

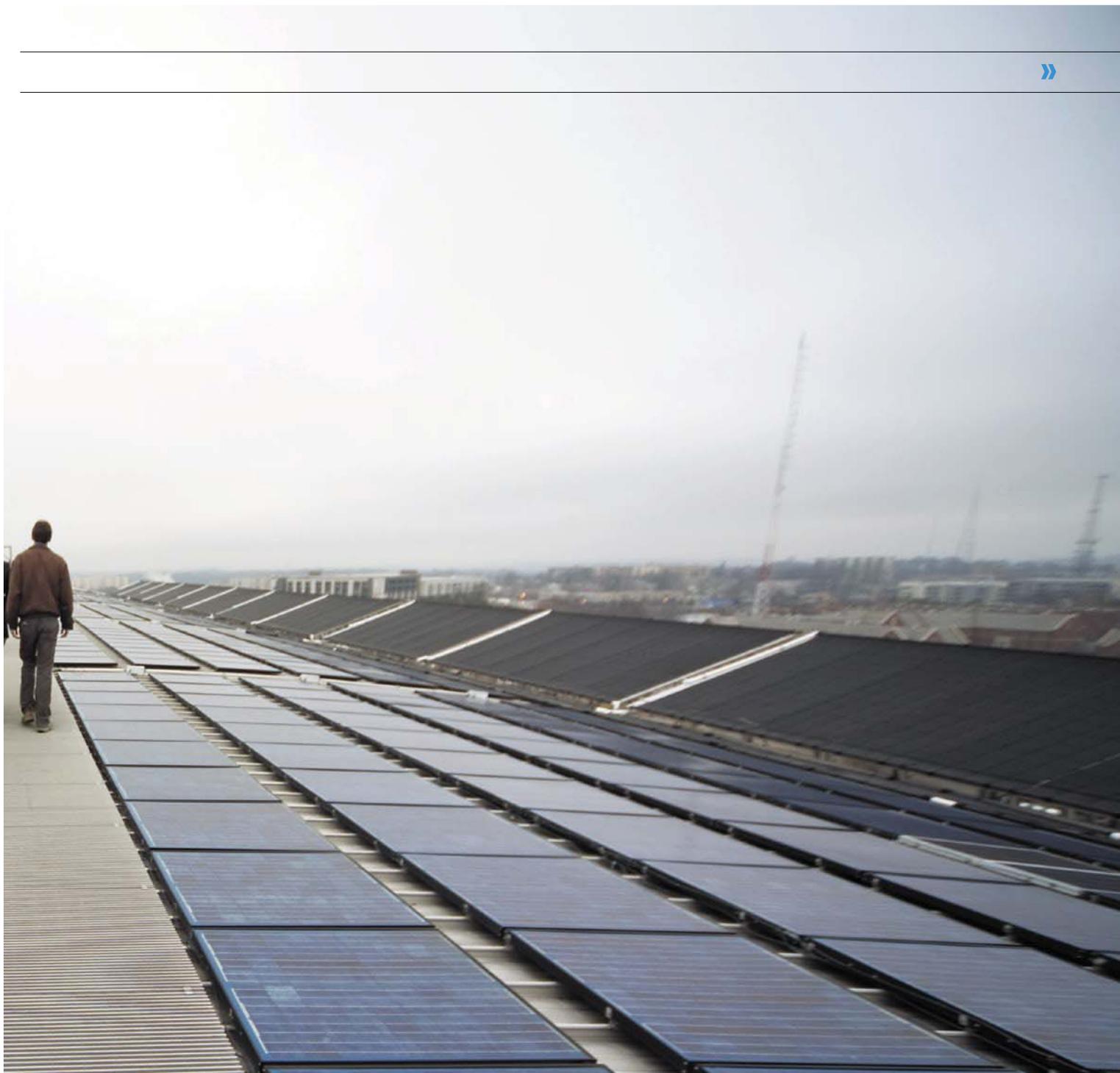


Long way to go

For the PV industry, Georgia is a tough nut to crack

Not many research centers in the US have set world records for solar cell efficiency. Stanford University did it with monocrystalline cells in the late 1980s, helping sow the seeds for a healthy PV market in California. In the 1990s, Georgia Tech followed up with the best multicrystalline cells, but Georgia is still waiting to reap the harvest. The first crop is starting to burst through the soil, but it might be contaminated by bad policy and Georgia's ongoing investment in nuclear power.

