

photosolar



Micro
Shade™

Deloitte.

Teaser

Project Munich

Key Investment Highlights

- Scientifically-proven high-performance solar shading technology
- No equivalent technology on the market with the characteristics and performance of MicroShade™
- Strong and growing need for simple shading devices driven by building design preferences for large glass facades that meet the increasing legal requirements
- Next generation power-generating MicroShade™ under development
- Strong reference installations
- Management team with both technical and commercial insight
- Well-protected intellectual property rights through patents and patent applications

Business case

Profile

- PhotoSolar A/S is a Danish technology and knowledge-based company that develops and markets advanced, transparent solar shading and photovoltaic solutions for new and refurbished buildings. The company produces and sells unique, proprietary metallic films to glazing manufacturers, who assemble them into standard glazing units and supply these to the building industry.
 - Founded in 2003 as a spin-out from the Danish Technological Institute (DTI) to create a good working environment and to reduce energy consumption in buildings with large glass facades, using aesthetic and maintenance-free solar shading
 - The company has raised Series A and Series B funding and is owned by the Danish state investment fund, Vaekstfonden, DTI and Dutch-based clean energy venture capital investor, Chrysalix SET
- PhotoSolar has developed MicroShade™, a unique and patented maintenance-free solar shading solution that creates a comfortable working environment while at the same time reducing energy consumption for cooling and ventilation in buildings with large glass facades
 - Reference installations in several buildings in Germany and Denmark, including the prestigious Confederation of Danish Industry building in the centre of Copenhagen
 - Partnering agreements with several top level architectural glass manufacturers
 - Design agreement with a leading international architects practice
 - Partnership with a number of knowledge centres, including the Danish Technological Institute
- A second generation of MicroShade™, currently under development and expected on the market in 2016, will have the ability to transform shielded solar energy into electric power
- PhotoSolar's ambition is to gain 4% of the 5 million m² European market for solar shielded architectural glazing by 2016
- The company is seeking to raise EUR 9m in the first half of 2012. This will fully fund the business through to cash flow break even based on the current product portfolio. Late 2013, based on the achievement of technical and commercial milestones, a final EUR 2.8m would need to be raised to complete the new product program
 - Current shareholders Vaekstfonden and Chrysalix SET will co-invest in the EUR 9m round

Timeline

Before 2001	<ul style="list-style-type: none"> • The founder, Eik Bezzel, heads up the photo electrochemical cell (PEC) research team at DTI • Basic research into dye-sensitized solar cells (n-DSC) at DTI
2001-2003	<ul style="list-style-type: none"> • Several patent applications are obtained, and research concentrates on building integrated photovoltaics (BIPV) systems • PhotoSolar is spun off as independent start-up
2004-2008	<ul style="list-style-type: none"> • Switch from n-DSC to multi-crystalline silicon (mc-Si) technology • Prototype development and rigorous testing • Vaekstfonden invests in PhotoSolar
2009	<ul style="list-style-type: none"> • MicroShade™ is launched successfully in the market • Sales team in Denmark established • Approx. 1,000 m² sold
2010	<ul style="list-style-type: none"> • Chrysalix SET and Vaekstfonden co-invest in PhotoSolar • Sales team is set up in Germany • Approx. 1,000 m² sold
2011	<ul style="list-style-type: none"> • Market penetration and product development • Sales team in Germany expanded • New CEO (Alistair Higgins) and Chairman (Hans Christian Petersen) • Approx. 2,400 m² sold



Alistair Higgins, CEO
11 years in senior positions at Saint-Gobain Chartered Accountant, London
Graduate Cambridge University



Eik Bezzel, CTO & Founder
First CEO of PhotoSolar
12 years with the Danish Technological Institute
M.Sc. Engineering, DTU

Business model

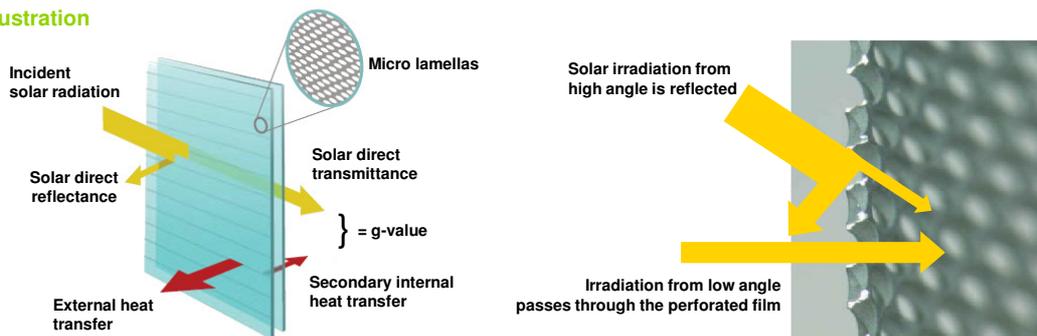
A strong need for effective and energy efficient shading systems

