



Here a ground-mounted system from Sika is being installed. The back rails are applied to the rear sides of the modules using adhesive technology.

Photo: Sika Solar

# Cost pressures as innovation driver

In order to reduce the costs for solar farm mounting systems, manufacturers are focussing in particular on the installation time and materials. Additional services such as the installation by local personnel are also intended to attract customers.

**T**he Spanish manufacturer of solar farm mounting systems Alusin Solar has an unusual reason for improving its Muniellos system. “We were rather put out by the feedback from customers who assumed that our system was only for roofs,” says Jorge Prado, Marketing Manager at Alusin. “This was somewhat annoying, given that half of the 50 plus megawatts we have supplied so far have been for ground-mounted installations.” In order to make up for this lack of communication, Alusin optimised its system for solar farms and launched a new marketing campaign under the slogan “cheap and easy”, whereby the mounting frames for ground-mounted systems are intended to be cheaper and easier to install. The same applies for the other manufacturers of such systems. Further developments and improvements to existing systems are, however, generally in response to the cost pressures prevailing in the market.

“In the 2013/14 financial year, we have found that the market prices in many PV markets worldwide have collapsed by up to 20 %,” says Benedikt Grimm, Marketing Manager at Krinner Schraubfundamente.

He says that to break down these costs in terms of watt peak prices is difficult. “Which prices are realistic and competitive differ considerably in accordance with the specific underlying conditions regarding the wind and snow loads and the ground conditions, etc., and the overall volume of the project,” he explains. Costs for trades such as foundation laying, mounting installation and mechanical module installation can range “from less than 100 €/kW to 200 €/kW with extreme conditions”.

Michaela Moritz, Marketing and Account Manager at Hill & Smith in the UK, has also noticed a considerable reduction in prices during the last year. “Whereas customers were prepared to pay a price of up to 16.00 £/W (approx. 19.27 €/W) for the mounting system two years ago, this price has now dropped to about 8.00 £/W (approx. 9.63 €/W) – a huge gap!” Their prices refer to supply only, excluding installation. They say that the price drop makes it a “challenge to remain competitive in the market, which is highly price driven, especially in continental Europe.” There are many systems on the market, though they

differ greatly in quality. Hill & Smith Solar, as part of Hill & Smith Holding PLC, a group listed on the London Stock Exchange, is careful, however, to ensure high quality standards. “We use the Eurocode for our design to ensure that we offer high quality products,” says Moritz in identifying one quality assurance measure.

### Slide-in technology helps save time

A main starting point in reducing the balance of system costs is the installation time. In order to shorten this, manufacturers are developing, for example, new installation techniques. A current trend is slide-in technology. What this may look like is shown by the “PowARSnap 90B” system from the French mounting system manufacturer ARaymond Energies. Richard Petri, Business Development Manager at ARaymond, explains how it works: “With its one-piece design, consisting of a flanged slot that slides onto the underside of the module frame, the system enables the modules to be easily snapped into a standard strut rail, without any tools or torquing operation.” Tests have shown that this has led to a three- to fivefold reduction in the time taken to install each module. Hill & Smith also has a “panel slide-in system”. According to Moritz, this is the “most popular system” in the product range. “The back-2-back rail system doesn’t require clamp fixings and thus makes installation quick and easy.”



Krinner is also deploying new module support rails with slide-in technology for its new ground-mounting solution – Flex V. Also new with this system is a keyhole system enabling an “extremely quick” mounting of the module support rails as well as installation-optimised node connection systems. In addition, the number of components has been reduced, adds Marketing Manager Benedikt Grimm. Krinner has also developed new rail supports for its Flex III and V systems. The longitudinal and traverse supports, which are made of aluminium or steel, have been structurally optimised. The material has been designed and produced to precisely support the loads occurring in each individual project. “The

**ARaymond’s PowAR Snap is compatible with a wide range of framed modules.**

Photo: ARaymond



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The new Flex V solution from Krinner has a keyhole system for quickly installing support rails, new module support rails with slide-in technology and installation optimised node connection systems.

Photos (2): Krinner

Around half of the mounting systems so far supplied by Alusin are for ground-mounted solar power plants totalling more than 50 MW.

Photo: Alusin



tailored cross-sections enable considerably less surplus material to be used," explains Grimm.

