Oerlikon Solar at a glance

<table>
<thead>
<tr>
<th>Headquarters Location</th>
<th>Trübbach, Switzerland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Established</td>
<td>2003</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>Over 700 worldwide</td>
</tr>
<tr>
<td>Locations</td>
<td>13</td>
</tr>
<tr>
<td>Global Reach</td>
<td>Sales and service centers in the USA, Europe, China, Taiwan, Korea, Singapore and Japan</td>
</tr>
<tr>
<td>Technology Expertise</td>
<td>Manufacturing equipment and end-to-end production solutions for thin film silicon photovoltaic (PV) modules</td>
</tr>
<tr>
<td>Customers in Production</td>
<td>12</td>
</tr>
<tr>
<td>Equipment &amp; end-to-end lines installed</td>
<td>&gt;450 MWp installed</td>
</tr>
<tr>
<td>Awards received</td>
<td>(EMBARGO until Sept. 8, 2010) Solar Award 2010 in the segment “Thin Film Innovation” for the KAI MT at EUPVSEC in Valencia, Spain</td>
</tr>
<tr>
<td></td>
<td>2009 Cell Award for the KAI 1200 PECVD equipment as “best technical product for thin film module manufacturing”</td>
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<tr>
<td></td>
<td>2009 Solar Industry Award for our TCO 1200 LPCVD equipment in the category “Thin Film Innovation”</td>
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</table>

What does Oerlikon Solar do?

Oerlikon Solar is the world’s leading manufacturer of proven end-to-end thin film silicon PV solutions. The company provides solar panel manufacturers a quick path from concept to revenue. Oerlikon Solar thin film PV equipment and factories provide customers with the lowest cost of ownership (CoO), fastest time to deployment, highest reliability and superior technology advantages with technology that is predictable and reliable.

Oerlikon Solar provides customers with the capability to scale up rapidly to meet the fast-growing demand for solar PV, demand that will accelerate as the cost of PV energy approaches grid parity. Oerlikon Solar’s progress towards reaching grid parity by the end of 2010 is driving market expansion for its customers’ end products. Oerlikon Solar customers have the dual advantage of the industry’s most advanced thin film PV technology that is also the most tested, proven and reliable (2.5 million modules produced on Oerlikon Solar customers’ production lines and more than 450 megawatts installed capacity). Because of this, customers have the fastest time-to-market with Oerlikon Solar.

Oerlikon Solar manufactures stand-alone equipment and end-to-end manufacturing lines including full ramp up support and maintenance support. Oerlikon Solar has developed and proven advanced thin film silicon processes including amorphiHIGH PERFORMANCE and Micromorph® technology for the mass production of thin film silicon solar modules. These
technological breakthroughs from Oerlikon Solar provide significant power and efficiency gains, which drive up efficiency and drive down cost, thereby moving solar closer to grid parity.

**Operational Structure**

Oerlikon Solar is one of six business segments of Oerlikon Group, one of the world’s leading high-tech industrial groups specializing in machine and plant engineering. Oerlikon Group is a provider of innovative industrial solutions and cutting-edge technologies for textile manufacturing, thin film coating, drive, precision, vacuum and solar systems. A Swiss company with a tradition going back 150 years, Oerlikon Group is a global player with approximately 16,000 employees at 157 locations in 36 countries and sales of CHF 1.6 billion in 2010. The company ranks either first or second in the respective global markets.

Oerlikon Solar was established in 2003 and became an independent business unit in 2005 within the Oerlikon Balzers Coating segment. Due to market growth and potential, Oerlikon Solar was established as Oerlikon Group’s sixth business segment in fall 2007. Oerlikon Solar brings together the corporation’s extensive and wide-ranging solar competencies and technologies for solar production lines and equipment.

Oerlikon Solar is headquartered in Trubbach, Switzerland, with an R&D lab in Neuchâtel, Switzerland, and a pilot line in Trübbach that provides a key strategic asset for the company’s R&D capabilities. Oerlikon Solar has grown to more than 700 employees worldwide. Global customer support and training are provided through sales and service centers in Europe and Asia-Pacific. U.S. Revenues for FY09 were reported at CHF 442 million and the HY2010 revenues were reported at CHF 74 million. Oerlikon Solar customers have manufactured almost 3 million panels to date and Oerlikon Solar has 447 active patents. The company has more than 200 global customer support personnel at 13 locations in nine countries.

