Green Building
A Case Study

Pennsylvania State University Sala Building - Practicing What They Teach

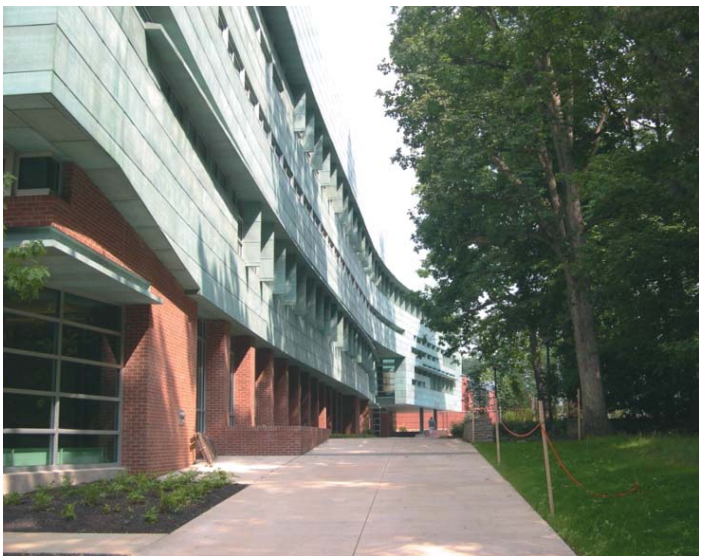
The copper cladding used traditional flat seam technique to tie the building into its more traditional surroundings.

INTRODUCTION

When given the opportunity to construct a new building to bring Penn State's Schools of Architecture and Landscape Architecture together, both of which had been teaching sustainability for a number of years, the architects set out with the objective of matching the design with a number of the School's values and teaching principles. From the recycled copper cladding which covers the majority of the building's exterior, to the extensive use of glass to remove the division between the inside and outside worlds, their success is apparent.

THE BUILDING

Overview - The Stuckeman Building completes the new Arts Quadrangle at the University, appropriately bridging the old and new parts of the campus. The architects accepted the challenges and opportunities of this location to construct a building which incorporates some of the best traditional elements of the past with a vision of what is possible in the future. The 111,000 ft.^{2} (10,300 m^2), $26.5 million facility takes the shape of a gentle arc on one side cradling the water tower and forest to its South.[1]



The pre-patinated copper clad South facing feature cradles and compliments its existing surroundings. Photo: courtesy of Joe Nagy WTW Architects

One of the goals of the building was the removal of divisions. This included both the division between the workspaces and their surrounding natural inspiration and the faculties, ideas, and students. To achieve this, the designers started with a highly collaborative process including representatives of the faculty, students, administration, office of the physical plant, and the design team.[2] The result is the extensive use of glazing which allows for day lighting, allowing students to have a sense of being connected with their surroundings (e.g. natural, social, and academic), as well as inspiring those passing by to have open views of the extensive work spaces. Inside, guests are welcomed by an open presentation space which encourages anyone to observe, learn or partake in the proceedings. This theme of openness is carried through to the work studios on the north and south sides. These large open spaces encourage collaboration and the cross fertilization of ideas. Without losing sight of the functionality of the building, faculty offices, a number of classrooms, and study spaces provide greater privacy supporting different needs and learning styles.

What Makes It Green - The Building's Features

A Clear Commitment - From the beginning of the project there was a clear commitment by all involved to practice what they "teach", and the achievement of a LEED® Silver rating at a minimum was one of the design criteria. With this goal in mind, the designers used the prism of sustainability to consider all of the issues around the building, including its siting, envelope, mechanical systems, and material inputs. They made extensive use of computer modeling in the design phase to consider the impacts of different design and material choices on the performance of the building. For instance, the design called for the building to be as transparent as possible. However, the more glass one uses the greater the glare and heat fluctuations within the building. By using copper sun shades, the designers were able to maximize the use of glazing while minimizing the downsides of its use. The computer modeling also helped them to optimize the envelope, lighting and mechanical design, as well as minimize the building's energy use. Other sustainable features in the building include:

