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# Solar Panels

By Mary Lieth and Heiner Lieth

**Combining photovoltaic solar energy with plant production is a commercially viable option**

Photovoltaic (PV) solar panels typically consist of flat panels that capture as much sunlight as possible year-round. The panels convert the light to electricity. Panel installations are usually in places where 100 percent shade is acceptable or desirable.

In greenhouse or nursery operations the panels that have been installed generally have been made on rooftops, in parking lots, loading docks, reservoirs, etc., basically any place that plants aren't typically grown. Until now.

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Our innovative and reliable products are found throughout the climate control industry, including research facilities, universities, wholesale production growers, garden centers, botanical gardens and hobbyists. Wadsworth offers a full line of products for bio-climates including highly sophisticated integrated controls, interpretive software, curtain systems, vent automation and excellent product training.



Wadsworth Control Systems has the experience, products, durability and forward-thinking technical staff to meet all your environmental control needs.

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# GREENHOUSE STRUCTURES

## TOTALLY TUBULAR PANELS

Solyndra, a photovoltaic technology company based in Fremont, Calif., has developed a solar panel consisting of parallel tubular, cylindrical modules arranged on a rectangular frame. The panel allows some light to penetrate between the tubes. The percentage of light passing between the tubes is a function of the distance between the tubes.

The original intended use for the panel was on flat roofs where each panel is oriented with the tubes running north-south and a white background (e.g. roof surface or reflective cloth) reflects light that passes between the modules back to solar cells on the underside of the tubes, allowing for energy capture that would otherwise be lost. The shade created by these solar modules is similar to the shade created by the slats on lath houses.



While electricity generated by photovoltaics generally costs more than electricity produced by other sources, photovoltaic system costs are projected to continue to decrease as designs become more advanced and demand increases.

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This information goes into a simple investment tool they've created for figuring out the exact cost to heat your specific greenhouse and then calculating payback (excluding maintenance) on energy curtains.

Energy savings pay back—and smart business owners know exactly how much and when. Svensson energy screens provide quick payback and higher climate performance. Save energy while creating better growing conditions and a stronger operation – that's no gamble.

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 **svensson**

## PHOTOVOLTAIC SHADE HOUSE

Researchers at the University of California-Davis wanted to determine the feasibility of using a photovoltaic shade house for growing nursery crops in which Solyndra solar panels are used instead of lath or shade cloth. Nearly all outdoor container nurseries and some greenhouse operations have some shade houses as part of their facilities. It was the purpose of this research to determine how plants would respond to production under the panels and how to balance the level of shade.

A photovoltaic shade house was built in November 2009 at the university consisting of three different shade systems. The objective is to test how commercial container plant production might be affected by shade of various technologies.

As a baseline comparison one shade



Plants, including alyssum, Japanese boxwood, coleus, coreopsis, euonymus, hydrangea, loropetalum, Pacific wax myrtle, sweet olive, Japanese spurge, rose, Swiss chard and thyme, showed no differences in growth and quality when produced at various solar panel shade levels.

## ATLAS

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We understand that every customer's needs are different. For more information or to consult one of our qualified sales associates, please call 800-346-9902 or visit our website at [www.atlasgreenhouse.com](http://www.atlasgreenhouse.com).

Remember, at Atlas, our business is helping your business GROW!



## CO-EX CORPORATION

CO-EX Corporation manufactures a full line of polycarbonate sheet including Macrolux® multi-wall sheet, Rooflite® corrugated sheet, BDL® standing seam modular panels and Modulit vertical glazing systems. CO-EX products work well in any application where light transmission, impact strength and durability are important.



Always on the cutting edge, CO-EX has introduced several new products during the last six months. Rooflite HD, a high diffusion corrugated polycarbonate sheet for use in greenhouse applications, allows a higher level of PAR light to reach the plants resulting in greater yields and healthier plants. Vega and Polaris are high performance glazing materials for use with metal industrial roofs and with metal roofing sandwich panels. Ondalite is produced in both 3 mm twin wall and 6 mm triple wall sheets which incorporate a pre-shaped waved structure. Ondalite is ideal for covering in industrial buildings, in vertical wall panels and in street shelters.

CO-EX Corporation, Phone: 203/679-0500 or 800/888-5364, E-mail: [info@co-excorp.com](mailto:info@co-excorp.com), Web: [www.co-excorp.com](http://www.co-excorp.com)

## GREENHOUSE STRUCTURES

treatment was created using a conventional shade cloth system at about 35 percent shade. Another treatment (designated S88) consists of Solyndra panels with modules spaced at 88 mm to create a 35 percent shade level. Another shade treatment was created by conventional Solyndra Series 100 rooftop panels spaced at 44 mm (designated S44, a ~70 percent shade level). Within each section of the shade house, the trials were placed only in the central, northernmost areas of each house section to assure that the plants are not exposed to adjacent light conditions.

