Solar Combisystems – Changes on the market place since Task beginning

A Report of IEA SHC - Task 26

Solar Combisystems

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Solar Combisystems – Changes on the market place since Task beginning

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A technical report of Subtask A

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Contents

1 Introduction

In the first year of Task 26, the participants performed a review of the generic solar combisystems found on the market in the participating countries. The review was published as a 44-pages coloured booklet [1] as well as on the Task 26 web site. These publications have formed the basic background for all Task 26 activities.

In the course of the Task, Norway joined the 9 participating countries. Accordingly, the Norwegian system was included into the review as the generic system #9b. This inclusion was made only on the web site.

In May 2002 the SHC Executive Committee requested that the changes encountered on the market place since the Task beginning be compiled in order to perform a very first assessment of the impact of Task 26 on the market. This compilation has also been needed ahead of the preparation of the Task Final Deliverable, the Design Handbook for Planners, which will be published as a publicly available book, i.e. without any reference to [1].

The present Technical Report is the Task's response to the two above mentioned needs. It has been edited on the basis of an inquiry among the Task participants. It should be noticed that Finland left Task 26 one year before its completion; therefore, the Finnish participants were not included in the inquiry and no recent information is available for System #7.

The changes encountered since 1999 are presented in Chapter 2. At the same time, a few minor errors found in [1] are listed for the sake of completion.

2 What has changed on the market place since 1999?

2.1 Generic system #1, Basic Direct Solar Floor

(communicated by Philippe Papillon and Thomas Letz, France)

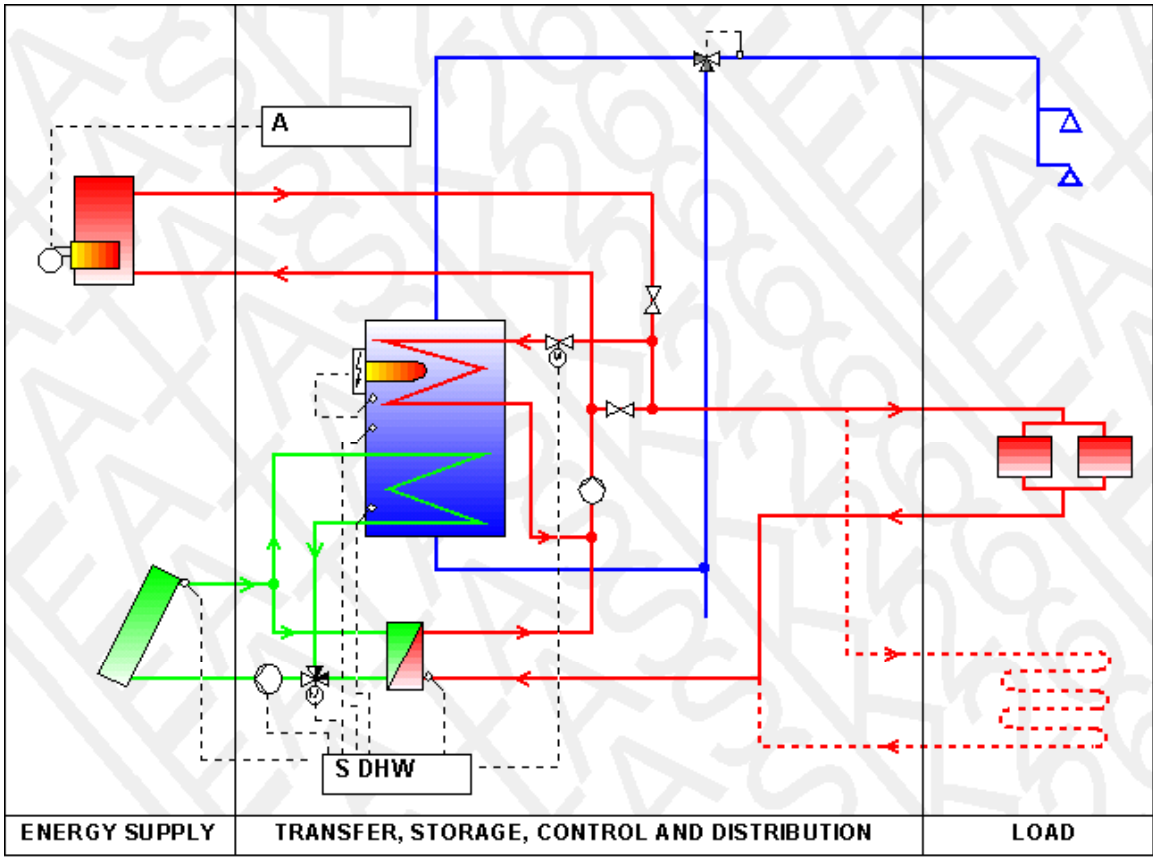
Market expansion for direct solar floors.
Number of systems sold in 2001: about 60.
Stable cost.

