Heat from the continuous collector

The solar field on the roof of a carport in the ecological district of Balma-Gramont should achieve yields of over 1000 kWh/ m^2 a year. With 444 m^2 of aperture area it is considerably smaller than the projects which SAED is really aiming for with the technology.
Graphic: Jean-Pierre Larrouy, Architect

In September two solar supported heating networks are going into operation in the south of France. They are the first commercial projects to use the new tube collector by SAED, with its continuous collector tube.

There is not even a correct technical name for the solar system on the roof of a carport in the ecological district of Balma-Gramont near Toulouse. Large area collector doesn't really fit the bill, for although they absorb the sun's rays, you usually understand the word collector as meaning individually manufactured units which are joined up with pipes during the installation process. The 444 m² solar field in Balma-Gramont, however, consists of two long steel collector tubes which are linked up to the 5,000 vacuum tubes via heat pipes. The head of each heat pipe consists of an aluminium sheet with three channels, which is wrapped around the collector tube. The inside of the collector tube thus remains free of obstructions and the pressure loss remains low despite the long tube length. The two loops should be able to achieve a thermal power of 300 kW. In Les Constellations the collector field has an aperture area of 204 m^2 and at 150 kW has considerably less thermal power. A typical collector loop is 160 m long (80 m in each direction), has approx. 2,000 vacuum collectors and achieves a heating capacity of around 100 kW.

The system in Balma-Gramont and a further one in the eco-village of "Les Constellations" near Montpellier are the first two commercial projects to use the continuous collectors by Sophia Antipolis Energie Développement (SAED). The collectors will be connected to the local district heating networks to provide housing blocks, shops and offices with heat. The specific heat costs should lie between 6 and 7 €-ct/kWh. However, this is actually just the preliminary version of what SAED Managing Director Franck Giaoui envisions: "The two systems are really somewhat too small to make full use of the advantages of our technology. Our aim is projects approximately five to ten times the size," he says. But for now the demonstration projects will have to do.

Without storage or back-up directly into the network

Both systems have in common that the solar energy will deliver a pretty small share of the heat. In Balma it is 15 %, in Les Constellations 5 %. The bulk of the heat will come from a biomass plant in each case. In Balma the solar heat and biomass together will supply 80 % of the heat, with a gas boiler covering the peaks. In the summer the solar system should provide 100 % of the hot tap water demand.

In both cases there is no real heat storage and no back-up heat source in the solar loop. The solar collectors supply a constant temperature to the heat exchanger that links up the solar system with the network. For this to work, one measure is to adjust the flow in the solar system. Additionally, there is a small buffer in the solar system. In Balma it is a 2 m³ tank which balances out fluctuations. The desired supply temperature in Balma is between 55 and 105 °C; in Les Constellations the maximum is 85 °C. These temperatures can easily be reached by the SAED systems, as they were developed for temperatures of up to 130 °C. The main heat storage is on the network side. In Balma, for example, there are two tanks with 12 m^3 each.

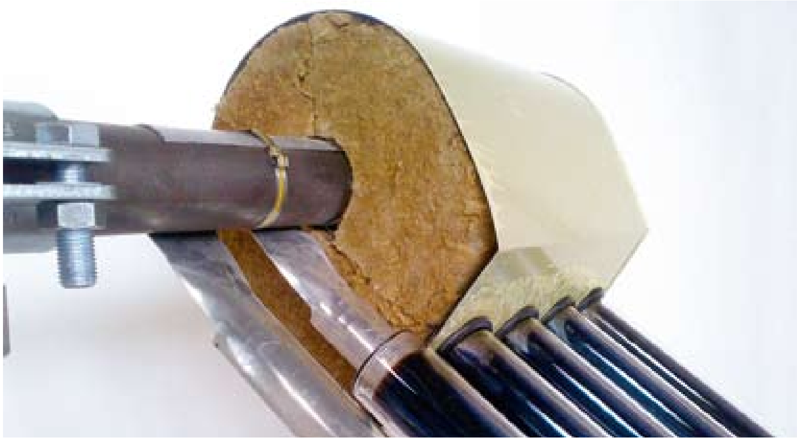
The system is technically demanding, as it requires precise control. In comparison, in Denmark the solar heat is normally first fed to a storage. Depending on the weather, the temperature levels on the solar loop can be varied, so that high yields can always be achieved. On the other hand the concept of direct infeed is exciting as it enables solar heat to be integrated into existing heating networks. There are similar approaches in Sweden. From experience gained with the systems there you can see that the success of such a concept is strongly dependent on a professional operation. The operator of both district heating networks and the accompanying solar systems is Cofely, France's largest energy service provider. SAED expects yields of over 1,000 kWh/m² a year for both projects.

Drain-back saves on hydraulics costs

The system in Les Constellations has another innovation too. While a classical pressure system is used in Balma, a drain-back system is used in Les Constellations. In general drain-back systems are often used by many manufacturers to protect the field from destructive high pressures. SAEDs technology does not need such a protection because the long steel collector tube can withstand high pressures and temperatures.

The reason for the different technical concept lies in the differing framework conditions. In Balma the network is operated at high temperatures. A pressurised system is thus required so that the water doesn't turn to steam. Additionally, the height difference between the collector field and the hydraulics control centre is not enough for a drain-back system, as the solar field is installed on a carport. The hydraulics required for the conventional pressure system make up approx. 25 % of the cost of the solar system in the Balma case.

The system in Les Constellations is smaller, but the costs for the hydraulics would hardly be lower. If a normal pressure system were used, one would thus have to spend approx. 40 % of the system costs on the hydraulic control centre alone, estimates Giaoui. By using a drain-back system the hydraulic control centre is between 20 and 50 % cheaper. The framework conditions in Le Constellation for using drain-back are good; the difference in height is adequate, as the solar system is installed on the roofs of the boiler buildings. Also, the required supply temperature does not go above 85 °C, so there is no risk of the water turning to steam.



Heat pipe with a difference: the aluminium plate meets up with the steel collector tube on the outside and thus transfers its heat without increasing the pressure drops and balance losses.

Photo SAED

Dress rehearsal for larger aims

In September the continuous collectors are to be installed in Balma-Gramont and the solar system inaugurated. The French Environment and Energy Management Agency ADEME is supporting the project and will monitor the yields. The project in Les Constellations is to be completed at the end of the year.

At the same time, Giaoui is looking for new and larger projects. Drying fruit and pasteurising milk somewhere in Africa, the Middle East or Latin America: these are the applications which he has in mind. Obviously also copper mining, which requires copious amounts of heat for the electrolysis baths at the remote mines and which has recently discovered solar energy in Chile. What is still missing is the right sales network outside Europe, however, as SAED is a small company. But Giaoui promises that he has the cheaper solution on offer for large projects of 10,000 m² and above, requiring temperatures of around 90 °C. He states approximately 3 to 3.5 €-ct/kWh as a target cost – a price for heat which can certainly compete against diesel and probably against heavy fuel and gas.

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