

**To: Student Sustainability Committee
University of Illinois at Urbana-Champaign**

**From: Nathan A. Deppe-Plant Care Facility Coordinator
Office of Research, College of ACES**

Date: February 24th, 2012

**Re: Proposal for Energy/Shade Curtains for the Plant Sciences Laboratory
Greenhouses (12 Rooms)**

Project Lead Contact Information

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I. Detailed Project Description:

Installation of Energy Shade Curtains in the Plant Sciences Laboratory (PSL) Greenhouse

A. Project Goals

1. Decrease energy usage to heat the greenhouse rooms
2. Decrease energy usage to cool the greenhouse rooms
3. Increase natural light quality in the greenhouse rooms
4. Decrease the use of high intensity supplemental lighting
5. Decrease energy usage by the application and removal of whitewash

B. Definition of sustainability and the relationship of the project to this definition.

You state that sustainability encompasses economic, environmental, and social practices that meet the needs of current generations without jeopardizing the ability of future generations to meet theirs.

Our project would meet this definition by reducing the amount of energy required to heat, cool and light the greenhouse rooms year round. It would be sustainable economically, by reducing the University of Illinois' energy costs in the long term. It would be sustainable environmentally by emitting fewer pounds of carbon dioxide.

This project would do the following.

- 1) Reduce the use of natural gas energy provided by Abbott Power Plant to heat the greenhouses in the winter;
- 2) Reduce the use of electricity by the supply and exhaust fans and the pad pumps to cool the greenhouses during the summer months.
- 3) Reduce our use of electricity by the high intensity lighting by providing the highest level of natural daylight inside the greenhouse rooms year round.
- 4) Eliminate the energy used to apply whitewash in May and remove the whitewash in October, in addition to the cost of the materials and the labor to do these applications.

C. Feasibility evaluation. (Not applicable)

D. Longevity and/or permanence of project results on campus.

The energy shade curtain material normally lasts 7-10 years. Then, the material will need to be replaced due to heat and UV deterioration. The curtain material is the least expensive component of the curtain installation. The results of this project will be a continued reduction of energy use by the PSL Greenhouse, both steam and electricity. This will only increase as more curtains are installed.

E. Project governance structure (if applicable) (Not applicable)

F. A Summary of communication with relevant campus administrative entities and Facilities & Services personnel.

Keith Erickson provided the energy costs for steam and electricity for my calculations. Facilities and Services fully support the installation of energy/shade curtains

in the greenhouses. They are aware of the significant energy savings these curtains provide in the long term.

G. Location

The PSL Greenhouse is located at 1201 South Dorner Drive, Urbana, Illinois. The College of ACES has already installed shade energy curtains in 27 of the 64 greenhouse rooms. We would like to install energy shade curtains in 12 rooms across the PSL greenhouse

Facilities and Services (F&S) has approved this new construction in the past. A Facilities and Services electrician has done all of the electrical wiring to connect the shade curtain motors to the Argus Control System. For this project, that would equate to \$18,000 in electrical work for Facilities and Services.

H. If applicable, comparisons to similar projects at other campuses.

State of the art institutional/research greenhouses constructed today all have energy shade curtains to reduce energy consumption needed for heating and cooling. They also install them to provide the highest quality of natural light levels to reduce the use of high intensity lighting year round, and thus, save on electricity usage.

II. Budget & Fundraising:

1. Detailed budget.

Energy/shade curtains cost, approximately, \$10,000 per room to install, including materials and labor. The XLS15 Revolux curtain material made by LS is for energy savings and shading (see attachment). Installation includes the drive shaft, a reversible motor, stainless steel and nylon support cables, all structural and mechanical components to mount the curtain system and motor, and a controller to connect it to the existing computer-automated greenhouse control system (Argus). There will be additional costs for Argus override switches and software which has averaged \$100 per room. There will also be electrical costs to connect the shade curtain motor to the Argus Control System. This cost has averaged approximately \$1500 per room (done by F&S).

In order to complete this project, however, we require additional funding. We would appreciate grant money and/or a zero percent interest loan to help us fund installation of these systems that will undoubtedly save the University from unnecessary overuse of water, electrical, and heat (steam) utilities.

We are requesting funding for a total of 12 greenhouse rooms:

Energy/shade curtains, material and labor:	102,000 (\$8500.00 per room)
Argus Control System relays and software:	1,200 (\$100.00 per room)
Electrical wiring to connect motor to controls:	18,000 (\$1500.00 per room)
Total costs:	\$121,200

Operation and maintenance costs would consist of the operation of a 24-volt signal from the Argus Control System telling the curtain motor to open or close. It is an integrated control system that monitors the room temperature, outside light levels and desired light intensity setting for the crop being grown. The Argus Control System decides if it will continue to open or close the curtains in order to maintain the desired

light levels and temperature settings. Annual maintenance includes checking that all of the support cables are tight and that the curtain motor is not leaking oil. The shade curtain material should also be inspected for premature rips or shredding.