2.2 Generic system #2, Heat Exchanger between Collector Loop and Space-Heating Loop

(communicated by Klaus Ellehauge, Denmark)

In [1], System #2 has been represented with an external boiler as the only auxiliary heater. However, an optional electric auxiliary heater is often used in the summer time instead of the gas or oil boiler, and the boiler is turned off in this season.

The complete hydraulic scheme is as follows:

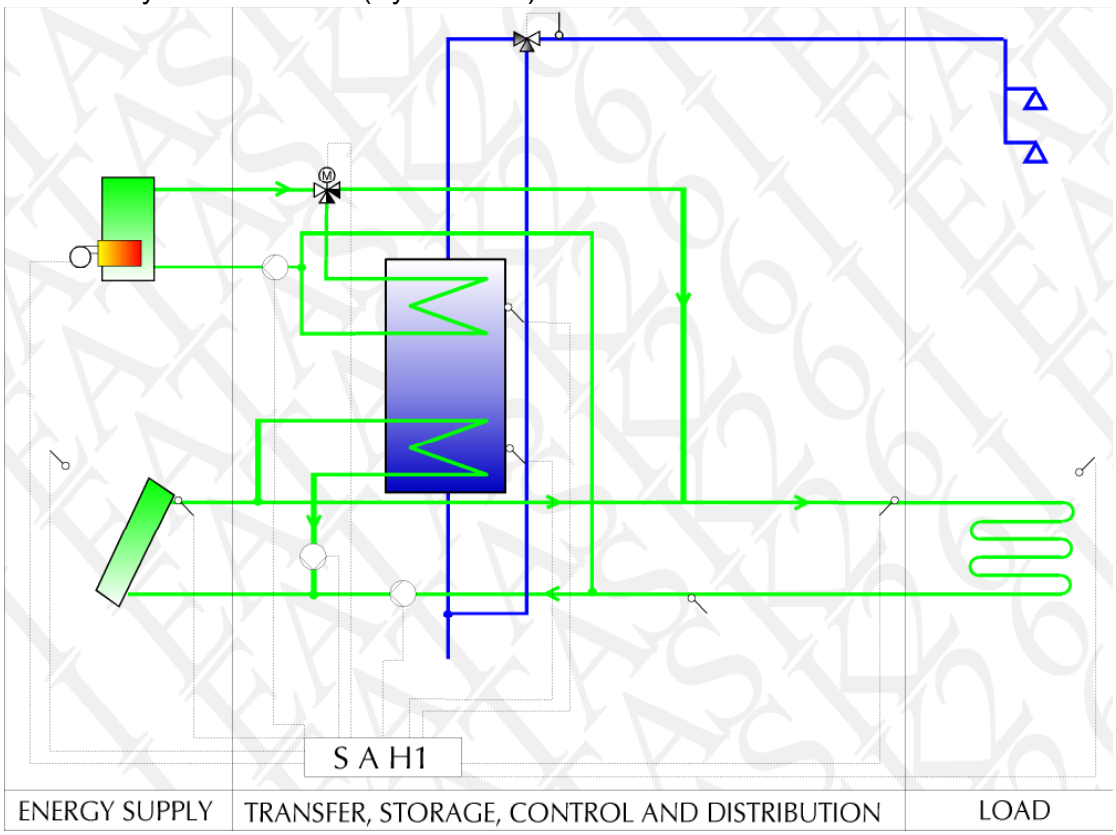


2.3 Generic system #3, Advanced Direct Solar Floor

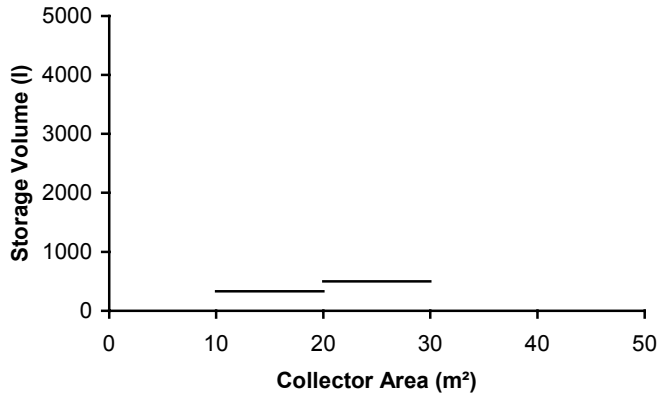
(communicated by Philippe Papillon and Thomas Letz, France)

