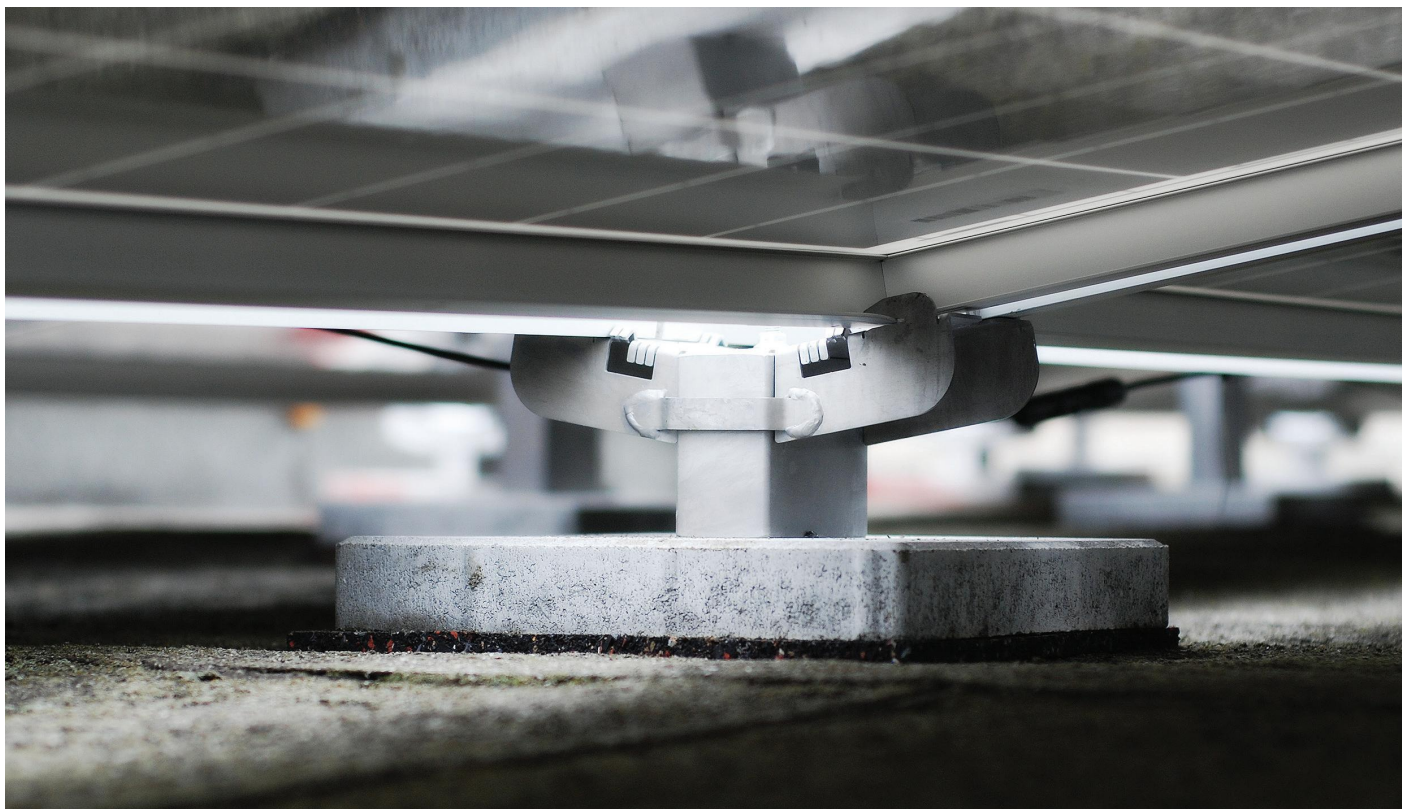


# Top of the world

**Commercial rooftops** | Innovations in commercial rooftop PV mounting systems are offering new possibilities for installers as they seek to drive down costs. Andy Colthorpe looks at some of the key developments that are helping breathe life into a segment that has so far been slow to take off



Credit: RenuSol

The global rooftop PV market, combining both residential and commercial applications, “has grown tremendously” in the five years between 2010 and this year, according to MJ Shiao, director of solar research at GTM Research. GTM’s findings show the total rooftop market was about 1.4 times bigger in 2015 than it was in 2010, split fairly evenly, around 52% to 48% in favour of commercial systems. However, the past five years have also seen a decline in the share of the total PV market that rooftops enjoy, losing out to ground-mount in various incentive-driven markets, Shiao says. While hardly surprising for anyone following the past few years in PV, putting a figure on the fact that the share has slid by as much as 40% in that time from 70% of the market to just 30% puts that slide into sharp relief.

Banks are becoming more comfortable lending for large-scale solar and homeowners and tenants have a multitude of options open to them for financing

rooftop arrays. For commercial rooftop arrays, however, the business case has been less clear cut, exacerbated by bureaucratic red tape, investment risk and other non-technical barriers such as long decision-making processes.