Ajeet Rohatgi traces his professional roots to Westinghouse, a company that helped build the modern electric grid and then supplied it with machines to produce and consume energy. In the 1970s, around the time Westinghouse was putting the first computer-controlled elevators in tall buildings, Rohatgi was in the company's research lab studying how silicon impurities affect high-efficiency solar cells. Westinghouse was reshaping



industry in the 20th century. Rohatgi's project was not.

A native of India who sees social value in making electricity accessible, Rohatgi packed up in the mid-1980s and transferred his research to the Georgia Institute of Technology, better known as Georgia Tech. The move carried a fair amount of risk. Westinghouse, a ribbon solar producer, was one of a few companies running a dedicated R&D lab for photovoltaic (PV) technology. Georgia Tech had a strong electrical engineering program but

no real history with solar energy. Rohatgi would have to build a lab of his own.

»In the first few days when I sat at my desk, I said, did I make a mistake leaving Westinghouse? There's nobody here. Nobody talks solar,« Rohatgi says during a recent visit in Atlanta. In due time, he brought together the people and the machinery to run a state-of-the-art lab. The US Department of Energy recognized the lab in 1992 as a national leader in crystalline silicon PV technology, and 4 years later Georgia Tech set efficiency records

with 18.2 and 18.6 percent multicrystalline cells. (Germany's Fraunhofer Institute for Solar Energy Systems holds the current research record of 20.4 percent.)

The work that Rohatgi started at Westinghouse and continued at Georgia Tech is beginning to have huge ripple effects. Using ideas he developed in the lab, Rohatgi founded Suniva, a solar cell

Rare sight: The site of the 1996 Summer Olympics swim competition has a 342 kW solar system on its roof – one of the very few PV systems in Georgia.



Trophy cells: UCEP keeps record-breaking polycrystalline cells in a modest display case at Georgia Institute of Technology.



Home and away: Hannah Solar CEO Pete Marte is eyeing solar markets

manufacturing company based 30 minutes from downtown Atlanta. In its short history, Suniva has supplied cells for the first MW-sized project in Georgia and some of the first MW projects halfway around the world in India.

In spite of these achievements, Georgia resembles so many other slow-growing PV markets in the US. State policy favors traditional energy sources, like coal, natural gas and nuclear power, with few provisions for renewable energy. System integrators have to contend with tough limits on subsidies and rules that restrict access to financing. They also have to counter misleading information about PV system prices.

A lot has changed in the time since Rohatgi arrived in Georgia filled with doubt. He's not the only one talking about solar anymore. Georgia Tech demonstrated the potential of crystalline silicon technology. Suniva is driving down costs. And developers are proving that PV projects can be profitable. With these contributions, Georgia has already left its mark on the PV industry. The big question is whether the state will manage to reap some of the financial benefit or simply give it all away.

Incubating an industry

From the time Ajeet Rohatgi started developing solar cells in his Georgia Tech lab, the University Center of Excellence for Photovoltaics Research, it didn't take long before the technology

burst into prominence. Rohatgi did not have to travel far to bring solar energy to the world. In 1996, Atlanta hosted the Summer Olympic Games and, by extension, the city hosted visitors from all over the world. In a partnership with the US Department of Energy and Georgia Power Company, Rohatgi designed a 342 kW PV system with Solarex solar panels for the roof of the Georgia Tech aquatic center, the facility where US swimming sensation Amy Van Dyken won four gold medals.