System #3 is no longer manufactured. It has been replaced by System #3a with a simplified hydraulic scheme compared with System #3.The two DHW storage tanks have been replaced by a single one with two immersed heat exchangers. However, the heat management philosophy remains unchanged.

The new hydraulic scheme (System #3a):



New relation between storage tank volume and collector area:



Market expansion for direct solar floors.
Number of systems sold in 2001: about 240. Period 1999-mid 2002: more than 400 units sold.
Stable cost.

2.4 Generic system #4, DHW Tank as a Space-Heating Storage Device

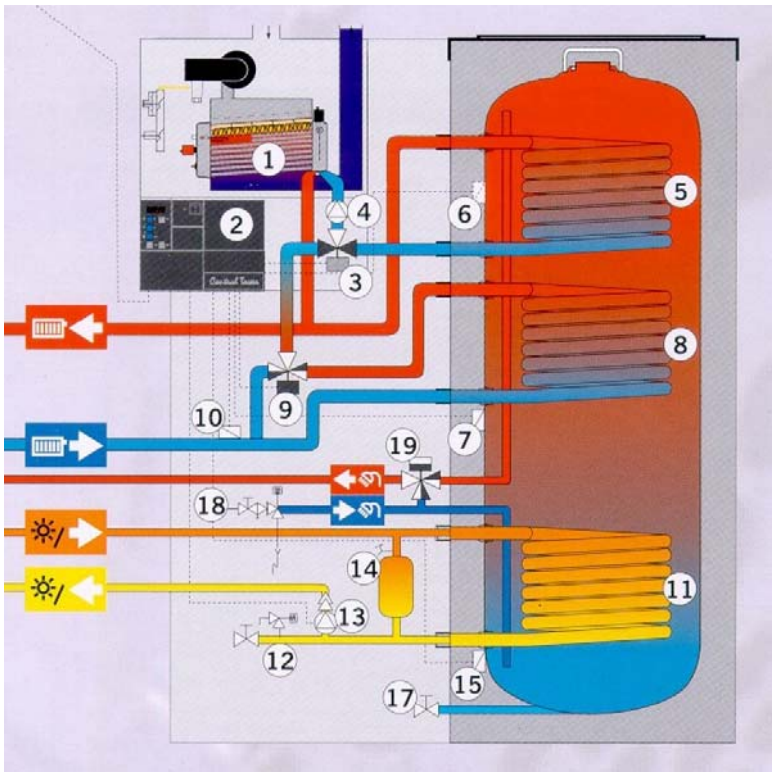
(communicated by Klaus Ellehauge, Denmark)

This system is not marketed and sold very much.

