Report on Solar Combisystems Modelled in Task 26

Appendix 4:
Generic System #8: Space Heating Store with Double Load-Side Heat Exchanger for DHW

A Report of IEA SHC - Task 26

Solar Combisystems

December 2002

Jacques Bony
Thierry Pittet

INTERNATIONAL ENERGY AGENCY
Solar Heating & Cooling Programme

Report on Solar Combisystems Modelled in Task 26

Appendix 4:
Generic System #8: Space Heating Store with Double Load-Side Heat Exchanger for DHW

by

Thierry Pittet* and Jacques Bony**
Thierry.pittet@eivd.ch
Agena.jbony@bluewin.ch

A technical report of Subtask C

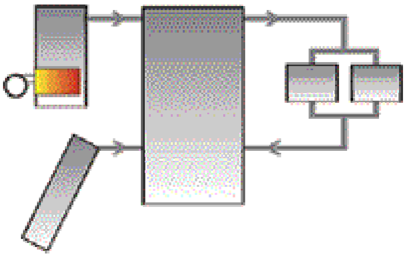
*EIVD
University of applied sciences
Route de Cheseaux 1
Case postale
CH-1401 Yverdon-les-Bains
Switzerland

**AGENA ENERGIES
Solar collector and heating systems
Avenue du grand-Pré
CH-1510 Moudon
Switzerland

Contents

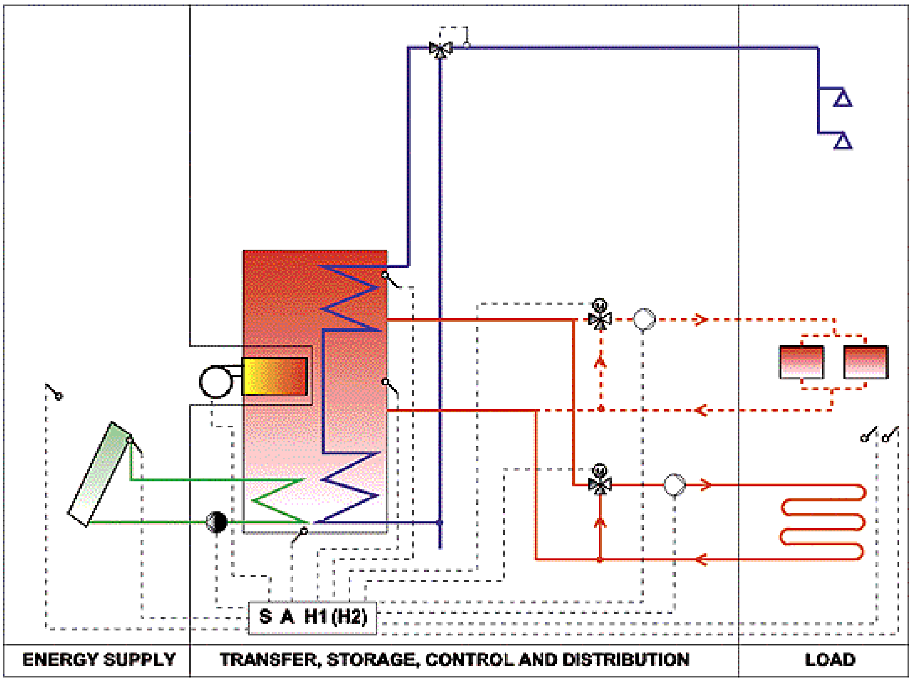
1 General description of System #8 Space Heating Store With Double Load-Side Heat Exchanger For DHW

(Switzerland)



Main features

This system is a compact unit for space heating and DHW, with an integrated gas or oil burner. The storage tank is fitted out with two immersed horizontal finned-coil heat exchangers (one in the upper and one in the lower part) for DHW preparation and a third one in the bottom for the collector loop



Heat management philosophy

The speed of the collector loop pump is varied in accordance with the temperature in the middle of the tank and the temperature difference between the collector outlet and the bottom of the storage tank. The storage tank set-point temperature, which controls the auxiliary burner, is automatically adjusted to the space heating needs. The controller is able to anticipate when solar heat is available from the collector and switch off the burner. Space heating is managed by the controller, taking into account solar passive gains detected by a second room temperature sensor. In the case of heating floors, a storage tank discharge can be forced in order to store heat in the building structure. In such a case, the room temperature may deviate from its set-point value by as much as 5°C. The control strategy is designed to adjust the start time to improve thermal comfort.

Specific aspects

One single controller is in charge of the whole system (collector loop, DHW, space heating and auxiliary burner), with a display that indicates proper operation. Overheating is prevented by cooling the lower part of the storage tank after the sun has set by using the collector as a heat sink. There is no legionella risk because DHW doesn't stagnate in the storage tank.

Influence of auxiliary energy source on system design and dimensioning

This system can be used with a gas or oil auxiliary burner. Alternately, a wood boiler can be connected directly to the lower part of the storage tank. In such a case, the boiler should be used cautiously to avoid competition between solar and auxiliary energies in the commonly used, lower section of the storage tank.

Cost (range)

The total cost of the whole system with a gas or oil burner is about 20 000 to 23 000 EUR, for a collector area of 8 to 16 m². Installation costs and a heating floor are included in these figures. A similar reference system without solar heating costs about 11 000 EUR.

Market distribution

This system is rather new in Switzerland (1998). At the end of 1999, 25 systems have been installed with a total collector area of about 300 m². Two companies are marketing this system.

This system is presented thanks to the Swiss Federal Office of Energy

2 Modelling of the system

2.1 *TRNSYS model*

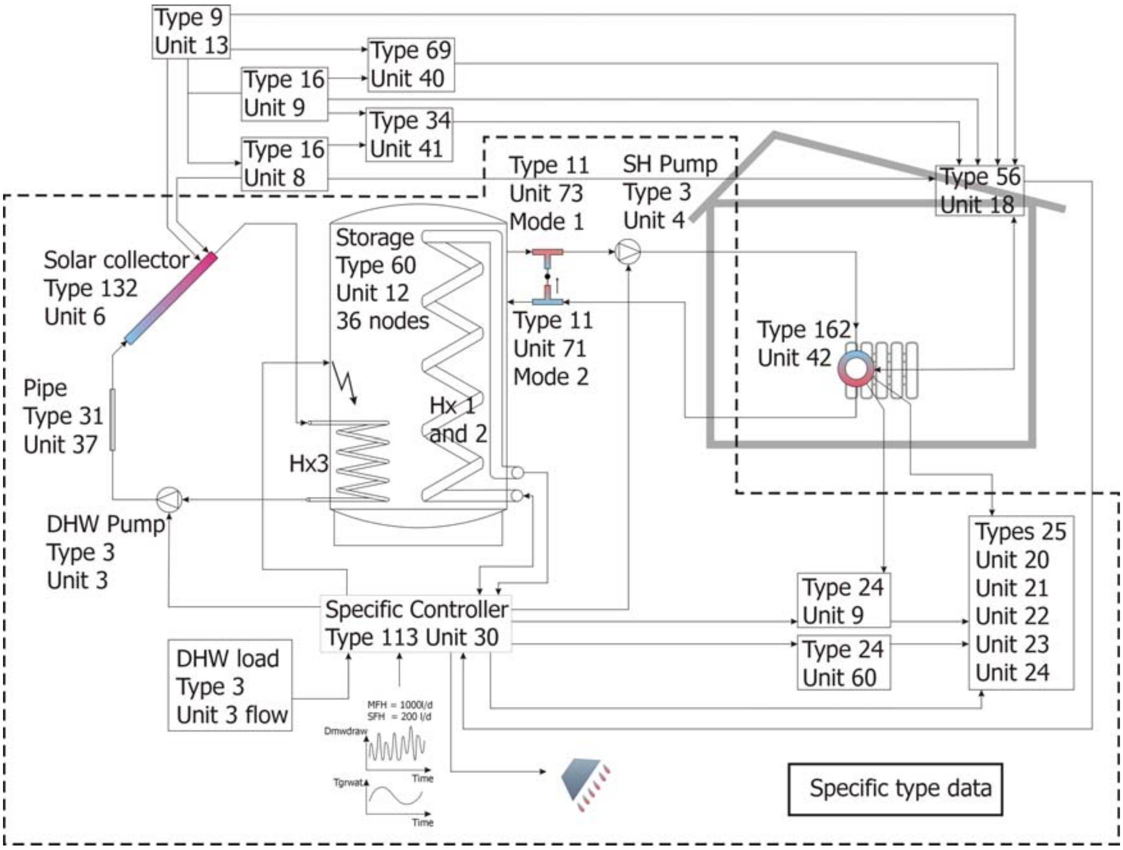


Figure 1: Modelling of System #8 in TRNSYS

2.2 *Definition of the components included in the system and standard input data*

2.2.1 Collector

Collector	$\eta 0$, a1, a2, inc. angle modifier (50°)	0.8, 3.5, 0.015, 0.9
	Area	
	Specific mass flow	10 to 30 l/m²h

Data defined in [1]

2.2.2 Pipes between collector and storage

Model : One type for cold side
Pipes: Inner diameter: 15 mm Total Length : 30 m
Insulation: Thickness : 20 mm (4.85 W/m²K) Thermal Conductivity : 0.042 W/m.K

Data defined by Heimrath (in agreement with tests and measurements)

2.2.3 Storage

Type : 60 Last update: 01. July 1999

Storage tank	Total volume	0.830 m³
	Height	1.818 m
	Store volume for auxiliary	0 m³
	Number of nodes	36
	Medium	Water
	Insulation thickness, thermal conductivity	10 cm, 0.024 W/mK
	Heat input system collector	
	Relative position of collector loop temperature sensor	0.25
	Start $\Delta\vartheta$, hysteresis, Collector loop	6 K, 4 K

Heat Exchanger N°1: Medium: Water / Water
Type of heat exchanger: serpentine
Heat Transfer Coefficient: 13.5 W/K

Heat Exchanger N°2: Medium: Water / Water
Type of heat exchanger: serpentine
Heat Transfer Coefficient: 13.5 W/K

Heat Exchanger N°3: Medium: Glycol (40%) / Water
Type of heat exchanger: serpentine
Heat Transfer Coefficient: 401 W/K

Data defined by Bony (in agreement with tests and measurements)

2.2.4 Boiler

Included in the type 60 – electrical heating element

Aux. Boiler		20 kW
	Mean annual efficiency	98 %
	Energy	20 kW
	Minimum running time	0 min
	Minimum stand still time	0 min
	Start $\Delta\vartheta$, hysteresis, auxiliary	DHW: 6 K; SH: 10K

Data defined by Bony (in agreement with tests and measurements)

2.2.5 Building

Type56 – Load File [2]

2.2.6 Heat distribution

Radiators

Radiator	Radiator area (SFH)	11.67 m²
	Heat capacity (SFH)	5 x 1263 kJ/kgK
	Set flow- and return temperatures (SFH)	40 / 35 °C
	Set flow rate	0,236 kg/s

(Data defined [1])

2.2.7 Control strategy

See appendix 1 (No availability)

2.3 Validation of the system model

The TRNSYS system model has been validated by test and simulation on the real combisystem that the manufacturer lend to our laboratory.

