BUILDING THE GREEN DREAM: THE SCHOOL OF INTERNATIONAL SERVICE AT AMERICAN UNIVERSITY

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INTRODUCTION

On April 1, 2008, the School of International Service project was well underway, but the real beginning of American University's greening started this day when President Neil Kerwin signed the ACUPCC (American College and University Presidents Climate Commitment) before the full membership of the EIPT (Environmental Issues Project Team), later renamed the Sustainability Committee. This day marked the formal beginning of AU's commitment to reduce green house gas emissions, renew and continue recycling programs, and make a concerted effort campus-wide to have an ongoing impact on environmental issues. The ACUPCC carried with it some serious benchmarking goals and reporting and Dr. Kerwin pledged that the commitments would be met before the deadline.

A new building for the School of International Service had officially been in the planning, design, redesign, and documentation stage for 5-1/2 years, but it had been the dream of that school's Dean for almost twenty. To say it was the catalyst for the ACUPCC commitment would be an exaggeration, but two weeks before the signing ceremony demolition of the new building's construction site began. It made the building suddenly real and the commitment to ACUPCC more important and timely. William McDonough and Partners had designed a gem of a building and McDonough's world-wide reputation had rubbed off on the team, the students, the Alumnae, and the administration. The university's slogan, "American Dream Is Green," was not only pertinent, it was coming alive in a 300 foot by 400 foot hole 54 feet deep. The start and stop dream of Dean Louis Goodman was actually happening.

KEYWORDS

architecture, sustainability, daylighting, energy, shared values, teamwork

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It was fitting that the new School of International Service (SIS) made such an impact on the university community. In 1893, American University was chartered by Congress as a graduate school to train diplomats. The future School of International Service was born at that time. The university officially opened in 1914 and the School of Diplomacy, Jurisprudence, and Citizenship under Dean Albert Putney began as the precursor to SIS. In 1924, the School of Diplomacy was integrated into the new graduate school of the Political Sciences and ten years later renamed the School of Public Affairs. In 1935, the Department of International Affairs was created and reassigned to the Graduate School of Social Sciences, which was combined with the School of Public Affairs to form the School of Social Sciences and Public Affairs.

In 1957, the original School of International Service broke ground. In 1958, the new building opened to what seemed at the time an overwhelming student body of 30 freshmen, 10 transfer students, 25 full-time and 63 part-time graduate students, and 10 full-time faculty. When Dean Goodman came on board in 1986 there were 400 students and 40 full-time faculty. When the new SIS building opened in May of 2010, there were over 3,000 undergraduate and graduate students and 200 faculty members.

This meteoric growth was nothing short of spectacular and everyone at American University felt that the new building should be equally spectacular. Through much upheaval during the Vietnam War, ongoing college realignment and course definition, administration changes and multiple deans, and a never-ending shortage of office space, the School of International Service increased enrollment and academic standing. The School was focused on a new building in keeping with its stature at American University, other schools of international studies around the country, and diplomatic circles. The new building was originally going to sit on the site of the old SIS building (now called the East Quad Building), but as the program for the new building developed into an actual plan, it became apparent that the existing site, although large enough to accommodate the building's size, dwarfed the adjacent buildings in such a way as to make the building uninviting and over-scaled. The East Quad building sat next to a surface parking lot that was meant for expansion of the university library, but it was obvious that the SIS building footprint on the parking lot site was ideal for the new building. Befitting the building's importance to the University, it sat on the last available corner of the main quad and neither overwhelmed the quad nor seemed too big. The renderings of the building pointed to an outcome that everyone had anticipated and construction began in March of 2008. It really was going to happen.

The first challenge was to find an architect who could make the dream a reality. In 2002, many architectural firms were looking at their practices differently, embracing green building approaches, trying to understand LEED, and wanting to add a major sustainable project to their portfolio. In the spring of 2002, Professor Paul Wapner's Global Environmental Politics class was a sponsor of the DC Environmental Film Festival, where William McDonough was the keynote speaker. Paul invited Dean Goodman to go with him to the opening event. Knowing that the architect selection for the new building would be occurring soon, Dean Goodman asked McDonough if he would be interested in making a presentation for the project. McDonough was not only a green architect, he was ahead of the curve, having integrated green building practices into his firm before he ever moved his practice from New York to Charlottesville, Virginia, when he became Dean of the Architecture School at the University of Virginia. He not only made a presentation, he survived the cut and was awarded the project along with Quinn Evans Architects. Programming began in the spring of 2003.

