Invitation to take part in a

Technology procurement competition

Systems for solar-heated domestic hot water supply in detached houses

A Swedish technology procurement competition forming part of IEA Task 24, Solar Procurement

Contents

On behalf of the Swedish Competition Organisation for IEA Task 24, 2000-01-21:

Background

As part of the IEA 'Technology Procurement, Solar Heating' project (International Energy Agency, Solar Heating and Cooling, Task 24, Solar Procurement), Sweden, Denmark, Canada, the Netherlands and Switzerland are cooperating on joint procurements of solar heating technology.

It has been noted at the international level that:

- although many countries have put a considerable amount of work into research, development and demonstration of solar heating technology there has yet, despite this, not been any significant market breakthrough. However, the work that has been carried out in these fields over many years has created a sound knowledge base for solar heating technology.
- the market for solar heating is local, and sales are generally through local contractors to a few environmentally aware purchasers. Most systems are manufactured in the same country as that in which they are installed, and there are significant price differences between countries.
- today, solar heating installations are too expensive to achieve any larger scale market penetration. A considerable fraction of this cost is simply due to the high proportion of marketing input needed in order to sell just a few installations. In addition, production volumes are low, insufficient to support rational production, which also contributes to an unnecessarily high cost.

The objective of this IEA project is to create an organised purchaser group interest in solar heating systems. This potential market exists in the form of the purchaser groups in each of the countries: other countries are considering joining the project. The purchasing volumes thus created create new opportunities for manufacturers to invest in more efficient production processes and to rationalise their marketing and distribution. In this way, technology procurement projects can open the way for manufacturers to find larger national or international markets.

The overall objective is to create and maintain an expanding market for solar heating systems. An important factor in any such attempt to influence the market is that the cost/performance relationship must be improved. This also includes more rational installation methods, as installation costs constitute an important part of the total cost.

This international project is being operated in two stages (see also under Time Plan), of which only the first stage is at present confirmed.

- Stage 1 (up to and including 2000) is concerned with national procurement activities (types and number of systems with separate performance specifications etc.), but with an overall international coordination.

- Stage 2 (from 2000 until and including 2002) will involve a greater degree of international harmonisation of performance specifications and coordinated procurement activities.

This competition documents are concerned only with Stage 1, the Swedish procurement activities.

The Swedish technology procurement competition for solar-heated domestic hot water systems in detached houses

The Swedish 'Solar-heated domestic hot water systems in detached houses' technology procurement competition is for a complete system as specified in Appendix 1.

- It is estimated, as stated in Appendix 1, that the total number of systems to be supplied in this stage of the competition will be at least 1000.

- It is also a requirement that it will be possible for purchasers to buy only the solar collector modules, at prices stated in the material submitted.

- It is expected that the first systems would be supplied in the autumn of 2000, with deliveries continuing over a year from that date, in accordance with a framework incentive agreement.

Phases of the technology procurement competition

The competition has been divided into the following three phases (see also under Time Plan):

- *The 'paper' phase* = written proposals, which will be assessed against the competition's performance specification after opening the tenders. Parties submitting tenders will be notified if their proposals have been selected to go forward to the next phase.

- *The testing and evaluation phase* = laboratory testing of selected systems, in accordance with the test procedures described in Appendix 2. In addition, factors relating to installation will be assessed.

- *The delivery phase* = distribution in accordance with the framework incentive agreement (see the model form in Appendix 4). Orders will be grouped in conjunction with regional campaigns, starting in the spring of 2000, and complemented by other information activities and the taking of orders via the project's website.

Advertising the technology procurement competition

The competition will be advertised both nationally and internationally via the EU Official Journal. The competition documents (in Swedish) will be sent directly to known Swedish manufacturers. In addition, the Swedish and English documents will also be available on BFR's website http://solupphandling.bfr.se and on IEA Task 24's website at http://www.ieatask24.org

Qualifications for submitting entries

A prerequisite for participation in the competition is the ability to be able to fulfil the above phases of the procurement, i.e. not only to have the capacity to supply samples or prototypes for evaluation, but also subsequently to be able to mass-produce and deliver solar heating systems having a performance equal to that of the samples or prototypes.

A check will be made to ensure that participants fulfil the general requirements in respect of financial soundness set out in the Public Procurement Act.

Submission of entries

Entries must have been received by not later than 2000-03-31 at the address below. Three sets of all documents, in the form of one original and two copies, shall be supplied.

Miljöaktion Värmland (Värmland Environmental Action Programme)
Attention: Matti Nordenström
Landstingshuset
SE-651 82 KARLSTAD

NB: Envelopes, wrappers etc. must be marked: 'IEA Task 24 SOLAR PROCUREMENT'.

Evaluation of entries

Entries will be evaluated by a jury appointed by the Swedish Competition Organisation. The jury will be looking for entries that are "most economically preferable", as set out in the Public Procurement Act.

Obligatory requirements must be fulfilled.

As mentioned above, a substantial improvement in the total cost/performance relationship is most important in achieving greater market penetration of solar heating technology. For this reason, both the cost aspects of the system and hardware components and the erection/installation aspects in relation to performance will be decisive in evaluating entries received.

In addition to the obligatory requirements, there are also ***desirable requirements***. Achievement or bettering of the desirable requirements, and analysis of other information provided, will be included in the evaluation with the relative weightings as shown below.