- The role of solar shading systems is to improve thermal and visual comfort by moderating direct solar radiation at required periods, controlling diffuse and reflected radiation, and preventing glare from external and internal sources, whilst ensuring that daylight and natural ventilation are not excessively reduced
- Widespread preferences for large glass facades in new and refurbished commercial buildings by architects and engineers for reasons involving design trends, occupant comfort and environmental concerns have created a strong need for intelligent yet simple shading devices
 - Highly-glazed buildings are often subject to intense solar radiation and resultant internal heat build-up and glare which must be controlled during all seasons
 - Conventional solar shading systems such as exterior shades, solar control glass and solar protection films applied to the glazing do not adequately address both thermal and visual comfort as they are either expensive, lead to high maintenance costs, or significantly limit architectural expression
- Concerns about climate change and escalating energy prices are also driving legislative requirements for the use of energy-saving technologies in buildings
 - Today's buildings account for 40% of total energy consumption and 36% of CO₂ emissions in Europe, which has led the European Commission to approve the Energy Performance Building Directive (EPBD 2010) which stipulates that by 2020 all new buildings constructed within the EU after 2020 should reach nearly zero energy levels (nZEB policy)
 - Common use of high energy-consuming solutions like air-conditioning will only be possible in limited and specialised situations
 - The consequence is that progressive or movable shading systems with a lower g-value than today's standard are needed

The solution

- PhotoSolar has developed MicroShade™, a metallic film with a patented 3D micro-lamella structure. Embedded in insulating glazing units, this is a transparent and effective solar shading structure, replacing interior and exterior solar shading devices whilst providing an aesthetic, robust and economic solution that can easily be integrated into any glazed facade
 - The strip of micro-lamellas filters sunlight according to the same principle as ordinary blinds. Sunlight incident at low angles passes relatively unimpeded through lamellas while solar radiation incident at high angles is effectively blocked up to 100%
 - On average throughout the day, MicroShade™ lets in close to 50% of natural light through the window and reflects 90% of heat

Illustration



- MicroShade™ is available in (A) standard, (B) roof-specific and (C) design versions, all of which bring key advantages over conventional solar shading solutions (appendix 1):
 - Zero cleaning and maintenance, and therefore a much lower lifetime cost (saving EUR 30 a year per m²) compared with conventional external blinds
 - Building owners save energy and maintenance costs for A/C and cooling, get a higher indoor comfort level and useable floor area
 - Developers save A/C investment and get a competitive solar shading that is easy to install
 - Users enjoy an unimpeded view and outdoor light inside and excellent indoor climate without the discomfort of direct sun beam heating and glare
 - Promotes architectural freedom by eliminating external shading structures, while setting new standards for the relationship between solar shading, light transmittance, colour rendering and environmental concerns



Standard version



Roof version



Design version

Business strategy



Inside angled facade with MicroShade™



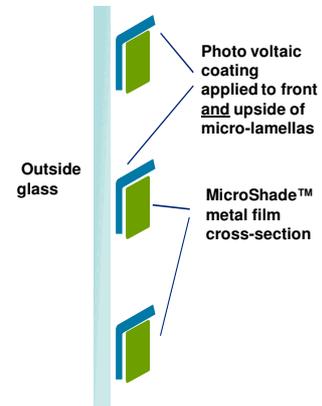
MicroShade™ in office glazing facade



Inspiring outside view

Future solution

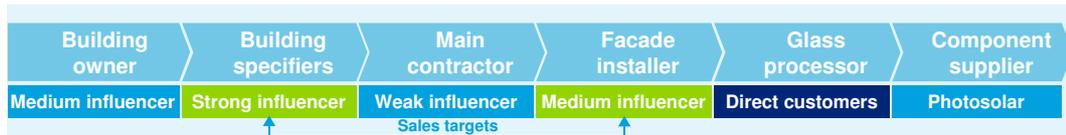
- A second generation of the product, MicroShade™ Power, is under development and will be the first photovoltaic device to combine solar power and efficient shading in one product with 50% transparency
 - The product is expected on the market in 2016
 - To finish the development of MicroShade™ Power, an additional EUR 2.8m needs to be raised by 2014
- MicroShade™ Power produces a total output of 50 W_p/m² or 50 kWh/m² yearly in Northern Europe, enough to power any residual need for air conditioning
- Photovoltaics are flexible in size and are produced to project specifications
- Optical quality, out view, progressive shading and beam shading properties similar to MicroShade™
- MicroShade™ Power modules are compatible with typical facade systems and exterior cabling systems
- The product is developed for subcontracted manufacturing, and care is taken to use known technology, wherever possible