The School of International Service (SIS), the largest School of International Relations in the country, was housed in thirteen different buildings on campus when the new building commenced. With enrollment just over 3000 students and 200 faculty members, Dean Goodman had been lobbying for the new SIS building a long time. Started at least once into the concept stage, the earlier schemes were abandoned in favor of other projects at the university. There were two primary requirements expressed by the dean—one, the new SIS building had to be an inspiring place, "a place to dream," and two, it had to be as sustainable as the budget would allow, the very minimum being LEED Silver, soon to be an American University standard.

FIGURE 1. School of International Service at the Quad.

As the design team began developing the program for the new SIS building, the campus as a whole was awakening to the importance and benefit of "green". It was also awakening to the idea that this new building could be something different, that it could embody the spirit of American University, raise expectations about curriculum and the faculty, and express in physical form the highest academic ideals of the Board of Trustees, the administration, the faculty, staff, and students. There was a buzz about this new place and everyone was curious to see how it would come together. American University committed itself to the American College and University President's Climate Commitment (ACUPCC); we became a pilot for the USGBC's Volume Certification (multiple campus buildings) program; we began using STARS (Sustainability Tracking, Assessment, and Rating System); participated in Recyclemania; created more green roof projects; and took on the Sustainable Sites Initiative; such that "green" was no longer something we preached, but something we practiced. The new SIS building not only responded to the campus heritage of transparency, intellectual curiosity, and social awareness; the building embraced and symbolized a new campus heritage. Everything from bicycles to trash collection came under scrutiny and a subtle, and at times not so subtle, transformation took place. Carbon neutrality became an increasing concern and measuring its impact on campus an intense practice, as everyone was interested in being sustainable.

It has paid off.

In January, 2011, AU earned a STARS Gold rating, attaining the highest score of any campus in America, and in March 2011, the United States Green Building Council (USGBC) awarded the SIS Building a LEED Gold Certification.

American University President Neil Kerwin expressed this important idea at the building's dedication. "The new School of International Service building is the embodiment in physical form of the academic excellence, social awareness, and intellectual curiosity of American University." Nothing so accurately reflects the very essence of not only the School of International Service, but of the commitment of American University to excellence in every respect.

The architects, engineers, students, and faculty worked diligently to ensure that the SIS Building embodied the idea that a sustainable building could inspire a place to dream. The beauty of the SIS building was that every major design goal was met through the efforts of an excellent design team, contractor, project management, and dedication to a lofty ideal. The program changed, the building changed, and the students changed, but the project team held steadfast to the idea that this should be a special place—a place to dream.

THE CHALLENGES

The architectural team, contractor, sub-contractors, and AU worked very hard to make this project successful and to overcome problems. We met formally every two weeks, but several times in between to ensure that the project was moving forward and problems were getting solved. The typical way we approached specific problems was to address them in our bi-weekly project meeting where we would discuss the best way to solve the problem. We would sometimes call in a specific sub-contractor or vendor and discuss a solution or multiple solutions with them. Most importantly we had conferences with every major sub prior to their installation that involved not just company officers, but the superintendent and foreman.

As the push toward carbon neutrality gained traction, bicycles as a legitimate mode of transportation to and from campus became huge. All along we had dedicated showers and bike racks to the project, but cycling was beginning to have an impact city-wide, with bike-share programs and increased bike lanes on major urban streets in place and ready for expansion. Beyond SIS, the push for more bike racks campus-wide was growing and the demand was insatiable. Meeting that demand is an on-going effort to this day.

No project of this magnitude (72,000 sq. ft. above ground and 120,000 sq. ft. below grade) is without problems. The very first problem was one of design—the building was too expensive and the floor plans too inefficient. AU ordered a re-design of the building to decrease the building size and decrease the incredible 50% ratio of useable space to support space. The school's enrollment and faculty continued to grow and decisions had to be made as to how much space would actually be built. The new building was smaller, more efficient, and less flamboyant than before, but it was also a better building because the inefficiencies were gone and the building was affordable.

Once the building re-design was settled and the building was permitted, the first construction problem came quickly and was potentially time consuming and expensive.