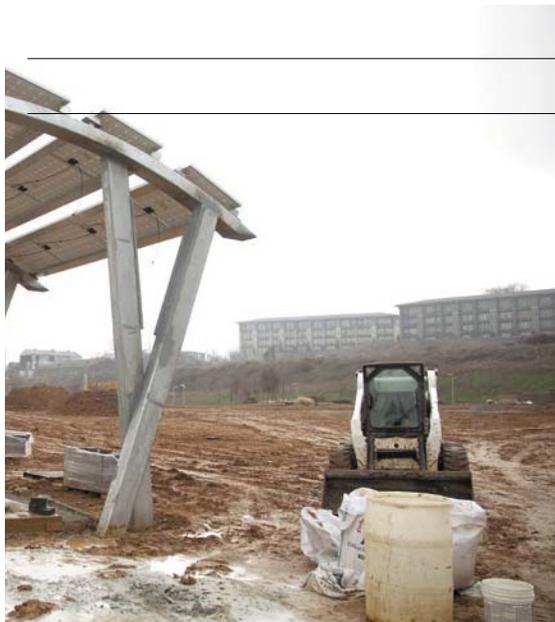
Rohatgi says he planned the aquatic center array to be the world's largest rooftop installation. »We did some research and we found that the largest was about 320 [kW] somewhere. So we said, let's do 340.« With efficiency gains in cell technology, the same roof space today could accommodate a full megawatt of capacity, but it would be 15 years before Georgia saw its first MW-sized solar farm. In fact, almost 15 years would pass before Georgia would see another large commercial PV project. In January 2010 a northwest Georgia installer, United Renewable Energy, said its 144 kW system at a warehouse in Dalton was Georgia's largest installation since the 1996 Olympics. The system has since been expanded to over 540 kW.

The PV industry hadn't abandoned Georgia. At UCEP, Rohatgi was actively collaborating with PV companies throughout the crystalline silicon supply chain. Clients include equipment

manufacturers like GT Solar and Centrotherm, cell manufacturers like Evergreen Solar and Sunpower and metal processing companies like Heraeus and Dupont that make paste to form electrical contacts on the cell surface. As PHOTON interviewed Rohatgi in his office in early February, a team from Dupont was huddled in a UCEP conference room talking about how to produce paste for making n-type solar cells.

Since Rohatgi founded his cell manufacturing company in 2007, he said UCEP clients view the lab as a conduit to Suniva. A partnership with Varian Semiconductor is a good example of the arrangement. For close to 2 years, Rohatgi's team worked with Varian on an ion implantation machine for increased efficiency in the cell production process. The group built a pilot-scale machine, gave it the code name »Fred,« and hid it behind a curtain in the R&D space at Suniva. In February, the cell maker was introducing the first of four ion implanters into its production line. Suniva credits the machine in the development of the 19-percent efficient ARTisun Select solar cells, and it said the ion implanter soon will help commercialize a 20-percent efficient n-type cell.

UCEP has been a tremendous asset for the PV market in Georgia. Suniva is headquartered in the state primarily because of its heritage as a Georgia Tech spin-off and its proximity to UCEP. The German module manufacturer Mage



in the northeastern US for most of his PV installation work this year. One of his Georgia projects is a 21 kW shade structure in the Atlanta Beltline economic development zone.

Jenna Close / photon-pictures.com (3)

Solar also cited UCEP when it selected Dublin, Georgia, as its North American headquarters last May. But the state has done little to capitalize on its potential as a manufacturing base. Suniva, for one, makes no secret that a future expansion of its manufacturing capacity will take place elsewhere. Last year the company had a deal for a federal loan guarantee to build a production plant in Michigan. Suniva opted to forgo the federal assistance and is no longer pursuing the Michigan plant. The company is aggressively fundraising in the private sector and still expects to announce a manufacturing expansion this year – only not in Georgia.

Unfriendly territory

In the Georgia Power utility's service territory, which covers most of the state, customer-owned PV systems are not allowed to generate more than 0.2 percent of peak electricity demand. This limits overall PV production to about 33 MW. You won't hear many people in the industry complaining about the cap, however, because there are more immediate impediments to market growth.

A 1973 law called the Georgia Territorial Electric Service Act represents one of the biggest obstacles. This law was designed to create some competition for electricity service by allowing large consumers to choose their supplier. But once the choice is made, the law makes it difficult to switch to a different supplier. In

practice, this rule has made it nearly impossible for business owners to negotiate power purchase agreements (PPAs), one of the most popular financing options for commercial PV systems in the US.

Without access to PPAs, there have been few long-term sources of financing for PV systems in Georgia. Using federal stimulus funds, the state set up a modest \$4.5 million rebate program and wound up spending most of the money on PV installations. In addition, the government makes available \$2.5 million per year in tax credits for renewable energy investments. When the Georgia General Assembly met for its latest legislative session, PV businesses advocated to extend and increase the tax credit. They won another modest government contribution: \$5 million of annual tax credits for the next 3 years.

