CADDET renewable energy

IEA OECD

Integration of Solar Collectors into the Building Process

Summary

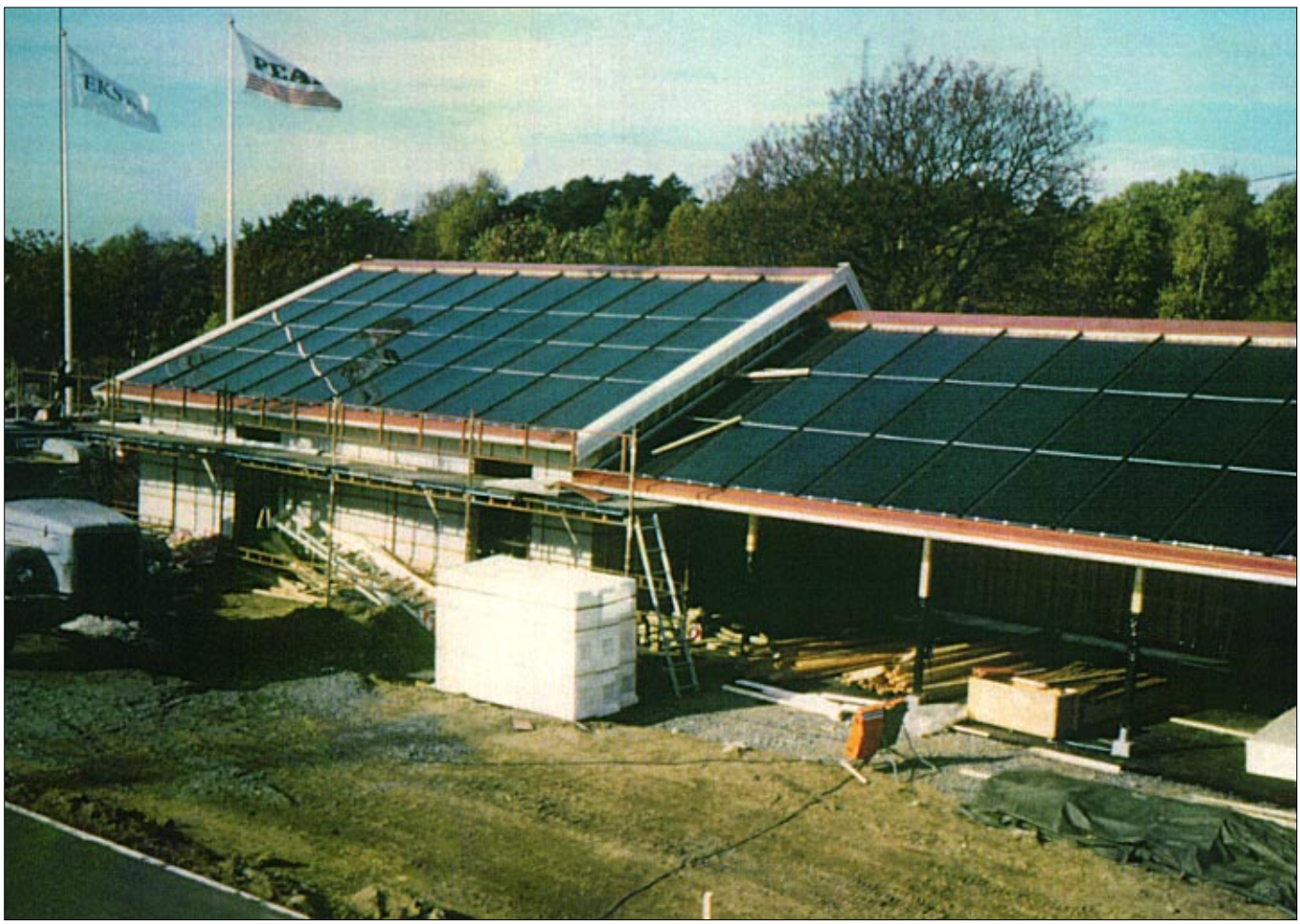
A new type of prefabricated solar collector roof module has been used in a small new residential building area in Onsala, south of Gothenburg, Sweden.

This development has resulted in a better integration of solar collectors into the building process, together with reduced investment cost and improved thermal performance compared to previous designs.

Highlights

- **Considerably simplified building process**
- **Lower investment cost**
- **Improved performance**

Installing the roof module collectors at Onsala, Sweden.