Evaluation/weighting	**%**
• Erection/installation aspects	40
• Price/performance aspects for the system and components	30
• Environmental aspects	10
• Degree of completeness of information in the proposal	10
• Maintenance/length of life aspects	10

Physical submission of test installations/prototypes etc.

Test installations/prototypes that have been selected for further consideration shall be sent by the manufacturer/supplier, at the latter's cost, to the specified test site.

At the test site, the manufacturer/supplier will be responsible for erection and installation of the system, but will follow the instructions and time plans of the test organisation in all other respects. The actual testing will be financed by the competition organisation.

Final evaluation

The competition organisation will nominate one or more winners.

The competition organisation reserves the right to reject incomplete proposals.

Property in the goods/system, origination rights etc.

The manufacturer/supplier retains property in the goods/systems, origination rights etc. for the test installations/prototypes submitted. If the entry contains parts etc. that will be the subject of patent applications, this shall be specifically pointed out in the entry.

Secrecy of competition entries and development

Section 8, Paragraph 6 of the Secrecy Act applies to the competition documents and other documents relating to the project and held by Miljöaktion Värmland, Värmland County Council. One of the effects of this is that a company's commercial and operating affairs and circumstances, such as inventions, designs or economic conditions, that have not been made public in any other way are regarded as secret provided that it can be assumed that the company would suffer if such information became available to the public, to competitors or to others.

This protection under the Secrecy Act applies for 20 years from the date of receipt of the documents.

Decisions on secrecy considerations are the responsibility first of the Värmland County Council, and may be appealed to the Administrative Court of Appeal and thereafter possibly to the Supreme Administrative Court.

After competition entries have been received, all entrants will be asked for information indicating on which parts of their entries information may not be released due to secrecy considerations.

Questions

Please submit any questions concerning these documents by not later than 2000-02-07, in writing, to one of the following addresses:

matti.nordenstrom@miljoaktionvarmland.org, (Matti Nordenström, Miljöaktion Värmland, Landstingshuset, SE-651 82 Karlstad) or to fax number +46 54 19 43 06.

Questions received will be collated and replied to by not later than 21st February 2000. All questions and answers, in Swedish and in English, will be available from this date on websites http://solupphandling.bfr.se and www.ieatask24.org.

Time plan, Stage 1

Competition documents (Stage 1) sent out/published	2000-01-21
Submission of written questions concerning the competition documents	2000-01-24 - 02-07
Written replies to written questions received	2000-02-21
Latest date for submission of competition entries	2000-03-31
Notification of selected samples/prototypes	2000-05-05
Submission of selected samples/prototypes to SP	2000-05-29
Testing/evaluation	2000-05-29 - 07-31
Nomination of the winner(s)	2000-09-29
First deliveries, Stage 1	2000-11-01

Performance specification - Solar-heated domestic hot water systems for detached houses

General

Extent

1. System
2. Costs
3. Solar collectors
4. Solar collector circuit
5. Heat storage tank/water heater
6. Energy meter
7. Environment
8. Marking

General

The following is a description of the requirements drawn up by the competition organisation for the International Energy Agency, Solar Heating and Cooling, Task 24, Solar Procurement technology competition.

Extent

This performance specification covers **solar heating systems for the production of domestic hot water** for detached houses or for apartments in smaller apartment buildings, both new and existing, in Sweden (which has a Nordic climate). The system consists of the following main component groups: solar collectors, a hot water heat storage tank and the necessary equipment for transferring heat from the solar collectors to the domestic hot water system. The requisite control equipment is also to be included.

Those systems which, after a first investigation 'on paper', are regarded as being worth testing, will be tested in accordance with prEN 12976-2 - ISO/DIS 9459-5: see Appendix 2. **Manufacturers whose equipment is sent forward for testing in this way must have a prototype available for testing by not later than the date specified in these competition documents**.

1. System

Obligatory requirements

1: The proportion of heat supplied by solar energy must amount to at least 50 % of the total annual domestic hot water requirement for a household, under the following conditions: a south-facing position, with a 30° roof slope, climate data as for Stockholm, 1986, domestic hot water requirement of 2650 kWh/year (= on average, 150 l of hot water per day at a temperature of 50 °C).

If the annual tank losses are assumed to be 500 kWh, the solar collectors should supply at least 1825 kWh/year to the hot water storage tank (1325 + 500). See Appendix 2.

2: With the electric immersion heater or other non-solar heat input turned off, and with an incident solar energy input of at least 6 kWh/m², day, it must be possible to raise the temperature of at least 150 l of water to >50 °C by the end of the day.

3: In all other respects, the system shall fulfil the requirements for domestic hot water production set out in the 1994 Swedish Building Regulations.

Information required

1: A drawing of the system showing the various components in it, together with a description of the method of hot water production (i.e. whether it is stored directly in the heat storage tank or heated in a heat exchanger). If some other arrangement is employed, it must be described.

2: A function description (possibly with details of different operating modes, such as spring, summer, autumn and winter).

3: User instructions, with suggestions for suitable installation arrangements, maintenance procedures, fault-tracing etc.

4: Installation instructions and instructions for commissioning.

These instructions must describe the installation work on a step-by-step basis, such that the intended function and performance are achieved. Installation must not require anything other than normal professional trade skills. If some special authorisation is required for any particular part of the work, it must be pointed out.