The market and go-to-market strategy

- The annual volume of the non-residential glazing market in Western Europe is close to 20 million m² of which the volume of solar control glass for the non-residential market accounts for about 25%
 - South-facing elevations are therefore assumed to be 5 million m², which is the minimum addressable market for MicroShade™
 - The target is to convert 4% of this market to MicroShade™ over 5 years and obtain an annual sales volume of 210,000m²
- MicroShade™ is an innovative specified product being introduced to a conservative market operating on long project lead times. It therefore takes time to build a strong sales position
- To obtain the market share, PhotoSolar actively markets its products to top building specifiers (architects and engineers) and owners, tracked through the construction supply chain, and ultimately sold to architectural glazing processors who embed the products into 2- or 3-layer glazing units following agreed quality standards

Contract value chain



- Initial market focus is targeted at building specifiers in Northern Europe, specifically in the Nordics, the UK, Germany and the Benelux
- Activities to support the go-to-market strategy include
 - Build database of key architects, engineers, owners and facade installers
 - Key account management for top influencers and all direct customers
 - Targeted marketing and promotional activities
 - Project identification (leads) and tracking through detailed CRM system

Company status

- PhotoSolar employs 13 employees with Alistair Higgins (CEO) and founder Eik Bezzel (CTO) forming the management team and Hans Christian Petersen as Chairman
 - CEO with strong business development and management experience from 10+ years in the glass and construction industry
 - CTO with extensive R&D experience in the construction industry, including 10+ years of R&D within photovoltaic
 - Chairman with strong credentials and wide experience in key account selling to architects internationally
- Sales pipeline is now growing with identified projects evaluated at over EUR 12m, and OEM sales channels are established and ready to be exploited

Financials

Profit and loss statement

EURm	FY11E	FY12E	FY13E	FY14E	FY15E	FY16E
Revenue	0.6	1.1	3.6	10.4	21.6	38.5
EBIT	<u>(1.7)</u>	<u>(1.8)</u>	<u>(2.4)</u>	<u>(0.3)</u>	<u>3.9</u>	<u>14.4</u>

Source: Management information

Cash flow statement

EURm	FY11E	FY12E	FY13E	FY14E	FY15E	FY16E
Cash flow for the period	(0.0)	(2.2)	(2.7)	(2.7)	1.8	11.3
Liquidity at the end of the period	<u>0.6</u>	<u>(2.3)</u>	<u>(6.1)</u>	<u>(8.8)</u>	<u>(7.1)</u>	<u>4.2</u>
Option to boost MS-P development beyond 2013				(2.8)	(1.4)	(1.4)
Liquidity at the EOP with extra MS-P cost	<u>0.6</u>	<u>(2.3)</u>	<u>(6.1)</u>	<u>(11.7)</u>	<u>(11.3)</u>	<u>(1.5)</u>

Source: Management information

MS-P: MicroShade™ Power

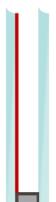
EOP: End of period

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Appendix

	MicroShade™	Solar control glass	Exterior shading
			
	Embedded solar shading	Coating on glass	Exterior blind or screen
Thermal efficiency	✓	✗	✓
Beam shading	✓	✗	✓
Maintenance and cleaning	✓	✓	✗
Wind stability	✓	✓	✗
Simultaneous outlook and shading	✓	✓	✗
G-value* (typical range)	0.09	0.26-0.42	0.10-0.20
Investment cost (EUR/m ²)	500	570	500
Yearly running cost (EUR/m ²)	0	29	30
Total costs in 5 years (EUR/m ²)	500	715	650
Total costs in 10 years (EUR/m ²)	500	860	800
Comments		<ul style="list-style-type: none"> • Electricity cost EUR 0.25/kWh • Coefficient of performance (COP)** equals 3 • Capacity determined by surface temperature 	<ul style="list-style-type: none"> • Maintenance cost 10% of initial cost of shading

*G-value: The 'G-value' measures the degree to which glazing blocks heat from sunlight
G-value is expressed as a number between 0 and 1. The lower a glazing's G-value, the less solar heat it transmits
** COP: The ratio of heat output to the amount of energy input