Opening a new window of opportunity with backsheets

Endurans™ Solar Technology Lab

While the name Endurans™ Solar may be relatively new to some in the solar industry, the people and portfolio behind it will be familiar to many, having previously been part of DSM Advanced Solar. Last year, the company doubled its growth, thanks to a new generation of backsheet technologies that break the mould in terms of performance and sustainability, all while remaining cost competitive. Clearly, the market has spoken. So, we sat down with the company's founding member, Vivek Chaturvedi, to discover more.

PES: Welcome back to PES Vivek. Could you briefly introduce Endurans™ Solar?

Vivek Chaturvedi: Endurans™ Solar is a subsidiary of Worthen Industries, a US manufacturing company that has been applying science and technology to develop various adhesives, coatings, extruded films, and laminated products since 1866. Headquartered in New Hampshire in the United States, we really are a global organization.

In addition to production in the US, we also have major operations in Europe and China. In fact, we have almost quadrupled our capacity in co-extruded backsheets in the last 18 months.

PES: It is a relatively new name in solar, but you have quite a heritage in this industry, is that correct?

VC: Indeed, we all previously worked at DSM Advanced Solar for many years, which was divested to Worthen Industries in 2021. So, you could say that with Endurans™ Solar we now offer the best of both worlds: the renowned innovation and R&D capabilities of DSM, combined with Worthen Industries' know-how of polymer processing and its long heritage of commercializing materials-based solutions.

PES: Endurans™ Solar is a specialist backsheet company. Before we get into the details of your portfolio, why has the role of the backsheets become so significant?

VC: A backsheet represents less than 5% of the total module cost, yet it can really make or break a PV panel over the 25-plus years of its life. To use an analogy: you can build a multi-million-dollar home, fully insulated and protected from outside elements like heat, rain and dust. But if you leave just one small window open, it can render everything inside that home ruined very quickly.

So, as module efficiencies continue to rise, and we see installations happening in more extreme climate locations, the choices that PV manufacturers make today are more important than ever.

PES: Can you very briefly summarize the backsheet technologies and solutions from Endurans™ Solar that tackle this challenge?

VC: We have developed two specific solutions. Firstly, our Endurans™ HP, or High Performance, backsheet is a novel solution for conventional PV modules, based on both an innovative material stack and processing method.

Secondly, our Endurans™ CB, or Conductive backsheet, bringing greater efficiency and cost-effectiveness to high-power density back-contact modules. This can be used in everything from residential rooftops to e-vehicles.

PES: Let's start with the Endurans™ HP. Why was it developed?

VC: We created this technology in direct response to the cost-down trend that has put every component in the PV module under extreme price pressure, including the backsheet. More than ever, we have seen mainstream players reducing the thickness of backsheet protective layers and compromising on material choices across all the layers and adhesives in order to save money.

The result: greater risks to PV plant performance, higher failure rates and lower returns. To put that into perspective, some 9% of all module failures are related to the backsheet component, according to the IEEE. In 2020 it is estimated that this resulted in $260m of invested capital being lost.

PES: So, what makes your high performance backsheet the superior choice?

VC: The answer is twofold. The backsheet is based on a more efficient and cost-effective material stack. This is then manufactured using a unique, lamination-free, co-extrusion process that enables superior protective qualities.

PES: In fact, you are now the market leader in co-extruded backsheets. Why has your technology succeeded where others in the past have failed?

VC: The material we create from our co-extrusion process is built around the strongest core layer on the market, made from a modified functional polymer called high-performance polyolefin (HPO) instead of PET. Polyolefin is naturally and intrinsically better suited to long-term protection than PET, a fact that is now increasingly recognized in the market.

Our Endurans™ HP therefore has much better water barrier properties and retains its mechanical properties for far longer. But the proof is in the performance data. There are now 20 million modules installed worldwide featuring these backsheets, with zero failures over seven-plus years. It's proven beyond all doubt.