Comments: Requirements 3 and 4 need be fulfilled only in connection with prototype testing.

2. Costs

Obligatory requirements

1: The cost for a complete system must not exceed SEK 16 000, including value-added tax, as delivered to a customer in Karlstad.

Costs shall be expressed assuming an annual production/sales volume of 1000 systems.

2: The system shall have at least two years' guarantee.

3: One of the objectives of this technology procurement competition is to achieve low installation costs for the complete system. Entrants must therefore state attested typical installation times as needed by an authorised installer.

Desirable requirements

1: The cost for a complete system must not exceed SEK 14 000, including value-added tax, as delivered to a customer in Karlstad.

Costs shall be expressed assuming an annual production/sales volume of 2000 systems.

Information required

1: The cost of a complete system, with all components.

The cost of the solar collectors alone must also be stated, as a basis for evaluation.

2: Attested typical installation times by an authorised installer for the typical house as described below, broken down as further described:

A 1½ storey house, having existing heat supply equipment/hot water storage tank for domestic hot water on the ground floor.

a) Installation of the solar collectors on an existing roof. Assume that the roof is tiled.

b) Installation of connection pipes to and from the solar collectors (indicating their routing and length) between the collectors and the heat storage tank (running the pipes outside the house and through the exterior wall to the connection point).

c) Installation of a new heat storage tank with circulation circuit, or of a complete equipment unit, additional heating equipment and connection to the existing domestic hot water circuit.

3: The cost for possible options, e.g. energy meter, regular maintenance and the amount of electrical energy required for operation.

3. Solar collectors

Obligatory requirements

1: The solar collectors must be approved by testing by SP or some other internationally recognised test institute.

2: The solar collectors winning the competition must be P-marked.

Information required

1: Test certificate from SP or from some other internationally recognised test institute.

New solar collector designs must have been submitted for SP's initial inspection for the P-marking process, and test certificates must be submitted by not later than one month after the concluding date of this stage of the technology procurement competition.

2: The solar collector dimensions, weight, performance etc.

3: A description of installation etc.

4. Solar collector circuit

Obligatory requirements

1: Electronic control unit, with sensors for starting and stopping functions, pressure protection and overheating protection to be included.

2: The system shall have a circulation circuit, with thermally insulated pipes for connection between the solar collectors and the heat storage tank.

Desirable requirements

1: As far as possible, the equipment of the circulation circuit shall be built into a factory-made 'drive unit' in order to facilitate as quick and simple installation as possible.

The circulation circuit for the solar collectors should include: circulation pump, reverse-flow protection, antifreeze to prevent the heat transfer medium in the solar collector circuit from freezing, any temperature limitation device if needed for the solar collectors, filling and drain valves, collecting vessel (drain tank) if required etc. Pressure limitation and expansion device in order to avoid damage to the collectors, including safety valve and pressure gauge. Thermometers for indication of temperatures to and from the collectors. Insulated double pipe connection between the solar collectors and the heat store.

2: The signal cable for the sensors in the solar connectors should be integrated in the piping connection between the solar collectors and the heat store.

One way in which this could be done is to use the 'lifeline' system, which has been developed in Canada and consists of an integrated and insulated set of pipes and wires, comprising the liquid supply and return connections and the signal connections for sensors fitted in the collectors.

Information required

1: The design and standard lengths of the pipe and wire connections.

2: A function description, including recommendation for suitable siting of the control unit.

5. The heat storage tank/water heater

Obligatory requirements

1: The maximum size of the heat storage tank must not exceed 600 x 600 x 2200 mm (width x depth x height).

2: The heat loss from the tank must not exceed 600 kWh/year.

3: The heat storage tank must be approved for use as a hot water calorifier, and be modified as required for use with solar heating systems.

Pressurised tanks must be approved for a hydraulic pressure of at least 1 MPa, with allowance for any water hammer. The normal tap water system pressure is 0.6 MPa. The heat storage tank must be made of suitable materials and in such a manner as to resist corrosion.

See Reference /1/ and ISO TR 10217 for further information on corrosion.

The tank must be fitted with all necessary filling and drain devices, together with safety devices for pressure and temperature protection. A set of valves for connecting to the cold water supply is not included in the delivery.

4: A complete set of auxiliary heat supply equipment shall be included. This may consist, for example, of an electric immersion heater or of some means of supplying additional heat to the solar heating circuit.

> *The 1994 Swedish Building Regulations require immersion heaters to have a rating of at least 1.7 kW if the system includes a hot water storage tank with a capacity of about 200 l. Alternatively, the water temperature may also be raised outside the hot water storage tank, using some form of electrical storage or through-flow heater. Note, however, that this generally requires a higher installed power supply capacity in order to meet the 1994 Building Regulation requirements, amounting to about 35 kW for on-demand heating of cold water.*

The additional heating system must be straightforward to set up and adjust, and the hot water storage tank must be fitted with a least one thermometer, displaying the temperature in the upper part of the tank.

If the additional heat is supplied directly to the heat storage tank, the internally or externally fitted immersion heater must be installed in, or connected to, the upper third of the tank in order to be able to maintain the necessary temperature there. In systems in which the domestic hot water is stored directly in the heat storage tank, the top of the tank must be continuously maintained at a temperature of at least 60 °C. In systems in which the tap water is heated by drawing it off through a heat exchange coil or a heat exchanger, it must be heated to a temperature of 55 °C.