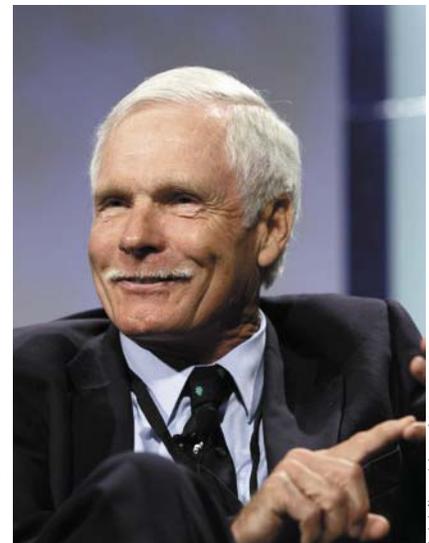
One irony about Georgia is that the state's leading solar ambassador, Suniva, has tremendous political influence in Washington, DC, but very little clout in Atlanta. In its short history, Suniva has lured US Secretary of Energy Steven Chu to visit its manufacturing plant. Secretary of Commerce Gary Locke has also paid a visit, and last year he appointed Suniva's vice president for sales and mar-

keting Brian Ashley to a high-level advisory committee on renewable energy and energy efficiency.

In state politics, the real power broker is Georgia Power. The utility won an enormous legislative victory in 2009 when the General Assembly passed and the governor signed a law allowing the company to bill ratepayers for the upfront cost of constructing a \$6 billion nuclear power plant. When Georgia Power broke ground on this project, an expansion of the Vogtle Electric Generating Plant, it became the first nuclear power project started in the US since a partial meltdown at the Three Mile Island nuclear power plant in 1979.

Georgia Power's commitment to nuclear power dwarfs its support for solar

Georgia's leading investors including Ted Turner are developing PV projects in states with better solar incentives. Turner's firm, Turner Renewable Energy, and Southern Company, Georgia Power's parent company, completed a 30 MW solar park in New Mexico this year.



Frederic Neuma / photon-pictures.com



Brighter days: As a strategic director at Suniva and vice chair of the Georgia Solar Energy Association, Anthony Coker works to create a more favorable economic climate for PV in Georgia.

electricity. While the company has arranged for customers to pay for an expensive nuclear power project, it says a small PV program must be managed separately from the rest of the power portfolio so there's no upward pressure on electricity rates. The utility doesn't seem to realize how low PV system costs have become.

Installers in Georgia are quoting prices of \$4.50 to \$6.25 per W for small PV systems. On a section of the Georgia Power website offering customers information about solar energy, the utility says prices range from \$7.75 per W all the way up to \$12 per W. Questioned by PHOTON about system prices, Sy Allen, a Georgia Power project manager says keeping up with PV market information is a struggle. »Our intent is not to discourage solar,« he says, indicating that the utility might take down the pricing information from the website. Several weeks later, as this article was going to press, the inaccurate price information hadn't changed.

Last year, the state Public Service Commission gave Georgia Power a chance to find out just how inexpensive a PV project can be. The commission approved a utility-owned PV project up to 1 MW at a cost of no more than 17¢ per kWh. In a bidding contest, Georgia Power could have found out if a developer would be able to build the entire project at the agreed-upon price. Instead, the company decided to break up the proj-

ect into several smaller pieces. Allen says this will provide production data from around the state and increase visibility for the project. »Even if we were to do a large system, I don't feel we could get it at 17¢ per kWh,« Allen says. This way, Georgia Power will ask property owners to subsidize the installation costs, which are certain to exceed the state-imposed limit, in exchange for the privilege of hosting part of the system.

Solar diaspora

If all the Georgia residents who finance PV projects kept their renewable energy investments in the state, the market would be booming. In this fantasy, Georgia would be home to the Cimarron Solar Facility, a 30 MW solar farm owned by Southern Company, the energy firm that also owns Georgia Power, and Turner Renewable Energy, a company controlled by the Atlanta-based billionaire Ted Turner. In reality, the Cimarron plant is operating in New Mexico.

Trey Pippin, another Georgia resident who owns the state's first megawatt-sized PV system, has also discovered better investment opportunities away from home. A southern Georgia pecan farmer, Pippin became interested in PV when his family business won a grant from the US Department of Agriculture to make the pecan farm more energy-efficient. He completed two projects in Georgia and now has up to 16 more projects in



Buy America: Suniva makes solar cells in Georgia and assembles modules to qualify for federal stimulus-funded projects.

the pipeline in North Carolina, where there's a stable tax credit with available funding and utility companies with an appetite for PV power.