2.5 Generic system #5, DHW Tank as Space-Heating Storage Device with Drainback Capability

(communicated by Huib Visser, the Netherlands)

This system is no longer manufactured. The manufacturer moved to a system similar to generic System #4, however still with a drainback capability. The new system is easier to handle at installation time: the whole storage/auxiliary equipment is subdivided into two factory-assembled parts. The first one includes the auxiliary heater, a condensing gas burner. This part is mounted above the second one which includes the store (still filled with DHW) and all other components, as sketched below:



Solar combisystem with 'click-on' auxiliary. The auxiliary heater comprises (1) stainless-steel heat exchanger, (2) control management system including solar module, (3) 3-way valve and (4) system pump. The heat store contains (5) hot water heat exchanger, (6) hot water sensor, (7) sensor for control of the 'space heating / solar' 3-way valve, (8) space heating heat exchanger, (11) collector loop heat exchanger and (15) store sensor for collector loop control. Inside the system case, there are also (9) 'space heating / solar' 3-way motor valve, (10) 'space heating / solar' return sensor, (12) filling and draining point for the collector loop, (13) collector pump with flow restriction, (14) drainback tank with level tap, (17) tap for heat store drainage, (18) cold water inlet combination with safety valve and (19) thermostatic mixing device. Not in the figure is (16) collector sensor for collector loop control.

Recent market figures from the Netherlands are given globally with System #6. See next paragraph.

2.6 Generic system #6, Heat Storage in DHW Tank and in Collector Drainback Tank

(communicated by Huib Visser, the Netherlands)

The second Dutch manufacturer also has a two-part system, according to System #6 in [1]. The part with the auxiliary heater is mounted above the second one, each part being pre-assembled in the factory. Installation is easy and the required floor area is indeed very small.

The Dutch market share for solar combisystems of both types #4 and #6 globally considered, increased in recent years from about 5% of all sold solar heating systems to about 15%. This corresponds to 750 sold systems in 2000 and 950 in 2001. These figures apply to small system sizes as described in [1].

2.7 Generic system #8, Space Heating Store with Double Load-Side Heat Exchanger for DHW

(communicated by Thierry Pittet, Switzerland)

Since the beginning of Task 26, System #8 has been modified several times. The objective was to introduce the improvements identified by the researchers into the manufacturer's production. The following steps have been done:

Thermal losses of the tank (kWh)

Year 1999

2760

(0 %)

Year 2000

2659

(- 4 %)

1833

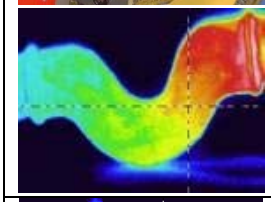
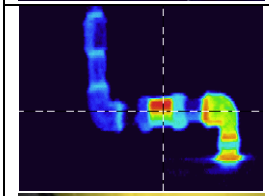
(- 34 %)

Year 2001

1726

(- 37 %)

Year 2002

	Improvements	Average tank temp-erature	F_{sav} and relative gain
	Original combisystem	49.2 °C	28%
	Flow break added on the inlet space-heating return pipe	48.4 °C	29.3% (+5%)
 	Improved burner insulation Siphon traps added on inlet and outlet of space-heating connecting pipes	50.7 °C	32.8% (+17%)
 	Improved insulation of tank bottom Siphon traps on collector loop pipes Piece of wood added under the tank	51.1 °C	32.8% (+17%)

2.8 Generic system #11, Space Heating Store with DHW Load-Side Heat Exchanger(s) and External Auxiliary Boiler

(communicated by Chris Bales and Peter Kovacs, Sweden)

This is still the dominant type on the Swedish market and is also still sold by many different small companies. Most still sell the same system but with different versions of the collector. However, a few system changes have been made:

- There is now a space-heating store with integrated pellets burner much as the store in the Swiss System #8. This is called the BioSol boiler and is sold by several different companies. The store has extended (vertically) heat exchangers for preheating the hot water and for the collector circuit – this has been shown to improve performance of the system.
- Other stores have also come onto the market with more optimised inlet and outlet heights for the heat exchangers as with the BioSol boiler. This means that the pre-heating of DHW in the bottom of the store that used to be applied only in some stores, today is the standard solution when using coil heat exchangers.
- The work reported within Task 26 on overheating protection has made at least one company change to a low-pressure collector circuit where during stagnation the contents of the collector are pushed down into an expansion vessel.
- Some companies also sell a variation of System #11 with the internal heat exchangers for preparation of DHW replaced with an external load-side DHW unit. This is still only a small market segment as yet.

2.9 Generic system #12, Space Heating Store with DHW Load-Side Heat Exchanger(s) and External Auxiliary Boiler (Advanced Version)

(communicated by Chris Bales and Peter Kovacs, Sweden)

No significant changes. The system is still sold but has a smaller market share than at the start of the Task.

