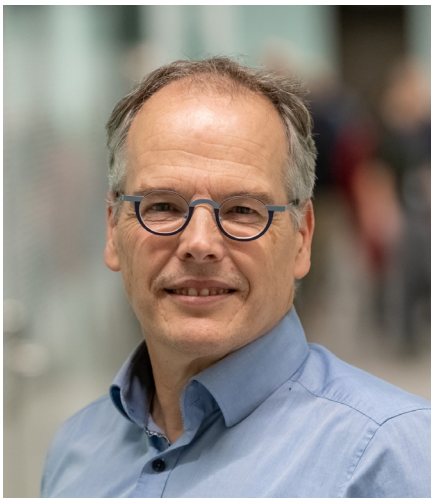
Stopping solar waste with circularity

Words: Imco Goudswaard, Sustainability Manager at DSM Advanced Solar



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No matter how much the solar industry talks a good game about sustainability, the reality is that we are ignoring a looming issue: solar waste. There will be at least 24 billion PV modules installed on earth by 2050 – enough to stretch to the moon and back. That's a conservative estimate. How on earth, literally, are we going to dispose of today's PV modules safely and responsibly once they reach their end of life? What will the financial, environmental and societal cost be? You could call it the solar industry's own 'inconvenient truth'.

Solar energy is already infinitely better for our planet than burning coal, gas and oil, so it's no wonder recyclability and circularity are low on the agenda today. Some people might think, what's the huge rush to make solar even more sustainable, especially when the industry is still fighting to compete with fossil energy?

At DSM, we create materials technology for PV modules. We spend much of our time thinking about how materials perform at the most intricate and precise level – and not just our own materials, but many of the materials used in the solar industry. But we are also thinking about what happens after performance. How can we design with circularity in mind?

Start circular thinking

The best way to stop solar waste from piling up is to design based on the concept of circularity: nature's own perfect cycle.

The idea is to move beyond pure recycling by re-imagining and redesigning the way that solar products are made and re-used – and of course, that starts with materials.

We need to find new ways of designing and manufacturing PV modules based on innovative materials that can be readily absorbed back into the solar supply chain, in their purest, highest quality form, rather than recycling into products were lower qualities are acceptable. Or even worse, sending them to landfill, with the associated increase in carbon- and eco-footprint.

Most importantly we need to do this in a profitable way that benefits all stakeholders. Which is precisely what the team here at DSM is starting to achieve in one area of PV module design – the backsheet.

Bringing viability to sustainability

Backsheets are a critical component of the PV module, protecting it from the elements, as well as providing a range of benefits including electrical insulation, reflectivity and mechanical strength.

Traditionally, photovoltaic backsheets have been manufactured through a multi-layer lamination process, where a core layer of