3 Simulations for testing the library and the accuracy

3.1 Result of the TRNLIB.DLL check

Run SCS1a.trd (send by Richard) and note your results in the boxes below:

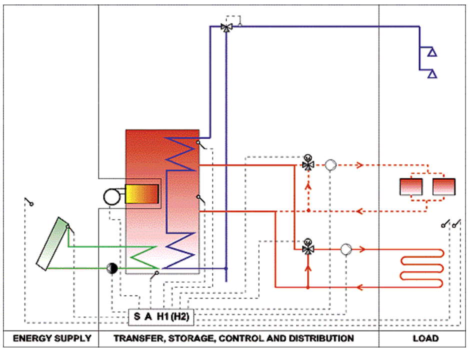
	$F_{sav,therm}$	$F_{sav,ext}$	FSI	E_{boiler}	$Q_{penalty, SH,Low}$	$Q_{penalty, SH,Up}$	$Q_{penalty, DHW}$
Richard's Result	0.7900	0.7406	0.3006	9443	30	26480	
Your Results	0.9881	0.9242	-1347	534	38600	26490	62850000
Difference	-0.1981	-0.1836	1347.3006	8909	-38570	-10	-62850000

3.2 Results of the accuracy and the timestep check

Conv tolerance	Int tolerance	Timestep [h]	$F_{sav,therm}$	Epsilon
0.1	0.1	1/32	34.34	
0.01	0.01	1/32	33.79	-1.60
0.005	0.005	1/32	34.08	0.86
0.001	0.001	1/32	34.23	0.44
0.1	0.1	1/64	34.01	-0.64
0.01	0.01	1/64	34.19	0.53

4 Sensitivity Analysis and Optimisation

4.1 Presentation of results



#8 Space Heating Store With Double Load-Side Heat Exchanger For DHW (Switzerland)

Main parameters (optimised Base Case) :			
Building :	*SFH 60*	Storage Volume :	*0.830 m^3*
Climate :	*Zurich*	Storage height	*1.818 m*
Collectors area :	*12 m^2*	**POSITION OF HEAT EXCHANGERS: DHW:** Solar:	*Whole height* *Bottom*
Collector type :	*Standard Flat Plate*	Relative position of in/outlets: SH	*0.41 / 0.68*
Specific flow rate (Collector)	*10 to 30 kg/m^2h*	Thermal insulation	*10 cm*
Collector azimuth/tilt angle	*0 / 45°*	nominal auxiliary heating rate	*20 kW*
Collector upper dead band	*6 K*	**HEAT EXCHANGER: DHW:** **SOLAR:**	*13.5 W/K* *401 W/K*
Simulation parameter:		Storage nodes	*23 l/Node* *Max. 36*
Time step	*1/64 h*	Tolerances Integration Convergence	*0.01* *0.01*

Summary of Sensitivity Parameters

Parameter	Variation	[1]Variation in $f_{sav,therm}$
Base Case	-	34.19%
Collector size [m^2] (fixed store size (0.83 m^3)	4 – 20 m^2	23. – 38.93 %
Collector Size [m^2] (fixed store spec. vol. 0.069 m^3/m^2)	8.7 – 21.7 m^2	31.43 – 40.00 %
Store Size [m^3] (fixed collector area of 12 m^2)	0.5 – 1.5 m^3	32.82 – 34.24 %
Collector Azimuth [°] (fixed tilt of 45°)	-90° - 90°	28.17 – 34.19 %
Collector Tilt [°] (fixed azimuth of 0°)	0° - 90°	28.46 – 34.19 %
Climate (60 kWh SFH)	Carp. / Zur. / Stock.	60.0 % / 34.2 % / 28.8 %
Heating System Inlet Relative Height [-]	0.15 – 0.41	33.6 – 34.19 %
Heating System Outlet Relative Height [-]	0.68 - 1	33.24 – 34.19 %
Burner Internal Relative Height [-]	0.48 – 0.70	34.19 – 36.74 %
Store Insulation: whole store [cm]	5 – 20 cm	29.87 – 36.12 %
Collector Controller dT$_{start}$ [K] (constant dT$_{stop}$)	4 – 12	33.86 – 34.19 %
Store Charge Flow Rate Solar Loop [l/h·m^2]	20 - 40	33.72 – 34.19 %
Solar Heat Exchanger Area [m^2]	2 – 4	33.92 – 34.29 %
Collector Controller Sensor Relative Height [-]	0.11 – 0.3	34.04 – 34.28 %
DHW Storage charging temperature [°C]	55 - 80	28.44 – 34.79 %
DHW Storage Volume [m³]	0.03 – 0.09	33.54 – 34.67 %
DHW Controller Sensor Relative height [-]	0.82 – 0.97	33.31 – 34.19 %

[1] **The variation if fractional savings indicated in the table does not represent the values for the extremes of the range, rather the minimum and maximum values for the range indicated.**

Sensitivity parameter :	Collector size [m^2] (fixed store size 0.830 m^3)	4 – 20 m^2

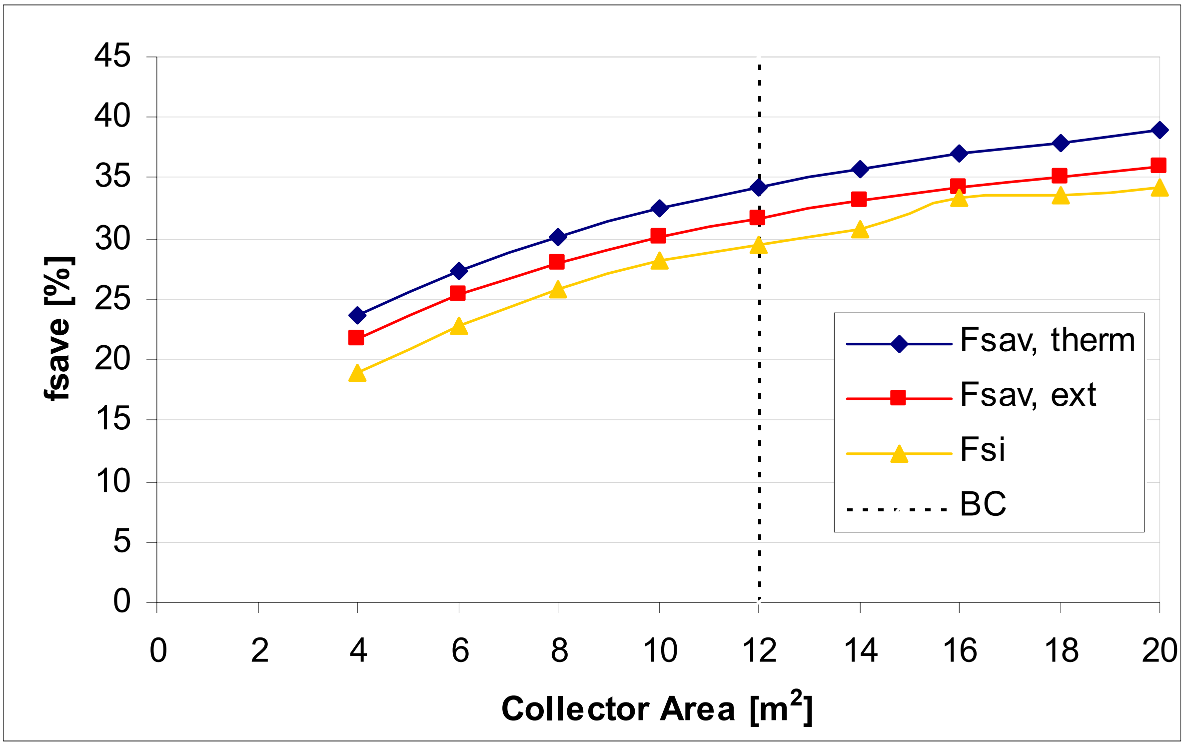


Figure 2: Variation of fractional energy savings with collector size with fixed store volume of 0.830 m^3.

Differences from Base Case
None

Description of Results
As expected the increase of collector area increases the f_{save}.

Comments
The variation of the electrical consumption of the solar loop pump is very low between 4 to 20 m^2 collector area. For the simulations this value is fixed. That is why the F_{si} follows the $F_{sav,ext}$.

Sensitivity parameter :	Collector Size [m2] (fixed store spec. vol. 0.069 m^3/m^2)	8.7 – 21.7 m^2

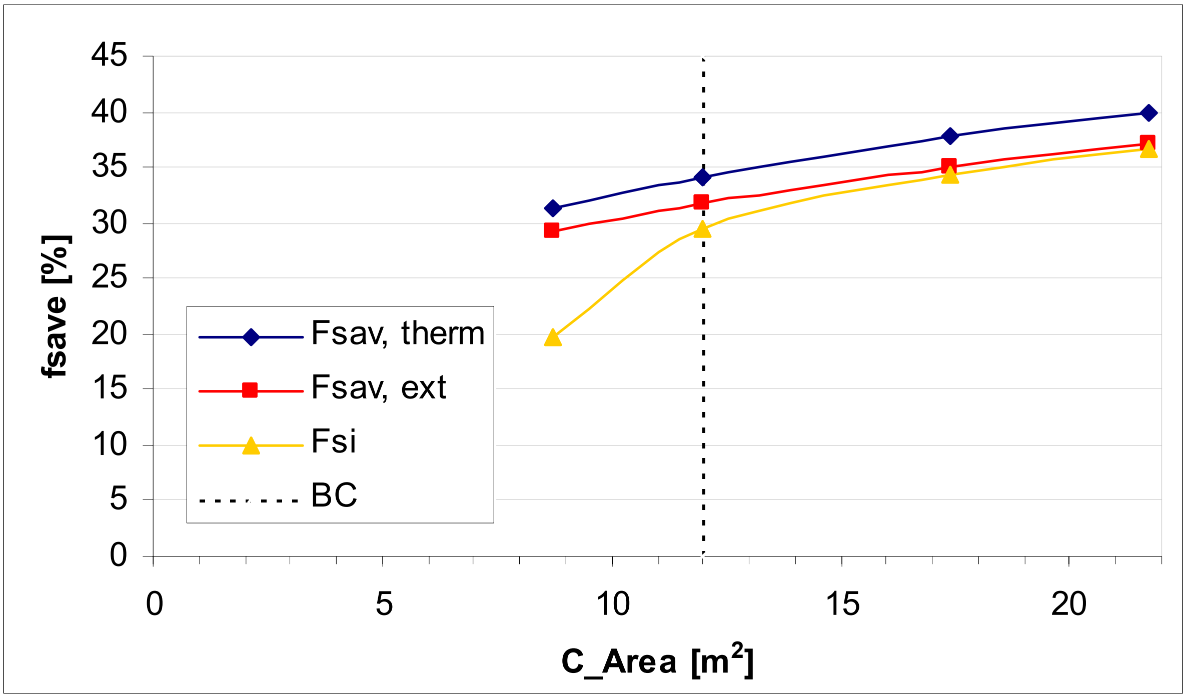


Figure 3: Variation of fractional energy savings with collector size with fixed specific store volume of 0.069 m^3/m^2.