Pippin's first project was a 200 kW installation on a 1.5 km² pecan orchard in Arlington, Georgia. There he got a 5-year contract to sell energy to Georgia Power at a rate of 17¢ per kWh. Pippin doesn't know what Georgia Power will do with the contract after 5 years goes by. »If they don't extend it, we'll use [the energy] to offset our consumption,« he says.

Pippin's megawatt-sized project can hardly be seen as an indication that more large-scale projects are on the way. Rather, it shows just how difficult completing such a project in Georgia can be. Pippin selected land for the project in a small part of northern Georgia that gets electricity service from the Tennessee Valley Authority (TVA) instead of Georgia Power. At the time, TVA offered a long-term, performance-based incentive of 12¢ per kWh plus consumption credits at retail electricity rates. Pippin managed to claim the incentive shortly before TVA scaled back funding for this subsidy program, called Generation Partners.

Asked how the PV development business compares with managing a pecan farm, Pippin says, »they're both very time consuming.« He says he'd like to do another project in Georgia, but it's hard to commit the funds without knowing if he can get a tax credit to help defray the installation cost.



in Asia. A waiver from the US Department of Energy allows Suniva



United Renewable Energy president William Silva and Julian Dossche added 365 kW to the roof of USFloors.

Jenna Close / photon-pictures.com (4)

On a small scale, the Georgia tax credit has uncovered some market potential for PV system installers. One Atlanta-area installer, Radiance Solar, has gained experience selecting balance of system components and improving installation times on rooftop projects. Another local installer, Hannah Solar, has tried carving a niche for itself doing installations for the agriculture sector. But these companies know if they only look for business close to home, they do so at their own peril. Hannah Solar CEO Pete Marte, for one, says he plans to do \$7 to \$10 million of business in Georgia this year and about twice as much in northern areas such as Maryland and New Jersey.

Straight talk

Slowly, one project at a time, Georgia continues to add PV capacity. Marta, the transportation authority for the Atlanta metropolitan area, is developing a 1.2 MW solar canopy. That project, scheduled for completion later this year, has been in the works since receiving federal stimulus funds in 2009. Another slowly developing project is Aerotropolis Atlanta, a big business district near the airport with plans to include up to 10 MW of solar capacity.

Supplying modules for both these projects is Suniva, the company with roots going back to the start of the PV market in Georgia. Looking back over the quarter-century since Suniva's founder Ajeet Rohatgi arrived in Georgia,

it's clear that the most difficult work is done. Advances in solar cell research gave the industry a viable product, and recent developments in the cell production process have driven down costs considerably.

PV company leaders still encounter opposition from government officials and the electric utility, but they're gaining confidence that market growth in Georgia is only a matter of time. Suniva's senior director of quality and strategic partners Anthony Coker exhibited this emerging confidence as he described a public discussion he helped lead at a recent economic development meeting.

Coker said that as he spoke, a Georgia Power representative in the audience started heckling him about PV system costs and return on investment (ROI). »I said actually the ROI in Georgia is not as good as some other states with higher electricity costs, but there is an ROI. You do get a return on your investment because the lifetime of these projects can be 30, 50 years.«

Then Coker compared the recovery rate for PV system investments to Georgia Power's nuclear power project, the Vogtle Electric Generating Plant, which had received financing assistance from the state government not long before. He

said the payback period on a PV system in Georgia, or the time it takes to save as much on electricity as you paid for the installation, might be 9 years.

»But my payback would be a hell of a lot quicker if I was allowed to do what you've done at Georgia Power. And that's skipped the PSC [Public Service Commission], lobbied the state legislature and passed a law that allows you to tax me 3 years ahead of building your nuclear power plant. I bet your payback on the nuclear power plant looks better than mine on solar,« he said.

Apparently, Coker made his point. »The crowd kind of went ›Oooh.‹ And then they cheered. And he sat down and never asked another question.«

Matthew Hirsch



Grand vision: From his post at the University Center of Excellence for Photovoltaics Research (UCEP), Ajeet Rohatgi yielded a world record for solar cell efficiency and spun out the manufacturing company Suniva.