**Latest achievements**

Oerlikon Solar has successfully demonstrated its ability to mass produce equipment for thin film silicon PV panel production by having delivered and ramped up over 450 megawatt of capacity – both amorphous and Micromorph® – to customers as of July 2010, meeting both time and performance criteria. Thanks to its long-standing experience in thin film coating, Oerlikon Solar enjoys a first-mover advantage and was the first company to deliver equipment on which a-Si thin film PV modules were produced at industrial scale.

Oerlikon Solar today boasts a thin film market share of 45 percent offering non-toxic, cadmium-free and environmentally friendly solar technology, competing primarily with U.S.-based First Solar, which uses Cadmium Telluride in its modules. Oerlikon Solar originally developed the core element of the front-end production line, the PECVD chamber (plasma-enhanced chemical vapor deposition) called “KAI”. Today, the company supplies full end-to-end solutions, enabling automated mass production of 1.4m² thin film silicon PV panels.

Oerlikon Solar’s latest accomplishment is the availability of a new production line “ThinFab” that reduces the manufacturing cost of thin film silicon modules to a record breaking € 0.50/watt peak ($0.70/watt). The Fab has the lowest module production cost per watt in thin film market and lowers production costs by 50 percent compared to that of c-Si. Oerlikon Solar customers have a competitive edge in the market as many of the technological improvements enable better performance, higher output and improved efficiencies to their existing production lines.
improvements lead to lowering the energy payback time of the modules down to one year, with lowest energy consumptions for photovoltaic production plants in the industry. Output capacity of the new ThinFab is increased to 120 megawatts corresponding to approximately 850,000 non-toxic and environmentally friendly solar modules per year with 10 percent efficiency at 143 watt peak (Wp) module performance.

**What awards has Oerlikon Solar won recently?**

(EMBARGO UNTIL Sept. 8, 2010, as this will be communicated by the organizers Sept. 9, 2010 at 7 p.m. CET.) Recently Oerlikon Solar won the Solar Industry Award 2010 in the segment “Thin Film Innovation” for the KAI MT at EUPVSEC in Valencia, Spain.

Recently Oerlikon Solar won the Solar Award 2010 in the segment “Thin Film Innovation” for the KAI MT at EUPVSEC in Valencia, Spain. Oerlikon Solar has been named the winner of the 2009 Cell Award, presented at the world’s biggest solar trade show, Intersolar 2009 Conference in Munich. The jury selected Oerlikon Solar’s KAI 1200 PECVD system as “the best technical product for thin film manufacturing.”

Additionally, Oerlikon Solar has been named winner of the 2009 Solar Industry Award for its proprietary TCO 1200 (Transparent Conductive Oxide).

**What is driving growth in the solar industry?**

As the world grapples with soaring energy prices, increased demand for power and the rising threat of global climate change, solar energy stands out as one of the most attractive sustainable energy options. More than 34 million megawatt hours hit the planet every day from the sun. This is 10,000 times more than what is use globally. Solar energy is inherently clean, creates no negative side effects, and in most parts of the world, is readily available in virtually unlimited quantities. With dwindling fossil fuel resources and increased environmental regulation, most experts predict a substantial transition toward solar power as a primary energy source in the near future.

Navigant Consulting expects total shipments to grow from 12 GW in 2010 to 44 GW in 2014 in the accelerated scenario, according to its Photovoltaic Manufacturer Shipments, Capacity & Competitive Analysis 2009/2010. Low-cost thin film solar modules present significant growth opportunities in this market. Navigant forecasts thin film manufacturing capacity of 12.3 GW in 2014 in an accelerated scenario as compared to 3.6 GW in 2010. The total PV manufacturing capacity is expected to increase to 51 GW in 2014 from 19 GW in 2010.

Faced with the urgency to increase renewable energy sources, governments around the globe (e.g., China, Canada, Japan, U.S., Switzerland, France, Italy, and Greece) are supporting solar energy production in various ways, including incentives, subsidies, feed-in tariffs and tax reductions.

