

FACT SHEET

TULiPPS™ Solar B.V.

- ✿ Headquartered in Eindhoven, The Netherlands, TULiPPS Solar B.V. is a startup company developing and commercializing a new *technology platform for solar photovoltaic (PV) modules*.
- ✿ TULiPPS was one of three companies nominated for the **2012 Dutch Solar Innovation Awards** in the *Industrial Development* category.
- ✿ The company was founded by Paul Stassen, a long-time plastics-industry executive with 23 years' experience in technical and commercial roles who is also the inventor of the company's unique new PV platform. Stassen's vision is that the new COSMOS system will become not only a new PV platform (technology tree), but also the industry standard for light and conventional flat roofs, pitched roofs, and building-integrated PV (BIPV) systems globally. The company expects to commercialize its initial COSMOS™ “plug-‘n-play” modules designed for light flat roofs in 2012.
- ✿ TULiPPS has already filed numerous patents and is currently building and testing working prototypes for pilot projects with early customers. Its novel solar PV module technology increases energy efficiency and design functionality, while lowering the cost, weight, and installation time, thereby making solar-energy generation a better investment.
- ✿ For more information, see: <http://www.tulipps.com/>, or eMail: sales@tulipps.com or phone: +31 (0) 40.7516.290, or mail: TULiPPS Solar B.V., High Tech Campus 9, 5656 AE Eindhoven, The Netherlands.

Problems with Conventional PV Modules for Light Roofs

- ✿ Conventional glass and aluminum solar PV modules for flat and pitched roofs have not changed substantially in terms of design or materials of construction in over 40 years. Not surprisingly, they have numerous issues.
- ✿ Current installation technology requires considerable labor to install, which represents a significant percentage of the total cost of ownership for such systems. In fact, labor costs have become a significant percentage of total cost as module prices have declined over several decades. This is particularly true during the last three years thanks to economies of scale gained through increased demand for PV modules as a result of the feed-in-tariff support from a number of European countries.

- ❁ Another issue with traditional module installations is that their height and angle of tilt necessitate a separate frame and support structure (generally aluminum) on top of which the glass PV module is mounted. The support constructions are generally assembled on site, increasing effort and time for PV module installers.
- ❁ In some cases (e.g. panels subject to high winds or positioned near the edge of roofs where wind vortices are strong), heavy ballast (usually concrete block or stones) must be loaded onto the support structure's flat base for additional stability. Hauling ballast up to a roof and distributing it throughout a large solar array not only is time consuming and hard work for installers, but adds so much mass that the systems are often too heavy for safe use on "light" flat roofs that otherwise would be ideal locations for PV panels.
- ❁ The alternative to ballast for solar arrays on flat roofs is drilling through the roof membrane to bolt modules to the understructure, an option deemed unacceptable due to cost, time, and the risk of causing leaks, or strengthening the roof's construction, which is another expensive undertaking and therefore is rarely done.
- ❁ Still another problem with conventional PV solar modules is that the external frame tends to trap dirt and dust in corners that fails to wash off panels during rain events. Moisture trapped in these corners can also support algal growth, leading to the need to clean panels every year, thereby increasing maintenance and cost of ownership further.

COSMOS™ Solar PV Modules

- ❁ Developed in partnership with leading companies in the automotive composites, roofing, and PV industries, and with financial support from the Province of Noord-Brabant in the Netherlands, and the Brabantse Ontwikkelingsmaatschappij, the new COSMOS™ module system from TULiPPS Solar B.V. has been carefully designed to address deficiencies with conventional PV systems, take full advantage of automotive "lightweighting" strategies, and to bring greater value to all members of the solar PV supply chain – from the PV module manufacturer, module installation companies, building owners, and investors.
- ❁ Work to date on the company's integrated COSMOS™ PV module design has successfully demonstrated that the patent-pending system reduces weight and costs, speeds installation, increases energy output per unit area, lowers maintenance, and improves functionality vs. conventional systems.

