



A safer, simpler and more efficient way of solar power collection

Airlight Energy's innovative parabolic trough solar collector shines a light on the reliability of Eaton's miniature circuit breakers and residual current devices

Location:

Biasca, Switzerland

Challenge:

Reliable, robust and easy to maintain electrical systems suitable for applications in challenging environments and remote locations worldwide.

Solution:

FAZ miniature circuit breaker, FRCmM residual current circuit breaker, NZM circuit breaker, EMR4 relays.

Results:

Eaton's high quality, internationally-qualified and supported components ensure high availability while allowing easy and fast installation and contributing to simplified maintenance.

Background

Parabolic trough solar collectors harvest the sun's energy by focusing its radiation onto a circulating heat transfer medium, which is typically either steam, thermal oil or liquid salt. However, these mediums circulate in the solar field at high pressure, so in the event of a leak people and the environment are at risk. This risk is significant when you consider that a 50 MW power station can use around one million litres of thermal oil.

Swiss company, Airlight Energy Manufacturing SA has prototyped an innovative parabolic trough solar connector that eliminates this risk - while also improving efficiency and reducing costs - through technological simplicity. The design, which uses air as the absorber medium, achieves two key benefits. Firstly,

temperatures of over 600°C can be realised and secondly, the air can transport the collected solar energy to a store filled with pebbles. At night, the transport flow direction can simply be reversed to deliver the solar energy as and when required.

Solar collection is performed with a parabolic pressure chamber enclosed by two foils. The first is a silicon fibre glass fabric tensioned into the base structure. The second is a cover foil made from a transparent, low refractive ETFE (Ethylene tetrafluoroethylene) material offering high light and UV permeability as well as a low tare weight. The chamber is pressurised to a few millibars using a variable-speed fan to give the parabolic reflector a 'perfect' curvature. This ensures a high radiation concentration onto the receiver.

Airlight Energy brought another innovation to the power plant in the form of the support structure, which was designed using lightweight precast concrete elements. This allows the reflector to be rotated on the foundation with very little energy required; tracking the sun to ensure optimum use of its radiation at all times. Furthermore, it enables the collector to be moved easily into a safe position during high wind speeds.

Challenge

These solar collectors are intended for installation in regions of strong, regular sunlight - and these include remote locations in Africa, Mexico, the Arabian Peninsula and some parts of India and Australia. Within these challenging environments, the electronic and electrical



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equipment installed into each collector has to be robust – and this includes the power distribution system and switchgear. Maintenance visits for such equipment on these sites are costly and time-consuming, and finding highly trained staff can sometimes be an issue. Lack of locally-available spares was another potential problem that had to be considered and allowed for.

Solution

Eaton proved capable of providing both a technical and logistical solution for Airlight Energy's switchgear requirements. It supplied components including miniature circuit breakers and residual current devices (FAZ and FRCmM) as well as EMR4 measuring and monitoring relays and an NZM2 circuit breaker which is used as a main switch. The products are used primarily to monitor the cables and systems for overcurrents or short circuits. Airlight Energy awarded the purchasing contract to Eaton due to the impressive features of the overall package; the high standard of finishing and material quality of all products suited the demanding target application.

Additionally, the busbar system used for the xEffect devices allowed fast mounting of the miniature circuit breakers and residual current devices in the power plant's control panel. This speed and simplicity, together with a versatile range of applications options, reduced original manufacturing costs and simplified maintenance on location. Additionally, the FAZ miniature circuit breakers, which are rated to 63 A, have on-board features to further simplify maintenance tasks. These include red-green contact position indication, clamping aid, protective cover and a three-position latching slide. Similarly, the FRCmM residual current circuit breakers have a large choice of rated currents and provide real contact position indication.

The products' comprehensive range of international approvals also underwrote Airlight Energy's export plans, as they could be confident that their systems could be qualified for use anywhere in the world. This advantage is complemented by Eaton's worldwide presence and local support, which means that spares can be obtained and quickly delivered to the solar collectors in their remote locations.

Results

The project is being supported by the Swiss Federal Office of Energy. Research and development work is partnered by specialists from the SUPSI technical university in Tessin, the Swiss Federal Institute of Technology Zurich (ETHZ) and the Paul Scherrer Institute. A test programme is being completed at the installation site of the third prototype in Biasca, Switzerland, where the relevant data is also being collected and the mathematical models are validated. All essential indicators, such as temperatures in the collector and in the storage bed are recorded, documented and visualised on screens in the control room.

Eaton looks forward to providing and supporting its flexible, rugged, internationally-qualified range of circuit protection products to Airlight Energy. This partnership will continue to develop the technology and install production systems where they are needed and effective in widely-distributed parts of the world.



The FAZ miniature circuit breaker includes features such as contact position indication, red-green, clamping aid, protective cover, three-position latching slide, rated currents up to 63 A



With the FRCmM products Eaton offers a complete range of compact residual current circuit breakers for residual current and additional protection; they are available in a large number of rated currents and feature real contact position indication

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Publication No. CS083068EN
February 2016