Glass industry focuses on the sun

Flat glass producers have discovered photovoltaics as an important sales market: they invest in new solar glass manufacturing sites, develop more efficient production workflows and improved products. This in turn benefits module makers: glass sheet prices are coming down permitting higher yields.

Interpane is investing in the future. One of Europe's biggest flat glass producers, the Lauenförde-based company has so far predominantly produced automotive and window glass. But since the automotive and construction industries proved less consistent buyers in times of crisis, Interpane entered the photovoltaics (PV) market in 2009. Investing EUR 190 million the Lower Saxons along with Dutch glass and solar systems producer Scheuten built a fully integrated glass factory in Osterweddingen near Magdeburg, which is entirely geared to PV needs. The factory produces translucent white glass and finishes the sheets right away so that they can be used for module production – right after production they are cut, polished, fitted with holes for power supply lines and coated with an anti-reflex film. Commenting on this Thomas Keyser, Sales Manager of the joint venture bearing the company name F-Glass now, said: "Osterweddingen is a Win-Win factory. Solar system producers receive top-quality glass for higher module outputs and we participate in the growing PV market."

F-Glass is synonymous with a rethinking process in the glass industry. To many producers PV has only been a niche catered to as a sideline until now. Of the 38 million tons of flat glass manufactured in 2009 at the world's float and rolled glass plants module producers only required to the tune of 630,000 tons for frame and carrier glass, i.e. not even two percent. For glass producers it was therefore not worthwhile to refit their lines designed for automotive and window glass production for PV production, let alone build new plants for it.

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Refitting alone generates tremendous costs. “Since solar glass is required to let plenty of light enter it must only contain one eighths of the amount of iron contained in plain and simple window glass,” explains Keyser. For such a quality purer silica sand and a hotter melting process is required. The lower-iron the glass the faster it cools off and this rapid cooling produces obstructive bubbles. To avoid these the molten glass must be heated to 1,600° Celsius. The crux of the matter: for re-calibration a line would have to be shut down and companies are not very happy to do so. “The investment cycle in flat glass production amounts to approx. 15 years. Over this period the float line must be in operation 24/7 to be profitable,” explains Interpane spokesman Marc Everling.

Key to low module costs

Since glass producers have only recently started looking to PV sizeable cost reductions for solar glass have failed to materialise so far. It is true that module prices have come down by 40% over the past two years but this is primarily due to economies of scale generated by higher production volumes, optimised production equipment for cells and modules as well as by tumbling silicon prices. In contrast to this, solar glass at some ten Euros per square metre still costs as much as four years ago when the solar boom took off. According to Sabine Hönig of the Technical & Mining University Freiberg it accounts for about 5% of the costs for silicon modules, and as much as 15% to 25% in thin-film panels where carrier and cover glass is needed. If module producers reduced their costs by a third yet again over the next three years, the cost of glass might even account for up to 60% of total cost. “Glass can become the bottleneck for a further reduction in production costs,” warns the expert.

But there is hope for better and more inexpensive material. “Solar energy is becoming more and more important to us,” says Keyser. This statement is confirmed by facts and figures: While float glass

producers recently operated their lines with only up to 90% capacity utilisation on account of dropping demand from the crisis-struck automotive and construction sectors, demand from module makers has been rising consistently. If the installation of solar systems continues unchanged PV will require almost 1.7 million tons of special glass in 2012 according to forecasts – nearly three times as much as in 2009. F-Glass will be one of the principal suppliers. The company plans to sell more than 100,000 tons of special glass to the sector annually – enough for some 1,300 megawatts of module output. The main focus of the Eastern Germans is on cost efficiency. The smelting furnace in Osterweddingen holds 2,000 tons of molten glass. At just under 1,600° Celsius the melt containing silica sand, lime, soda and cullet finally has the quality required for PV glass. To save energy engineers have insulated the melting furnace with 2,000 tons of refractory stone. “This allows us to reduce our requirements by 15%,” explains Keyser. Subsequently, the melt flows onto a liquid tin bath giving it the surface as smooth as a mirror. Then the glass is cooled down to 60° Celsius in the lehr and cut. The resulting products are four millimetre thick sheets, which allow 90.5% light transmission thanks to their low iron content of as little as 80 parts to a million. Anti-reflex layers increase light transmission even further up to 96.2%. For customary solar glass the transmission is between 90% and 95% on average.

By undertaking these processing steps right on site F-Glass saves further costs. Usually such glass is processed at a different site and product prices are increased by long distances and glass breakage. Scientist Hönig estimates transport and processing account for three quarters of the cost of solar glass. F-Glass supplies module producers with finished products right away. “This allows us to offer high-quality glass at competitive prices,” says Keyser.