**What are photovoltaics?**

Photovoltaic (PV) technology converts light energy directly into electrical energy through photovoltaic cells. Also known as solar cells, individual PV cells are electricity-producing devices made of semiconductor materials. PV modules consist of an assembly of PV cells, and can be combined to form an array of varying sizes and power output.
Solar PV is an increasingly important energy technology because it contributes to global energy supplies with virtually no negative environmental impact, such as air pollution or hazardous wastes. PV systems utilize an inexhaustible, free, and versatile source of energy. Solar PV energy can supplement existing power-grid systems and can also bring electric power to remote areas that are far from conventional power lines.

There are two different processes for producing PV cells: wafer-based silicon technologies and thin film PV technologies. Wafer technology requires a significant silicon supply. Thin film PV cells, a newer, innovative technology, employ silicon and other thin films on supporting substrates such as glass, polymer, aluminum, stainless steel, or metallurgical-grade silicon. They typically use amorphous, nanocrystalline, fine-grained polycrystalline, or epitaxial silicon layers that are only a fraction to a few micrometers thick.

What makes Oerlikon Solar different from others in the solar energy business?

Like the semiconductor industry, the rapidly growing solar energy industry comprises several key sectors that make up a well-developed supply chain: from materials makers to equipment suppliers to OEMs and device makers. Serving a rapidly growing global base of customers, Oerlikon Solar is a leading supplier of equipment and technology for large-scale production of solar modules.

By offering an end-to-end solution to multiple manufacturing partners, Oerlikon Solar’s business strategy allows large-scale energy producers and project managers to diversify their sourcing without sacrificing quality and consistency. Oerlikon Solar’s business model ensures replicability and scalability across its growing customer base around the world so utilities can lock into a standard design. For large-scale projects, Oerlikon Solar’s flexible end-to-end business model also provides new business options for utilities or utility-scale developers who choose to vertically integrate into module manufacturing to deliver low cost solar energy.

Oerlikon Solar has the strongest track record in solar equipment and factories in terms of the speed in which customers ramp up and start production. It also has the most customers in production to date. The company has delivered on or before schedule and has met guaranteed performance levels for every project. In six to eight months, Oerlikon Solar customers can quickly ramp up and start selling products to meet the demand for thin film solar panels.

Oerlikon Solar is the world’s leading supplier of proven, fully automated end-to-end solutions encompassing metrology and the entire production process — from glass cleaning to testing of the finished modules. This technology is backed by an industry-leading, full-service package for commissioning the equipment, integration of the company’s proprietary process technology and ensuring an efficient and timely production ramp-up. The non-toxic, environmentally friendly and highly effective Micromorph® tandem modules offer customers many advantages, including efficiencies of 10 percent becoming more in the near future.

What is Oerlikon Solar’s core technology?

As the world’s first manufacturer of automated production lines for thin film solar modules, Oerlikon Solar has extensive experience in integrating production technologies and processes to create end-to-end solar factories. The fully automated ThinFab is the latest generation in solar module manufacturing lines.
Oerlikon Solar’s ThinFab applied proprietary technologies for the mass production of thin film silicon solar modules include four key components:

**Next generation TCO**
- 60 percent higher throughput and 40 percent lower cost of ownership compared to the previous generation
- Best-in-class transmittance and light trapping enables a high efficiency thin absorber layer
- In-house front contact TCO enables cost-efficient local bare glass sourcing
- Extended maintenance cycles allow higher system availability

**Next generation PECVD KAI MT**
- 50 percent higher productivity (throughput)
- 50 percent less investment costs
- 50 percent less cost of ownership
- 25 percent less gas and electricity usage (best-in-class in facility consumption)
- Integrated Micromorph® process (no vacuum breakage between both absorber films) using 40MHz technology
- Optimized temperature cycles during deposition (fewer steps for heat & cooling)
- Contamination free processing enabled by the differential pressure in the Plasma Box® and the new gate valve isolation between the process chambers

**Next generation LSS Laser**
- Faster process through 50 percent tact-time reduction
- Reduced scribe separation leading to increased active area i.e., higher module power
- Improved process stability leading to even higher reproducibility

**New Low Voltage Module**
- Up to € 5.80 cost saving on electrical BOS per module
- Operating voltage (Vmp) in the regime of crystalline silicon
- Attractive homogenous black appearance across the entire module
- Excellent Micromorph® temperature coefficient of 0.26 percent/°C for Pmp
- Best in class TCO corrosion resistance even by applying transformer less inverters, leading to up to 3 percent higher energy yield