The heat storage tank must be prepared for possible later connection of waterborne additional heating instead of electric heating (i.e. incorporating a heat exchange coil).

Desirable requirements

1: The tank should be fitted with an integral heat exchange coil, with connections for connecting a source of waterborne additional heating.

Information required

1: The dimensions, weight and U-value of the tank (or a detailed description of how the tank is insulated).

2: The type of tank to be used (an unpressurised storage tank for indirect production of domestic hot water, or a pressurised tank for direct storage of domestic hot water), identification of materials used in order to resist corrosion, measures taken to prevent the transfer of taste or odour to the domestic hot water and how any input of health-hazardous substances, or the growth of micro-organisms in the water, is prevented. In general, features must comply with the requirements of prEN 806-1 and prEN 1717.

3: A description of how and where additional heating is supplied, and of how it can be controlled.

4: A description of the preparations for an inbuilt heat exchange coil, or a description of an inbuilt coil, with connections for connecting to a waterborne heating system.

5. A description of the necessary electrical connections, i.e. single-phase or three-phase.

6. Energy meter

Desirable requirements

1: An energy meter to indicate the amount of solar energy supplied to the tank or the net solar energy withdrawn from it.

This information may also be provided by simple calculation in/by the control unit.

2: Energy meter for additional heating, e.g. electricity meter.

This information may also be provided by simple calculation in/by the control unit.

Information required

1: Type of meter, costs, information for quality assessment and siting of the meter.

7. Environment

Obligatory requirements

1: The heat transfer medium used in the solar collector circuit must not be toxic, cause serious irritation of the skin or the eyes, or pollute watercourses, and must be biologically degradable.

2: Thermal insulation materials used in the solar collectors may not contain CFCs. In addition, the insulation must not contain substances which, when raised to stagnation temperatures, could release gases that can cause serious irritation of the skin or the eyes.

Information required

1: The type of materials used in the solar collectors and the type of heat transfer medium, together with their potential or possible environmental effects.

2: Environmental declaration (see Appendix 3).

3: Indication of whether the system manufacturer or subcontractors is/are certified to ISO 14000, EMAS or similar environmental management systems.

Comments: For the time being, polypropylene glycol is acceptable as an antifreeze, provided that steps are taken to prevent it being discharged to a watercourse. The solar collectors, and all other materials in the system, are intended to save energy and to reduce pollution and emissions. The system must therefore be designed to facilitate re-use of the materials as far as possible.

8. Marking

Obligatory requirements

1: Each system shall be fitted with a label, in a suitable and clearly visible position, with indication of the following:

- The name of the manufacturer or system supplier
- The system type designation
- The manufacturing or serial number, and year of manufacture
- The type of solar collector
- Absorber and aperture areas of the collectors
- Nominal tank volume in litres
- Permissible domestic hot water pressure (MPa)
- Recommended heat transfer medium, with any necessary warning of toxicity
- Maximum pressure in the solar collector circuit
- Any necessary warning to indicate that a safety component depends on an electrical supply
- The power requirement (W) for the circulation circuit and for the additional electric heater.

Information required

1: A description of the label and of its siting.

Tests, standards and references - Solar-heated domestic hot water systems for use in detached houses

SOLAR COLLECTOR TESTING

SP's initial testing:

- Scrutiny/examination of the drawings and material specifications
- Scrutiny/examination of the installation and operation/care instructions
- Pressure testing
- Stagnation and thermal shock testing
- Resistance to wind and snow loading
- Resistance to rain
- Determination of thermal performance
- Calculation of annual yield at 25 °C, 50 °C and 75 °C
- Resistance to freezing
- Material tests (certain components)
- Preparation of a properties profiles.

SP's procedure for P-marking thermal solar collectors

After the qualifying inspection tests, collectors are exposed outdoors under stagnation conditions for one year, which is regarded as constituting accelerated testing. At the end of this period, when retested, the collectors must show no significant deterioration in performance, and no significant deteriorations in components or materials. The collector may then be awarded P-marking approval if all the test requirements are fulfilled and agreements are reached with the manufacturer concerning future quality control.

Theoretical annual energy yield

SP calculates collectors' expected annual energy yield at T = 25, 50 and 75 °C. These values must be stated. When evaluating the entries, the evaluation group will make its own calculation of the expected solar energy production, based on efficiency factors as indicated by test certificates. SP's figures of annual energy yield are calculated for south-facing solar collectors at an inclination of 45°. The meteorological data used is that for Stockholm, 1986, for which year the total available insolation amounted to 1062 kWh/m². Calculations are made using the MINSUN simulation program, based on efficiency parameters as measured by SP. Note that the theoretical annual yields will be used primarily as a means of comparison between systems. In addition to insolation, the actual yield of a system

depends also on the design of the system itself, the orientation of the collectors, user habits etc. The reference area, which is usually the same as the transparent frontal area of the collectors, is used when calculating the thermal performance and annual energy yield. Mean temperatures of 25, 50 and 75 °C are defined as being the mean value of the input and output temperatures of the heat transfer medium when passing through the collector. 50 °C is a suitable temperature for comparison of solar-heated domestic hot water systems.