Caisson Drilling through Rock

When excavation hit 55 feet, it was apparent that sub-surface rock was going to be a problem. The caissons needed to be 35 feet deep and we encountered rock on most of the project site. We assembled the structural engineer, architect, and contractor on-site. Alternate solutions, field sketches, and field inspections were generated for site-specific problems, reducing the time wasted, unnecessary material utilization, and unworkable caissons to overcome the rock and stay on schedule. In some cases, caissons were eliminated in favor of spread footings or shorter caissons with more re-bar. Aside from that scare, there were some other issues. The next design issue went on almost as long as the project and was a key component of the building's success.

"Bucky" Panels

Dr. Kerwin asked, "What can be done to make sure people know this is a green building?" Green buildings don't necessarily advertise their green qualities and at the time, many new buildings with large expanses of glass and managed energy systems (Siemens Building Automation Unit) were responding to the LEED call, so the question was sincere and legitimate and not readily answerable. The design team came up with an interesting response. They developed the concept of the Bucky panel. 'Bucky' was a euphemism for the adaptation of Buckminster

Fuller's Dymaxion map (flat representation of the earth) as a visual reference to the SIS Building's green nature. Fuller could arguably be called the first modern designer to be concerned with the environment (after Frank Lloyd Wright) who felt that good design should measure its impact on the earth. (Wright just thought he was the only one worthy enough to design it.)

The Dymaxion map was considered by many to be a more informative map of the world, measuring distances with more accuracy and showing a truer relationship between countries. The map was a trademark of Fuller's, like the Dymaxion House and the Dymaxion Car. It was the perfect solution for identifying the new SIS building.

The map was resized, re-oriented and re-interpreted into 66 individual panels in four sizes based on Fuller's original idea. Some triangular pieces of the map weren't used, especially if that section of the map did not depict land. Other panels were duplicated. The panels were secured to the spandrel panels (the space between floors in a building) between the second and third floors. This was an important component of the building design. The panels looked simple, but required several meetings with the curtain wall (Kawneer) sub-contractor, the architect, the contractor, and the fabricator to get the panels right. The budget was small, and we met regularly to work out material choices, fabrication details, production times, installation requirements, and the finish. How to distinguish between water and land; how much detail to put into each panel so that it was recognizable as a part of the map; how to hang them from the structure so they had some depth; and on and on—little details that came up as we went.

FIGURE 2. Corner detail of "Bucky" panels.

Solar Hot Water and Pre-Heat

As work progressed on the project, one goal was to have solar photovoltaic (PV) panels on the roof (Standard Solar), even though originally they were to be added later. The structure was designed from the beginning to accommodate solar PV, but late in the game the opportunity to be "first" in DC with a solar transpiration wall (solar re-heat, provided by Capital Sun) and solar hot water put the team back to work looking into the cost impact, lead times, and optimum locations on the building for equipment. Solar transpiration, which acted like a simplified vertical solar panel, was a new and untested idea and only a few people in the DC area really knew how it worked. What everyone thought would be perforated black collector panels turned out to be a solid, thin vertical element on the penthouse wall that absorbed heat and made the air passing behind it warm enough to reduce the cost of starting the heating cycle every day during the winter. We held several meetings with the solar consultant and the sub-contractor to coordinate and expedite the installation. This was a first for all of us, so we examined and re-examined every detail.

FIGURE 3. Solar PVs and Solar Transpiration.

Terrazzo Patent Issue

Not every problem was a technology situation and although some problems were expected, others came out of the nowhere, like the terrazzo floor patent. It was an important design element from the beginning (there is approximately 4,000 square feet of terrazzo) and the University's intent was to use recycled glass in the terrazzo mix. As we prepared to place a large order for terrazzo (over four thousand square feet), a lawsuit between the two partners who owned the rights to the recycled glass mixture evolved and production ceased. The partner who was suing his other partner threatened the contractor with a lawsuit if we tried to use the recycled glass. Meetings with the architect and the terrazzo sub (Roman Mosaic Tile) resulted in a simple solution—no recycled glass. The university's interior designer and I met several times with the terrazzo sub to hand pick the chip colors, oversee sampling, and look at mock-ups. The recycled glass wasn't needed to enhance our LEED rating, but there were some tense moments over this issue and true to form, everyone did whatever it took to resolve the matter.

