Florida Solar Energy Center: One Year Later

The Florida Solar Energy Center moved to its new facility in September 1995. As might be expected, not all systems were properly functioning at first. In our first year we endeavored to improve our facility's performance.

HVAC Controls

There were a number of problems with the HVAC system which are being corrected.

Valves: Several of the modulating chilled water valves failed . This led to the air handler valves operating in an open state, increasing chiller load, causing zone overcooling and increased need for reheat.

Over-ventilation: The facility's demand-controlled ventilation system operates based on output from CO_2 sensors. However, the controls provide more ventilation air than originally intended. Measurements show that the air ventilation rate is over 30 cfm (14.6 L/s) per person as compared with our 15 cfm (7.1 L/s) target. This problem, associated with CO_2 sensor drift, is being addressed.

Dehumidification Performance/Controls

Humidity control: One outstanding aspect of the building's performance has been interior humidity control. Even with a higher than design outdoor air ventilation rate and very humid conditions, the heat pipe assisted chilled water dehumidification unit maintains the indoor relative humidity at 52% which ranges daily by less than 2%.

Temperatures: We optimistically assumed the interior temperature could be raised by one degree to 76°F (24.4°C) based on using an Energy Management Systems (EMS) and maintaining lower humidity conditions indoors. However, the average temperature within the building has averaged 73°F (22.8°C). Simulations suggest this increases space conditioning energy use in our facility by over 15%.

Lighting controls: Despite careful specifications, we experienced problems with the installation of lighting controls. A number of office occupancy sensors were improperly located (some behind opened doors!). Also, most were set to their maximum time delay and sensitivity. A source of lower than projected savings, these problems were corrected in the autumn of 1995.

Daylighting System Performance

The building's daylight dimming system has met or exceeded simulated performance. We conducted an experiment from December, 1995 to June, 1996 in which the daylight dimming system was evaluated in four offices in the main building. Two offices had interior light shelves installed, one office had no light shelf (the control) and the fourth had blinds to examine their impact on savings. Each office has two fixtures with two T8 lamps and an electronic dimming ballast with a nominal power demand of 128 W. The lighting was left on in the four offices 24 hours a day during the evaluation.

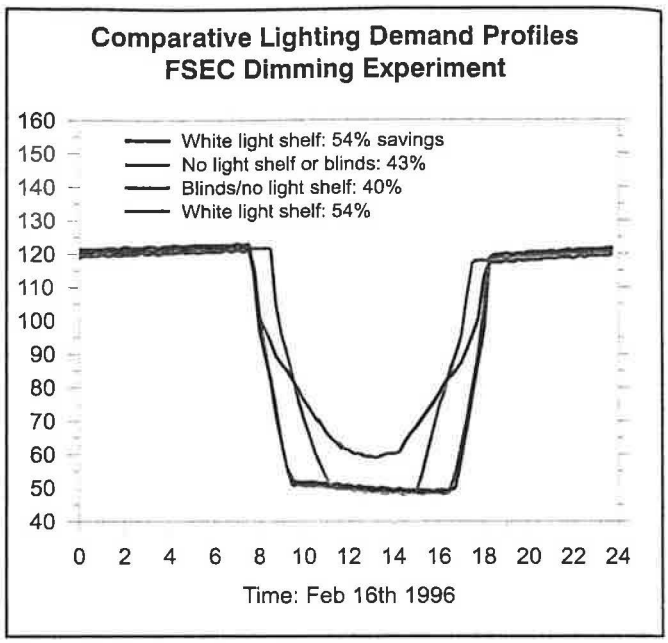

Figure 1: Performance of Daylight Dimming System in four FSEC offices during February, 1996.

The graph above shows the excellent savings achieved by the building's daylight dimming system between 8 a.m. and 5 p.m. approximately 54% with the light shelves. As expected, window blinds were a negative influence. However, the two rooms with a light shelf performed better than the office with no treatment during early morning and late afternoon hours during the utility system.

The data indicate that interior light shelves will improve the energy performance of the building (as well as provide glare reduction), while addition of blinds or curtains will compromise potential. Based on the results, we are installing interior light shelves in each south-facing window office.

Beyond the energy savings associated with dimming control, we are certain the daylighting design of the building is providing even greater savings than estimated. A spot check in the main office building on Oct. 9, 1996 under partly cloudy conditions found that only 24 of 47 occupied perimeter offices had electric lights on. Other offices relied on daylighting alone — a good indicator of design success.

Measured Energy Performance

We predicted that the new FSEC facility would reduce its annual energy use from 71 to 27 kBtu/ft^2 in an optimized vs. base configuration. Despite the problems identified above, and energy use associated with laboratory activities, metering has shown that part of the design objective has been met. Energy use in the office and laboratories totaled 49 kBtu/ft^2 from Oct. 1, 1995 - Sept. 30, 1996.

Although measured consumption was significantly greater than predicted, we know that our assumptions regarding indoor temperatures and outdoor air supplied must be revised. Monitoring over the next year should allow insight into how well the office portion of the facility is operating as well as the ability to better tune facility performance to reach original design goals. ■