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## RSi ramping up to Solar Grade Silicon production



*Turning on the first 500 MT (Metric Ton) arc furnace in Fall 2011.*

*RSi Silicon rebrands as Renewable Silicon International (RSi).*

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I have not been able to update *RSi Silicon commences Solar Grade Silicon production* since March 2009, until now.

In an interview last week with RSi President and CTO Dr. Steve Amendola and Executive Vice President Greg Mandor, I learned RSi plans to start one of two (2) 500 MT arc furnaces at their Easton, Pennsylvania USA, facility in late September or early October 2011 to produce commercial sized 100 to 400 kg (kilogram) customer samples of solar grade silicon. RSi expects to be producing solar grade silicon full time with the first arc furnace by the end of 2011 or early 2012.

Thus far, RSi has produced small batches of 6-7N (six 99.9999% to seven nines 99.99999% pure) solar grade silicon material using the now patented ChemArc process with small experimental sized furnaces.

RSi has not sold any solar grade silicon material to prospective customers, and although RSi has grown a silicon ingot, no silicon solar cells have ever been made from the material. RSi said not enough material had been produced to supply production sized Directional Solidification System (DSS) furnaces. RSi believes their 6N+ quality material will cast 7N multicrystalline silicon (mc-Si) ingots suitable for manufacturing mc-Si solar cells. Dr. Amendola said:

*So far results have shown that we can produce a 6N material which when you put it into the multicrystalline direct solidification unit gets better than 7N and will make a very good cell.*

RSi claims upward of 30 companies have expressed interest in sampling the material to date with new inquiries arriving weekly. Companies range from global brands to the smallest firms all vying for a limited number of initial samples.

As customers place solar grade silicon orders, RSi plans to ramp the second 500 MT arc furnace around 2Q 2012.

### **ChemArc process**

First described in *RSi Silicon: Solar Grade Silicon from Pennsylvania (then Alabama)*, the RSi ChemArc process is a combination of the wet chemistry purification of water glass, sodium silicate ( $\text{Na}_2\text{SiO}_3$ ), followed by carbothermic reduction. Instead of coal or wood, sugar, a renewable feedstock, is processed to create high purity carbon for the carbothermic reduction process in a submerged arc furnace. One Steven C. Amendola was issued a U.S. Patent for the process earlier this year:

*S. Amendola, "Method for making silicon for solar cells and other applications." U.S. Patent 7,922,989, issued April 12, 2011.*

At Engineering TV, Electronic Design's Technology Editor Bill Wong interviews Steve Amendola and tours the facility in Easton, Pennsylvania across the three videos linked to below:

*RSi's ChemArc Technology Produces Silicon for Solar Cells*  
*by Curtis Ellzey on July 08, 2011*

*The Chemistry of RSi's ChemArc Process*  
*by Curtis Ellzey on July 08, 2011*

*Tour of RSi Solar Grade Silicon Manufacturing Plant*  
*by Curtis Ellzey on July 08, 2011*

During the tour, the arc furnace reactions are discussed and intermediate material forms are shown. The tour also covers the wet chemical processing equipment for the *sodium silicate* and sugar followed by the 1 MegaWatt, 500 MT submerged arc furnace.

RSi emphasizes the renewable and sustainable aspects of the ChemArc process without making any sacrifices to material quality. The entire ChemArc process is supposed to require less than 25 kWh/kg (kilowatt-hours per kilogram) of energy, less than the Siemens process and resulting in faster energy payback for photovoltaic modules made using RSi's solar grade silicon. By using sugar, RSi claims the carbothermic reduction process has a carbon footprint close to zero.

RSi expects the ChemArc process to have high yields of 6N+ solar grade silicon though off spec material could still be used in blending applications.

Greg Mandor said:

*We are excited to start production, we are excited to introduce our product and our technology and to not only bring a product that can be cost competitive but also bring a product that can really change the industry from a renewable and sustainable point. You have a green industry that has green processes going into it.*

### **Pricing**

While RSi acknowledges the need to be cost and price competitive with polysilicon to entice customers, RSi was reluctant to discuss their pricing strategy. In a limited media release, Steve Amendola said:

*The lowest-cost producer for solar-grade silicon was at \$30 per kilogram. RSi is in the low teens per kilogram.*

### **Investors**

Outside of the Quercus Trust, RSi has not disclosed their investors who the company claims prefer to remain confidential. RSi claims just under \$30 million has been invested in the company without ever being required to file a disclosure form with the U.S. Securities and Exchange Commission (SEC). When I asked if the Quercus Trust had been a recent investor, Mr. Mandor said:

*Yes, they continue to support and believe in the technology.*

Although simple searches of the SEC EDGAR database using the Renewable Silicon International, RSi, RSi Silicon, or the Reaction Sciences company names are unproductive, there are a few SEC filings under BlueFire Ethanol Fuels, Inc. that detail a stock transaction in 2010 ([here](#) and [here](#)).

### **Future Expansion**

The RSi Easton site could potentially be expanded with 5000 MT of additional annual capacity. RSi believes the ChemArc process scales with reduced capital expenditures (CAPEX) and construction time to increase capacity. For example, a 5000 MT increase in capacity including wet chemical processing and an arc furnace requires around 14 to 18 months to complete for about one-tenth (1/10) the CAPEX required by a Siemens process polysilicon facility. RSi said a 10000 MT facility would only take a little longer to construct, about two (2) years.

Putting expansion plans in context, Greg Mandor said:

*We are focused right now on proving the technology, getting orders, that's priority number one. Getting into business basically, going from a technology to a business, and then we can work on how we want to expand from there. We do have different ideas about ways and places where we want to expand. Right now our focus is on getting into business.*

RSi has had trouble meeting their own milestones in the past including the premature production announcement in 2009. With the patent issued and a new round of funding, RSi appears to have honed their focus and goals. I look forward to RSi initiating operations on the first 500 MT arc furnace so the ChemArc solar grade silicon material can finally be tested in real world silicon solar cells.

A simple to way to create pure carbon from sugar is through dehydration with concentrated sulfuric acid via an exothermic reaction such as the extreme demonstration in the video, *Dehydrating Sugar by Sulfuric Acid (Mad Physics)*.