- Mechanical and electrical systems located in a raised floor, allowing for the easy adjustment of the spaces as occupant's needs change;
- A highly integrated monitoring system that uses light, occupancy, and weather sensors to control both lighting and venting systems, including automatic studio windows which allow for natural ventilation;
- Low-emitting building materials for better indoor air quality;
- Extensive waste recycling during the construction process;
- Native vegetation that requires no irrigation and protects the adjacent woods; and
- Showers and change rooms to encourage biking, walking and other alternative forms of transportation.[3]

COPPER'S ROLE

Over 80,000 lbs (35,000 kgs) of copper was used throughout this project. Most noticeably, copper was used in the 49,000 ft.^{2} (4,600 m^2) of pre-patinated, 95% recycled cladding on the South Wall.[4] From the cladding

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[1] Marshall, Amy Milgrub "New Architecture and Landscape Architecture Building Serves as a Model for Green Design." Arts and Architecture News Fall 2005. Available from www.artsandarchitecture.psu.edu/news/newsletter/fa05_beta/p01.html
[2] Nagy, Joe "PSU School of Architecture and Landscape Architecture (SALA) Project Description" WTW Architects March 1, 2006.
[3] Nagy, Joe "PSU School of Architecture and Landscape Architecture (SALA) Project Description" WTW Architects March 1, 2006.
[4] Marshall, Amy Milgrub "New Architecture and Landscape Architecture Building Serves as a Model for Green Design." Arts and Architecture News Fall 2005.

on the building exterior to the plumbing under the floor, copper contributed to the buildings financial and environmental performance, including the achievement of its LEED certification.

Copper's Unique Attributes - Throughout the project copper was considered a good material choice due to its recycled content, local availability, high rate of recyclability at the end of its use in the building, low or non-existent maintenance costs, and durability. Further, as the project called for a very sculpted exterior which fit with its more traditional surroundings, copper proved to be the ideal material with which to work.

Copper as a Bridge - The copper cladding demonstrates how to achieve both material performance and aesthetic objectives. Traditional flat seam techniques were used to tie the building into its more traditional surroundings and older campus buildings nearby. It was in part out of this interest that copper, glass, stone, and brick play such a prominent role in the building's envelope. Copper's flexibility allowed the designers to use the amount of glazing desired (while minimizing the glare which can often accompany it) by manipulating the copper to create vertical and horizontal sun shading. The shading minimizes glare and also reduces temperature variation within the building. The designer, Joe Nagy of WTW Architects, commented on how, due in part to the complexity of the project, they had concerns about effectively bringing all of the different envelope elements together as planned. To help address this, they went so far as to build a 20x15 ft.^{2} (6.1x4.6 m^2) mock-up of the envelope and called on Markon Roofing to conduct the installation of the copper cladding. Although they had limited experience in cladding at the time, Markon showed a real commitment to the project, working with the designers to achieve their vision. This effort paid off in the final product with Mr. Nagy referring to them as "one of the best contractors they have ever worked with."[5]

Copper's Low Maintenance and Durability - To maximize the low maintenance benefit of the cladding, copper was used for all of the soffits and sun shading. Over the building's life, the copper's limited maintenance and exceptional durability will translate into substantial cost savings and avoid environmental impacts from material cleaning and replacement. Another unique use of copper was on the ceilings of some of the large atriums. This provided an attractive accent to the rest of the gypsum ceilings.

While there was some concern that the higher up-front costs of copper would lead to it being 'costed out' of the final building, the University and designers made a real commitment to looking at the long-term cost implications of their material choices and this ensured copper's prominent role. Further, by making this argument early on and ensuring the Universityís support, the designers avoided extensive design changes during the construction phase.