Differences from Base Case

The inlets of the lower DHW heat exchanger, the electrical heater and burner outlet were all at the same height so that:

- The volume heated by the auxiliary change proportionally with the volume of the tank.
- The sensors for the thermostats controlling the store charging were always at the same height, at the outlet of heater.
- The height of the store is always the same (1.818 m).
- The thickness of the insulation is the same in each case (10 cm).

Description of Results

The increase of the tank volume and the collector area increases the f_{save} value. The decrease of the tank volume and the collector area decreases the f_{save} value with an increase of the penalty function due to a small buffer volume.

Comments

Heat exchanger area is constant for each case.

Sensitivity parameter :	Store Size [m^3] (fixed collector area of 12 m^2)	0.5 – 1.5 m^3

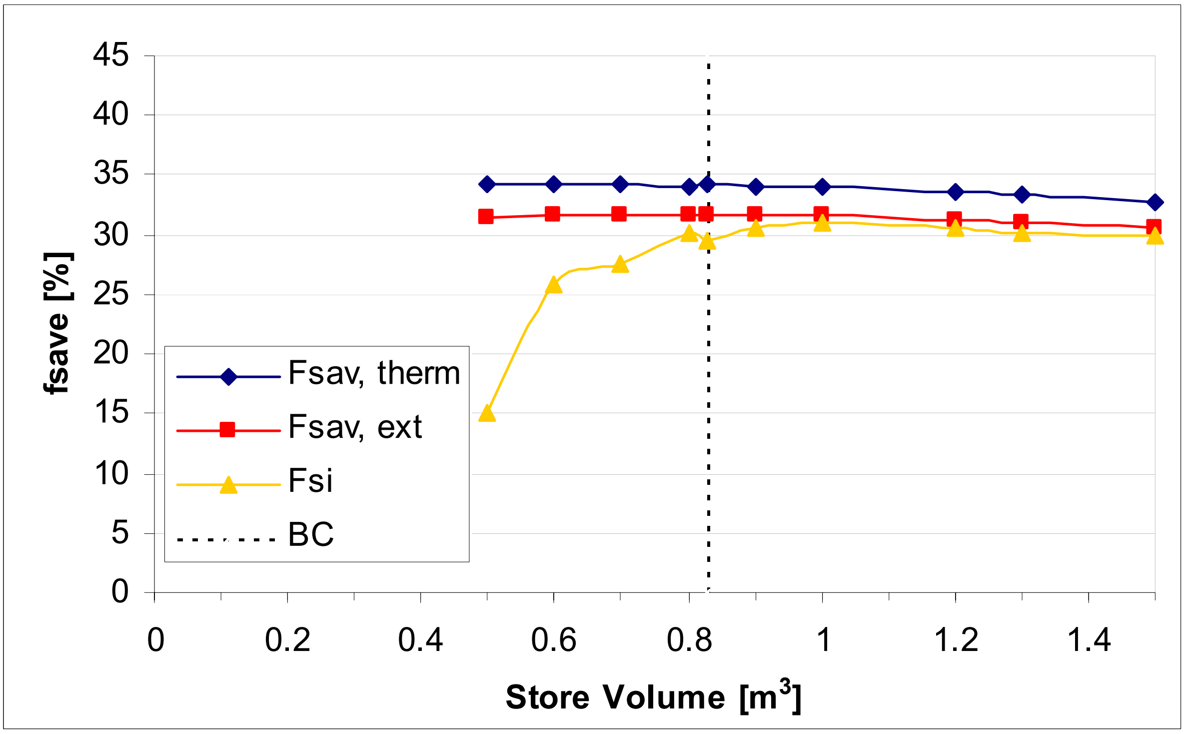


Figure 4: Variation of fractional energy savings with store volume with fixed collector area of 12 [m^2].

Differences from Base Case

- The volume heated by the auxiliary change proportionally with the volume of the tank.
- The sensors for the thermostats controlling the store charging were always on the same height, at the outlet of heater.
- The height of the store is always the same (1.818 m).
- The increase of the tank volume increases the f_{save} value. The decrease of the tank volume decreases the f_{save} value with an increase of the penalty function due to a small buffer volume.

Description of Results
Here the savings show an optimum near the base case. If we would like to perform the F_{si} curve for the small volume, we will decrease the F_{save}.

Comments
Heat exchanger area is constant for each case.

Sensitivity parameter :	Collector Azimuth [°] (fixed tilt of 45°)	-90° - 90°

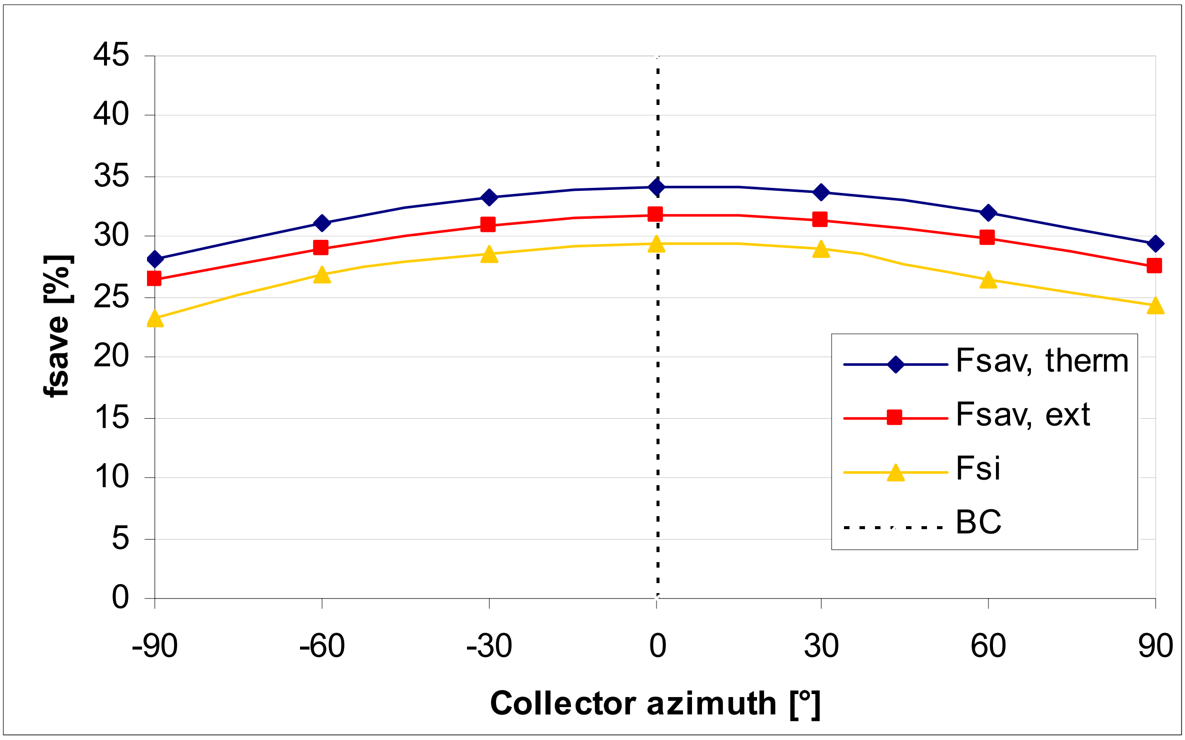


Figure 5: Variation of fractional energy savings with collector azimuth with fixed tilt angle of 45°.

Differences from Base Case
None

Description of Results
Here the savings show an optimum with a small shift to the west.

Comments
The value for –90° and +90° are very high

Sensitivity parameter :	Collector Tilt [°] (fixed azimuth of 0°)	0° - 90°

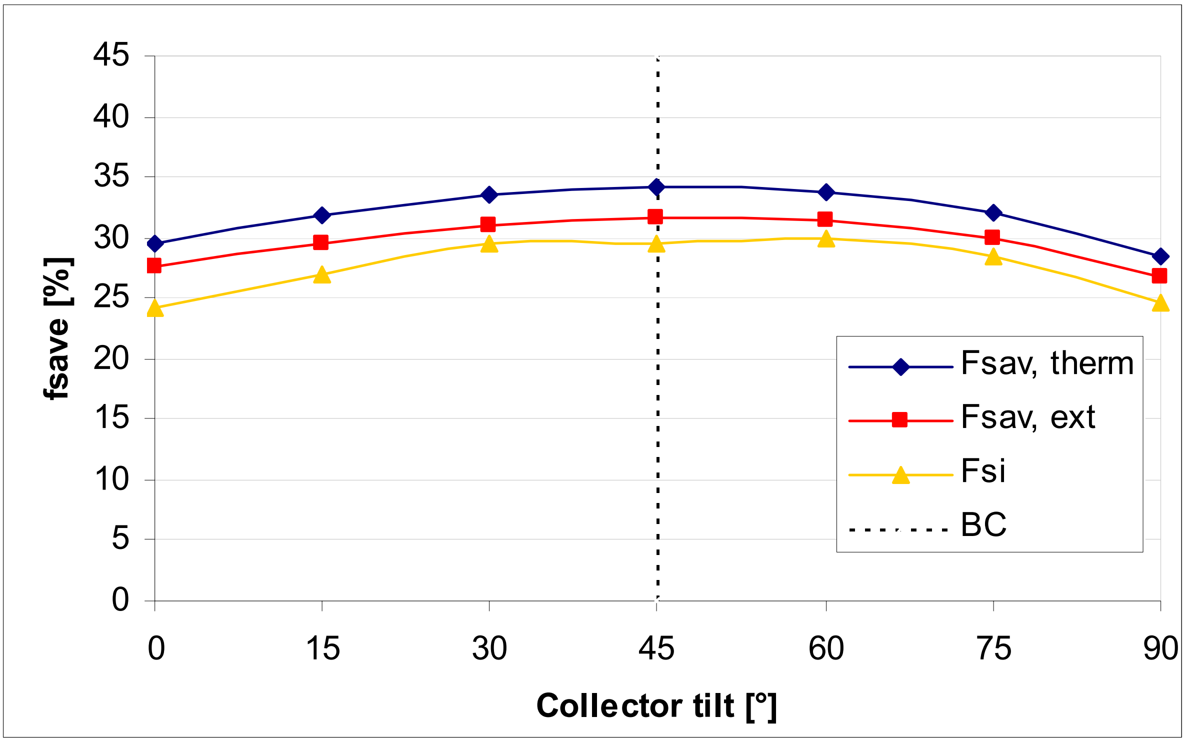


Figure 6: Variation of fractional energy savings with collector tilt, with fixed azimuth angle of 0°.