- ❁ Key to the success of the patent-pending COSMOS technology platform is the combination of tough automotive-grade composites, an integral frame and support system with *plug-'n-play* functionality, thin-glass PV modules, and a proven roof-anchor system that does not penetrate the roof membrane. Each component offers special benefits to the system.
- ❁ Central to the system's design is a thin (2-mm/0.08-inch) glass PV laminate that is integrally attached to the composite module base, forming a very-strong module structure. This construction eliminates the need for the cost, complexity, and assembly time required with an external aluminum frame while reducing weight 50% or more. It also helps the system achieve industry's lowest installed weight with a roof load of less than 8 kg/m² (1.6 lb/ft²). Furthermore, TULiPPS Solar is the first company to use special 2-mm/0.08 inch, single-layer toughened solar glass from Ducatt NV, produced via the patented tempering process developed by LiSEC Group. This ultra-thin ultra-clear glass provides frameless COSMOS™ solar modules from TULiPPS with increased break resistance, light transmittance, and energy-generating efficiency/unit area while also reducing module weight and overall costs (Watt-peak installed). Owing to TULiPPS' own patent-pending frameless module design, it is the first company able to take full advantage of the significant benefits of the special Ducatt glass produced on LiSEC tempering equipment that has the potential to significantly change how solar modules are built and their capacity to generate energy.
- ❁ Earlier, when the cost of individual modules was high, the goal was to achieve optimum efficiency for each module. Now that module costs are lower but the balance of systems costs are still relatively high, the focus is on maximizing the number of modules per roof. Owing to a much flatter installation angle (5°) that is possible with the COSMOS module, shadowing of units further back in an array is greatly reduced, allowing rows of modules to be placed much closer together – on the order of 0.3m (1 ft) apart rather than the usual 0.6-1.5m (2-5 ft) apart. The shallow assembly angle means modules can be shorter/lower to the ground, which eliminates the need for heavy ballast. Also, while the shallower angle is considered “less efficient” at generating energy on a per-module basis, the fact that more modules can be installed per unit area leads to a reduction in the cost per watt of energy generation and shorter payback time on the investment. *In fact, this approach represents a fundamental shift in philosophy for the solar industry.* Since the number-one goal at TULiPPS is to reduce the overall cost of PV systems, the ability to put far more modules on a roof safely and quickly helps reduce system costs by achieving the highest energy output (cost per watt-peak) at the lowest investment costs per unit area.

- ✿ In addition, TULiPPS has focused significant effort in its design work to help integrate features and functions that will make the modules easier and faster to install, effectively reducing labor as well as material costs. For example, *plug-'n-play* functionality permits modules to be connected quickly to low-profile feet, assuring rapid but secure installation or removal. Also, a proven roof anchor system, which uses no screws or bolts and does not penetrate the roof membrane, helps further reduce installation time and labor costs, eliminates the need for heavy ballast, and helps maintain roof-membrane integrity.
- ✿ The lightweight, smooth-edged modules are also safer for workers to lift, carry, and install. And since the modules are essentially frameless and install at a lower angle, aesthetics are improved and there are no edges or corners to trap dirt and dust or encourage the growth of algae. Debris simply washes off during rain, helping keep the units operating efficiently and reducing the need for maintenance. Also, the well-known design freedom offered by plastics/composites coupled with the ability to eliminate a rigid metal frame provides entirely new opportunities to create modules in unique shapes and larger sizes.
- ✿ The durable materials used in the support system – long-fiber thermoplastic (LFT) polypropylene (PP) composites – were carefully formulated to provide high bending strength at very-low weight. Preliminary flame retardancy testing indicates the materials will qualify with a V-0 flame-retardance listing with Underwriters Laboratories Inc. (UL[®]) 94 specifications in a halogen-free/ECO-compliant formulation, enabling modules to meet current and future requirements for roof-mounted polymeric components. Since TULiPPS plans to warrant its units for 25 years, materials also have been formulated for exceptional, long-term weatherability and ultraviolet (UV) stability. Special colorant packages have been formulated to broaden the LFT color palette from black and natural (typical automotive-industry offerings) to also include grey, green, and blue without interfering with mechanical properties. Inline compounding and molding on commercial scale equipment have also verified that the new materials process easily and produce parts with an excellent balance of physical and mechanical properties even under accelerated aging tests. And unlike aluminum frames, there is no need to electrically ground the support structure, because the polymers are inherently non-conductive.

- ✿ The innovative COSMOS modules support new financing and business models for solar PV energy. By reducing both purchase price and installation time and costs, as well as eliminating maintenance issues, and generating more energy per unit area, the total cost of solar PV ownership and the carbon footprint of energy production can be lowered considerably while shortening return on investment. This creates new business opportunities for roof-mounted, ground-mounted, and building-integrated solar PV module systems, or for more efficient thermal-PV (PV-T) modules, which generate both heat (e.g. for hot water) as well as electricity. The COSMOS technology represents the lowest PV system costs per Wp in the industry.
- ✿ The new technology is suitable for both silicon and thin-film PV modules. It is easy to implement in all existing PV module factories. The same versatile module technology can be used on flat or pitched roofs or with BIPV.
- ✿ TULiPPS Solar has just announced its newest product, which will make it industry's largest lightweight PV module at 1.98 x 1.64m/6.5 x 5.4 ft and industry's largest-capacity standard PV module at 120 cells/500 watt-peak (Wp) energy output when it is commercially available next year.

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Provincie Noord-Brabant

 COSMOS product development is sponsored by the PROVINCIE NOORD-BRABANT.



TULiPPS has been nominated for the 2012 Dutch Solar Awards.