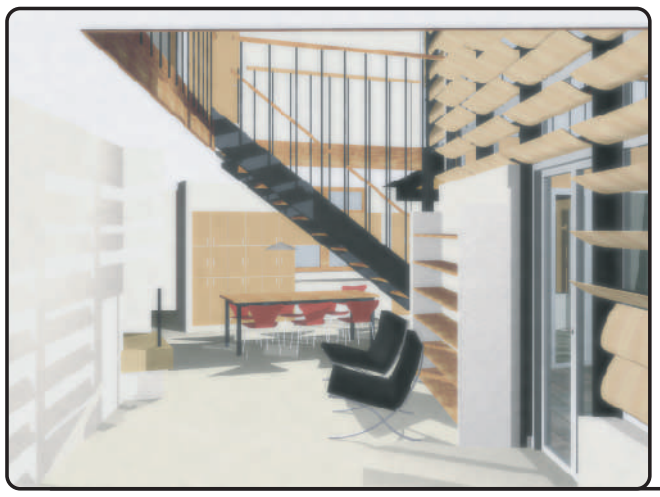
Design, Construction and Performance of a Multifunctional Hybrid Solar Wall



design

A single family house under construction in central Sweden will have inegrated hybrid solar collectors, that not only provide heat and electricity, but also daylight, passive heating, view and added aesthetic value to the interior.

The design has taken inspiration from the window's thermal and daylighting qualities, so that the window functions as the system's glazed outer surface.

The integration inside the windows allows the system to combine passive and active solar heating, and the concentrating, turnable and weather protected reflectors also function as solar protection while being a decorative element within the interior.

construction

The solar wall conists of a fixed absorber with PV-cells attached to it. The heat carrying water pipes supports the components between the house's vertical wooden pillars, and are also the rotation centre for the screens, that can be turned in 90º between two modes; open and closed.

The reflector screens are made in a sandwich construction with an EPS filling covered by a reflective film on the concave side facing the window, and a birch veneer on the convex side facing the interior.

The porous structure helps to lower the glazed wall's U-value when in an upright position at night time. During day time, the closed reflectors function as solar protection that reduces the risk of overheating, another problem in passive solar houses.

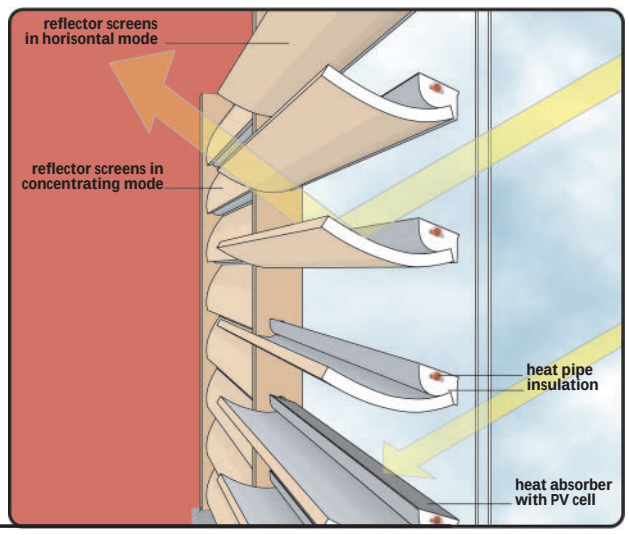
performance

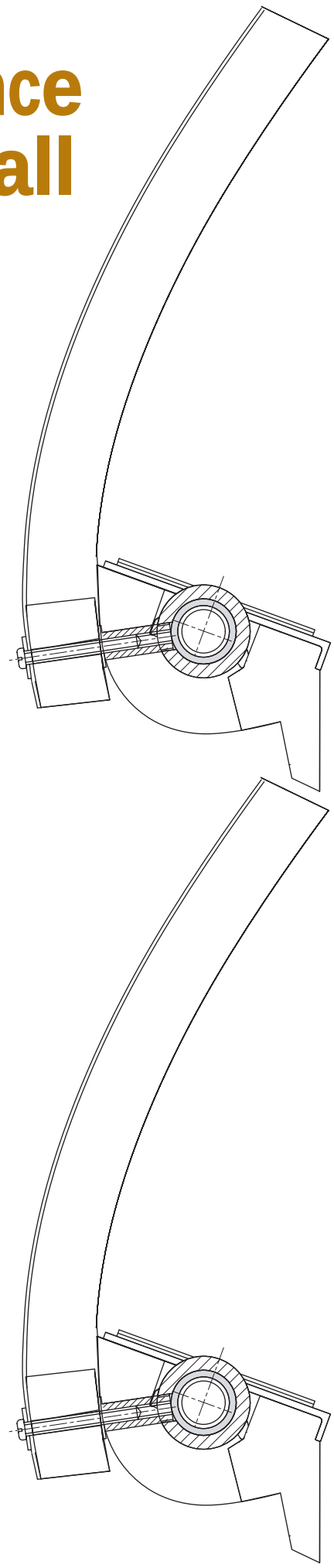
During day time, the closed reflectors work with a concentration factor of 2,7. Thereby, the active thermal performance is expected to be approximately 500 kWh/m^{2}a, and the electricity yield 240 kWh/m^{2}a, absorber area.

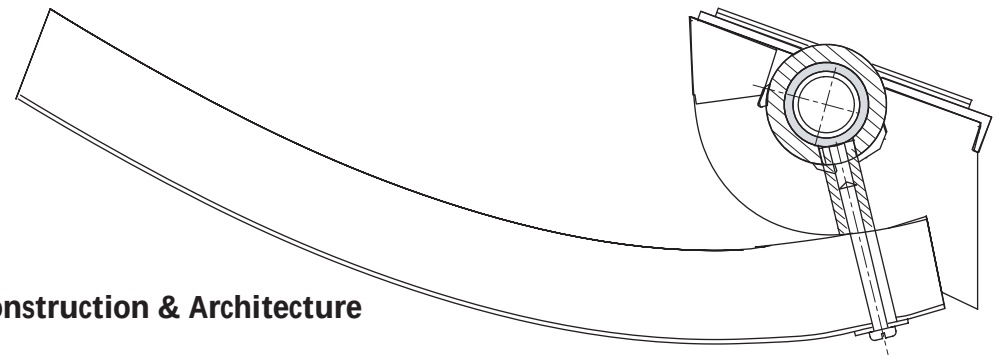
Besides this, the thermal surplus passively gained through the windows is directly passed on to the interior with the reflective blinds folded down.

Further on, the open blinds reflect daylight deeper into the interior via the ceiling.

No matter the physical performance, the system shows the path to a new way of integrating solar energy systems into buildings with cogenerative effects. Internal exposure and the possibility for interaction makes way for increasing engagement and environmental awareness.







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