However, Krinner is also creating potential cost savings with new, self-developed machines. "These machines enable the precision and quickness to be considerably increased during the planning, measurement and foundation work," says Grimm. Using the Krinner mounting system, these machines enable between 2 and 4 MW of PV capacity to be installed each day. The maximum capacity per month is about 40 to 100 MW.

At the moment, Schletter is particularly working on optimising its steel systems. The use of steel, which is cheaper than aluminium, is one way to save on material costs. "Our aluminium systems are already highly developed in terms of easy installation, configuration options and the installation speed," says Hans Urban, Deputy Managing Director of Schletter. He says that it is now a matter of gradually transferring these advantages to the steel systems and points out that this is much more complex than many would believe: "An innovation in the form of a new aluminium profile tool costs relatively little and can be brought onto the market very quickly." A new

The new machines from Krinner enable between 2 and 4 MW of PV capacity to be installed every day using the company's mounting frames



steel profile, on the other hand, requires expensive roll forming systems, considerable experience, and also time. "That's why this requires good planning in order to bring new generations onto the market."

## Frames plus installation

The Muniellos system from Alusin Solar, mentioned at the beginning, is based on a single pile driven into the ground. Two solar modules with 60 or 72 Si-C cells can be placed on it. This therefore reduces the mounting time, says Marketing Manager Jorge Prado. "The delivery time has also been improved by getting new partners in Europe and America." Delivery times are becoming an increasingly major criterion in winning project orders. Services that go beyond merely providing the mounting are becoming increasingly important, confirms Urban from Schletter. "Many end customers and investors want to review the supply chain in advance before you are even allowed to tender," he says. This requires reference projects. "It's essential to have reliable partners with an excellent performance capability, delivery capability and internationality." If desired, Schletter now organises the installation on the ground with qualified personnel. The company guarantees that the installers meet the regional requirements and have the required permits.

As Michaela Moritz reports, Hill & Smith have also noticed that customers are increasingly expecting more than just the mounting system and have already responded to this: "We recently started offering installation services together with the system. Many EPCs are only interested in quotes if both the system and installation can be provided. We feel that our position on the market is stronger and more work will be guaranteed if we can offer a package including both."

Moritz emphasises that the company supplies "highly flexible, custom-made systems that adapt to individual project requirements and locational needs". There is a whole raft of different options: landscape/portrait designs, single/double-leg

designs and various foundation options. “We can adapt table layouts and sizes to what is required, and we can design tables that adapt to slopes.”

## New adhesive technology

The Swiss company Sika Services which is a leading manufacturer of adhesives and sealants, wants to establish adhesive technology in the PV industry and thus create savings potential. “The rails are bonded to the rear side of the PV modules during the model production and only have to be hung or clicked onto the substructure on site,” explains Leo Scheiwiller, Corporate Market Field Manager Solar Energy at Sika. The company supplies the adhesive and the application expertise for the system. Sika customers include module manufacturers, integrators and producers that supply back rails, hooks or frames for the industry.

Depending on the system, Scheiwiller estimates the potential cost savings to be “up to 25 % when compared with framed solutions.” This could shorten the installation time by up to 40 %. In addition, there is less risk of glass breakage or micro cracks in the cells because smaller forces and peak stresses impinge on the glass and the cells. Furthermore, it is easier to wash of soiling and, because there are no protruding edges, snow can slide off more easily. The adhesive technology is also ideal for building-integrated systems, since they are used on the rear side of the modules.



To ensure that the adhesive bonds properly, several aspects need to be observed. For example, the glass must be dust-, grease- and oil-free. Back sheets and metal must be cleaned and possibly pre-treated. In addition, there are specific quality controls for the adhesive technology, for example for controlling the mixing ratio, reaction speed, mechanics and bonding. “The processing times need to be maintained due to the curing reaction of the dual-component adhesive,” adds Scheiwiller. “However, through precise specifications and the choice of adhesive, this can be tailored to the production.” Scheiwiller estimates

The Swiss Sika Solar company offers an adhesive technology for PV modules. Here the rails are bonded to the rear side of the PV modules during the module production and only have to be hung or clicked onto the substructure on site.

Photo: Sika Solar

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Hill & Smith offers various foundations such as concrete ballast foundations, pile driven foundations and anchor foundations.

Photo: Hill & Smith

that systems with an overall capacity of more than 100 MW can already be constructed with this technology.

