

# GROWERTALKS

## Features

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### Elemental Energy

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Renewable energy has had its roots, one way or another, in the growing of plants for centuries. It's little wonder that renewables have found their way into greenhouses, with a little boost from technology.

However, after the hype of various renewable technologies—wind, solar, geothermal, biomass—where do we stand today? How viable are they for the greenhouse industry?

What's happening out there?

Gauging interest is a fickle thing, but what we do know is that the implementation rate of various renewable technologies often depends on a lot of dollar signs. Yet, a few other factors are also influencing investment decisions.

Dan Kuipers, Director for Solar Photovoltaic Sales for TrueLeaf Technologies and founder of the grant and incentive firm Sustainable Energy Financing (SEF), has seen an uptick in interest in solar, and to a lesser degree, geothermal systems, while he notes a decline in wind turbine installations and biomass projects in the horticulture industry.

Much of that shift simply has to do with the costs of the technologies. Five years ago, a photovoltaic system cost about \$8.00 to \$10.00 per watt to install. Today, it's \$4.00 per watt. "Five years ago, wind could be deemed a better investment," states Dan. The cost of installation per watt was lower than solar and the overall generation from a wind turbine was often higher. That's changed, but he adds, "Wind is still a viable technology when done at the appropriate scale." He cautions that wind often makes the most sense when done on a larger scale so that installation, operation and maintenance costs can be spread out over many units.

University of Arizona Associate Professor Murat Kacira, who's currently studying off-grid greenhouse systems, says, "In U.S. commercial greenhouse settings, the interest in using solar photovoltaic (PV) systems to meet some or all of the power demands for greenhouse systems is gaining interest as PV systems are now more available and becoming affordable."

However, A.J. Both, associate extension specialist in controlled-environment engineering for Rutgers University in New Jersey, says, "I have the impression that the interest and implementation rate of renewable

energy systems in the U.S. are somewhat declining.” Part of that decline, he says, is due to declining natural gas prices and “a more stable oil price—albeit still much higher compared to the prices during several decades leading up to the start of the millennium, and much more sensitive to global political and economical issues.”

Richard Miller with Argus Control Systems in Canada often works on integrating these alternative energy systems with grower applications. He says, “We see some interest, but the high initial capital costs of many of these types of projects and very long payback periods [if any] has tended to deter most of our customers up until now. There currently seems to be the most interest in combined heat and power, biomass and solar generation.”

### Pricing

While the actual “supply” of renewable isn’t in question and renewable fuel sources aren’t subject to price volatilities, the technologies have certainly illustrated their own kind of price fluctuations.

Take, for instance, solar PV panels. A year ago, Dan watched prices drop and drop and drop as China “dumped” panels on the North American market and U.S. companies attempted to compete in price. He notes that the market was already loaded with an overabundance of companies trying to get into the industry. “In the U.S., the competition forced a lot of companies out and now there are fewer companies.”

That’s probably a good thing. After prices hit bottom, they’ve increased again but have begun to stabilize, says Dan. Though, he notes that when it comes to the other components—racking to hold the panels and inverters that convert the direct current to an alternating current (AC)—the prices are still coming down and companies are still innovating.

### The helping hand

Incentive programs may be one of the biggest influences on the actual number of renewable energy projects adopted by growers. A.J. explains that with budget constraints at federal and state levels, incentives are now limited.

In 2008, the USDA’s Renewable Energy for America Program (REAP) made \$220 million available for rural agriculture investing in renewable energy and energy-efficiency projects. Greenhouse growers were awarded six-figure grants to help offset the cost of biomass boiler systems, among other things. Five years later, the REAP program only funded \$21 million in activities, many of them smaller grants—with many geared toward solar projects. As we go to press, it’s not clear how (or perhaps if) Congress will determine the future of renewable energy incentives. While the REAP program is just one of several ways to help fund renewable energy projects, it remains a common thread among many of the growers who actually invest in such systems.

