB	9.6	750		Operating april 2003		
SWE_09	Götene	*100*	1		Höjentorps Energi o Miljö	9.6	500		Operating nov 2001		
SWE_10	Götene	*140*	2		Höjentorps Energi o Miljö	12.8	1500		Operating okt 2001		
SWE_11	Uddevalla	*150*	2		Ferm Energi	12.8	3000	Wood Burner			
SWE_12	Lysekil	*150*	2		Ferm Energi	9.6	750	Wood Burner			
SWE_13	Ljungskile	*250*	8		Ferm Energi	12.8	1800	Wood Burner			
SWE_14	Ljungskile	*130*	1		Ferm Energi	6.4	500	Electricity backup			
SWE_15	Uddevalla	*180*	2		Ferm Energi	9.6	1500	Electricity + Pellets backup			
SWE_16					Leif Göransson Solteknik	18.7	3000	Wood burner + Local distr network			
SWE_17	Örebro	*170*	4	electricity,and wood	Aquasol	26	1500	Electric "after heater" on DHW	Operting since about one month		
SWE_18	Kvarntorp	*160*	2	wood	Aquasol	26	1800		Operting since about 2001		
SWE_19	Glanshammar	*210*	2	wood, and electricity	Aquasol	26	1500	Electric "after heater" on DHW	Operting since about 2001		
SWE_20	Åsta, Glanshammar	*150*	3	Wood	Aquasol	17.2	2250		Operting since about 2002		
SWE_21	Attersta, Örebro	*140*	4	wood	Aquasol	10.5	1500		Operating since about 2003		
SWE_22	Örebro	*140*	4	wood	Aquasol	12.36	1000	Electric "after heater" on DHW	Operating since about 2003		
SWE_23	Kristenhamn	*150*	4	wood, and electricity	Aquasol	8.6	500		Operating since about 2003		
SWE_24	Örebro	*160*	3	electricity	Aquasol	17.2	1000		Operating since about 2002		
SWE_25	Garphyttan	*140*	5	wood	Aquasol	17.2	1500	Electric "after heater" on DHW	Operating since about 2002		
SWE_26	Frövi	*150*	3	wood	Aquasol	26	1500		Operating since about 2001		
SWE_27	Åsta, Glanshammar	*150*	2	wood	Aquasol	8.6	1000		Operating since about 2001		
SWE_28	Frövi	*110*	3	wood & oil	Aquasol	13	750		Operating since about 2001		
SWE_29	Kristinehamn	*130*	2	wood, and electricity	Aquasol	10.5	1000	Electric "after heater" on DHW	Operating since about 2003		

No	Site	Heated Area [m²]	Inhabitants	additional heat demand	Producer	Collector Area [m²]	Store size [ltr]	Patricularities	Status	Measur-ments	Generic system type (short characterisation and/or IEA26 generic system #
Italy - Installed and planned systems											
ITA_01	Villarbasse (Torino)	160	4	delivery of DHW to 7 additional persons in summer	Sonnenkraft	23.1	2000		operation since mar 03	detailed since mar 03	similar to #15
ITA_02	Bussoleno, Val di Susa (Torino)	90	4		self-built	7.6	600		operation since dic 03	light	#9, connected with pellets stove
ITA_03	Chivasso (Torino)	2800	45 persons staff, 100 persons for examination	air treatment of cooling system	Wagner & Co	60.8	4500		construction mar 03	light	similar to #13
ITA_04	Moncalieri (Torino)	324	4		Menegatti	14	1250		rennovation mar 03	light	similar to # 13, renovation of an existing plant
ITA_05	Avigliana (Torino)	110	4		Sonnenkraft	8.9	800		construction mar 03	light	#9
ITA_06	Rivanazzano (Pavia)	290	4	swimming pool	Sonnenkraft	23.1	2000		operation since oct 01	light since mar 02	similar to #15, antifreezing for holiday house
ITA_07	Paderno Franciacorta (Brescia)	70	3		Enerpoint, Ruesch	18.5	2000		operating since oct 01	light since mar 02	#9
ITA_08	Magenta (Milano)	*400*	2	swimming pool	Paradigma	14	*990*		operation since oct 02	detailed since dic 02	#16
ITA_09	Albiolo (CO)	*250*	4		Enerpoint, Ruesch	13.9	*500*		operating since dic 02	light since mar 03	similar to #2
ITA_10	Menaggio (Como)	508	no dhw heating	swimming pool	Enerpoint, Ruesch	20.9	*900*		operating	light since aug 02	similar to #9
ITA_11	Mergozzo (Verbania)	*160*	2	swimming pool	self-built	9.6	600		operating since dic 02	light since dec 02	#9
ITA_12	Comignago (Novara)	*70*	1	delivery of DHW to 4 additional persons in summer	Sonnenkraft	11.5	*800*		operating since oct 01	light since oct 01	#9, dhw for 5 persons in summer
ITA_13	Revello (Cuneo)	*160*	2		Sonnenkraft	11.5	*800*		operating since aug 02	light since oct 02	#9
ITA_14	Bolzano	120	4		Solvis	10.2	950		operating	detailed since apr 2002	#15
ITA_15	Vaprio d'Agogna (NO)	*210*	2		self-built	7.6	500		operating since aug 02	light since sep 02	similar to #4

No	Site	Heated Area [m²]	Inhabitants	additional heat demand	Producer	Collector Area [m²]	Store size [ltr]	Patricularities	Status	Measur-ments	Generic system type (short characterisation and/or IEA26 generic system #
The Netherlands - Installed and planned systems											
NEL_01	Millingen a.d. Rijn	163	4		Daalderop	4.61	180	low temperature floor heating	In operation since August 2002	light	6
NEL_02	St. Hubert	149	4		ATAG Verwarming	3	200	low temperature floor heating	In operation since August 2002	light	4
NEL_03	Loosbroek	200	3		ATAG Verwarming	4.49	200	low temperature floor heating	In operation since May 2002	light	4
NEL_04 - NEL_35	Brunssum	95	2-3		Daalderop	4.61	180	radiator heating; passive solar houses	In operation since September 2001	light	6
NEL_36 - NEL_89	Heerlen	122	2-5		ATAG Verwarming	6	240	low temperature wall heating; passive solar houses	In operation since January 2001	light	5
NEL_90	Dalem	128	2		ATAG Verwarming	4.49	240	low temperature floor heating	In operation since September 2001	light	5