Amphitheater Seating Options

With a chance to save $80,000 in an already tight budget, the amphitheatre seats went from being terrazzo originally, to carpet, to concrete, to wood flooring (FSC certified strip maple flooring). We wound up saving $70,000 when it was all said and done, but the important thing here was that we worked as a team with the millwork sub-contractor to develop details that would work with the terrazzo steps, a raw concrete face, and a wider step for students to sit on. We actually designed the details in the field with the millwork contractor and solved all the installation details in one meeting. We didn't even need shop drawings. It may seem like a small thing to worry about, but it was worrying about the small things that gave the entire project the feel that no detail was too small and every aspect of the project was important.

FIGURE 4. The Amphitheater seating.

THE OPPORTUNITIES

We followed the book on LEED and it presented opportunities as well as challenges, although I would characterize the challenges as being unforeseen situations in the field that were overcome because we had an overall game plan called the Basis of Design. Like putting together the LEED project team, which involved bringing every one of the consultants together early, the Basis of Design report required American University to look at every aspect of the building and the building process in a new way with a keen eye. Mechanical systems, waterless urinals (Sloan WES 5000), daylighting, energy consumption, energy management, finishes, indoor air quality, site planning, storm water management, as well as durability, maintenance, green cleaning, and accessibility all had to be considered.

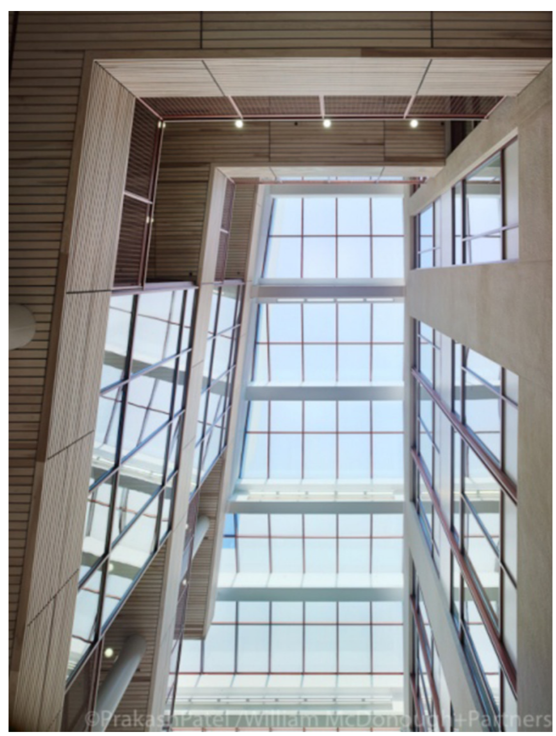
The team started almost immediately after the building footprint was established with the mechanical system. Taylor Engineering from California was the design engineer having already done several LEED projects there and having worked before with William McDonough on projects in San Francisco. They made several recommendations from straightforward forced-air distribution systems to under-floor duct distribution to four-pipe hydronic systems to dual fan–dual duct systems where the hot air distribution and the cold air distribution were ducted separately. The engineers preferred the under-floor duct system, but it was almost never used on the East coast. Even though it was the most energy efficient, the high first cost was considered a negative compared to the other opportunities. Although not common on the East Coast, the dual fan–dual duct was selected as being the best system from a life cycle standpoint. The university made that decision without hesitation and one of the major components of the SIS Building was settled without controversy.

One of the reasons the mechanical system selection seemed easy was because of an interested and dedicated project building team that included not only the architects, the AU project team, the Dean and faculty representatives of SIS, but also students. The students weren't just interested in having a voice; they were interested in the building process and methods for solving problems and enhancing the building's green presence. One such enhancement involved the building's roof and whether or not it would be a vegetated roof or something else. In the spring of 2005, the consensus was that the roof should and would be vegetated to slow the roof's water runoff and put less water in the DC storm system. The tradeoff: vegetated roofs are heavy and a 19,000 square foot vegetated roof, with three inches of soil, is very heavy. The structural engineer indicated that the structural steel framing system would have to be beefed up and would cost a lot of money. Over that summer, some enterprising students came up with the idea of capturing the roof's rainwater in an underground cistern (utilizing several manufacturers, but coordinated by W.L. Gary), filtering it, and recycling the water for use in the bathrooms for toilet flushing and also for irrigation. There would be no beefed up steel framing, no extra weight, and the school would have recycled water and more LEED points. As an added benefit, the roof would be a white finish reflective surface and lessen the heat load on the building.