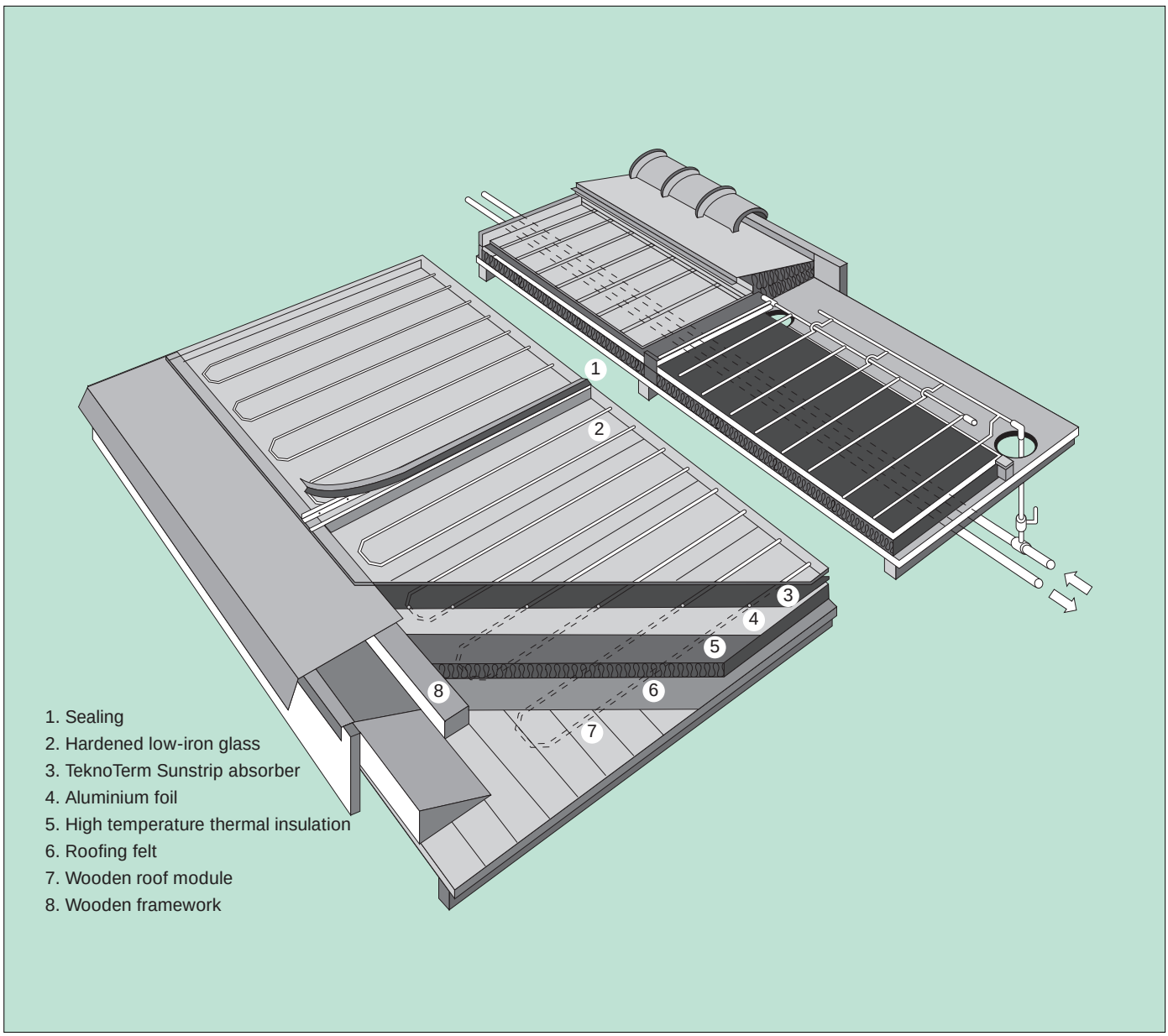
Project Background

Derome AB has developed a prefabricated roof module with an integrated solar collector. The design is based on a prefabricated roof module which includes the basic components of a solar collector; ie insulation, absorber and transparent cover. The roof module is 2,400 mm wide and is designed to be mounted directly onto roof trusses spaced 1,200 mm apart. Additional work on site only involves joining up connecting pipes and cover plates.

This new design is superior to previous types of roof-integrated collectors in several respects. The roof module is prefabricated using mainly traditional building materials resulting in better quality and lower costs. Marketing and manufacturing have been transferred to a building contractor, able to offer the complete roof construction as part of the normal building work.

The new solar collector roof module was tested and approved at the National Institute for Testing and Research in 1994. The development was supported by the Council for Building Research and carried out in co-operation with Building

Diagram of the roof module collector.



Services Engineering, Chalmers University of Technology and TeknoTerm, manufacturer of the absorber used in the collector.

Derome AB is the manufacturer of the roof module collector. The housing company, EKSTA Bostads AB, started to use solar assisted heating plants in the early 1980s and has now installed about 6,000 m^2 of roof-integrated collectors in about 10 residential building areas. For several years the company has used a combination of wood (70%), solar (20%) and oil or electricity (10%) for heating in all new building areas.

The Project

The new collector module has been used in a small new housing development in Onsala, south of Gothenburg. The building area comprises 36 apartments in 9 blocks with about 2,600 m^2 heated floor area. Roof collector modules with an area of 220 m^2 are connected to a central heating plant with an 18 m^3 water storage tank and supplementary boilers.

The buildings are built of wood, are well insulated and have floor heating systems and simple exhaust ventilation systems. Heat and domestic hot water are supplied to the buildings from the central heating plant via underground pipes. The solar system is designed to cover about 25% of the total heating demand; ie to give energy savings of the order of 25 kWh/m^2 heated floor area.