Costly processing

Euroglas from Haldensleben is also expanding its range to include PV. The company produces float glass in Haldensleben and Osterweddingen and built a new processing facilities right next to its parent plant in 2009. A sum of EUR 50 million was spent on the factory where the 3.21 m wide and 6 m long glass jumbos are processed further into carrier glass for modules. The next solar innovation is already in the pipeline. From the end of this year Euroglas also intends to offer cover glass with so-called transparent conductive oxide (TCO) layers. In thin-film modules these form the contacts from which the power generated is tapped. The special feature of Euroglas' TCO layers: according to company boss Christian Winter, they are especially conductive thereby allowing modules to achieve one percent higher yields than conventional layers – a big promise for a market where every tenth of a percent of efficiency gain counts.

However, float glass suppliers also have to expect strong competition because rolled glass manufacturers also have big plans with PV. Rolled glass is of minor importance on the market since it is not as even as mirror-like float glass. Architects and automobile makers do not accept this unevenness but for PV there are advantages for cover glass. The unevenness acts like a "light trap" thereby increasing the power yield of modules. Furthermore, rolled glass is cheaper to produce than float glass. "Quality requirements for raw materials are not that high and less energy is consumed because the hot tin bath is dispensed with," says Hönig.

The same quality more cost-efficiently produced – this makes old rolled glass very attractive for PV. Which is also why demand for the relevant equipment is rising, as Werner Haag of Fickert + Winterling from Marktredwitz in Upper Franconia reports. He says his firm's rolling mills are currently in great demand going on to say: "We

especially receive orders from glass producers in China." Just over the past 12 months 25 glass rolling lines were installed there – one fourth of the rolling mills were supplied by Fickert + Winterling according to Haag.

The glass module factory

In fields where plenty of money is made there is financial scope for innovations. This is why the plant builder from Upper Franconia has joined forces with other suppliers in the Solarvis network to work out a concept for a clearly smaller and lower-cost factory. Daily output of 30 to 50 tons is planned, and, hence five times less than the usual glass rolling mills, but at only half the cost, i.e. EUR 15 to 20 million. This would make it attractive for module producers to invest in their own glass factories. Companies could produce glass sheets according to their own specifications while saving transport costs at the same time. Explaining the underlying concept here Haag said: "We think that an in-house solution can be an economically attractive solution." Float line operators counter this argument by saying their 1,000 ton lines were perfectly geared to cover the fast growing PV demands. Furthermore, researchers and engineers have developed many new coating and processing strategies for large-batch production. "With small rollers a giant sputtering line is of no use," Bernd Szycka of the Fraunhofer-Institute for Layer and Surface technology in Brunswick adds for consideration.

The competition emerging on the glass market should stimulate innovations. The development potential of solar glass is far from being exploited. "If the glass industry is prepared to invest, cost reductions of up to 50% are possible by 2015," Hönig believes. Integrated glass production and processing or glass & module production plants can avoid transport costs. Likewise, thinner glass and new anti-reflex layers bring down costs. Quality sheets allow some 95% of the light to pass, future ones are said to allow 99% of

photons to transmit. Cells operated behind such glass sheets would also bring 4% more yield. At the world's leading trade fair for the glass industry, glasstec, and the concurrently held trade fair for solar production equipment, solarpeq, innovations for PV glass will be a central issue. From 28 September to 1 October 2010 companies and research facilities will present their innovations and projects in Düsseldorf. Furthermore the Symposium of the Special Show glass technology live will deal with the topic of semi-finished products for PV and solar thermal systems on the Friday of the trade fair. At the solarpeq Conference "Solar meets Glass" on 27 and 28 September the glass and solar sector will get together for the first time for a direct exchange on the possible synergies and mutual requirements here. The more efficient the exchange between the two sectors is the sooner both will profit from each other in the future.

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Photos accompanying the text

Photo 1:

Key raw material: Glass is considered one of the principal components of solar modules. The demands of the solar sector are rising rapidly. (Photo: BMU/transit/Busse)

Photo 2:

Blazing heat: The higher the temperature of the glass mixture in the melting unit the clearer the glass sheets at the end. (Photo: F-Glass)

Photo 3:

Non-stop glass: rolled glass is in great demand in the PV industry due to its low manufacturing costs and favourable properties. (Photo: Fickert + Winterling)

Photo 4:

Sized: After production the sheets are visually inspected and sized in a cutting line. (Photo: F-Glass)

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Photo 5:

Processing: A coating line applies functional layers to the glass under vacuum for improved light transmission. (Photo: F-Glass)

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