“In the US we look at the commercial space with a little bit of disappointment because it’s not growing nearly as quickly as the utility sector or residential,” MJ Shiao says.

## Tipping point

However, a tipping point may have been reached. In July, SolarCity launched an offering to enable small and medium-sized businesses (SMBs) to go solar.

“The vast majority of commercial buildings in the US house SMBs, so it’s a very large underserved market for solar and the challenge has been financing and cost,” the company’s vice president of communications, Jonathan Bass, says.

Smaller companies lack the investment-

**Reducing weight, installation time and cost have all been key objectives for commercial rooftop mounting suppliers.**

grade credit ratings of bigger firms, or consumer credit risk scores that can be leveraged by households. To put it very simply, by taking advantage of changes in property regulations and structuring a commercial lease blended with a PPA, the company hopes to take this “underserved market” to new heights.

Bass says SolarCity followed a strategy it always has in identifying a new market opportunity – as with residential and large commercial before it, the company waited until it could see an opportunity to undercut utility prices for customers. While the finance and regulatory aspects became favourable, however, it also necessitated serious cost reduction and innovation on the technical side to work, according to Bass.

## Cost cutters and yield maximisers

In SolarCity’s case, leveraging the know-how of Zep Solar, a US mounting systems maker it acquired in 2014, gave it the final



Credit: SolarCity

push it needed on cost to make the SMB commercial solar proposition attractive.

"Zep Solar have been working on their commercial solution for some time, they had not rolled it out when we acquired them," Bass says. "Now we're able to bid the vast majority of our commercial projects with their flat roof solution, ZS Peak."

ZS Peak incorporates the Zep Groove, the proprietary technology that put Zep Solar on the residential PV map. Adding a standardised groove to the mounting structure allows the installer to snap the module into the frame with relative ease. The groove also allows for easy grounding and can carry wires and other components.

The other key selling point of ZS Peak is the east-west orientation that it is designed for. Commercial rooftop solar is often about maximising the onsite self-consumption of the yield from PV. This is especially the case in Europe's challenging market. When the FiT is the main driver for PV, users simply want to generate as many kilowatts as possible – hence a south-facing orientation works best. However with commercial installations in the post-FiT era, especially in regions such as Germany that restrict how much can be exported to the grid, matching load to generation as closely as possible will get the best results in offsetting the cost of power.

"If you have a south-facing system, the efficiency is higher, because you direct the modules in the direction of the sun. So the overall gain for these systems is higher," Stefan Liedtke, head of German mounting systems manufacturer Renusol says.

"So you have a huge peak during lunch-

time and a little bit more efficiency, but with east-west, you have a flat generation curve over the day. So if you want to use your own energy and you have machines that are running the whole day, it's better to have an east-west system."

Additionally, Liedtke says, when placing a system in the east-west orientation, more modules can be fitted to the roof, an assertion Zep Solar would appear to agree with, claiming that ZS Peak can put 20% to 50% more PV modules over a typical south-facing installation.

### Optimum sizing

Renusol, acquired in 2014 by US commercial and utility-scale mounting system maker RBI Solar, has rolled out its own east-west commercial rooftop product, ZS10, to the UK market. Zep Solar too is preparing for a UK commercial rooftop rollout later this year.

Meanwhile, MJ Shiao of GTM Research says that more generally, sizing a system optimally is also an art that manufacturers and installers are learning more about.

"The marginal cost of installing solar has gotten to a point where it's economical. Adding another 50kW, another 100kW, is already going to be economical. So what you're trying to do is reduce some of the fixed costs: all the cost that goes into permitting – and this is especially true in the US – that goes into financing; all the transactional costs," Shiao says.

"If you can amortise those over a larger system, then you can reduce the resulting dollar-per-watt [cost] of the system significantly. You're paying a little bit more in hardware costs to generate the same amount of electricity but at the end of

**SolarCity's mounting subsidiary Zep Solar has helped the US installer gain a foothold in the commercial segment.**

the day you will offset a bunch of fixed costs, transactional costs and you'll end up looking a lot better overall."

It's not just fitting more modules in a better layout, Shiao says. As well as being able to potentially use a smaller size inverter for a less 'peaky' output, there is the question of how much strain a rooftop PV system – and rooftop – can handle.

"Wind loads are the big thing that contributes to structural costs. Obviously you don't want the system to fly off the roof but you also don't want it to weigh too heavily so that the structure of the building can't support it. So having more elements to deflect the wind and also not let the wind underneath the panels and things like that could also lower the amount of materials that are needed."

Increased modularity of the system, being able to fit it to different roofs with different obstructions such as air vents without having to redesign the entire array, is another winning innovation, according to Shiao.