Solar collector testing to prEN 12975-2

In addition to what is described above, testing in accordance with the prEN standard involves:

- Function checking of drainability (for solar collectors intended for use in drainable systems)
- Resistance to shocks and hail.

SYSTEM TESTING

So far, system testing to prEN 12976-2/ISO/DIS 9459-5 has not become a routine procedure applied by all test institutions. A somewhat simplified system test is therefore proposed here, to be regarded as a minimum requirement for the first procurement.

- *Antifreeze protection*

  for the solar collector circuit, but only for drainable (drainback) systems. It is important that filling and complete drainage are reliable. If necessary, testing of any electronic antifreeze protection system.

- *Overheating protection*

  for protecting the system against boiling and to protect users against scalding. Possible temperature limitation for the solar collectors and for the heat transfer medium.

- *Pressure testing*

  Testing to ensure that the system features withstand the permissible pressure, and testing the operation of pressure limitation devices. The applied standard is ISO/DIS 11924 or, in the case of non-metallic materials, at +10 °C above their maximum permissible temperatures.

- *Marking*

  Checking that a plate with the necessary marking is fitted in a suitable, easily accessible position on the system (e.g. on the heat storage tank). (See also the requirements in Appendix 1 concerning marking.)

- *Reverse flow protection*

  Inspection to ensure that a check valve, or other suitable device to prevent self-circulation, is fitted.

Calculation of thermal performance

Initially, the system performance, i.e. $f_{sol} = Q_{sol}/Q_{load}$, will be calculated from the specified parameter values and using the software used in ISO 9459-5, where:

$Q_{sol} = Q_{load} - Q_{aux}$

Q_{load} = 'load demand', calculated from $T_{hot\ water} - T_{cold\ water}$, here assumed to be 2650 kWh/year

Q_{aux} = electricity for immersion heater.

Measurement of thermal performance

The prototypes submitted for testing will be given a complete performance test for solar heating systems, in accordance with ISO 9459-5. f_{sol} will be determined as above, based on the identified parameter values, instead of on the specified parameter values. The performance specification requires that $f_{sol} > 50$ %.

The daily draw-off profile will be as set out in the 'Reference conditions for performance prediction' in ISO/DIS 9459-5, using the meteorological data for Stockholm, 1986.

Capacity testing with solar heating only (Obligatory Requirement 2): Conditioning to +10 °C prior to 07.00, no hot water draw-off during the day, draw-off at the end of the day (18.00) at 6 l/min until the tap water temperature has dropped to 40 °C. Insolation: > 6 kWh/m².

Hot water capacity and heat losses will be calculated on the basis of measurements in accordance with SS EN 255-3.

STANDARDS AND REFERENCES

Applied standards

In general, the systems will be required to conform to preliminary European standard prEN 12976-1:1997, which prescribes minimum requirements in respect of performance, materials, tests and documentation. In addition, there are certain requirements that are specific to this procurement competition, including compliance with the 1994 Swedish Building Regulations, Swedish climatic conditions and the need for low system costs. These requirements are clarified below.

Standards and building codes:

prEN 12975-1:1997 E
Thermal solar systems and components – Collectors – Part 1: General requirements

prEN 12975-2:1997 E
Thermal solar systems and components – Collectors – Part 2: Test methods

prEN 12976-1:1997 E
Thermal solar systems and components – Factory-made systems – Part 1: General requirements

prEN 12976-2:1997 E
Thermal solar systems and components – Factory-made systems – Part 2: Test methods

ISO/DIS 9459-5
Solar heating – Domestic hot water systems – Part 5: Outdoor test method for system performance characterisation by means of whole-system test and computer simulation.

ISO/DIS 11924:1995
Solar heating – Domestic hot water heating systems – Test methods for the assessment of reliability and safety.

ISO TR 10217
Solar energy – Water heating systems – Guide to material selection with regard to internal corrosion.

SS EN 255-3 'Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Part 3: Testing and requirements for marking for sanitary hot water units'.

preEN 806-1
Specifications for installations inside buildings conveying water for human consumption – Part 1: General

preEN 1717
Protection against pollution of potable water in drinking water installations and general requirements of devices to prevent pollution by backflow.

National Board of Housing, Building and Planning: BBR94 Building Regulations. BFS 1993:57, with changes BFS 1995:17

Hans Wennerholm. Rules for P-marking of thermal solar collectors. SP Swedish National Testing and Research Institute. CEN TC2312/N16,1994.

Other references:

/1/ Hans Wennerholm
The durability of domestic hot water heaters. SP Swedish National Testing and Research Institute, SP Report 1995:22 (in Swedish).

Information on solar collector testing

Information on development testing and other testing and evaluation in accordance with SP's P-marking rules for solar collectors is available from Hans Wennerholm (+46 33 16 55 40) or Peter Kovacs (+46 33 16 56 62).

For the years 1998-2000, the Swedish Government (through the National Energy Administration, STEM) is subsidising the cost of solar collector testing at/by SP with 50 %. This subsidy is available for 1) development testing, and 2) testing and evaluation for SP's P-marking. Grant applications are processed by SP.

