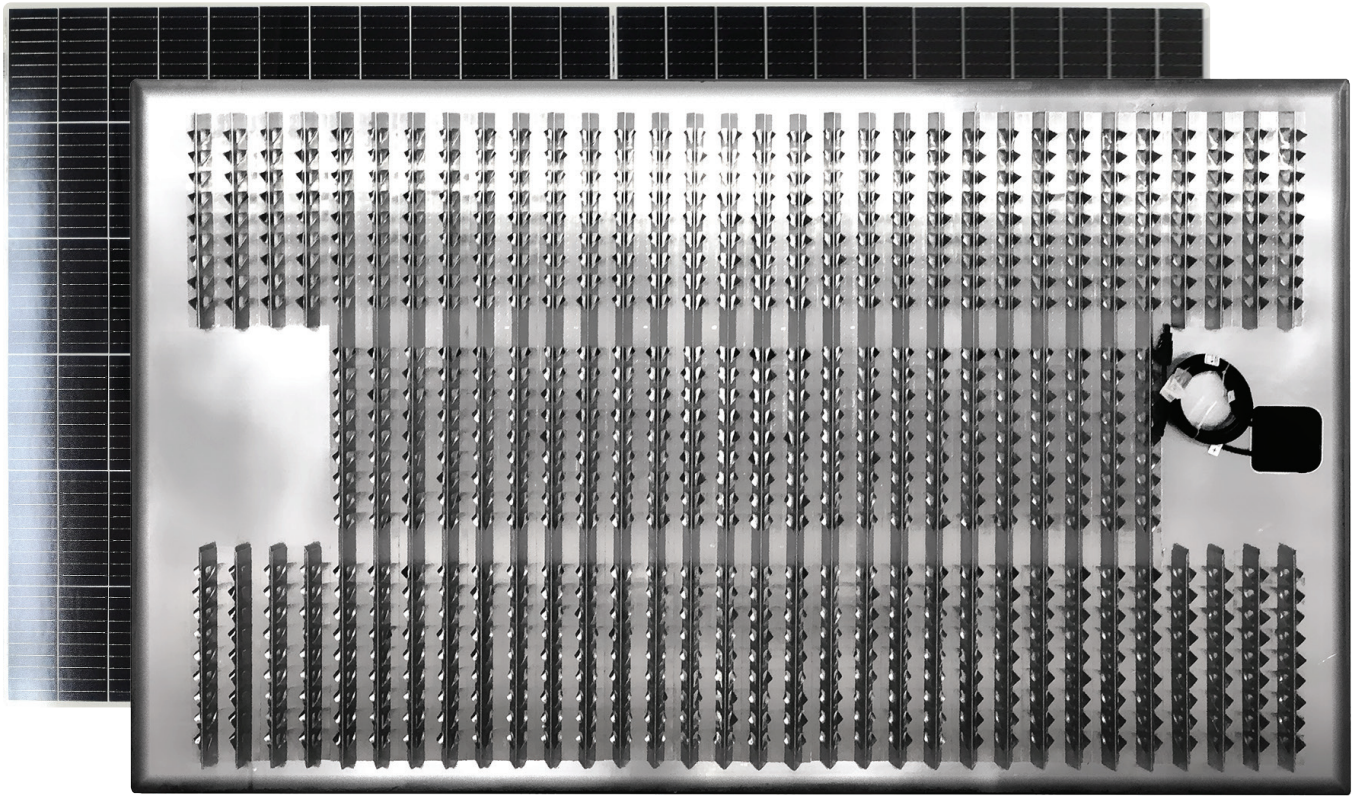


Overcoming module degradation

CEO & Founder, Simon Meijer, gave PES a thought-provoking introduction to COOLBACK. Their aim is to keep modules cooler, adding strength with less materials, whilst keeping an eye on their carbon footprint. What could be better than an R&D oriented company to lead the way in curbing module degradation?

PES: Thank you for taking some time out to talk to us Simon, it's lovely to have you with us. I'm sure many of our readers will be familiar with COOLBACK already, but it would be good to begin with a brief introduction to the company and the system.

Simon Meijer: It's great to have the opportunity. I started the company with the goal of improving module technology. We are a Dutch R&D-based company and we designed a new frame/backsheet solution that cools PV modules. After the introduction of the product, COOLBACK, we followed up by developing related products for PV manufacturing, including a completely automated assembly station.