Copper's Role in Securing LEED Credits

One area where copper played a significant role in this project was in achieving LEED credits. According to the designer, Joe Nagy of WTW Architects, the use of copper directly contributed to achieving 5 LEED credits.[6] Copper usually contributes to achieving the recycled content credit in a green building project, but in this case thanks in part to the 40 tons (35 tonnes) of copper used, it also helped the building score an innovation credit. The innovation credit was awarded primarily because the building more than doubled the recycled content criteria needed for the original credit. The building also earned a credit for local and regional material because 87% of the materials in the building were harvested within 500 miles (800 kms) of the campus, including the copper sheet which came from Revere Copper Products, in Rome, New York.[7] Further, by allowing the designers to achieve their goal of maximum transparency without the glare and temperature drawbacks, copper contributed to the achievement of a LEED credit for daylight and views.

LEED® Points Copper Helped to Achieve

Credit 4.1 Recycled Content:
7.5% (post-consumer + 1/2 post-industrial)

Credit 4.2 Recycled Content:
15% (post-consumer + 1/2 post-industrial)

Credit 5.1 Regional Materials:
10% Extracted & Manufactured Regionally

Credit 5.5 Regional Materials:
20% Extracted & Manufactured Regionally

Credit 8.1 Daylight & Views

Credit 1.1 Innovation in Design:
awarded for more than doubling the recycled content

CONCLUSION

When this project started, the designers faced a number of challenges, not the least of which was creating a link between the past and the future of buildings at Penn State. Looking at costs, function, environment and social performance, the designers created a modern functional building with few divisions between nature, inspiration, ideas and influences. This design was clearly a success, but with an eye to the future the building's owners are committed to monitoring its performance and in particular matching its performance against the predictions made by the computer modeling done in the design phase. It will be exciting to continue to learn from their experiences and to see what the young graduates incubated in this inspiring environment can accomplish.

[5] Interview with Joe Nagy WTW Architects September 2006
[6] Interview with Joe Nagy WTW Architects September 2006
[7] Marshall, Amy Milgrub "New Architecture and Landscape Architecture Building Serves as a Model for Green Design." Arts and Architecture News Fall 2005.

COPPER CONTRIBUTING TO GREEN BUILDINGS

Used for centuries as a 'noble' and aesthetically pleasing building material, today copper's role is more important than ever because of its substantial contribution to any building's environmental performance. Across its life cycle, from extraction to recycling, copper can enhance energy efficiency, resource use and indoor air quality, as well as minimizing transportation costs and impacts. Copper can be used in any number of applications in a building improving its environmental performance from its envelope and elements including - cladding, roofs, sun shades, eaves, flashings and downspouts to finishing products such as bathroom fixtures, to plumbing, through to innovative new technologies such as high efficiency electrical systems, on-demand lighting systems and photovoltaic cells. Many building products benefit from copper's recycled content, often over 80%, and its durability, which tends to be measured in generations rather than years. Copper's attributes are clearly demonstrated by its role in achieving up to 13 LEED credits across three performance categories - a number of which are demonstrated by the case studies in this series. Finally, its aesthetic qualities ensure designers can achieve their visual aspirations without sacrificing their environmental and cost performance objectives.

For more information on any of the case studies in this series, to learn how copper can be used in your next project, or find out how it can help you to achieve LEED certification, please contact the Canadian Copper & Brass Development Association through **www.coppercanada.ca** or the Copper Development Association through **www.copper.org**.

How Does Copper Make a Building Green?	Where is Copper Used?	Case Studies
Energy & Atmosphere (LEED) Optimize energy performance	Passive solar walls, high efficiency wiring and systems	York University
Material & Resources (LEED) Building reuse, Recycled content, Regional materials	Envelopes, roofs, plumbing, accents and fixtures	York University, Penn State SALA, E'Terra Inn
Innovation & Design Process (LEED) Innovation in design	Recycled content	Penn State SALA
Material & Resources (LEED)	Sunshades, plumbing, internal monitoring systems	Penn State SALA, York University, E'Terra Inn
Competitive Operations, Maintenance & Energy Costs	Passive solar heating, innovative and efficient technologies, low maintenance exteriors	York University, Penn State SALA, E'Terra Inn

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