In addition to new concepts, there are also detailed changes. For example, Alumero Systematic Solutions has changed the cross sections of the posts and joists for its one-legged system for ramming foundations. The Austrian manufacturer also now offers a flexible system with inclinations between 19 and 35° and earthing plates for potential equalisation, which are simply mounted on the middle clamp. Wolfgang Rosenstatter, Manager of the Solar & Photovoltaic Division at Alumero, sums up: "The structural potential is fully exploited, with an increase in the cross section and a simultaneous reduction of the weight." Furthermore the systems have become even more flexible and it is no longer possible to make mistakes while mounting. The simplicity of the mounting means that even installers who have never worked with the system do not have any queries.

The German manufacturer Oberhauser Solar-Befestigungssysteme is focussing on global

foreign markets and thus on the associated "minor system optimisations" regarding the spans, steel qualities, module fastenings and foundation types, "which are adapted to the local snow and wind loads," explains CEO Andreas Oberhauser.

### Foundations for diverse soils

The Indian manufacturer of ground- and roof-mounted structures Nuevosol Energy defines its goal as "faster installation, easier manufacturing and higher durability". For this purpose, the company has adopted different measures. Firstly, Nuevosol has introduced easy-to-tilt, seasonally adjustable structures. "Conventional seasonally adjustable structures were seen to have huge O&M costs associated with them. These structures were heavy and needed huge manpower to manually change the tilt every season," explains Himamsu Popuri, CEO of Nuevosol. The company has therefore introduced two-legged, tilted structures and hingeless structures, which so far have been deployed in installations with 70 MW.

To enable it to provide solutions for many different ground qualities, Nuevosol continues to offer a diverse range of foundations. "India has drastically varying soil profiles, which demands continuous innovation in terms of the type of foundation and the solar structures," says Popuri. The company therefore has new foundations, such as under reamed piles, rod foundations with chemical grouting, ballast foundations, ramming and concreting in its product range.

The ability to offer foundations for different soils is also obligatory for other manufacturers. Just one example is the British manufacturer Hill & Smith. Michaela Moritz says: "In terms of foundation options, we can offer pile driven foundations, anchor foundations, pre-cast concrete foundations or ballast foundations (purlins). For solar parks with various ground conditions, for example, if there are rocks in one part of the site or pipes in the ground, we can

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India has drastically varying soil profiles. Nuevosol therefore offers a variety of new foundations such as under reamed piles and rod foundations with chemical grouting.

Photo: Nuevosol

also offer hybrid solutions – for example some tables with driven in posts, others with a purlin foundation.”

However, back to Nuevosol. The company is also working on contour following structures. “Aluminium structures that follow the contours are prevalent in Europe and the USA. But it is not such an easy task, on the other hand, to get steel structures to follow the contours,” explains Popuri. “Since steel, however, is the material predominantly used for structures in India, we have had to develop steel structures that follow double sloped contours.” Nuevosol is also, however, investigating structures that are made up of a mixture of aluminium and steel. The company is also working on products with new materials such as Galvalume. Galvalume is steel covered with different combinations of corrosion resistant materials. Originally, only zinc-coated steel was used for making the mounting structures. There are two types: pre-galvanized steel and hot-dip galvanized steel. These vary from each other in terms of the thickness of the zinc coating. “Whilst zinc has been primarily used until now as the corrosion proofing material, we have seen that materials with a higher corrosion resistance, such as Galvalume, can be used to optimise the structure and reduce the cost while increasing durability,” explains CEO Popuri. With Galvalume, the steel is coated with zinc plus aluminium, unlike normal steel, where only zinc is used as a coating.

There are also innovations from the French tracker manufacturer Exosun. “In 2013 we improved our horizontal, single-axis solar tracker for ground-mounted, utility-scale solar plants – the Exotrack HZ,” reports Jean-Noël de Charentenay, VP Business Development at Exosun. “In 2013 we also launched our Exotrack HZ onto the US market with the opening of a subsidiary in San Francisco.”

Exosun’s aim is to make the system “more flexible and adaptable – to allow it to support more panels and reduce overall costs”. The horizontal Exotrack HZ single-axis tracker can increase the solar yield by 25 % in comparison with fixed systems. With this system, up to 4 MW of trackers can be controlled via a “unique, centralised control unit called Exobox”. In addition, it is designed to be just as simple and quick to install as fixed-mounted systems and is also intended to be very low-maintenance and “grease-free”.