In addition to the cooling solutions, COOLBACK strengthens modules and reduces degradation. This is enhanced by our custom designed and patented mounting clamps that we also sell and produce.

PES: Module degradation is obviously a big issue in terms of lifespan and performance, what do you see as the biggest causes of that degradation, are temperature and humidity mostly to blame?

SM: Indeed! Temperature changes and humidity significantly affect degradation, particularly with the backsheet, but the impacts can also be seen in the cells and other materials.

PES: Are certain countries and climates more prone to such degradation than others?

SM: The more extreme the climate, the quicker degradation accelerates. High radiation input obviously is the best for production, but it also has a detrimental effect on degradation.

Floating installations bring new challenges, as

well. The proximity to water, sometimes even salt water, create bigger temperature differences between the laminate and backside of modules, resulting in additional degradation.

PES: Is it arguable then that the materials used in module production ideally should differ depending on where the module is to be sited? Do you think this would make a difference to its longevity?

SM: This is already the case but, simply said, it also adds a lot to the cost. Think of heavy and thick (double) glass modules in locations with heavy snow, wind loads, or the extra sealant for floating situations. Smaller batches are produced at higher material costs and limits production scale.

Generally speaking, modules produced for these harsh conditions can extend module lifetime, but the warranties don't always cover certain locations, or situations. In some desert locations the module temperatures run above 80°C, so bye-bye warranty.

COOLBACK, on the other hand, is produced without adding costs or location-specific treatments. It performs perfectly in all these locations.

PES: What are some of the negative outcomes of module degradation and is it possible to calculate this in terms of the percentage of power likely to be lost and reduction in lifespan?

SM: We see the rate of degradation substantially increase when there are errors in production or materials. Then the module collapses. But most of the time, the degradation is around 1% per year. This is why manufacturers give a warranty on energy output that is based on 20% decline in 25 years.

Simply said, degradation is visible in lower output over time.

PES: How can COOLBACK guard against this, where perhaps other solutions are not able to?

SM: The 3 root causes of degradation are: temperature, UV light and bending of the module.

UV light has an effect, especially on plastics. COOLBACK uses aluminum in the backsheet to create a full water vapor and UV barrier. The structure of the COOLBACK profiles is designed to increase cooling through convection and to lower the maximum temperature in the temperature cycle.

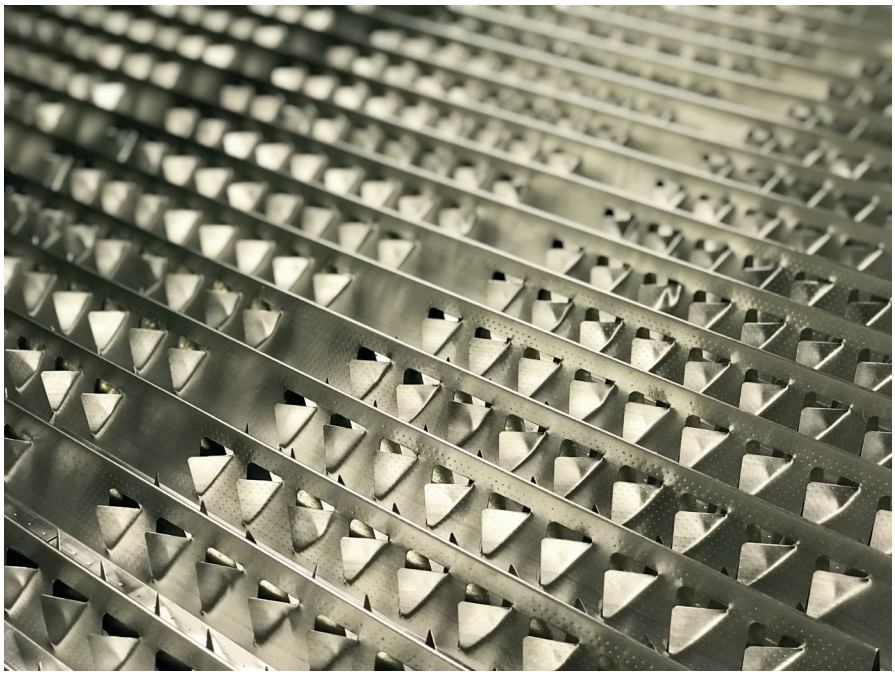
The shape of COOLBACK gives the module extreme strength that reduces bending to virtually zero. By preventing bending, cell cracking is greatly reduced, even at high wind or snow loads. These features cannot be found in any conventional frame or backsheet.