Differences from Base Case
None

Description of Results
Here the savings show an optimum at a bit less than 45° tilt.

Comments
We can notice that value at 0° tilt is quite similar that value at 90° tilt.

Sensitivity parameter :	Climate	-

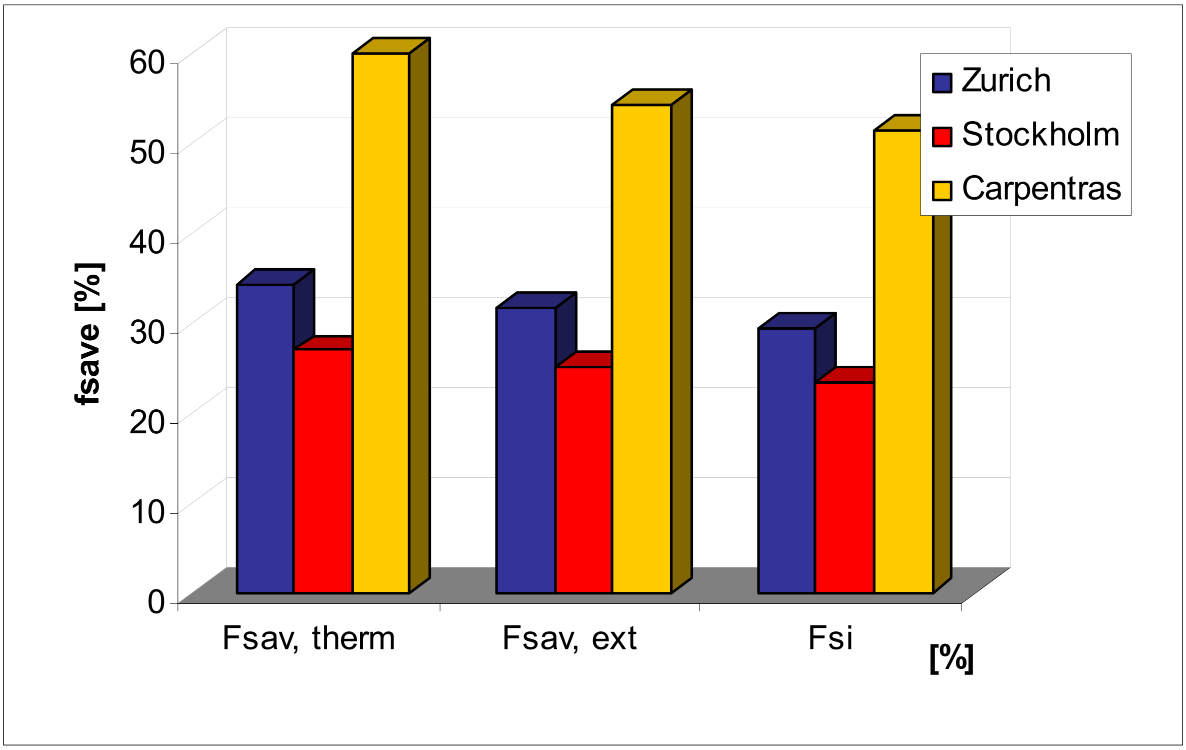


Figure 7: Variation of fractional energy savings with climate.

Differences from Base Case
None.

Description of Results
None.

Comments
None.

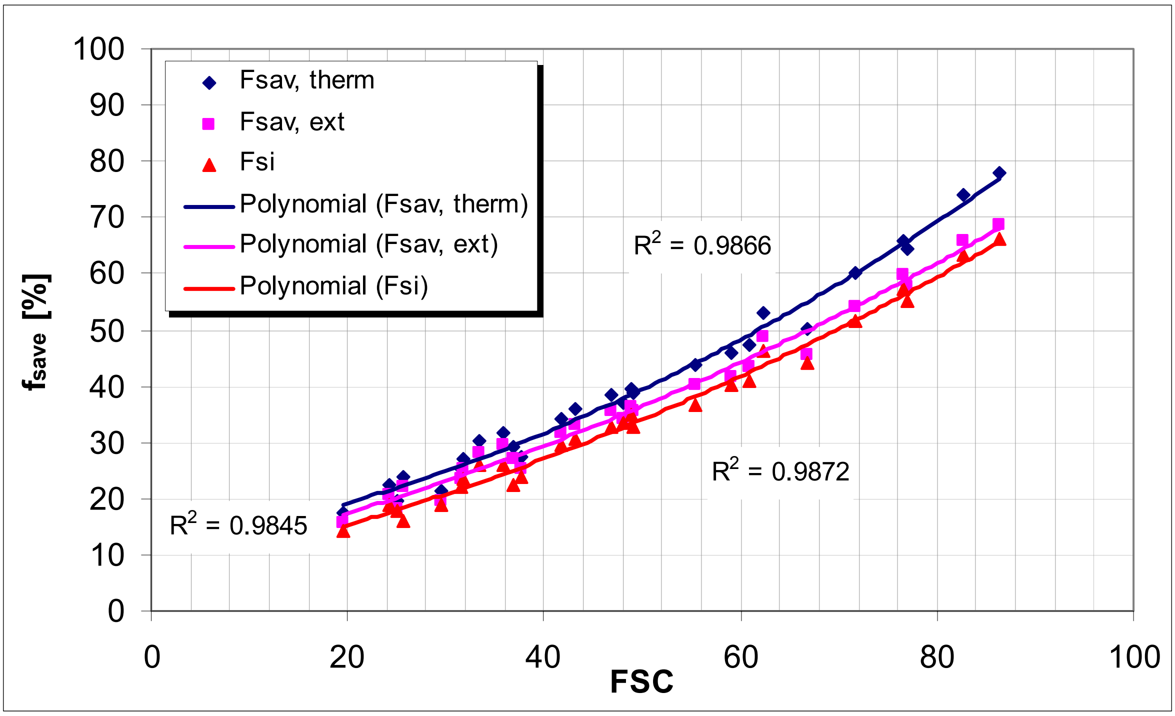


Figure 8: Variation of fractional energy savings with the fractional solar consumption (FSC).

Description of Results

The results for the 27 simulations, combinations of climate, collector area and load are shown above. The correlation is significantly for fractional savings against FSC.

Sensitivity parameter :	Heating System Inlet Relative Height base case [0.41]	0.15 – 0.41

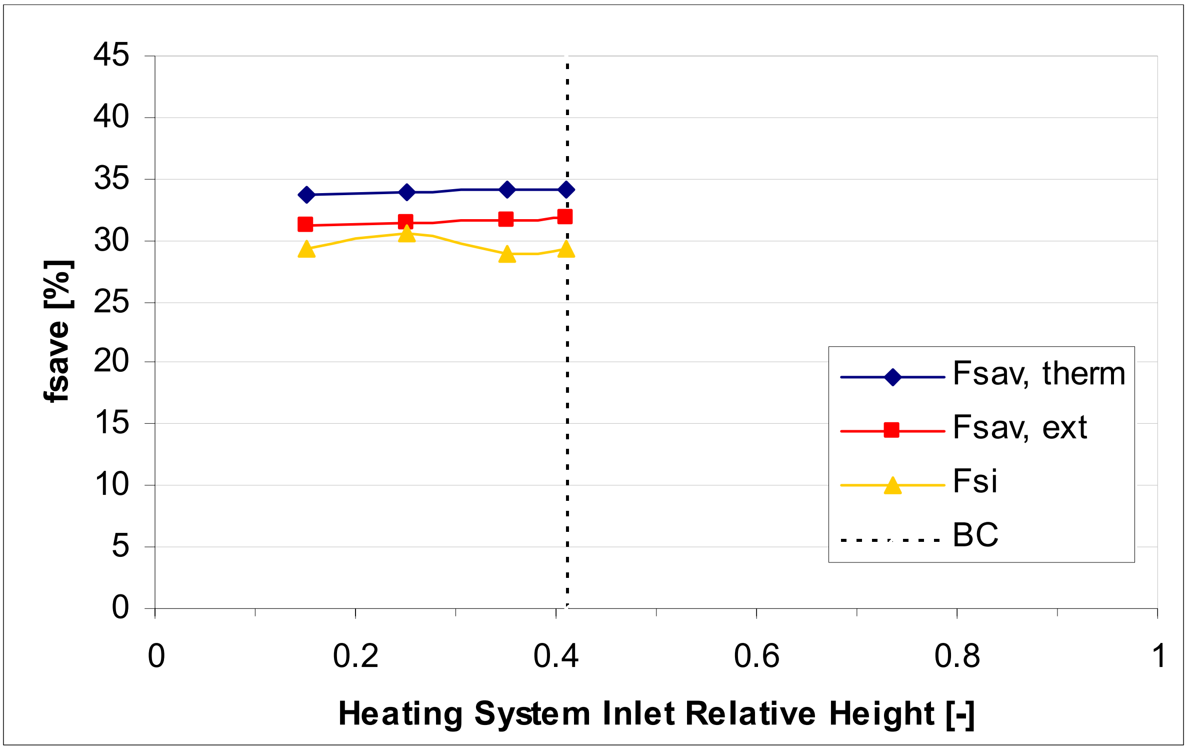


Figure 9: Variation of fractional energy savings with the position of the heating system inlet (return). Heights are relative heights

Differences from Base Case
None

Description of Results
Here the savings are nearly constant.

Comments
The building has got a big influence on the space heating return temperature. Then the result will be different.