**What is Micromorph® module technology?**

Invented by Oerlikon Solar’s Dr. Johannes Meier, the company’s proprietary Micromorph® module technology, which was introduced in fall 2007, combines two different silicon materials — amorphous silicon and microcrystalline silicon — in a top cell and a bottom cell. The amorphous top cell converts the visible part of the sun’s spectrum, while the microcrystalline bottom cell absorbs the sun’s power in the near infrared spectrum. Consequently, the new Micromorph® technology boosts the efficiency level up to 50 percent higher than traditional amorphous single cells. This process not only reduces energy production costs, it also has the potential for reaching conversion efficiencies of more than 10 percent. In addition, Oerlikon Solar is committed to using materials that are non-toxic, low cost and readily available.

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1 In combination with Oerlikon MMI
**Why is Oerlikon Solar’s module size the industry standard?**

Oerlikon Solar’s 1.4 m$^2$ substrates are the leading format currently available for equipping silicon thin film solar module production facilities, and have become the industry standard through numerous installations in overall PV. In addition to the fact that they are the only substrates available for wide-scale implementation today, this format has other advantages over larger substrates including higher efficiency, lower cost of ownership per watt, lower shipment costs and ease of transport and installation.

**How can we offer globally valid IEC (TÜV) certification?**

**TÜV Rheinland**

TÜV Rheinland approved that Oerlikon Solar passed all tests required for the certification of its Amorph Basic, amorph$^{\text{HIGH PERFORMANCE}}$ and Micromorph$^\text{®}$ thin film silicon PV modules.

Issued as a master certificate, it allows Oerlikon Solar to offer all end-to-end production line customers a dramatically reduced time-to-market (from six months to six weeks) for certified (Module Safety and Module Performance) modules. These certifications confirm both the technological lead and the viability of Oerlikon Solar’s end-to-end production technology.

The certification is valid across the entire globe and forms just one part of the stable platform upon which Oerlikon Solar is scaling-up its production and services.

**UL Master Certification**

Micromorph$^\text{®}$ and all other Oerlikon Solar technologies including technologies produced on commercial TCO or on Oerlikon Solar in-house produced TCO are UL certified (UL 1703). The UL Master Certificate is an important validation of product quality and bankability and will be a key factor for sales of products by Oerlikon Solar customers in the fast-growing market in North America.
What is grid parity?

“Grid parity” will occur when solar-powered electricity reaches cost parity with conventional fossilfuel-based electricity. This will first occur in most regions of the world during periods of peak demand, when conventional electricity generation is most costly, and when solar PV electricity generation is at its maximum level. Solar installations in the world’s sun belts will play a major role in achieving grid parity, and in "shaving" peak demand for electricity in these regions. In some regions around the globe (e.g., Southern California and Southern Europe) grid parity is already reality at midday.

Oerlikon Solar is committed to continually improve solar PV technology and reduce the cost of solar PV energy to reach grid parity, without government subsidies. Grid parity depends on a variety of factors, including lower cost of ownership for solar module production and increased module efficiencies. Oerlikon Solar is on track to reach $ 0.70/watt for equipment delivered by the end of 2010, which will move the company to grid parity with traditional fossil fuel energy resources. With the government support already in place, this will spur a major solar build out as the economics will, for the first time, favor solar power. The ability for a company to quickly scale while not sacrificing quality will be critical in addressing the demand and build out of solar power worldwide.

Who are Oerlikon Solar’s customers and partners?

Oerlikon Solar is the world leader in silicon-based thin film solar technology and end-to-end manufacturing solutions with 12 established customers worldwide representing over 450 MWp of yearly production capacity, enough to power approximately 400,000 households.

The company has a rapidly expanding global customer base. Recent customer sales include Astronergy, Sun Well Solar and Auria Solar Co. Ltd. (Taiwan), Tianwei and Chint Solar (Mainland China), Inventux, ersol Thin Film GmbH, SCHOTT Solar AG (Germany), Pramac Suisse (Switzerland), Gadir Solar (Spain) and HelioSphera (Greece) and Hevell LLC (Russia).

Besides a well established global footprint, Oerlikon Solar has significant partnerships with leading industrial companies such as Tokyo Electron (sales and customer service) and Flextronics (equipment manufacturing) to guarantee comprehensive customer service and support and rapid scalability throughout different geographies.