Solexel, Thin-Silicon Solar Startup, Lands $31M More in VC Funding

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Despite investor flinchiness in a recovering global solar market, Solexel, a thin-silicon solar cell and module builder, just raised $31 million in a Round D of funding aimed at moving the company to commercial production.

Solexel added new investor GAF, a large roofing materials manufacturer, to its roster of investors, which includes SunPower, KPCB, Technology Partners, DAG Ventures, Gentry Ventures, Northgate Capital, GSV Capital, Jasper Ridge Partners, and Spirox. The firm’s board of directors includes...

Mark Kerstens, Solexel’s chief sales and marketing officer, as well as its acting CFO, informed GTM that SunPower did not reinvest in this round, although all of the equity players did. The startup’s total VC funding to date is north of $200 million. Solexel has also scored $17 million in DOE and NSF grants and is still an active participant in the DOE SunShot program. The 55-employee startup hit an NREL-certified cell efficiency of 21.2 percent in 2014.

Solexel is looking to bring 20-percent-efficient photovoltaic modules to market in 2015. First Solar, the thin-film solar leader, recently announced that its manufacturing cost will plunge to $0.40 per watt by 2017. (GTM Research Senior Analyst Shyam Mehta looks at the potential of 36 cents per watt silicon-based modules here.)

As we reported previously, Solexel looks to partner in Malaysia to build the cells. The firm currently has a megawatt-scale pilot line in Milpitas which it intends to "copy-exact in Malaysia," according to Kerstens.

Solexel is hoping to mass produce 35-micron-thick, high-performance, low-cost monocrystalline solar cells using a lift-off technology based on a reusable template and a porous silicon substrate. According to the company’s claims, the process ensures that the thin silicon is supported during handling and processing, while the back-contact, n-type cell dispenses with the need for expensive silver, using aluminum instead. The process uses no wet steps, according to the CEO, Michael Wingert, and employs CVD on trichlorosilane gas at atmospheric pressure, with silicon deposited at a rate of 2.5 microns per minute. The cell uses nearly ten times less silicon than conventional c-Si cells, at about 0.5 grams per watt.
Mehrdad Moslehi, the CTO and founder of the firm, told GTM that at 156mm x 156mm, Solexel produces the largest back-contact cell in the industry. The firm may use a contract manufacturer to construct the modules, which will be available in frameless as well as framed versions. Solexel claims that its cells don't need the support of glass, and it envisions using lightweight, non-glass sandwich panels in future product offerings.

A resin and fiber carrier, akin to circuit board material, supports the thin cell and allows a diode to be added for module shading tolerance.

Kerstens notes, "Where we've done quite a bit of work is in form factor." He added that the flexible cells don't demand the standard glass sandwich and aluminum frame, and the company is "excited about working with lighter-weight solutions." That typically means building-integrated photovoltaics or solar tiles for residential usage and lightweight flexible panels for flat or low-slope commercial rooftops. The addition of roofing materials manufacturer GAF to the firm’s list of investors is not a coincidence.

The acting CFO was very involved in the fundraising efforts and noted that the investor landscape has improved since the company’s Round C raise in 2012 and 2013. Kerstens said that the reception has improved in family offices and with high-net-worth individuals. (This is a theme we’ll explore in depth at the upcoming NextWave Greentech Investing event next month. Kerstens plans to attend.)

Other firms in the thin silicon business include 1366 Technologies with its "direct wafer" technology using molten silicon directly converted into wafers, and Crystal Solar using a vapor deposition process for making thin crystalline silicon wafers.

*Slides from Solexel’s 2012 presentation:*
Disruptive Technology and Production Process
Proven in Semi, Mapped and Scaled to Solar

- **Reusable Template** – Foundation for Thin Cell Processing; Reusable >100x
- **Releasable Thin Mono-Crystalline-Silicon** – 10x to 15x Less Si Usage vs. Traditional
- **Back Contact/Back-Junction Cell Design** – 3%+ Points Higher Efficiency vs. Traditional
- **Planar Flex Backplane** – Strength & Support for Cell; Smart Cells for High Energy Yield
- **Module** – Full-Square 156 x 156 mm² Cell Boosts Module Power, All-Black Aesthetics

World Record 156 mm x 156 mm Full-Square Cell Efficiency
Using Ultrathin (35 μm) Epitaxial Silicon Absorber

**Cell Efficiency = 19.02%**

- 156 x 156 mm² full-square cell (243 cm²)
- 35 μm epitaxial silicon
- $V_{oc} = 670 \text{ mV}$
- $J_{sc} = 37.15 \text{ mA/cm}^2$
- $FF = 76.38\%$
- Cell Power = 4.6 Wp; $I_{sc} = 9.03 \text{ A}$
No Epi or Cell Degradation with Template Reuse

- Demonstrated 50 template reuses, clear path to 100+ template reuse
- No degradation of lifetime, defect density, or cell efficiency with reuse

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