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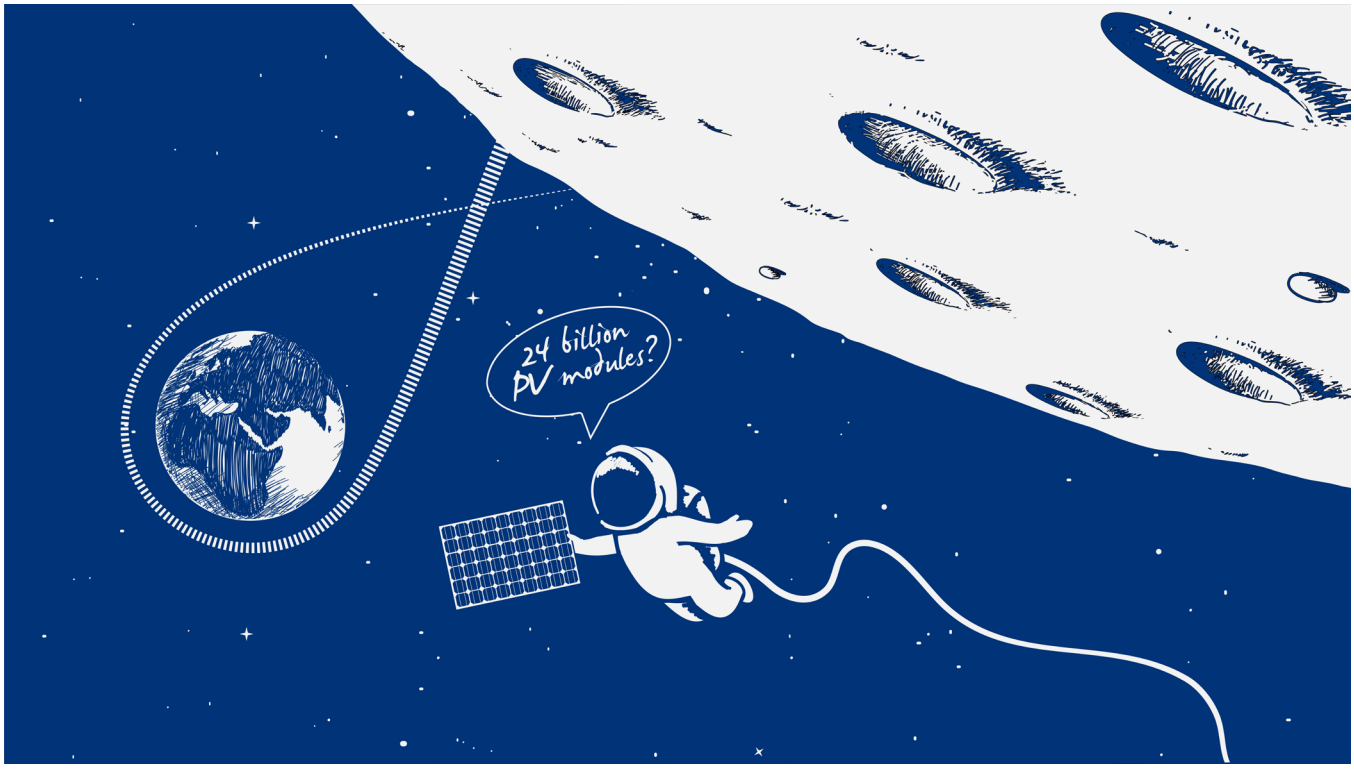

low-cost polyethylene terephthalate (PET) is sandwiched between two weather-resistant polyvinylfluoride (PVF/PVDF) or other fluoropolymers films.

On the surface, this formula appears to have worked well enough for nearly half a century; but as previously mentioned, at DSM our job is to study materials in forensic detail.

First, under continued cost pressure, module performance and lifespan can be compromised by replacing traditional outer layers with thinner or low-cost alternatives, which leads to problems with cracking, delamination and unwanted absorption of water.

Secondly, these traditional, laminated backsheets are bad for the environment. The adhesives needed to stick the layers together make the laminate difficult to recycle. They also often contain PVF, which can’t be recycled at all. And because of the fluoropolymer compound in the backsheet, special controlled incineration – read expensive – is required to catch the toxic gasses that are formed when fluoropolymers are burnt.

At DSM we set about attempting to solve this dual problem – and thus proving that sustainability and profitability really can go hand-in-hand (as part of our purpose-led, performance-driven approach to business). Specifically, our aim was to create a multi-layered PV backsheet through a single-step co-extrusion process that doesn’t need lamination or fluoropolymers.

For inspiration we scanned the world and found the answer in China, a manufacturer called Suzhou Sunshine. DSM acquired Suzhou Sunshine and building on the expertise from both companies, succeeded in creating what we call our Endurance backsheets. Endurance backsheets are extruded with several advanced solar materials through a single die, bonded to last, and built to withstand all that nature can throw at them.

In fact, Endurance backsheets were independently and exhaustively tested for two years prior to launch, withstanding abuse from heat and dust in demanding environments like Western India, all with excellent results.

Granted, this 21st century backsheet now contains superior materials. The production process is more efficient and cost-effective; this in turn creates stronger more durable PV modules that can generate power for longer; and simplifying the associated value chains enables greater control over the composition of the materials themselves.

Most importantly – and returning to the original point – these backsheets contain no fluorine and are 100% recyclable. In other words, they form no part of the ‘stairway to the moon’ our industry is prone to building from solar waste.

An industry-wide effort

We don’t have all the answers at DSM — and we are not the only ones making progress in this area. In fact, a handful of companies are now successfully co-extruding backsheets and there are clear signs of change.

If we are to make clean, affordable energy a reality for all, then we do really need to work together as an industry.

At DSM we believe so strongly in these sustainability principles that we recently integrated the United Nations’ Sustainable Development Goals into our company strategy. The clock may be ticking but we still have time to create the kind of solar industry that benefits all.

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