Common cause

Georgia enters talks to join national solar industry association

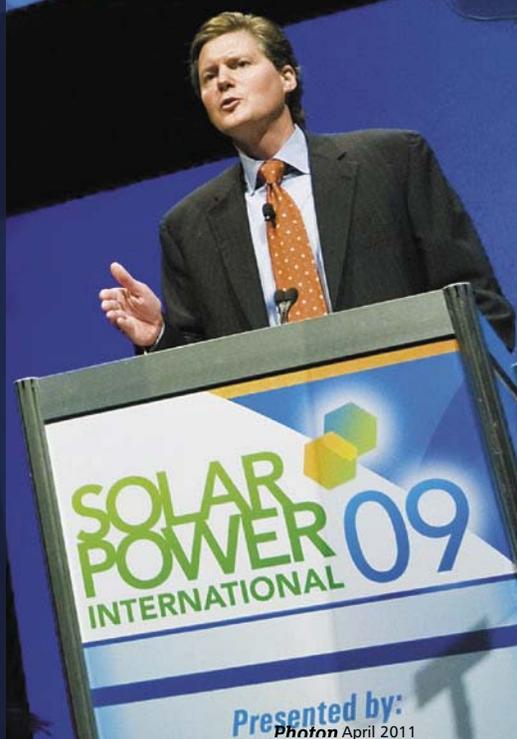
Bully pulpit: When Solar Energy Industries Association President Rhone Resch speaks, people listen.

Interest in the 9-year-old Georgia Solar Energy Association has never been greater. Membership is at an all-time high. But not everyone is satisfied. As an affiliate of the American Solar Energy Society, Georgia's trade group puts much time and effort into education. Its influence on public policy has been limited. Some leaders, wanting more lobbying muscle, hope to start a new organization linked with the Solar Energy Industries Association. So far, teaming up with SEIA has been easier said than done.

Pete Corbett remembers a time about 4 years ago when the Georgia Solar Energy Association's monthly meetings turned up fewer than 10 people. Sharing information with the rest of the group's members wasn't a problem because all the members were there – all eight of them. Members were energetic if not always on target with a unified message for policymakers. »We were hungry, each one of us trying to do something on our own,« Corbett says.

Today, GSEA faces a different set of problems. New members are sprouting up like wildflowers. The group has to find space to seat 75 people or else crowds are likely to line the walls of the meeting room. As the saying goes, there's strength in numbers. With over 300 dues-paying members, GSEA should be able to work with state representatives and build support in the capitol for PV incentives, right?

Corbett, who serves as secretary on the GSEA board of directors, says it hasn't worked out this way, in part because some state officials don't take the





PV industry seriously: »They've been treating us like stepchildren. I'd like to go to the state legislature having [Solar Energy Industries Association President] Rhone Resch behind me.« The desire to change public policy is a primary reason why Corbett is negotiating with SEIA to form a state chapter in Georgia.

Lobbying muscle

As a 501(c)3 nonprofit, GSEA is limited by the amount of money it can raise for certain activities like political organizing, Corbett says. An SEIA affiliate, incorporated with a 501(c)6 tax status, wouldn't have the same limitations. There are many other reasons why Georgia would benefit from a partnership with SEIA – and why SEIA stands to gain from the arrangement, too.

For Georgia, affiliation would bring the possibility of using SEIA's brand name and its recognizable logo. It would give local leaders access to SEIA's extensive member network and its research, legal and financial resources. Local leaders would also gain some higher level of representation within SEIA and the possibility of revenue-sharing deals from Web-based seminars and conferences.

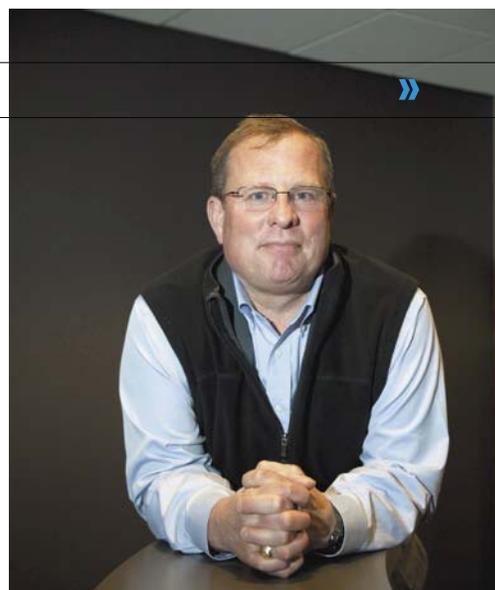
Capitol steps: Pete Corbett wants an alliance with SEIA leadership in Washington, DC.

