



*"Amanecer Solar CAP" in Chile - monitored by Bender*

## The largest photovoltaic system in Latin America

**The Atacama Desert**, one of the driest landscapes on earth, runs approximately 1,200 km along the Pacific coast of South America. There are places here which do not register rain for decades. With so little rainfall, many places along this coastal desert remain completely uninhabited. Only the large deposits of lithium, copper, silver, gold, and platinum have led to industrial settlements, which form Chile's present economic backbone.

**The most important producer** of iron ore and pellets on the American Pacific coast and the largest steel producer in Chile is the CAP Group.



▶▶▶ In order to ensure the electricity supply to their new “Cerro Negro Norte” plant, a mountain surface mine 42 km east of the city of Caldera, the CAP Group planned the construction of one of the largest photovoltaic power plants in Latin America in Copiapó, in the heart of the Atacama Desert. The North American company SunEdison was chosen as a partner for this project.

SunEdison is a world leader in the field of photovoltaic and semiconductor technology and is one of the largest suppliers of innovative solar energy solutions. With the development, financing, operation, and monitoring of solar plants in more than 35 countries on five continents, SunEdison runs over 1,000 photovoltaic power plants with a total production of 5 GW (as of 31 July 2015).

The “Amanecer Solar CAP” in Chile has more than 310,000 photovoltaic modules spread over an area of 250 hectares. It was constructed in just six months and was commissioned in May 2014. The energy generated runs into the largest integrated grid in Chile, the SIC (Sistema Interconectado Central).



With an investment of USD 250 million and an installed capacity of 100 MWp, the PV power plant produces 370 GWh of clean energy every year and reduces CO<sub>2</sub> emissions by approx. 135,000 tonnes - enough energy to supply 125,000 households every year. The energy produced is approximately 15 % of the CAP Group’s yearly consumption. This also means that the Group saves more than 71 million litres of fuel, which would be needed to create electrical energy if this plant did not exist.



This large photovoltaic power plant was built so that the minus pole of the PV battery was functionally earthed against ground. Functional earthing is preferred when degradation of PV modules via the PID effect<sup>1)</sup> is to be prevented. Functional earthing is achieved using a GFDI – a switch which breaks this earthing in the event of an overcurrent due to a first fault and subsequently leaves the PV battery unearthed. In the past, fires often occurred when using large, functionally earthed PV batteries despite the use of a GFDI. Therefore, the standard NEC 2014 now requires insulation monitoring for the direct current part of PV systems (PV batteries) in section 690.5 “Ground-Fault Protection”.

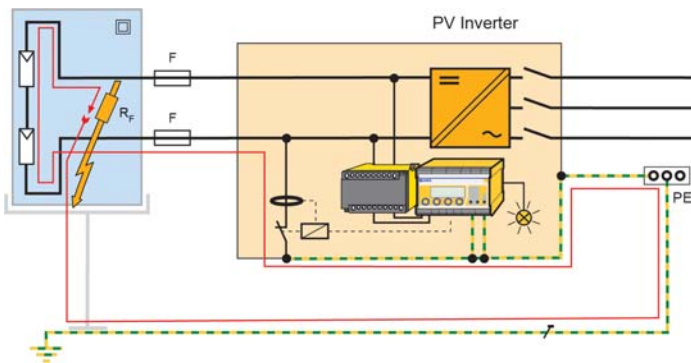
Insulation monitoring is performed periodically whenever functional earthing is not ensured by the GFDI. Frequently, insulation monitoring is performed in the morning before the PV system is started.

*(Also see: Rebekah Hren, Brian Mehalic: Understanding the NEC 2014 and Its Impact on PV Systems: Page 3 of 12, Section 690.5 “Ground-Fault Protection”. In SolarPro magazine Issue 7.3, Apr/May '14)*

<sup>1)</sup> PID (Potential Induced Degradation) is an effect which affects PV modules and leads to creeping loss of performances over years

Fig. 1

Excerpt Section 690.5 "Ground-Fault Protection"



In order to monitor the insulation resistance of PV systems within the range of AC, AC/DC 0...793 V or DC 0...1100 V, isoPV series ISOMETER<sup>®</sup> insulation monitoring devices from Bender are used. And that is how the "Amanecer Solar CAP" solar park came to use the isoPV-3 with an AGH-PV3 coupling device. The measurement procedure which has been specifically adapted for slow voltage fluctuations, is ideal for satisfying the demands of modern PV plants.

Due to the extremely large dimensions of the "Amanecer Solar CAP" and the EMV interference suppression measures, leakage capacitances of up to 2000  $\mu$ F against ground are to be expected, which are taken into account by the isoPV-3 through automatic adjustment to optimise the measuring time. In addition, the insulation monitoring device satisfies the voltage ranges required here and the simultaneously low insulation level.

At the same time, the isoPV3 series is approved as per UL508 and UL1998 and thus conforms to the strict US regulations. ■

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## INFO

**107 ISOMETER<sup>®</sup> isoPV-3s** with an AGH-PV3 are used within the plant; one per frequency converter. This ensures not only the continuity of energy production but also protects both the personnel and the plant itself.