Performance details

- Solar-heated domestic hot water systems for detached houses

Type/name of the system:	
Place of manufacture:	
Company submitting the tender:	
EN ISO 9000 quality assurance, certificate no.:	
Date/Signature:	
Name in block capitals:	
Address:	
Telephone:	
Fax:	
E-mail:	

Contents

1. Information required

Enter the information required in the right-hand column. Enter quantified data in figures, with other requirements confirmed as appropriate, in accordance with Appendix 1, Performance Specification, e.g. by 'Fulfilled', 'Included', 'See technical description' (pages 4-10 in this appendix), 'See our Appendix x' etc.

COMPETITION CONDITIONS			PROPOSAL
OBLIGATORY REQUIREMENTS	**DESIRABLE REQUIREMENTS**	**FORM OF PRESENTATION**	
1. System			
1: 50 % solar heat			%
2: >150 l >50 °C			litre
3: 1994 Building Regs.			
		1: System drawing	
		2: Function description	
		3: User instructions	
		4: Installation instructions	
2. Costs			
1: Max. SEK 16 000, incl. value-added tax		1: Complete system of which solar collectors	SEK SEK
	1: Max. SEK 14 000, incl. VAT	1: Complete system of which solar collectors	SEK SEK
2: Guarantee period			years
3: Typical installation times (hours)		2: Installation times for a) solar collectors, b) piping, c) heat storage tank and drive unit/circulation circuit	a) hours b) hours c) hours
		3: Accessories (type and cost)	SEK
3. Solar collectors			
1: Tested		1: Test report	
2: P-marking			
		2: Dimensions, weight etc.	
		3: Installation descr.	
4. Solar collector circuit			
1: Control unit			
2: Circulation circuit			
	1: Drive unit		
	2: Signal cable		
		1: Design	
		2: Function description	

5. Heat storage tank/calorifier			
1: 600 x 600 x 2200 mm			mm
2: 600 kWh/year			kWh/year
3: Approved calorifier			
4. Additional heating			
	1: Integral heat exchanger		
		1: Dimensions, weight etc.	
		2: Type	
		3: Additional heating	
		4: Integral heat exchanger	
		5: Electrical connection	
6. Energy meters			
	1: Solar heat		
	2: Additional heat		
		1: Type, cost, siting etc.	
7. Environment			
1: Heat transfer medium			
2: Insulation			
		1: Environmental impact	
		2: Environmental declaration	
		3: Certification	
8. Marking			
1: Rating and data plate			
		1: Information on plate and siting	

2. Technical description

The domestic hot water heating system, including the solar collectors, shall be documented in sufficient detail to enable the evaluation group to form a reasonable idea of the system's cost/performance relationship. In addition, the documentation must clearly indicate the most important material and environmental characteristics, in order to be able to gain an idea of the system's life and of its environmental impact due both to normal operation and subsequent disposal. Please use the following forms in order to facilitate presentation and make it easier to compare all entries on an equal basis.

Definitions:

Solar collectors: The smallest unit of a solar collector (e.g. a solar collector case).

Solar collector circuit: The circuit that connects the collector(s) with the heat store/domestic hot water calorifier, including pumps, valves, other equipment and sensor signal cables.

Heat store/domestic hot water calorifier: Heat storage tank, including additional heating equipment.

Solar heating system control system: A control unit for starting and stopping the solar collectors and system features and functions.

Solar collectors	Description
Type (flat plate, vacuum, CPC etc.)	
Mounting (incorporated in roof, surface mounting, free-standing etc.	
Minimum slope angle (°)	
Lifting device (required if module weight exceeds 60 kg)	
Number of fixing points per module	
Module dimensions - gross area (m²) - glazed area (m²) - absorber area (m²) - width (horizontal) (m) - height (up the roof surface) (m) - thickness (m) - reflector area (m²)	
Module data - Empty weight (kg) - Weight including heat transfer medium (kg) - Max. operating pressure (MPa) - Max. permissible temperature (°C)	

Test certificate attached, Yes/No - Issued by - Date of issue	
Solar collector coefficients, test results η_0, b_1 (W/m².K), b_2 (W/m².K²)	
Thermal yield (kWh or kWh/m²) as obtained by SP. - at 25 °C, 50 °C, 75 °C	
Stagnation temperature (ambient temperature 30 °C, and insolation 1000 W)	
Cover sheet - type (colour if applicable) - thickness - coefficient of transmission	
Absorber (colour if applicable) - type - thickness - surface coating (colour if applicable) - coefficient of absorption α - coefficient of emission ε	
Module - Edges (material, thickness) - Base (material, thickness) - Insulation (material, thickness)	

Solar collector circuit	**Description**
Drawing attached - Yes/No	
Solar collector unit (number. of modules, area)	
Flashing included? (material, colour)	
Fluid connection (within collector unit) - Parallel (number of modules) - Series (number of modules)	
Connection pipe - module (material, size)	
Connection pipe - solar collector unit (material, size)	
Volume of heat transfer medium in the system with standard length circulation connection (litre)	
Recommended heat transfer medium - concentration - boiling point (°C) - freezing point (°C)	
Recommended flow rate/pressure drop - per module (l/h,m²) - per module (Pa)	