TrueLeaf agrees that incentives (rebates, grants, low-interest loans and tax breaks) seem to make or break the deal with their customers; most greenhouses aren’t willing to invest in the technology without some sort of financial incentive that lowers the payback. Dan has observed that with conventional systems, most growers want to see a payback of two to three years. “For green projects, many growers will accept five to seven years because of the co-benefits that these types of project possess in relation to marketing value, branding and long-term benefit,” he says. “But, in order to hit these return targets, you need to leverage those available

incentives.”

Grants, incentives, utility/state rebates and energy credits can take a project that would typically take 10 years to pay off and bring it down to five.

Cozy Acres, a wholesale grower of annuals, vegetables and herbs in southern Maine, used the REAP program and the Natural Resources Conservation Service’s EQUIP program to fund 25% of their photovoltaic and geothermal systems as well as 100% of the cost of insulating the side walls of seven existing greenhouses with roll-up sides. Owners Jeff and Marianne Marstaller are at work building this new greenhouse that will focus on organic growing and be zero emissions.

Jeff says, “The photovoltaic system also carries with it a 30% U.S. tax credit, with the commercial geothermal carrying a 10% tax credit.”

With accelerated depreciation taken into account, they expect the payback on their geothermal and PV systems to be about five years. However, Jeff quips that, “The term payback is not fair for the photovoltaics as, after the investment is recaptured, the electricity it produces is FREE!”

#### Regulatory and political issues

A.J. also brings up the point that regulatory issues have stymied some growers. He says, “In my state [New Jersey], we’ve seen regulatory issues [Clear Air Act] having a negative impact on the implementation of renewable energy systems.”

No doubt, we’ve all seen the battles over wind farms divide communities. Such conflicts have led to many locales making much more rigorous requirements for installing such wind systems, and permits and variances can be difficult to obtain, depending on your location.

#### Intrinsic value

But there’s something else weighing in with these folks. Some call it the right thing to do or taking responsibility or adaptation.

A.J. bookends his thought that renewable energy isn’t going to be one of the biggest concerns for greenhouse growers in the future with the suggestion that perhaps it should be a concern. He notes that a September 2013 report from the Intergovernmental Panel on Climate Change (IPPC) states, rather certainly, that human activity is negatively impacting the climate.

“The green industry should take this opportunity to assess its role and what steps it can take toward reductions in carbon emissions and environmental contamination while growing high-quality products with a workforce that is adequately paid [including benefits],” A.J. says. He points to life-cycle assessments as being one tool to study your entire production process and find out the impacts of a product, as well as ways to improve its production.

“I believe the green industry in particular should do more to provide transparency so that it can contribute as much as possible to solving [or at least mitigating] the negative impacts of carbon emissions and environmental contamination. This transparency will go a long way in promoting the ‘green’ aspects of our

industry,” says A.J.

Dave and Joyce Hart of Hart’s Greenhouse, with three locations in Connecticut, fully admit that it was the incentives that finally made them take action and really start the process of inquiring about solar PV panels, but there’s an intrinsic value to their renewable energy project, too. They worked with TrueLeaf, who recommended a grant writer and applied for a REAP grant, which they received to help offset the cost of their 24kW solar PV system. Yet, they’re also adamant, “If we didn’t get the grant, we were still going to go ahead.” Dave says, “It’s just the right thing to do.” If this project goes well, they hope to expand.

#### Changing the way they do business

You can talk about ideals and ethics and responsibility, but there’s something else that the growers we talked with also seemed to bring up. Renewable energy is helping them redefine their businesses—not just what they’re about and who they are, but what they grow.

Cozy Acres, for instance, has primarily been a spring production facility, but their new geothermal system will heat a new 3,000-sq. ft. greenhouse that’ll be used year-round for growing organic leaf crops for sales to local restaurants and farmers markets, in addition to their traditional potted vegetables and herbs in the spring.

“The heating system will be a new 10-ton geothermal system that heats a radiant floor during the day and then adds any supplemental heat during the night via a heat exchanger,” explains Cozy Acres’ Jeff Marstaller. “The ground source heat pump will acquire its heat from a horizontal, closed-loop system of piping that will approximate a mile in line. The soil in which the piping is situated is a fine sand that remains moist to wet throughout the year.” They have a goal to make sure that the electrical usage in this greenhouse remains less than that generated by the solar panels, which produced 39,000 kW in their first year. If need be, Jeff says they’ll consider installing heat curtains and solar water tanks to improve energy efficiency.