The research focused on identifying differences in plant growth and performance between the various shade treatments, as measured by height, width, canopy volume, plant biomass and plant quality. Plants that have been studied

include both herbaceous and woody perennials, annuals and leafy-green vegetables. To date approximately 65 different plant varieties and their responses to the different shade treatments have been studied.

### VARYING PLANT RESPONSES

Results from the trials so far have ranged from typical growth responses to the unexpected. The highest level of shading was expected to result in smaller plants in terms of biomass. Higher shade was also expected to cause stretching resulting in weaker plants for some varieties. These responses did occur for some plants. However, a large number of plants did not show these effects.

Many plants (alyssum, Japanese boxwood, coleus, coreopsis, euonymus, hydrangea, loropetalum, Pacific wax myrtle,

sweet olive, Japanese spurge, rose, Swiss chard and thyme) showed no difference between treatments for any shade level used. Some varieties (azalea, cabbage, gaura and pittosporum) grew better under the highest shade level treatment than the lowest shade level.

There also seems to be a seasonal effect, with more dramatic differences between trial groups occurring during the winter months. However, for some varieties, these differences level out as light levels become higher and days become longer, to the point of light saturation where additional light does not provide additional photosynthetic benefits, and can even result in increased dehydration and sun damage.

### HORTICULTURAL APPLICATIONS

The research shows that combining

## DEGLAS

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photovoltaic solar energy utilization with plant production is a viable option. For a variety of crops this technology even provides a clear advantage, particularly if the investment costs in the photovoltaic elements are returned through selling the generated electricity. This technology provides growers with a production shade house that enables them to also produce clean, domestic, renewable energy.

### REAL WORLD APPLICATIONS

Many countries are establishing policies that encourage energy conservation and renewable energy generation on small and large scales. One common type of policy, called a feed-in tariff, allows for renewable energy generators to sell their excess electricity to the local electrical



Growers need to work with their own utility to determine if a photovoltaic system is economically viable.

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# GREENHOUSE STRUCTURES

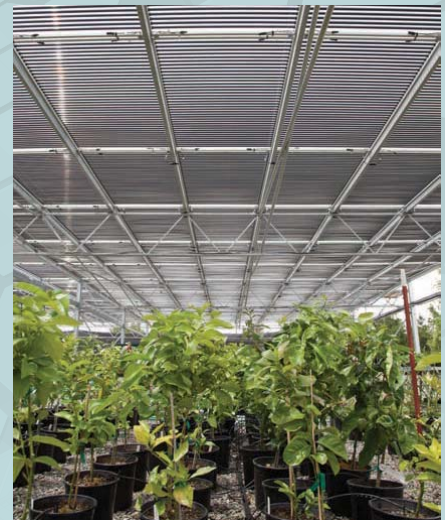
utility at a fair rate that is guaranteed for a specific period of time. Other utilities have policies that focus initially on energy conservation projects (like additional insulation, increased boiler efficiency and added energy curtains) and then on renewable energy incentives. Other popular incentives include rebates and tax credits for the purchase and installation of renewable energy generators.

Each electrical utility provides different incentives so that each greenhouse or nursery operation would need to work with their own utility to determine if installing a photovoltaic system would be economically viable, based on the projected energy generation and consumption patterns. With greenhouses consuming considerable electricity for cooling and lighting, many businesses

could calculate their return by looking at the savings generated on their power bill and investigating the incentives.

While electricity generated by photovoltaics generally costs more than electricity produced by other sources, the cost of solar energy has steadily decreased over the past decade. Photovoltaic system costs are projected to continue to decrease as designs become more advanced and demand increases. 

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Solyndra, a photovoltaic technology company, has developed a solar panel consisting of parallel tubular, cylindrical modules that creates shade similar to the slats on lath houses.

## THE STUPPY RAINBOW® PLUS

The Stuppy Rainbow® Plus is an excellent choice for the commercial grower who wants an affordable, productive and profitable growing space. Its quality, performance, value and versatility allow growers to cover anything from 1,000 to 1 million square feet. The strength and durability of the Rainbow Plus delivers years of efficient, dependable crop protection and environmental control.

The Rainbow Plus features:

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- Direct connection of bows to columns through the Y and L connectors to accommodate higher loads with open columns; easy connection of an HBM or truss allows the Rainbow Plus to meet the toughest conditions and codes



- Purlin and bracing connections made using a brace band and purlin block, eliminating holes to maintain the full strength of the bow for roof support (drop purlins are available on the Diamond to increase condensate control)
- Direct connection of the bows and columns that allow the gutter to be designed for work and water removal, not to be a structural member; the gutter also has an extruded-in Polylock®, making installation of covering more efficient