PES: Can you explain a little bit about how COOLBACK works and the format of the system?

SM: The COOLBACK system is based on a backsheet with an aluminum outer layer, with profiles attached to it. The backsheet and profiles can fit any sized module since it's a modular system that is easily made to size. The module is frameless and is mounted via the back profiles at several points that optimize the load distribution.

PES: COOLBACK is a frameless design, what advantages does this have?

SM: Yes: frames tend to collect dust and dirt, especially on low inclination angles. They also tend to collect humidity that allows moisture to creep into the module. A frameless module minimizes soiling and prevents moisture build-up. And although



Simon Meijer

installing frameless modules is easier, I have to admit they do need to be installed with a bit more caution. This is why we supply corner guards to protect the modules during transport and mounting.

PES: Are there any other parts of COOLBACK's construction that make it particularly advantageous, perhaps in relation to common concerns such as cell cracking, and the stackable design, as a couple of examples?

SM: The rectangular shape of the profiles adds strength that pretty much eliminates bending, thus helping to prevent cell cracking.

This same shape makes back-to-back stacking possible to save space! Our modules take up only about half the space in a shipping container, which lowers transport costs and results in a lower CO_2 footprint.

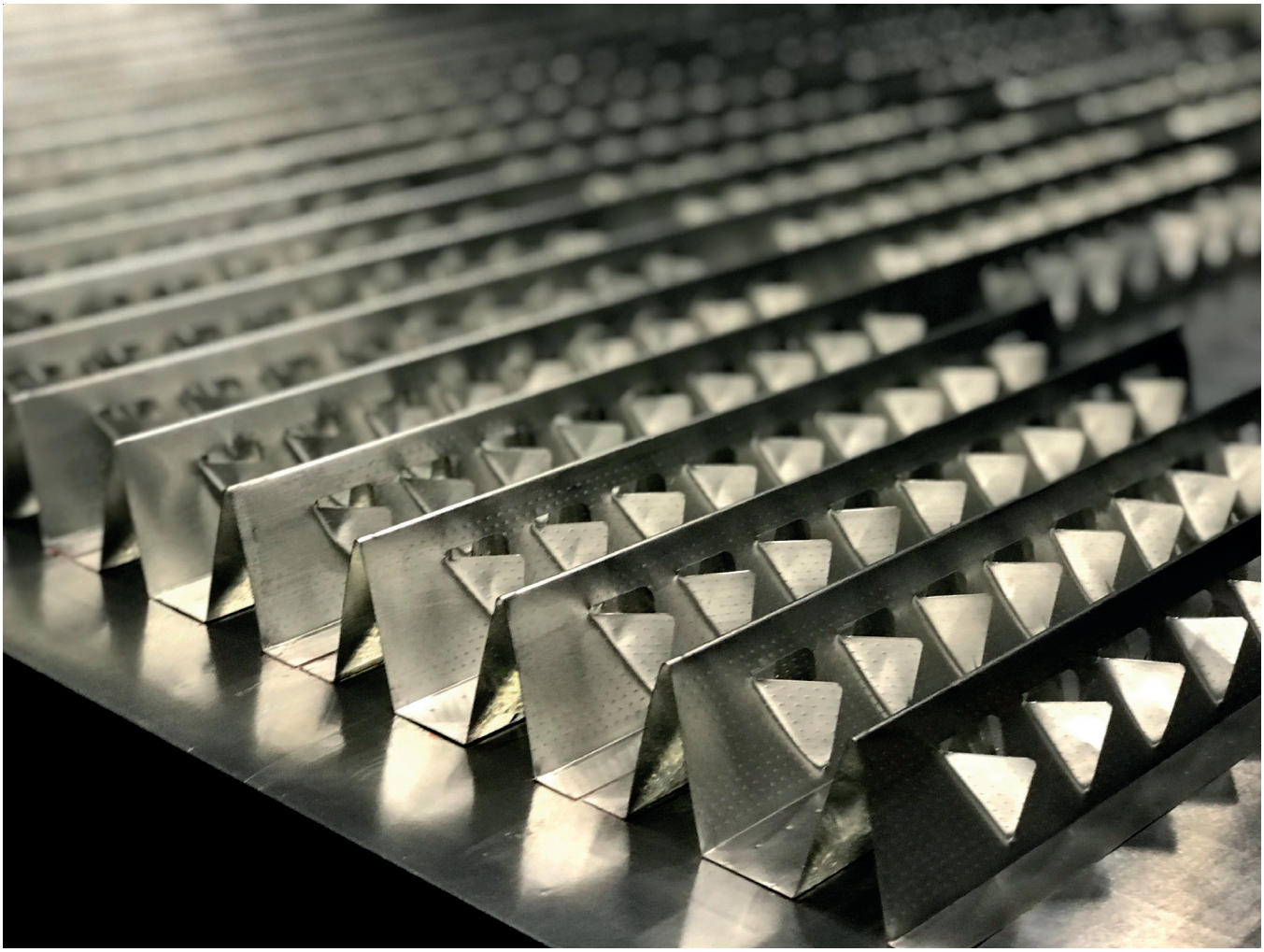
PES: Can you explain how a lower operating temperature increases energy yield and what that means for your customers in relation to return on investment?