PES: Clearly, the technology is more effective. But is it cost-effective?

VC: We understand that for manufacturers, changing their bill of materials is a big step. But costs simply cannot be cut any more from the conventional backsheet manufacturing process, even while the risks continue to rise. We therefore created a flagship product called the Endurans™ HP D15 to tackle this challenge. This is the ultimate 'all-purpose' product, enabling manufacturers to remain on the cost-down curve while safeguarding their investment.

PES: So, risk is reduced?

VC: Yes, not just risk to the integrity of the backsheet itself, but the inherent risk in the entire manufacturing process. A conventional, laminated backsheet contains three pre-manufactured films, glued together by adhesives, often all from different vendors. That creates challenges in the supply chain, and the material composition and quality is difficult to control.

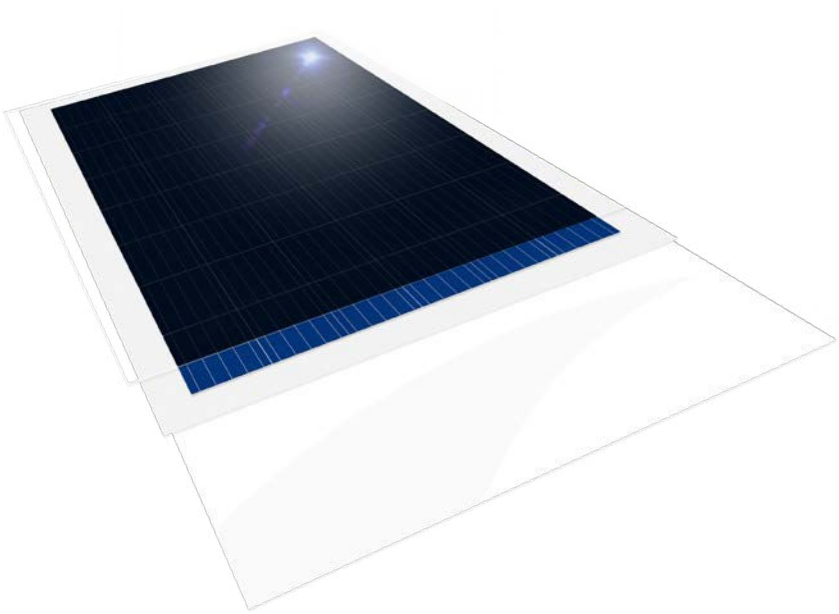
With our co-extrusion technology we have total control of the value chain, from raw materials to end-product. Everything is under one roof, manufactured to a high, consistent quality in a single process. In post-pandemic times especially, this is a great benefit to customers.

Vivek Chaturvedi

PES: Speaking of customers, can you talk about some of the names using your products?

VC: The technology has gained real traction now. In Japan, for example, Sharp, a long-standing customer, is now introducing modules with our Endurans™ HP D15 backsheet for residential rooftops in their local market, probably the most demanding

Endurans HP production site Suzhou



Panel material stack with Endurans™ HP

and evolved in the world; as well as for solar panels in Europe, the Middle East and Africa.

In India, our Endurans™ HP D15 backsheet is being used by several Tier 1 manufacturers. In North America, premium module manufacturer Silfab Solar is a customer. Meanwhile, in Europe, the Endurans™ HP D15 backsheet is being evaluated as part of SolarDuck's offshore floating PV demonstrator, where it is included in CHINT modules.

PES: The other key technology is the conductive backsheet. In fact, you are now the merchant market leader in this technology too. Can you tell us more about it?

VC: This has been a real innovation journey because in many ways we are creating a whole new market. Back-contact technology, i.e., with no busbars, tabbing and stringing on the front of the solar cell, has always been a compelling concept because of its potential to generate instantaneous and lasting gains in energy yield of 3%, while also enabling a clean aesthetic effect on the front of the PV module.

The challenge faced by the industry was always striking the right performance/cost balance to drive mass adoption, which we're now solving with our Endurans™ CB backsheet.