2.10 Generic system #15, Two Stratifiers in a Space Heating Storage Tank with an External Load-Side Heat Exchanger for Domestic Hot Water

(communicated by Thomas Krause and Dagmar Jaehnig, Germany)

A number of improvements have been made for this system:

- The external load-side heat exchanger for DHW is now located apart from the store. Previously, it was located under the store insulation. Moreover, a new thermostatic valve is mounted on the heat exchanger inlet line from the store, to limit the inlet temperature to 65 °C. The new design facilitates maintenance and provides a better protection against scaling of the heat exchanger.
- The exhaust gas heat exchanger of the condensing gas burner has been improved, resulting in a cost reduction and a 1% higher burner efficiency in the heating period when there is only a negligible solar contribution.
- A new controller is now provided, which is able to control 2 instead of only 1 space-heating loops with mixing valves. The integration of this additional control function saves EUR 1340 for the customer, compared with the acquisition of a second separate control unit for the second space-heating hydraulic loop.

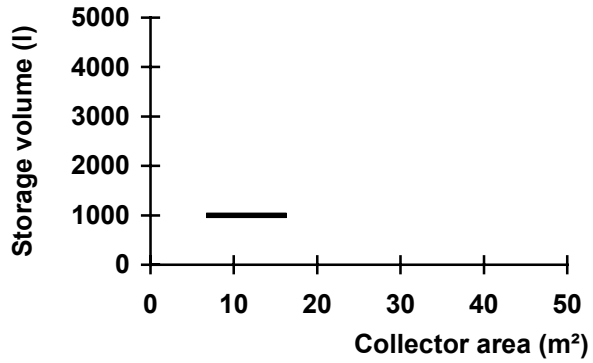
The new market figures are: more than 3'000 systems and more than 20'000 m^2 of solar collectors sold to date. The manufacturing company and the product distribution company have been merged. The new single company's name is Solvis GmbH & Co. KG.

2.11 Generic system #17, Tank Open to the Atmosphere with Three Heat Exchangers

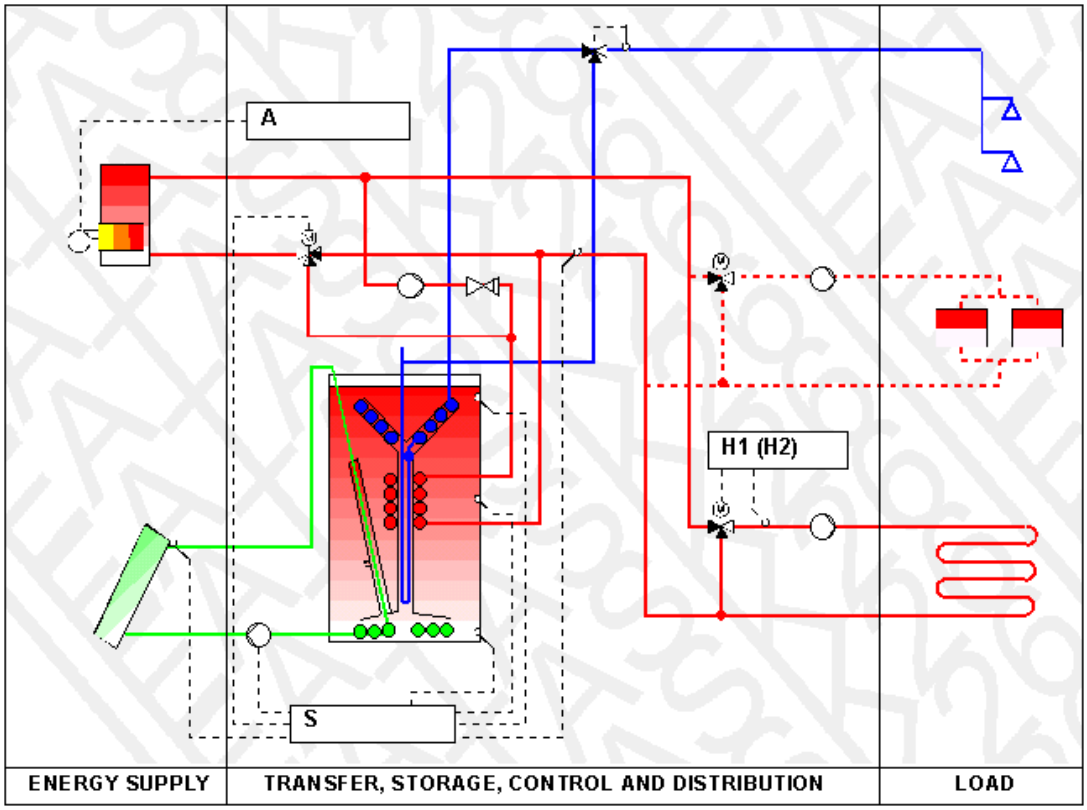
(communicated by Andreas Siegemund, Germany)