Sensitivity parameter :	Heading System Outlet Relative Height base case [0.68]	0.68 – 1.0

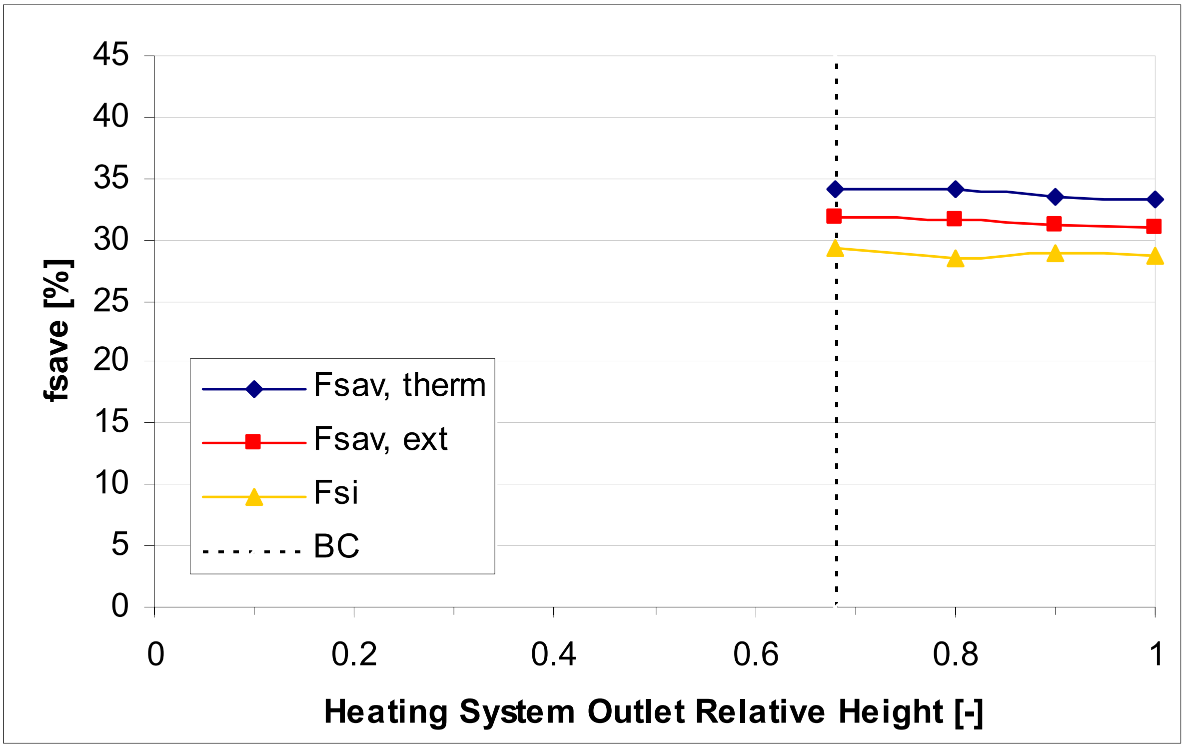


Figure 10: Variation of fractional energy savings with the position of the heating system outlet (flow). Heights are relative heights

Differences from Base Case
None

Description of Results
Here the savings are nearly constant.

Comments
We are at the optimum with the base case, and we can not choose a lower value for the relative height because of the position of the gas burner (see next figure).

Sensitivity parameter :	Burner internal Relative height [0.54]	0.48 – 0.70

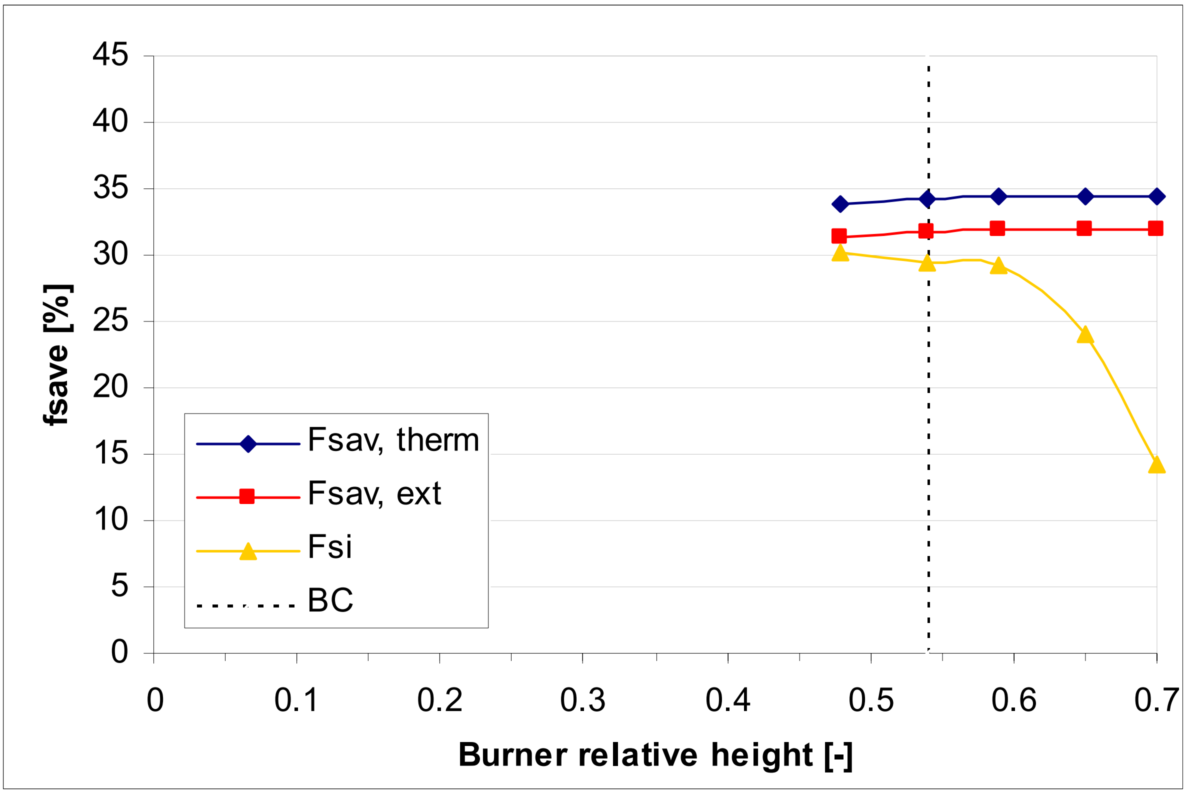


Figure 11: Variation of the relative position of the internal gas burner.

Differences from Base Case
Value of the relative position between outlet/inlet and burner stay constant.

Description of Results
None.

Comments
When the position of burner is higher, the penalty function increases because the DHW volume becomes smaller.

Sensitivity parameter :	Store Insulation: whole store [m]	5 – 20 cm

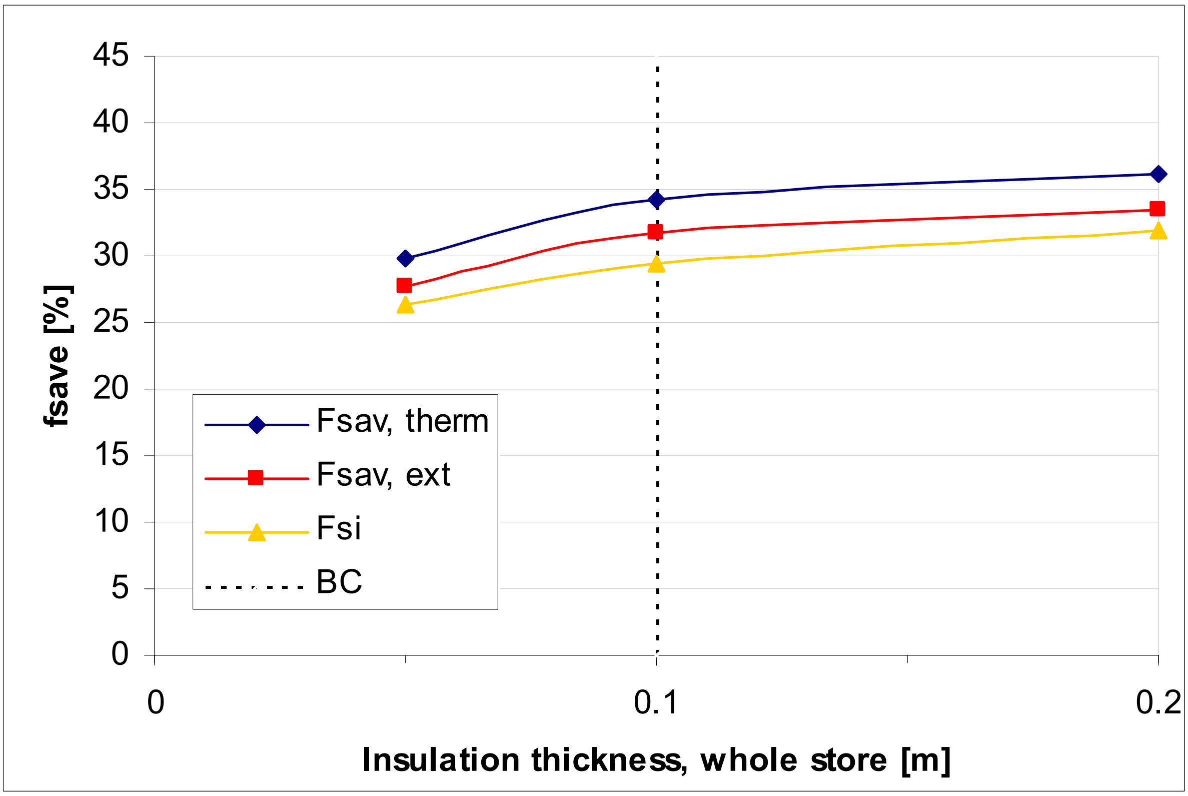


Figure 12: Variation of fractional energy savings with the thickness of insulation around the whole store.

Differences from Base Case
None

Description of Results
Here the increase of insulation thickness from base case is not very significant for the f_{save} value.

Comments
The main thermal losses come from the thermal bridges (burner, pipe connexions, …) so, it is not necessary to increase the base case insulation thickness.

Sensitivity parameter :	Collector Controller dT_{start} [K] (constant dTstop)	4 – 12 K

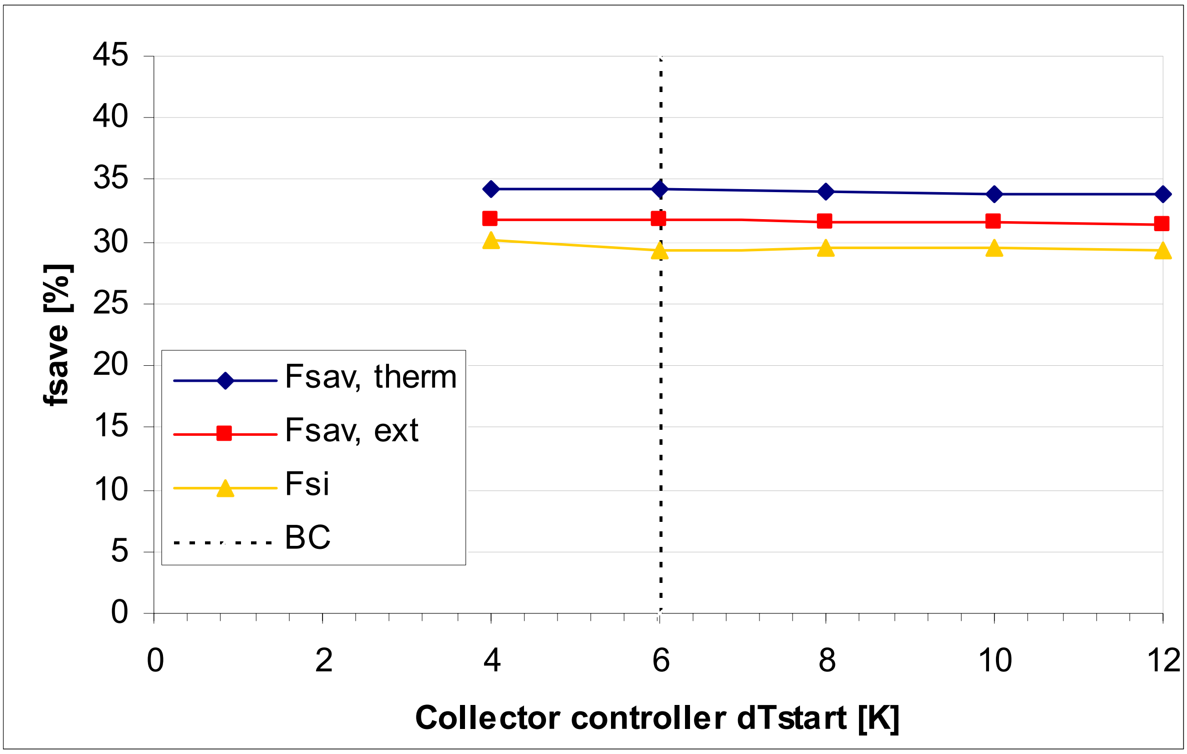


Figure 13: Variation of fractional energy savings with the collector controller settings.