The collector modules are installed on the south roofs of the heating plant building and an adjacent carport. The prefabricated modules have a standard width of 2,400 mm, are mounted directly on the roof trusses and connected in the same way as ordinary roof modules. In order to increase the available roof area, both the heating plant building and the car port were designed with an asymmetric roof with a longer slope to the south.

Extra Investment Costs Associated with the Solar Collectors

Solar heating system	SEK	SEK/m^2
Roof module collectors	185,300	838
Connecting pipes	47,000	213
Tank 18 m^3	60,000	
Heating plant equipment	98,500	
Sub-total	390,800	1,768
VAT (25%)	97,700	
Total	488,500	2,210

Performance

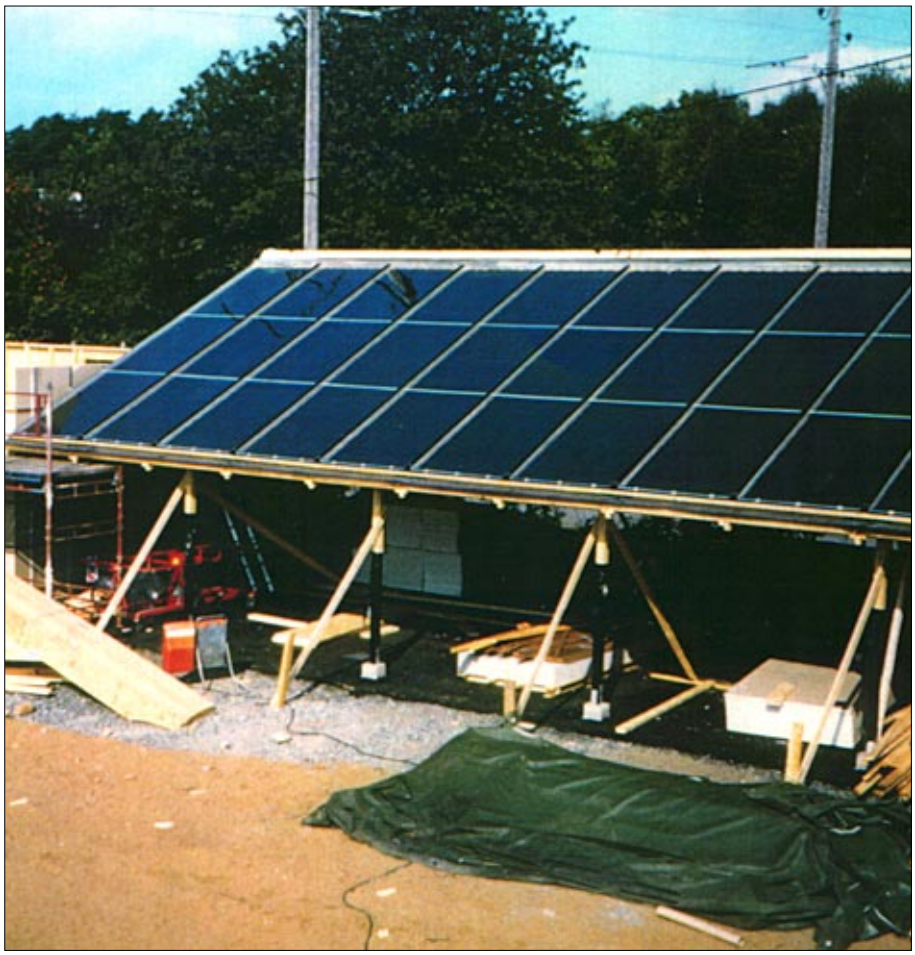
Building work commenced in August 1995, the roof modules were installed in September 1995 and the tenants moved into their apartments in May 1996. Monitoring started in March 1996 and the results are in agreement with the estimates. The estimated average solar yield is 60 MWh/year.

Economics

The extra cost (shown in the table) for the solar system is based on actual contracts from November 1995. The new roof collector modules show a cost reduction of around 30%, related to the costs of previous plants with roof-integrated collectors.

The cost of an ordinary tiled roof is estimated to be SEK 95,000 (where SEK is the Swedish krona) but the total cost for the roof with solar collector modules is SEK 280,300 giving an extra cost of SEK 185,300 associated with the solar collectors. The total cost of the water storage tank is SEK 120,000. The tank replaces part of the domestic hot water system and is used in connection with the boiler, and only 50% is dedicated to the solar system. The total heating plant cost is SEK 395,000 and the part needed for the solar collectors is estimated to be 25%.

An estimated average solar yield of 60 MWh/year and an annuity of 0.08 results in a solar cost of SEK 0.60/kWh. Equivalent prices for other summer heating options are: electricity SEK 0.65/kWh and oil SEK 0.45/kWh. The total cost for the building area amounts to SEK 9,000/m^2 heated floor area, which means that the extra investment cost for the solar system, ie SEK 180/m^2, amounts to only 2% of the total building cost.



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