The following changes have been made since the beginning of the Task:

- Range of collector area and storage volume: The new range is 7 to 16 m^2 at 1'000 L



- The automatic change between summer and winter modes is no longer an option but a standard feature of the control unit.
- Two temperature sensors on the flow and control lines of the collector loop are no longer used by the control unit. Compare the new hydraulic scheme with the former one in [1]. Note: By the way a drawing error involving the cold water connection of the DHW mitigation valve has been corrected.



New market figures: The total collector area in operation is about 14'400 m^2 (previously 10'000) with about 1'800 systems (previously 1'400) installed by 450 companies in several countries: Germany, Austria, Italy (new), France (new), Switzerland, Spain and Belgium.

2.12 Generic system #18, Finned-Tube Load-Side DHW Heat Exchanger in Stratifier

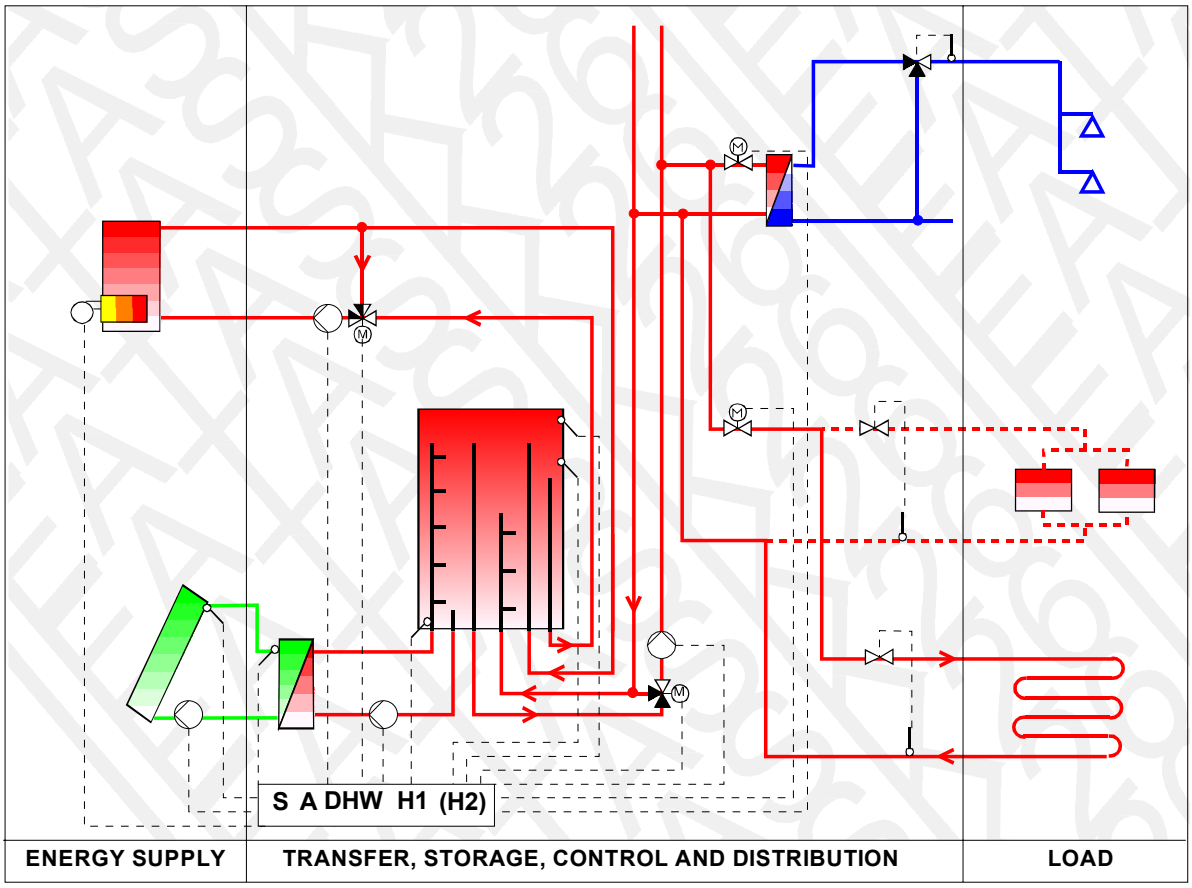
(communicated by Klaus Vajen, Germany)