Differences from Base Case
Dt_{stop} unchanged.

Description of Results
Here there is slight decrease in performance with increasing dT_{start}, however the difference between the values for 4 and 12 K is very small.

Comments
None

Sensitivity parameter :	Store Charge Flow Rate Solar Loop [l/h·m^2]	20 – 40 l/h·m^2

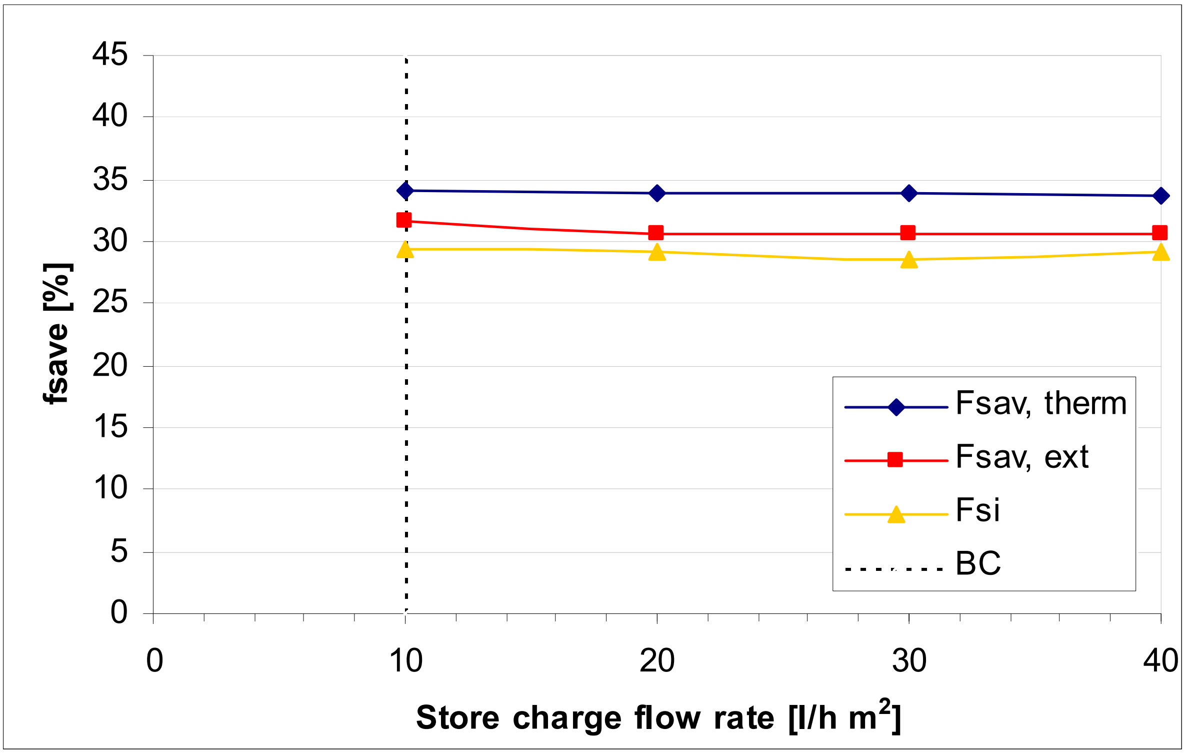


Figure 14: Variation of fractional energy savings with the store charge flow rate.

Differences from Base Case
In the base case, the store charge flow rate is variable from 10 – 30 l/h·m^2.

Description of Results
The store charge flow affects the annual savings slightly.

Comments
Warning, the value of the base case is not 10 l/h·m^2 but between 10 to 30 l/h·m^2.

Sensitivity parameter :	Solar heat exchanger area [m^2]	2 – 4 m^2

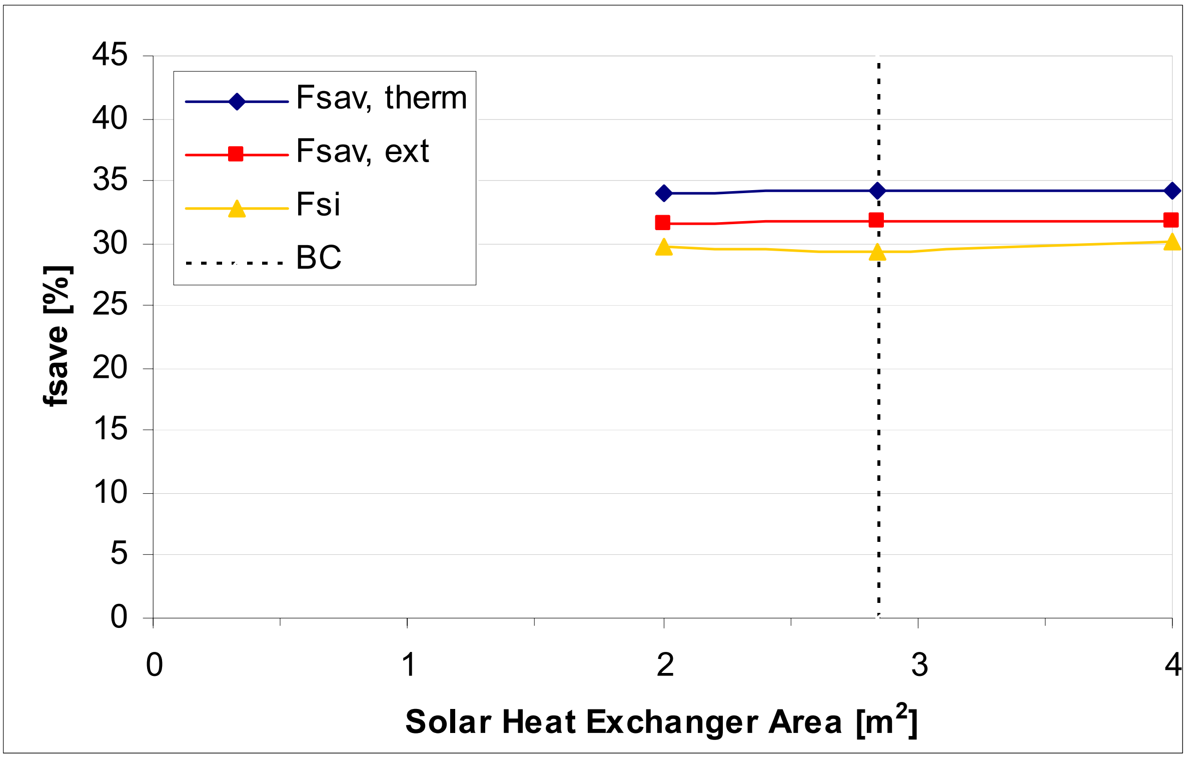


Figure 15: Variation of fractional energy savings with the solar heat exchanger area.

Differences from Base Case
None.

Description of Results
No difference from base case.

Comments
The solar heat exchanger is oversized for 12 m^2 collector area.

Sensitivity parameter :	Collector controller sensor Relative height base case [0.25]	0.11 – 0.3

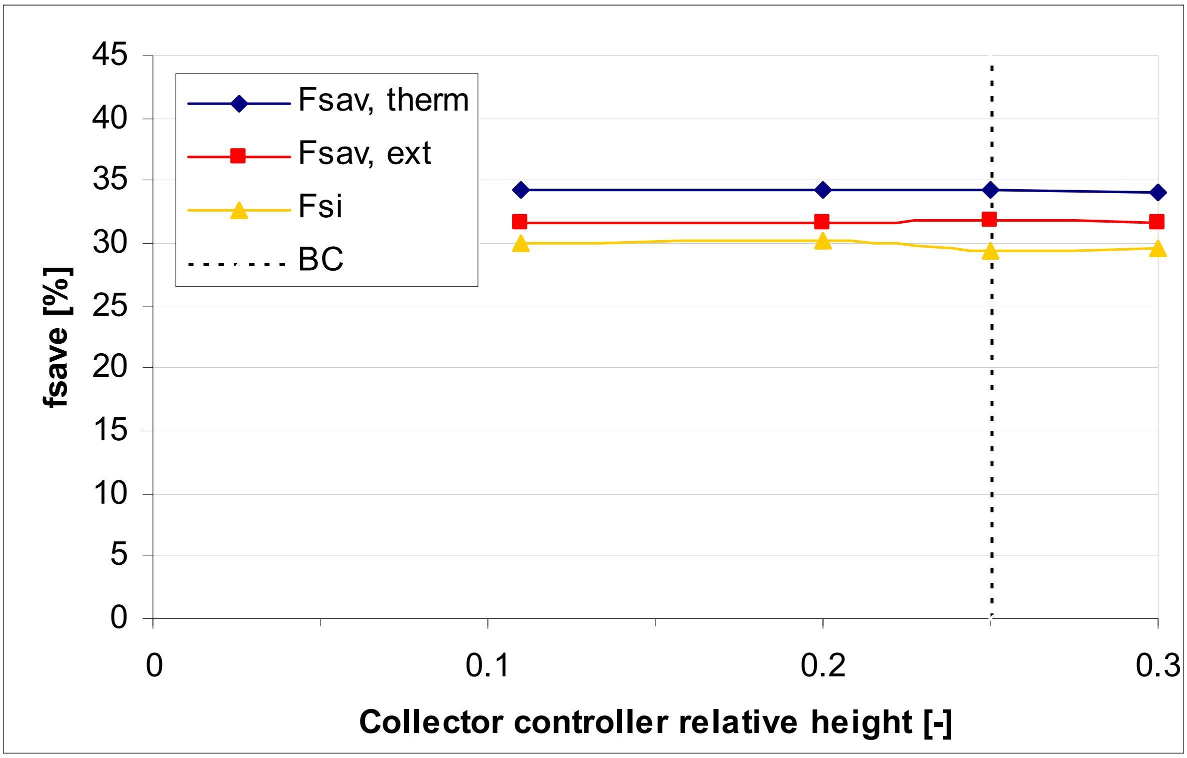


Figure 16: Variation of fractional energy savings with the relative position of the collector controller sensor.

Differences from Base Case
None.

Description of Results
None.