- solar collector circuit (l/h or l/h,m²) - solar collector circuit (Pa)	
System has - internal heat exchanger - external heat exchanger	
Pump, solar collector circuit, including two shut-off valves - type - power	
Expansion vessel - volume (l) - safety valve - opening pressure (MPa) - pressure gauge	
In addition, the circulation circuit includes: - check valve - filling valve - drain valve - vent valve (nipple) - flow regulator (e.g. Tarco) - number of shut-off valves - thermometer in the return connection	
If an external heat exchanger is used to charge the heat store with solar heat: pump, solar heat charging, including two shut-off valves - type - power	
Circulation connections to the collectors: - standard length - material - integral insulation - insulation material - integrated double connection - integrated signal cable	

Heat store / domestic hot water calorifier	**Description**
Schematic drawing attached - Yes/No	
Type of heat storage tank (pressurised, unpressurised etc.)	
Test certificate attached - Yes/No - issued by - date of issue	
Volume (l) (Total, heat store or calorifier volume)	
Dimensions (overall) for installation (mm) - Height / Width / Depth	

- Necessary clearance height (mm)	
Net weight (kg)	
Pressure - Max. test pressure (MPa) - Operating pressure (MPa)	
Method of solar heat transfer: (external heat exchanger, integral coil, integral inner tank, shell type tank, direct with drainage, other) Heat transfer capacity (W/K, LMTD)	
Type of domestic hot water production: (Directly in the pressurised calorifier, integral heating vessel, integral coils, external heat exchanger, other)	
Heat transfer capacity with indirect domestic hot water production at a flow rate of 0.2 l/s (W/K, LMTD)	
Charging with waterborne external heat: (Directly to an unpressurised tank, via integral heating coil, integral inner tank, shell type tank, other)	
Heat transfer capacity with indirect domestic hot water production at a flow rate of 0.2 l/s (W/K, LMTD)	
Is there an active temperature stratification system in the tank? Yes, No	
Materials of/in the: - tank - solar heating charging circuit as above - domestic hot water production as above - any other heat charging as above - active corrosion protection?	
Connection sizes: - solar collector - for hot water and cold water - electric immersion heater in the tank - other heat supply	
Electrical supply: - single phase or three phase - power (kW)	
Tank insulation - material - thickness (mm) Loss at $\Delta T = 30$ °C (W)	
Type of cladding (must be hose-proof) - material - colour	
Type of thermometers (in the top of the tank and in the water heating portion),	

position	
Type of solar heat sensors (in the bottom of the tank), position	

Solar heating control system	Description
Control diagram attached - Yes/No	
Test certificate attached - Yes/No - issued by - date of issue	
Control principle: - Differential temperature - Insolation sensor - Other	
Entire system integrated in a control unit - Yes/No	
Start/stop sensors - in the solar collector, type, position - in the tank, type, position	
Differential temperature control: - ΔT_{start} (°C) - ΔT_{stop} (°C)	
Insolation sensors: - H_{start} (W/m²) - H_{stop} (W/m²)	
Type of overheating protection: - Function description - Solar collectors, operates at (°C) - Type of sensor - Tank, operates at (°C) - Type of sensor - Positioning	
Type of antifreeze protection: - Function, operates at (°C) - Type of sensor - Positioning	

Energy meters	Description
Solar collectors: - Type of meter - Placing - Cost	
Control unit: - Calculating - Cost	
Solar heat (net): - Type of meter - Placing - Cost	

Additional heat: - Type of meter - Placing - Cost	
Electricity meter: - Type of meter - Placing - Cost	

Marking (example of the rating/data plate)

3. Environmental declaration

The solar collector modules offered and specified in these documents

Type .....

Serial No. .....

contain ***more than 1 kg of the following reusable materials:***

Metals	Aluminium	kg
	Iron and steel	
	Galvanised steel	
	Copper, brass, bronze	
	Other metals	
Other	Glass	kg
	Polymers (plastic, rubber etc.)	
	Foamed materials	
	Mineral wool and glass fibre	
	Wood	
	Other material	

Recommended heat transfer medium/media
- Chemical substance
- Environmental impact
- Discharge restrictions

In addition, the solar collector contains the following quantities ***(over 1 g) of the following non-reusable*** materials:

.....
..

.....
..

In addition, the system contains the following products (e.g. tin, Teflon™, paints and varnishes, toxic substances etc.), the use of which is covered by restrictions due to their adverse environmental impact:

.....
..

.....
..

4. Other documentation

The following documentation must be attached to the entries:

- *Drawings of the solar collectors, showing dimensions and with details of materials and any restriction on mounting angle*

- *Drawings and instructions for connecting the solar collector unit to the hydraulic modules*

- *Installation instructions for the solar collectors, including transport instructions*

- *Instructions for recommended heat transfer medium, as well as for filling, draining and changing the medium*

- *Recommended heat transfer medium flow rate*

- *Any instructions needed for dealing with overheating and antifreeze protection*

- *Instructions for replacing solar collector glazing*

- *Any special requirements in respect of maintenance*

- *Instructions for end-of-life disposal*

Appendix no.	Description

MODEL FORM OF FRAMEWORK AGREEMENT

FOR SUPPLY AND DELIVERY OF SOLAR-HEATED DOMESTIC HOT WATER SYSTEMS FOR DETACHED HOUSES

The following points will be included in any framework agreement:

1. The parties to the agreement:
   The purchaser:
   The supplier:

2. The purchaser undertakes to encourage the ordering of at least 1000 systems in the form of call-off orders from various property owners/organisations/private persons, as based on the terms and conditions in this framework agreement. Orders are subject to the receipt of any necessary public authority permissions or acceptance of their requirements or conditions and to the achievement of approved test results.