Furthermore, it has been verified that Exosun can resist high winds of up to 200 km/h (125 mph). In 2013, the Exotrack HZ completed wind tunnel testing with the engineering and consulting firm CPP, Inc. to assess the product’s design durability and reliability in turbulent wind conditions. “Upon completion of extensive testing during the summer of 2013, the Canadian Standards Association (CSA), an accredited, nationally recognised testing laboratory, confirmed that Exotrack HZ accords with the UL 3703



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Exosun has introduced its horizontal, single-axis solar tracker (Exotrack HZ) to the US market by opening a subsidiary in San Francisco. Photo: Exosun

standard for solar trackers,” reports de Charentenay. This standard corresponds to the UL 2703 standard for fixed-tilt structures. According to him, Exosun is the first solar tracking company to earn this certification. This year Exosun will launch version 2 of the Exotrack HZ, with an improved industrial process including the redesign of the PV module fastening.

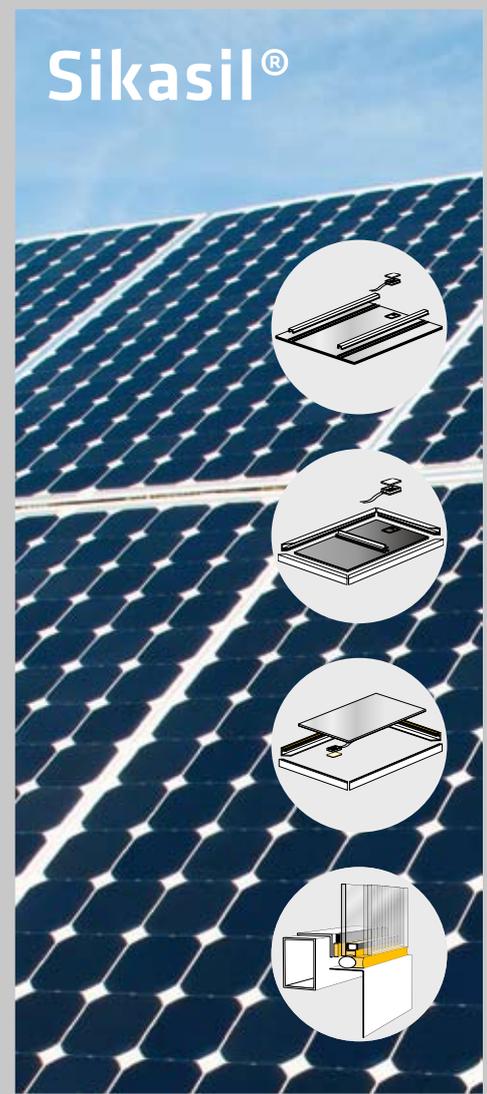
## Trend towards trackers

Established tracker manufacturers should brace themselves for a new competitor, since Schletter is also planning to enter the market for tracker systems. “Country-specific regulations and, in particular, the better distribution of the energy supply across the day, are leading to a renaissance in tracker solutions,” says Hans Urban in justifying this step. He does not want to provide any further details yet but announced that the product will be available this year. Nuevosol has also set its eyes on the tracker segment. The company wants to launch an “economical tracker solution” on the market this year. “Single-axis tracking in India is seen as uneconomical and unreliable. We are set to change that notion,” underlines CEO Popuri.

Other manufacturers are pursuing different goals. For example, Alumero sees a development focus on east-west aligned systems, which, in addition to southern alignments, are occurring increasingly frequently, as Wolfgang Rosenstatter confirms. Krinner wants to revolutionise the installation technology for screw-in foundations in difficult and hard soils and further develop its installation optimised system connectors. Michaela Moritz from Hill & Smith is not yet ready to reveal any new products for this year but, with a view to the near future, says: “We might be looking at markets outside Europe. This will mean further changes and adaptations to our systems. We might also consider increasing our current product range and start looking into the small-scale, ground-mounted market.”

ARaymond is focussing on standardisation. “We believe that the standardisation of the installation process will become more and more critical for EPCs. Therefore, we plan to extend this new concept to a wider range of applications such as trackers, rooftop systems, carport installations or any type of PV installations that favour tool-free systems with standard rails.” Additional technical functions, such as integrated grounding, could soon be introduced to the market. Alusin wants to continue working on reducing the costs and installation time. Schletter also identifies its goal as optimising the installation and costs with all systems “to the extent allowed by the structural loading and material usage”. There is reasonable certainty that these goals are at the top of the agenda for all manufacturers.

Ina Röpcke



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