Comments
Without stratification (our case) the influence of the position of the collector sensor in the tank is not significant.

Sensitivity parameter :	DHW Storage charging temperature [°C]	55 – 80

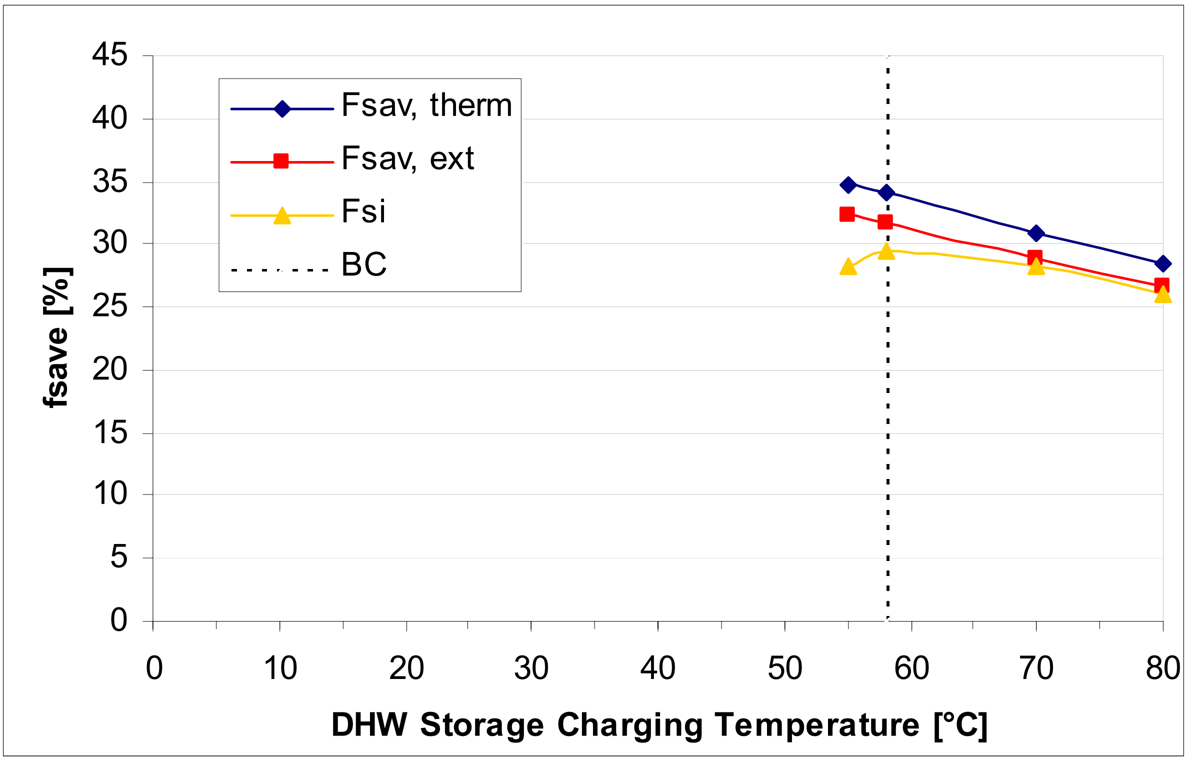


Figure 17: Variation of fractional energy savings with the DHW storage charging temperature [°C].

Differences from Base Case
None.

Description of Results
When the temperature is very low, the penalty function increases.

Comments
The base case is the optimum.

Sensitivity parameter :	DHW Heat Exchanger Area [m^2]	4.4 – 13.06 m^2

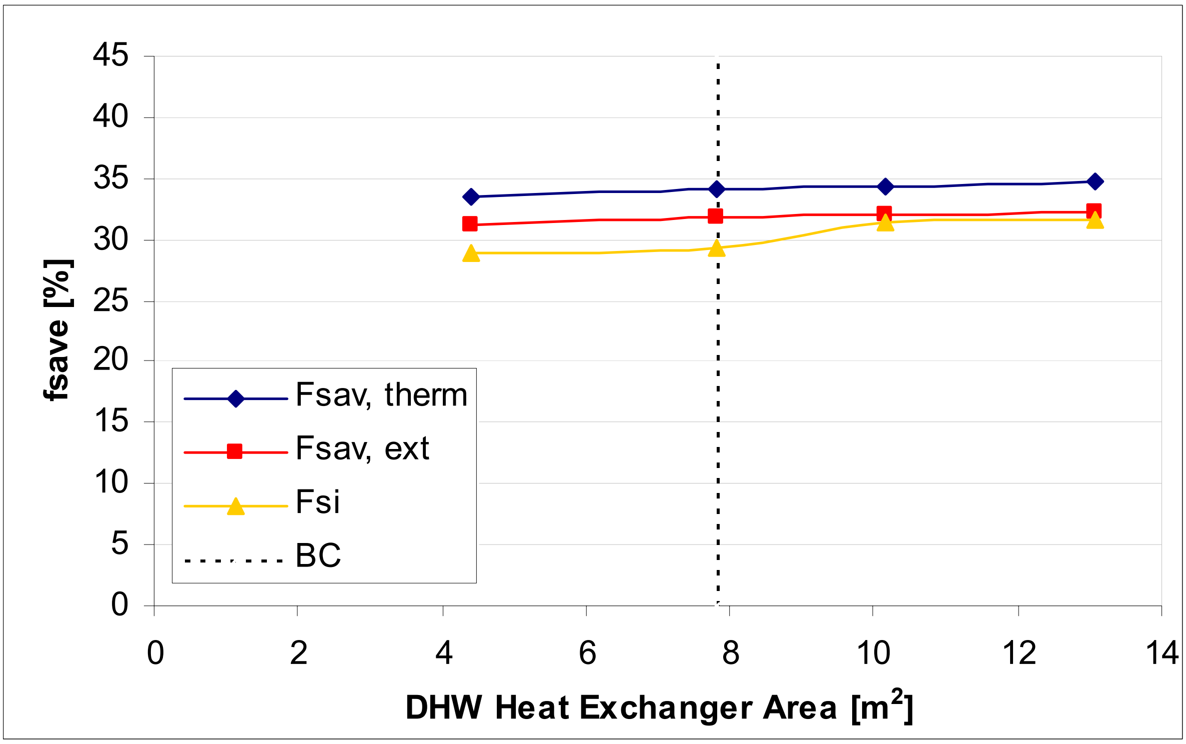


Figure 18: Variation of fractional energy savings with the DHW heat exchanger area.

Differences from Base Case
None

Description of Results
The DHW heat exchanger area affects the annual savings slightly. The penalty function is lower for a big heat exchanger area.

Comments
None.

Sensitivity parameter :	Store Charge Controller Sensor Relative Height [-]	0.82 – 0.97

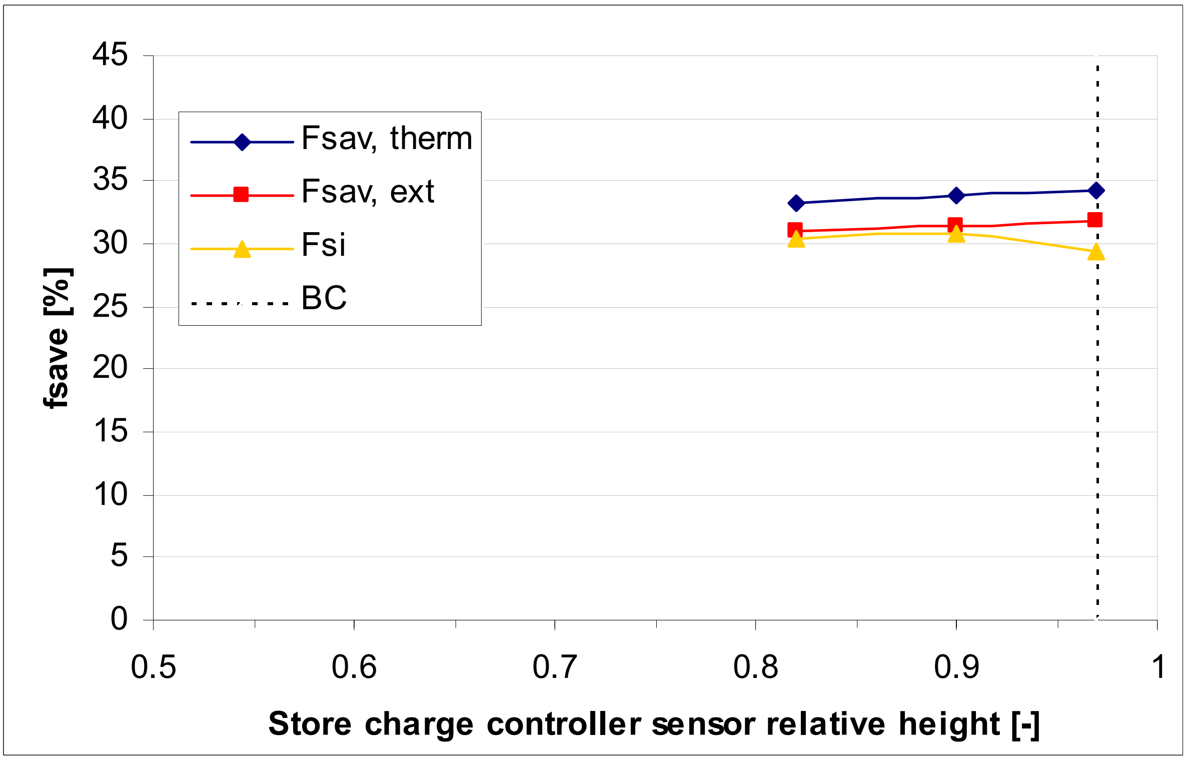


Figure 19: Variation of fractional energy savings with the store charge controller's sensor position.

Differences from Base Case
None

Description of Results
The position sensor affect the annual savings slightly. The penalty function is lower for lower position.

Comments
The position of the store charge sensor influences the volume of the DHW buffer.

4.2 Definition of the optimised system

The optimised System #8 is the one who is commercialised by the manufacturer. But we know that a good stratification in the tank will increase the f_{save}. Next step for System #8 is to test a new concept of regulator with predictive meteorological data and of course to find some variation to improve the system for a low additional cost.

5 Analysis using FSC

For the optimised system the analysis based on FSC [3] should be carried out.