Without funding from the committee, this project will not be able to move forward. Our allocation of maintenance funds for the PSL and Turner Hall Greenhouses has decreased annually from \$131,000 in 2001 to \$81,000 in 2011. These maintenance funds are used for all repairs and maintenance of existing greenhouse equipment for 100 greenhouse rooms, totaling ~ 90,000 square feet of greenhouse space in the PSL and Turner Hall Greenhouses (excluding the new USDA addition). We have been able to upgrade, approximately, five (5) rooms per year since FY06. In 2010, we were able to upgrade nine (9) rooms thanks to a loan from the Student Sustainability Committee. This installation was completed in late June of 2011.

Facilities and Services (F&S) have supported the installation of this new equipment. All of the electrical wiring for these shade curtain systems has been done by F&S. However, in FY10, we had other costly repairs that took precedence over this upgrade project. Given the state budget situation, it is expected that additional state budget cuts are coming for FY12 and beyond. Therefore, this will halt the progress of this upgrade project.

2. Fundraising

We have been pre-approved for **\$18,143.04** in grant incentives by the Illinois Department of Commerce and Economic Opportunity for installation of curtains.

We request that the SSC consider our request for grant incentives and/or a zero percent interest loan to cover the installation of energy shade curtains with seals for 12 greenhouse rooms to keep this energy savings upgrade moving forward.

III. Timeline

A. Detailed Timeline

Our project is dependent on the receipt of funding from this committee. If the University of Illinois experiences additional state budget cuts, the amount of maintenance funds allocated per year could continue to decline, thus, decreasing our ability to pay for these long-term energy upgrades. Our greenhouse facilities are only getting older, and will require more repairs and/or replacement of equipment, not less.

Normally, we do these installations in March or April because we need them fully operational by May. It normally takes the contractor two weeks to install six curtain systems. It takes another two weeks for the electrical work to be done. Therefore, to install 12 new curtain systems may take a total of two months, provided the plant material and the plant benches are moved out of the rooms ahead of time.

IV. Energy, Environmental, Social and Economic Impact

A. Renewable Energy Projects – Not applicable.

B. Energy Efficiency Projects – Applicable.

Based on industry standards, energy shade curtains can save, approximately, 20-55% in energy use depending upon the type of material used and how it is installed. We estimate that the energy savings by installing energy shade curtains in three ranges of rooms in the PSL Greenhouse will average approximately 20% energy savings. This is a conservative estimate. As of July 1, 2011, we have energy shade curtains in six ranges of the PSL Greenhouse including 27 of the 64 greenhouse rooms.

Thanks to a grant from the Student Sustainability Committee in 2010, we were able to install meters to track heat, electrical and water usage between a room with energy shade curtains and one without curtains. To date, we have data that indicates an estimated 32.3 % savings in electricity and 28.8% less water used for cooling in rooms with energy curtains (See Attached). From December 1st-January 31st 2012, we used approximately **50% less heat** to warm our room with the energy shade curtain, and during the night hours, heating was reduced by an average of **75%**.

C. All Projects

a. Environmental Impact

Energy curtains will undoubtedly mitigate carbon dioxide emissions through reduction of electricity and heat (steam) production. Also, requiring less water for cooling will help reduce water supply used from the local aquifer.

b. Social Impact

The greenhouses serve the needs of researchers and faculty who teach and conduct plant laboratories inside the greenhouse. The energy shade curtains make the greenhouse rooms a more pleasant environment in which to work by keeping the room temperatures cooler and reducing light intensity and glare.

c. Economic Impact

On the negative side, these curtain systems are expensive to install at approximately \$10,000 per room. However, on the positive side, these curtain systems will minimize the wear and tear on our heating and cooling equipment, provide a much higher quality of light for plant growth, reduce the use of high intensity lighting, and eliminate the annual cost and labor to apply and to remove whitewash.

V. Outreach and Education

Many classes use the greenhouses on a weekly basis for class laboratories in the departments of NRES, Crop Sciences and Plant Biology. We also have students in Agricultural Engineering and Food Science who use our greenhouses for classes and research projects. Dozens of graduate students in NRES and Crop Sciences use the greenhouses for their masters and PhD research projects on an annual basis. At least half of the people we serve in the greenhouses are undergraduate and graduate students.

The students would not play a direct role in this project, but the faculty, staff and students conducting research or plant production in the greenhouses would benefit directly from the improved growing conditions provided by these energy shade curtains.

Many faculty members in the Departments of NRES, Crop Sciences and Plant Biology utilize the greenhouses as part of their classroom curriculum by taking students on tours to teach them about greenhouse management and operations, having students grow plants in the greenhouses to teach plant production methods, or to teach them insect identification and integrated pest management methods.

The local media uses the greenhouses on a regular basis to cover research in progress, seasonal crops being grown such as poinsettias and spring bedding plants, and tropical plants spotlighted on Channel 3 on the Morning Show.

The PCF and Plant Biology greenhouse staff conduct dozens of tours each year to elementary, secondary, high school and junior college students to educate them about greenhouse operations and management, plant identification, and plant production methods. We also give dozens of tours to community groups, not-for-profit organizations, and private sector industry. These tours are wonderful opportunities to share the many ways the greenhouses are striving to reduce our carbon foot print.