"When you get up there, you'd love for [a roof] to just be this flat, open space but in reality there's a lot of stuff that's up there in terms of roof obstructions, in terms of vents, things that basically you need to avoid as you're placing the system. [A] degree of modularity allows the installers and EPCs to not have to worry about things like cutting the rail to the exact length you need."

### To rail or not to rail

In every PV industry segment, what works in one country might not work in another. Clenergy, a Sino-Australian company which specialises in mounting systems as well as branching out into power electronics and downstream project engineering, has experience of this first hand. The company has supplied mounting solutions to projects including a whopping 24MW rooftop installation in China's Hainan province, completed in 2013.

Thomas Gertsch, Clenergy's chief technical officer, says wind loads are also one of those key differences, along with the differences in type of roof structure.

"As an example, in Europe, where wind speeds only reach around 32 metres per second, aerodynamical ballasted systems are the way to go as it requires very low ballast and no penetration. In Australia, or Southeast Asia, with cyclonic wind speed up to 70 metres per second, ballasting is not an option and the design of the fixing and the capacity of the roof becomes key."

Indeed, just as Clenergy has adapted from the Chinese and Australian markets to go elsewhere, European and US rooftop commercial systems are increasingly being deployed, as with Renusol's FS10, without rails, using ballasts instead. As well as innovating towards success, the industry has had to learn from harsh previous experience.

"If you tell a roofer there is a flat roof and that you want to run a rail five metres long on it, he would say you are crazy! Because a roof is never flat, it's impossible. If nevertheless you put on a rail, it wears on the roof and it takes one, two, three years, and the roof is not watertight anymore," Renusol's Liedtke says. "Then there is thermal extension and contraction and these things [systems built on rails] are just crawling down the roof".

As well as these general rules, Gertsch of Clenergy adds: "Every roof is different and every mounting system has its own design rules. So all commercial roof projects have to be designed in close collaboration between the mounting system engineers and the developers."

Clenergy's modus operandi on commercial rooftops involves working "based on the most accurate site inspection [possible]", with the company helping installers with site inspection forms, calculations and other 'soft costs'.

### Labour days

The final part of the puzzle is physically getting a system running on a roof. Every company will inevitably make claims on ease of installation or labour costs saved over competitors' offerings that are hard to verify and depend on a multitude of factors. Yet all the manufacturers *PV Tech Power* spoke to are in agreement that cutting installation time can lower costs dramatically. Bass says SolarCity recently completed a 300kW installation in two days, as opposed to the three weeks it would have taken, pre-ZS Peak. The ZS Peak system also has a handy 'snap-together' locking method for construction, which Zep Solar UK engineer Keith Harrison explains is what automatically grounds the system and makes it safe.

Clenergy's Thomas Gertsch says: "In countries where labour is expensive like Japan or Australia for example, pre assembly and innovative design are key to reducing the time installers spend on the roof."

Stefan Liedtke says that with Renusol's product 80 modules can be fitted onto one pallet for installers to carry, making their logistical task easier and trips up the roof less hazardous, while Renusol makes similar 'we're the fastest' claims on speed of installation to Zep Solar.

GTM's Shiao says that there will be limits to how far manufacturers can outcompete – once an installer has selected its supplier of choice, there is a certain amount of loyalty to a trusted brand that is hard for a rival to win over, as well as the costs of re-training staff to use new systems, however well designed. The race to cut costs will also have its inevitable share of casualties as consolidation kicks in, Shiao says, especially as the US' federal investment tax credit (ITC) is planned for step down in 2017. Nonetheless, Shiao says, as much as 8% of a commercial rooftop PV installation's system costs can be found in the mounting structure, which comprises the bulk of structural balance of system (BoS) costs.

Better relationships between manufacturers, installers and customers will help companies build brand loyalties and a clear understanding of what each product can do as markets mature, according to MJ Shiao. On the technical side, there is still scope for more to be done. Material innovations, such as the replacement of the more expensive but corrosion-free aluminium with better forms of galvanised steel are already moving at pace, for example, the analyst says.

Whatever the future holds, it's certainly true that for BoS, as with modules, costs are certainly falling at speed and are there to be used to the best advantage, Shiao says: "One of the things that we see in the next five years is that while we think that the cost of the BoS will fall, even as much as 10% a year, there are still tremendous things that could happen within this space." ■

# EKO

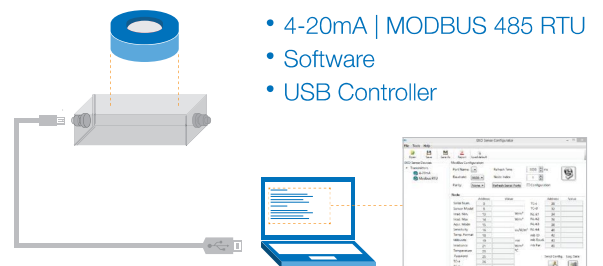
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