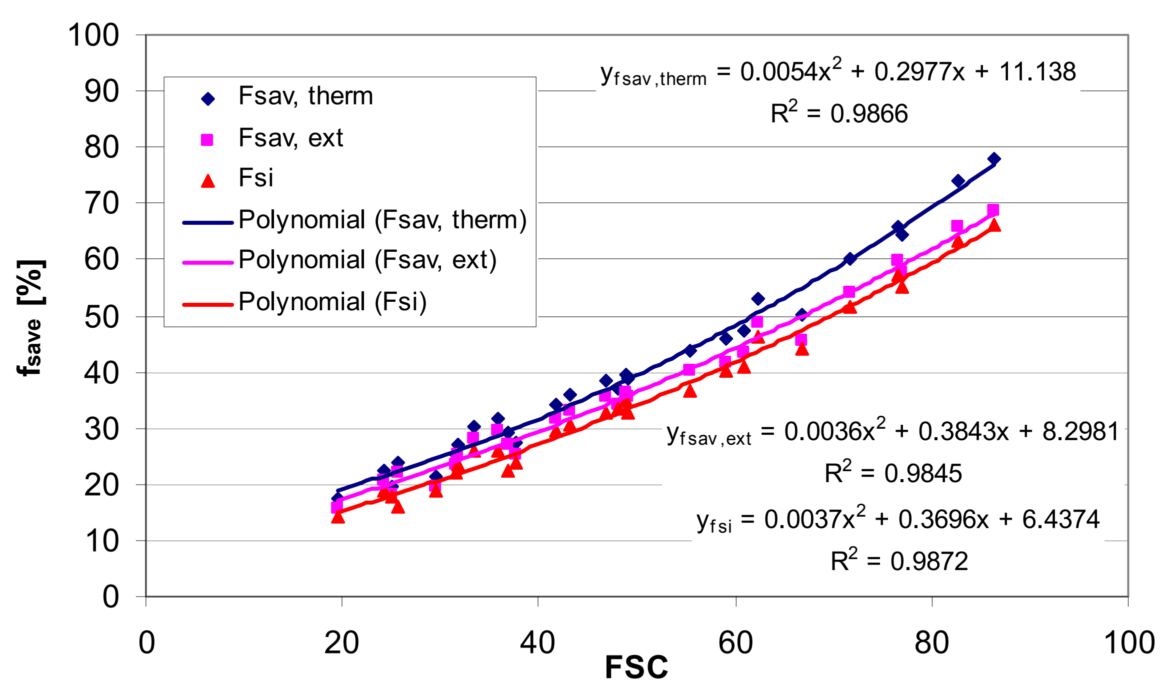


Figure 20: FSC for 3 climates (Carpentras, Zurich, Stockholm) and 3 loads (30, 60, 100 kWh/m²·a single family buildings).

- Additionally a range of collector areas and storage volumes can be compared
- Also FSC analysis can be used for the optimisation

6 Lessons learned

- It's important to consider the difference between simulation runs on different computers. For the same deck simulation the results are sometimes different because of different .dlls created by compilers on different computers.
- Optimisation is not the variation of one parameter but the variation of a few parameters together. The difficulties are to change one parameter without forgetting the influence on the other to always keep a realistic system.

7 References

[1] Weiss, W. (ed.), Solar heated houses – A design handbook for solar combisystems, IEA SHC Task 26, Solar Combisystems, James & James Science Publishers, 2003.

[2] Streicher, W., Structure of reference buildings, Technical Report of Subtask C, IEA Task 26 Solar Combisystems, 2003.

[3] Letz, T., Validation and background information on the FSC procedure, Technical Report of Subtask A, IEA Task 26 Solar Combisystems, 2002.

8 Appendix 1: Description of Components specific to this System

These are components that are not part of the TRNSYS standard library AND not part of the types used as "standard" by Task 26.

8.1 Type 11: Specific controller for System #8

Inputs:

HEATING LOOP

Tm_cuve	TEMPERATURE IN THE MIDDLE OF THE TANK	(°C)
Thaut_cuve	TEMPERATURE IN THE TOP OF THE TANK (°C)	
Tcon_amb	ORDER TEMPERATURE FOR THE AMBIENT T° BUILDING	(°C)
Textn0	OUTSIDE TEMPERATURE	(°C)
Tret_ext	RETURN TEMP. OF HEATING LOOP WITH ANOTHER CONTROLLER	(°C)
Tamb	AMBIENT TEMPERATURE	(°C)
Tcuve_ch	OUTLET TEMPERATURE OF THE TANK FOR HEATING	(°C)
Hencl_bru	HOUR FOR ON/OFF OF THE BURNER (0 OR 1)	(-)

SOLAR LOOP

Tbas_cuve	TEMPERATURE IN THE BOTTOM OF THE TANK	(°C)
Tcapt	TEMPERATURE OF THE COLLECTOR	(°C)
mout_sol	MAXIMUM FLOW RATE FOR SOLAR LOOP	(°C)

DHW MIXING VALVE

Tcuve_e	OUTLET TEMPERATURE OF THE TANK FOR DHW	(°C)
Cons_ecs	DHW DEMAND	(kWh)
m_max_e	DHW MAXIMUM FLOW RATE	(l/h)
mtot_e1	DHW MAXIMUM FLOW RATE AT THE NEXT TIME STEP	(l/h)
UAbuild	UA VALUE OF BUILDING	(W/K)

Outputs:

msol	FLOW RATE OF THE SOLAR LOOP	(l/h)
Tch_2	TEMPERATURE OF HEATING LOOP	(°C)
DTcheff	DIFFERENTIAL EFFECTIVE TEMPERATURE FOR SH	(°C)
mch_tot2	FLOW RATE FOR HEATING LOOP	(l/h)
Aux	SWITCH ON OF THE BURNER	(-)
On_aux	COUNT OF SWITCH ON OFF THE BURNER	(-)
Time_aux	TIME OF SWITCH ON OF THE BURNER	(h)
mret_ch	HEATING FLOW RATE INTO THE TANK	(l/h)
m_brass	HEATING FLOW RATE INTO THE TANK FOR MIXING	(l/h)
m_in_e	INLET FLOW RATE FOR DHW HX	(l/h)
Tmelange_e	MIXING DHW TEMPERATURE	(°C)
Tin_e	INLET TEMPERATURE DHW HX	(°C)
Qcalc_e	DHW LOAD A DAY	(kWh)
Tmin_e	MIN DHW HX TEMPERATURE	(°C)
Tmax_e	MAX DHW HX TEMPERATURE	(°C)
Surch_s	OVER HEAT TO THE SOLAR LOOP	(-)
ONOFF_S2	STATE OF THE SOLAR PUMP	(-)
Time_sol	FUNCTIONING TIME OF THE SOLAR PUMP	(h)
Time_ch	FUNCTIONING TIME OF THE SH PUMP	(h)
Tmin_capt	MIN COLLECTORS TEMPERATURE	(°C)
Tmax_capt	MAX COLLECTORS TEMPERATURE	(°C)
Tmin_amb	MIN AMBIENT TEMPERATURE	(°C)
Tmax_amb	MAX AMBIENT TEMPERATURE	(°C)
Qch	SH ENERGY A DAY	(kWh)
Qaux	AUXILIARY ENERGY A DAY	(kWh)
Pen_DHW	DHW PENALTY ENERGY	(kWh)

Pen_SH20	SH PENALTY ENERGY BELOW 19.5°C	(kWh)
Pen_SH24	SH PENALTY ENERGY ABOVE 24°C	(kWh)
Wfan	ELEC. ENERGY (FAN OF THE AUXILIARY HEATER)	(kWh)
Wch	ELEC. ENERGY (SH LOOP PUMP)	(kWh)
Wsol	ELEC. ENERGY (SOLAR LOOP PUMP)	(kWh)
Tmax_cuve	MAX TANK TEMPERATURE	(°C)
rend_g	BURNER EFFICIENCY FOR GAS	(-)
rend_o	BURNER EFFICIENCY FOR OIL	(-)
Trend_b	TEMPERATURE AT THE BURNER LEVEL	(°C)
t1H3	USING TIME FOR THIS PARAMETER	(h)
t1H4	USING TIME FOR THIS PARAMETER	(h)

Parameters:

HEATING LOOP

DT140	DIFFERENTIAL ON/OFF OF THE BURNER	(°C)
Text161	EXTERNAL REFERENCE MINIMUM TEMPERATURE	(°C)
Tch162	MAXIMUM REFERENCE TEMPERATURE START HEATING	(°C)
DT168	DIFFERENTIAL TEMPERATURE BOILER/HEATING T°	(°C)
I170	TYPE OF BUILDING (HEAVY=3/LIGHT=1	(-)
R171	HEATING SPEED (1 OR 0)	(-)
P182	INTERNAL AMBIENT SENSOR (1 OR 0)	(-)
Infl183	FRACTIONAL INFLUENCE OF INT. AMB. SENSOR	(-)
Tecs190	TEMPERATURE OF DHW	(°C)
DTecs191	DIFFERENTIAL TEMPERATURE FOR DHW	(°C)
TBOT_1H3	BOTTOM TANK TEMP. TO STOP BURNER FOR DHW MODE	(°C)
DT_1H4	DIFFERENTIAL TEMP. COLLECTOR/BOILER ORDER	(K)
DT_1H5	MAXIMUM DIFFERENTIAL TEMP. COLLECTOR/TANK	(K)
DTon_ch	DIFFERENTIAL TEMP. AMB./ORDER	(°C)
mrad	EXPONENT RADIATOR	(-)
mch_tot	MAX FLOW RATE OF THE HEATING LOOP	(l/h)
DTchnom	DIFFERENTIAL TEMP. COME IN/RETURN HEATING	(°C)
Textam	SMOOTH TEMPERATURE ON/OFF (1/0)	(-)
Paux	AUXILIARY POWER	(kW)

SOLAR LOOP

Tmax_1A4	MAXIMUM SOLAR COLLECTOR TEMPERATURE	(°C)
DTon_1A1	DIFFERENTIAL TEMP. SWITCH ON SOLAR PUMP	(°C)
DToff_1A2	DIFFERENTIAL TEMP. SWITCH OFF SOLAR PUMP	(°C)
Tmax_1A6	MAX TEMPERATURE FOR COOLING	(°C)
DT_1A7	DIFFERENTIAL TEMPERATURE FOR COOLING	(°C)
m1AB	MAXIMUM FLOW RATE	(l/h)
Vmin_1B1	FRACTIONAL MINIMUM SPEED OF SOLAR PUMP	(-)
Vmax_1B2	FRACTIONAL MAXIMUM SPEED OF SOLAR PUMP	(-)
DT_1B4	DIFF. TEMP. BEGINNING INCREASE SOLAR SPEED	(°C)
DT_1B5	DIFF. TEMP. MAX SOLAR SPEED	(°C)

DHW MIXING VALVE

Tinecs_m	AVERAGE TEMPERATURE FOR DHW	(°C)
DTinecs	DIFF. SHIFT TEMP. FOR DHW	(°C)
OFFS_ecs	OFFSET FOR DHW TEMPERATURE	(°C)
IEADHW	ON/OFF LOAD SPECIFICATION FILE	(-)

OTHER

Pfan	POWER OF THE FAN OF THE AUXILIARY HEATER		(kW)
Pch	POWER OF SH PUMP		(kW)
Psol_max	POWER OF SOLAR LOOP PUMP	(MAX SPEED)	(kW)
Psol_min	POWER OF SOLAR LOOP PUMP	(MIN SPEED)	(kW)

Availability: NO