SM: At higher temperatures, the standard PV solar cell loses yield at around 0,4% per degree Celsius. So contrary to the 'labeled' power, for instance 400Wp, which is measured at 25°C cell temperature. An average cell temperature of 65°C easily loses 16% output. And a cell temperature of 65°C is quite normal in a European situation.

The losses are even more evident in a desert environment, where cell temperatures reach 80°C, reducing output by 22%. These are peak levels at noon, of course. With average daily irradiance and temperatures, taking seasonal changes into account, we can guarantee an extra 3-5% output. This translates to immediate extra return on a project.

PES: Do these benefits come at a cost? Presumably this is a more expensive option than a traditional frame?

SM: Fortunately, no. Costs remain the same.



Both COOLBACK and a framed module use the same amount of aluminum, COOLBACK is just designed for better functionality. And we also developed our production in a way that does not add costs.

PES: Is COOLBACK a universal solution for all solar modules?

SM: We can fit all monofacial modules. And because of its modularity, it is perfectly suited for the growing cell sizes. The only modules we do not fit are the bifacial modules since COOLBACK would block the backside irradiance too much to be beneficial in that setup.

PES: Can the system be installed retrospectively, or does this only take place during the module's manufacture?

SM: High-speed and automated production are key to assembly at reasonable costs. We deliver directly to the manufacturer for that reason.

PES: Your headquarters are in the Netherlands, which presumably means you are able to reach customers worldwide; are you a global company or are there markets you would still like to break into?

SM: The demand for PV is worldwide and we are in contact with end customers all over the globe. Our location in The Netherlands is beneficial when it comes to language, logistics and R&D.

The module manufacturing is done mainly in China. We have a foothold there and will be expanding to serve B2B sales.

PES: It has been very interesting to find out more about how the problem of module degradation can be overcome. Before we sign off, we'd like to focus on the future for a moment if that's okay? How do you think global warming and subsequent environmental changes are impacting degradation of mechanisms and what do you see as the best form of defence against this?

SM: We are in interesting times. A lawsuit was recently won against the Royal Dutch SHELL group, forcing them to do more to prevent global warming. Solar energy will continue to grow, motivated in part by the general public, no doubt.

We also see Europe is getting warmer: wine harvesting in The Netherlands and the installation of air conditioning are both booming. These higher temperatures and more extreme weather patterns will cause increased degradation, in general. To defend against this we have to be careful with our resources and utilize them in the best possible way. Smart design and material use are most relevant. On top of that we should be aware of our own footprint, of course!

PES: Are there any new technologies you are seeing or would like to see coming through in the future to help with these issues?

SM: Definitely! We are currently working on several projects and will introduce them during the next few years. A key element encompasses smart production with less use of materials. To give a sneak preview: COOLBACK gives so much extra strength to a solar module that glass thickness can be reduced. This impacts the amount of material used and allows for lighter-weight modules, reducing production costs. Steps to lower the cost of energy per unit are ongoing!

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