3. Delivery of systems . . . .

4. The competition is divided into phases, as described in the competition documents. The Purchaser shall authorise the start and continuation of each phase.

5. Contract documents
   These consist of the contract, the competition documents and appendices, any requirements associated with orders, the competition entry and applicable parts of ALOS 81.

6. Prices
   Prices including value-added tax.
   Options

7. Times
8. Testing in accordance with ...
9. Guarantee
10. Terms of payment
11. Property rights, design rights etc. and the right to refer to this competition in marketing.
12. Secrecy
13. Service and maintenance

14. Representatives
15. Resolution of any disputes
16. Termination (if results cannot be achieved within the intended time etc.)
17. Call-off rights within the prescribed time period for the specified group of purchasers.
18. Rights to, and obstacles in the way of, assignment.

Description of the reference house

-Front of the house facing due south (see the elevation drawing, 'Entry facade')
-Exterior walls are described from the outside and in: floor/ceiling structures from the top and down.

Exterior walls
22 x 120 mm vertical cover boarding
Wind barrier paper
22 x 70 mm nailing battens on 45 x 95 mm studs, 600 mm centres
120 mm Grade A mineral wool insulation between the studs
Plastic film vapour barrier
13 mm gypsum board
Surface finish

Internal load-bearing walls
45 x 70 mm studs, 400 mm centres
On both sides: 13 mm gypsum board
Surface finish

Internal non load-bearing walls
45 x 70 mm studs, 400 mm centres
On both sides: 13 mm gypsum board
Surface finish

Ground floor
Floor covering
22 mm particle board
45 x 220 mm floor joists, 400 mm centres
100 mm Grade B mineral wool insulation between the joists
13 mm asphaboard

Upper floor
Floor covering
22 mm particle board
45 x 220 mm floor joists, 400 mm centres
13 mm mineral fibre board
Woven textile ceiling, except in the kitchen utility room, which have a ceiling of hard surface-finished wood fibre board, and the bathroom and shower room, which have ceilings of woven-reinforced plastic.

Roof void floor structure
13 mm mineral fibre board
45 x 120 mm joists, 1200 mm centres
Woven textile ceiling

Outer roof structure
45 x 220 mm T 200 structural timber or double 34 x 220 mm stress-graded timber roof beams, 1200 mm centres
30 mm building paper-clad Grade A mineral wool insulation
150 mm Grade B mineral wool insulation
Plastic film vapour barrier
Hard wood fibre board cladding to occupied area
Surface finish

Outer roof cladding
Concrete tiles
45 x 70 mm tile battens
3,2 mm hard wood fibre board

Translation: Swedish - English

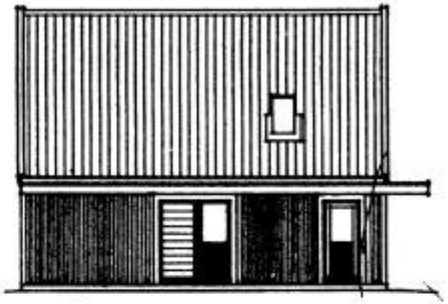
Fasad och sektion	Elevations and section
Skala	Scale
Fasad mot gata	Street elevation
Entréfasad	Entrance elevation
Sektion	Section
Fasad mot trädgård	Garden elevation
Långfasad	Side elevation

Plan	Plan
Skala	Scale
Förråd	Store
Sovrum	Bedroom
Vardagsrum	Sitting room
Sop	Refuse
Bilplats ...	Carport
K	Shelf
KPR	Cloaks
VV	Domestic hot water
G	Wardrobe
WC	WC
Bad	Bathroom
TM	Washing machine
DM	Dishwasher
Tvätt	Utility
Kök	Kitchen
TS	Dryer
KS	Refrigerator
F	Freezer
Allrum	Breakfast room
ST	Cleaning items
L	Wardrobe
Bottenplan	Ground floor
Dusch	Shower
KLK	Walk-in wardrobe
Överplan	Upper floor

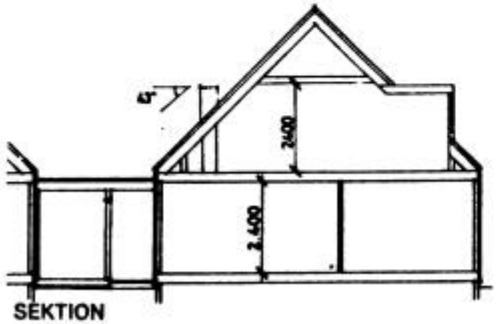
Fasad och sektion

Typhus
Skala 1:200

FASAD MOT GATA

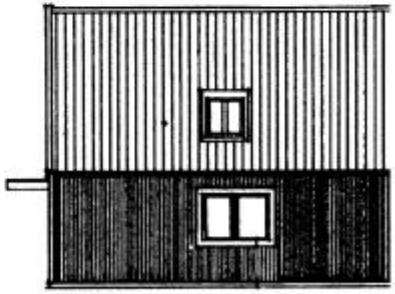


ENTRÉFASAD



SEKTION

FASAD MOT TRÄDGÅRD



LÅNGFASAD

Plan

Typhus

Skala 1:100