This system disappeared from the market. It was a little bit too expensive. In Germany, the market trend is towards simpler and cheaper systems.

2.13 Generic system #19, Centralised Heat Production, Distributed Heat Load, Stratified Storage

(communicated by Wolfgang Streicher and Werner Weiss, Austria)

The main changes are related to the replacement of the decentralised DHW storage tanks in the individual flats by decentralised once-through heat exchanger units, according to the following hydraulic scheme:



Accordingly, the local heating network is now continuously operated at about 60 ºC. Previously, it was operated at a lower temperature (about 40 ºC) except in the periods of time needed to reload the decentralised DHW storage tanks. During these periods the space heating was switched off and the network operated at 65 to 70 ºC. The new compact heat delivery stations mounted in the flats include heat and water meters, the DHW heat exchanger, the DHW and space-heating control unit and all pipe work and valves. The load-side DHW heat exchangers prevent any legionella problem. The local heating network return line usually has a temperature below 30 ºC at the storage tank. This is good for high solar inputs from the collectors.

The heat management philosophy has been modified as follows:

- The biomass boiler starts up when the solar yields are insufficient to heat the tank above 60 ºC. It runs until the middle sensor shows approximately 65 ºC. This temperature level in the upper part of the store is needed to provide about 50 ºC at the primary side of the DHW once-through heat exchangers.

- The volume for the storage of the auxiliary heat is calculated according to the expected peak heat load and the heat power of the auxiliary heater.
- The space-heating distribution system in the dwellings is calculated using a maximum design flow temperature of 50 ºC.
- The local network flow temperature is kept constant at about 60 ºC. There is one or two differential-pressure-regulated network pumps. In the case of two, they are of different size and operated in parallel.
- The DHW heat exchanger is kept to a temperature of about 50°C at the inlet, over the whole year by a small mass flow rate through the heat exchanger all the time. If a DHW demand occurs, the valve on the primary side of the DHW heat exchanger opens and the mass flow through the valve is controlled by the DHW set-point temperature. The heat exchanger is designed for a maximum DHW demand up to 15 L/min.

The new market figures are: This system has been marketed in Austria since 2000 and several systems, with a total collector area of more than 4'000 m^2, have been sold. Several companies manufacture and market this system. So far, it has only been installed in Austria. Manufacturers: Sonnenkraft GmbH, SOLID, others (see http://www.gswb.at).

2.14 Generic system #21, Large Stratified Storage Tank for Seasonal Heat Storage, Air Heating System

(communicated by Klaus Vajen, Germany)

In Germany the market for large solar combisystems with long-term storage capability as described in [1], is negligible. System #21 in [1] with its 87 m^3 storage volume has still to be considered as a prototype.
Note: Here, we do not address the largest solar heating systems with seasonal heat storage in water or ground material with volumes as large as 10'000 to 100'000 m^3.

3 References

[1] Jean-Marc Suter, Thomas Letz, Werner Weiss, Jürg Inäbnit (Ed.); Solar Combisystems in Austria, Denmark, Finland, France, Germany, Sweden, Switzerland, the Netherlands and the USA – Overview 2000
IEA SH&C Task 26 Solar Combisystems, 2000, ISBN 3-905583-00-3