PES: So how and why does the Endurans™ CB backsheet unlock the potential of back-contact technology?

VC: Our team created a unique cell-interconnection concept that minimizes optical and electrical losses and offers the highest module power density available today. As a result, the Endurans™ CB is now an essential component of high-power back-contact modules being mass-manufactured worldwide, using both MWT and IBC cells.

PES: Can you outline some of the applications for this technology?

VC: In the residential rooftop segment, our North American customer, Silfab Solar, has launched the Silfab Elite SIL-370/375/380 module, a premium offering featuring the Endurans™ CB backsheet. In e-mobility, the product is being used by our customer Lightyear as part of an Integrated Photovoltaic (VIPV) solar roof in its Lightyear One model.

Another customer is Energyra, which is not only using the Endurans™ CB in its standard PV modules, but also developing and testing various exciting new module concepts.

PES: One critical topic for the solar industry is of course sustainability. What does your backsheet technology contribute here?

VC: Our backsheet technology offers the lowest carbon footprint in the market and full recyclability. While backsheet production waste is usually landfilled or incinerated, our waste is re-used. That will start to have a major impact once module end-of-life volumes explode in 10 years' time.

Our backsheets do not contain any fluorine, PFAS or adhesives. To put that into perspective, if the percentage of fluorine in the polymer waste fraction rises above 1%, the cost of incineration jumps sixfold. I'm pleased to say that our backsheets do not contribute to this in any way.

PES: Finally, what does the future hold for Endurans™ Solar and its customers?

VC: Our ultimate goal is to become the one-stop shop for customers by offering a family of durable PV polymers that contribute to better solar modules. So, for example, we can now also offer customers a range of insulator sheets, patches and specialty encapsulants, since we took over the product portfolio of the Tomark-Worthen joint-venture, last year.

Meanwhile, our innovation work continues, helped by our broader geographical reach which now enables us to respond much faster to customer and market needs. Ultimately, the market is moving fast. Legislation is evolving. Customer needs are constantly changing. Our goal is to stay ahead of the curve and give our customers the best chance to succeed.

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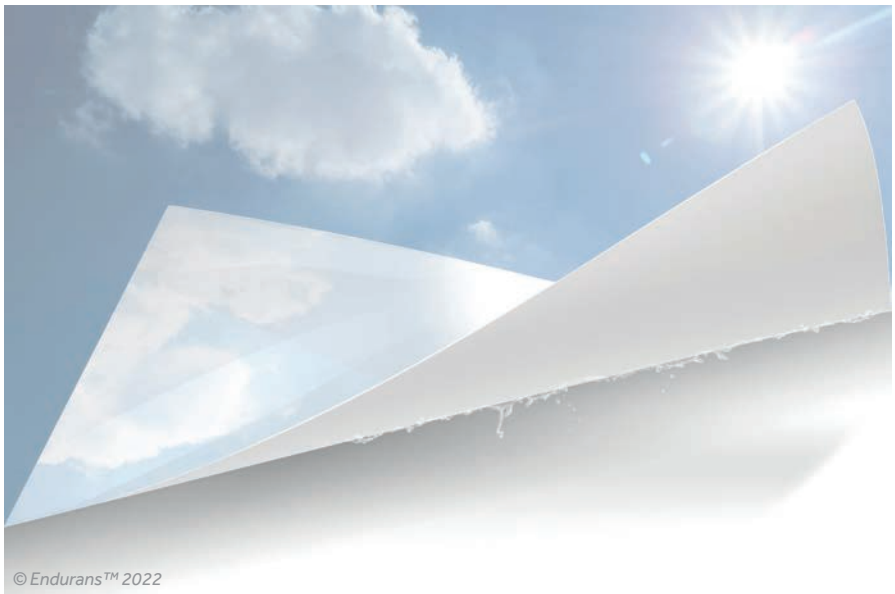

Endurans™ HP backsheet