“The resulting plants, grown with organic soils, fertilizers and beneficial insects, along with the fact that there are no emissions in the facility make the end product very appealing,” says Jeff. As a result, Cozy Acres is also developing a new brand, called the Triple E—“where the earth is aided by energy that is emission zero.”

Hart’s Greenhouse also has big plans to publicize their solar PV system. “We’re a small business. We’re going to publicize this and let people know what we’re doing,” says Joyce. “People are really excited about it.”

They’ll be growing tomatoes in the greenhouse that the solar system will serve, allowing them cater to a burgeoning local food market, in addition to their traditional floriculture products.

#### Before you invest

Gene Giacomelli, professor in the Ag & Biosystems Engineering Department at The University of Arizona and Director of Controlled Environment Agriculture Center (CEAC), urges growers to carefully consider their energy conservation (heat and electrical) before they start with new technology. Reduce the demand for heating or for electrical power, he advises. “Then, and only then, the renewables should be considered and employed,” says Gene.

His colleague at The University of Arizona, Professor Kacira, echoes that recommendation. After looking at

energy savings, growers “should integrate all possible renewable energy alternatives (i.e. solar, geothermal, biomass, wind) and technologies based on their availability for a given locality.”

Installing?

When Dan Kuipers gets a call from a client interested in a renewable energy system, there’s a simple process he walks them through. But he warns that while the technology itself isn’t really that difficult, there’s some front-end work you need to put in before you can break ground.

Here’s the typical process:

1. Ask: What type of payback are you interested in?
2. Ask: What’s the scope/scale of the project?
3. Ask: Do you have a location—where are you going to put it?
4. Now, you can work with someone to create a budgetary design—cost of the system, incentives, funding. “Determine the framework for how this system needs to work for you in order for it to be a good investment,” says Dan. Biggest isn’t always the best.
5. Now, it’s time for paperwork and planning. Applications, agreements, zoning, permits. Here’s where you start talking with your utilities and neighbors. “All of that takes time,” he says. “I can’t stress this enough.” Be sure to explore your funding options before you spend a dime. For instance, with the REAP grant, you need to submit the grant application before you pay for anything.

Dave Hart can hardly believe he hesitated to hire a grant writer, but after investing in one (and in return getting a 200-page binder of forms and documentation), he’s a strong advocate. “It’s worth it,” he says. “It’s not going to break the bank. Don’t be afraid.”

While they let someone else do the writing, Hart’s can handle the installation of TrueLeaf’s TrueSolar PowerStation, which prides itself on being a grower-installed system.

For Simply Native Nursery in western Illinois, solar power was the perfect solution for this small nursery. They didn’t have electricity in the area when they first built, so installing 15 W solar panel to power a deep-cycle marine battery was the quick and easy solution. Owner Kathy Hale-Johnson says they’ve been using this system reliably for four years. The battery powers a 12-volt DC pump and timer, which provides irrigation via a low-pressure drip tape. While most growers choose to connect their solar PV panels to the electrical grid system and sell the power back to a utility, Kathy is content with her battery system. It does require draining before winter, and the pump and battery are stored inside to avoid freezing. But she likes the portability and ease of the system. In addition, she says her utility charges a large fee to tie into their grid. “It is unlikely that we will ever go to that scale to produce power,” she says.

There are always improvements to be made. At the University of Arizona CEAC, they’re looking at determining the limitations and capabilities of an off-the-grid system and to provide recommendations for stakeholders. Murcat says, “The successful and practical integration of solar energy systems to greenhouses

will also require strategic and innovative approaches, complementing system components such as unique glazing technologies, climate-control strategies and production systems. Our ongoing and future research on alternative-energy integrated greenhouse systems at UA-CEAC is directed towards that.”

With the desire to be greener and more self-contained, growers and their colleagues around the world have, if nothing, shown the viability and variability of renewable energy systems. With a little research, and some number crunching, there's a way to figure it out. **GT**