(Solar Power International would not be included. This conference is run by an organization that's legally separate from SEIA.)

For SEIA, affiliation would bring closer contact to its grassroots constituents. The partnership would help the national leadership disseminate a unified policy message that members can take to their local representatives in Congress. And it would give SEIA feedback about state and local issues that might develop into topics of national conversation.

A new beginning

Corbett says he first approached SEIA over a year ago about forming a state affiliate in Georgia. The negotiation has gone slowly because, for the first time in over 30 years, the national leadership has begun to formalize its relationship with affiliate groups all around the country. SEIA general counsel Tom Kimbis, who joined the association last year from the US Department of Energy (DoE), says improving relations with affiliates was one of his first priorities: »There was not



Jenna Chast / photo-pictures.com

much going on in terms of interface between national SEIA and the dozen or so chapters on the ground. My peers and I saw this as a lost opportunity for solar as a whole.«

At DoE, Kimbis helped start the Solar America Cities program and saw the mutual benefit the federal government and its partner cities drew out of the program. He says this could be a model for strengthening ties with SEIA's local and regional chapters. There's a great deal of interest from states aside from Georgia that want to form new chapters. Kimbis says Wisconsin, Nevada, Michigan and Minnesota have all expressed a desire to affiliate. Tennessee has begun operating as an SEIA chapter, and so has Missouri and a grouping of states near the Gulf of Mexico including Louisiana, Alabama and Mississippi.

For now, there remains a sizable imbalance between the resources within the national SEIA organization and the collective resources of its affiliates. Many of the affiliates operate on a shoestring budget with management provided on a volunteer basis. SEIA's national office, by contrast, reported a 20-person staff and a \$5.8 million budget in its latest nonprofit filing to the Internal Revenue Service.

Kimbis hopes a new relationship with the affiliates will ensure the entire association, in the nation's capitol and in state capitols around the country, has the resources needed to thrive. Corbett hopes SEIA's influence soon extends to the gilded domed statehouse in downtown Atlanta.

Matthew Hirsch

Running on a shoestring: Operating budgets for SEIA affiliates.

State and regional chapters	Founded	Employees ¹⁾	Salaries	Membership dues	Budget
Arizona	1992	0	\$0	\$36,265	\$32,301
California	1978	2	\$178,107	\$268,235	\$328,087
Colorado	1989	4	\$156,765	\$174,727	\$392,788
Florida	1977	0	\$0	\$90,624	\$88,729
Great Lakes ²⁾	1995	4	\$144,525	\$61,035	\$497,612
Hawaii	1977	1	\$40,000	-	-
Heartland ³⁾	1994	0	\$0	\$0	<\$100
MDV ⁴⁾	2010	0	\$0	\$85,621	\$98,170
Mid-Atlantic ⁵⁾	2009	1	\$46,500	\$99,748	\$80,635 ⁸⁾
New England	2002	0	\$0	\$83,255	\$106,880
New York	2007	1	\$49,050	\$47,379	\$84,819
Oregon	2004	1	\$46,798	\$146,025	\$500,831
Tennessee	2010	0	\$0	\$0 ⁹⁾	\$0 ⁹⁾
Texas ³⁾	1995	0	\$0	\$0	\$0
State totals		14	\$661,745	\$1,092,914	\$2,130,217
National SEIA		20	\$2,276,857	\$2,768,006	\$5,839,515

¹⁾ some chapters report independent contractors as employees, ²⁾ covers Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin, ³⁾ covers Kansas, Iowa, Missouri and Nebraska, ⁴⁾ covers Maryland, District of Columbia and Virginia, data from 2008, ⁵⁾ covers Delaware, New Jersey and Pennsylvania, ⁶⁾ PHOTON estimate, ⁷⁾ 2006 data, ⁸⁾ launched in September 2010; reported no dues or budget, ⁹⁾ SEIA affiliate is unfunded subsidiary of Texas Renewable Energy Industries Association