One of the best things about the SIS building, and one that people might take for granted, is the amazing amount of daylight the building receives and uses. The 3,600-square-foot atrium is skylighted (Viracon) with 98 glass panels. The glass is "fritted," which means it is covered in a white perforated sheet especially made to absorb the UV rays of the sun and keep heat gain to a minimum inside the atrium, not unlike a microwave oven. On cloudy days, the light level is quite high. The perimeter offices have 12-foot ceilings and the glass (Viracon, various product numbers) extends to three feet off the floor. This allows an enormous amount of light into each private office. To transfer this free light into the interior of the building, we built transoms above the doors as well as sidelights to create a shared light effect. One of the things we learned after the project was finished was that the fluorescent strip lighting in the corridors is too much on a sunny day. These lights will be reconfigured electrically to accommodate motion detectors and override switches in order to minimize artificial light in the corridors. Even with this current condition, the electrical load on the building is only about 2.7 w/ft^2.

We learned greater lessons in the garage.

FIGURE 5. Atrium Skylight.



PARKING IN THE DARK

One of the requirements of this project, like all new building projects at AU in recent years, was to increase parking at the project site in order to decrease the number of on-street parking spaces students used in the neighborhood. We did this, in part, by replacing an 88-vehicle parking lot with a 300-vehicle parking garage, increasing the overall parking capacity on campus and providing more handicap spaces, carpool spaces, and parking for alternative fuel vehicles. This was not the only parking garage on campus, but it was the first garage to utilize LED fixtures (Infinilux, model LB 36) as a light source. The other parking structures used metal halide fixtures in the drive aisle, which made for dark spaces and even darker corners. It also made for many complaints and unsafe conditions.

The SIS garage was something different. There we utilized 224 LED light fixtures that hang at a uniform height of eight feet. (The parking garage ceilings are 15 feet high). The fixtures are uniform in their layout and light every square foot of the garage. The fixture itself is a 36-bulb LED panel set into a vented aluminum frame mounted on a pole, with airline wire that keeps the fixture from falling to the parking deck if it is hit with enough force to knock it off the hanger rod. Since the LED panel is made of individual lights, one bulb can burn out without affecting the others. The fixture life is about 6.5 years, compared to about three years for any kind of conventional lighting. The payback for the extra cost was about five years and there have been no complaints about the lighting level.

One of the most challenging aspects of the LEED Scorecard is Sustainable Sites. One might think these are easy credits and simple matters to solve. I would encourage all to not take it lightly. There are seventeen possible points in the LEED scorecard for the site and the opportunities range from how to site the building to storm water management to Heat Island Effect. And, of course, it does set the stage for everything else. When we made the decision to delete the vegetated roof, we realized that much of our storm water strategy went with it. We had a way to deal with storm water from the roof (the cistern and recycling the water), but we weren't dealing with the storm water on the surface. We elected to use rain gardens that would slow down the rainwater on the plaza and pre-filter the ground water before it entered the storm drain. Once the rainwater passes through the vegetation that filters it, it is filtered again with sand filters inside concrete vaults before it enters the city's water supply. This approach has been critical for putting cleaner water back into the system and will probably become a citywide requirement in the future that all storm water will be treated on site.

The flip-side of that approach was how we handled roof water. The original intent was to have a 19,000-square-foot vegetated roof. This seemed at the time to be the greenest approach, but this decision was delayed pending further investigation of other options. A 19,000-square-foot vegetated roof, with a minimum of three inches of soil plus the weight of the plants, would add a lot of weight. The need for additional structural steel would increase the cost and that was not desirable. As we thought about this situation, the AU students involved in the project—and perhaps some who were not—began looking at green alternatives to a vegetated roof. Their recommendation was to use a light membrane roof in combination with a cistern system that would capture rainwater that could be recycled for toilet flushing and landscape irrigation. The lightweight membrane replaced the dirt that was necessary for a green roof, meaning no extra weight would be added to the structural load. The cistern allowed water collected from the roof to be stored in a 60,000-gallon concrete container on the bottom level of the parking garage and then be used to flush toilets throughout the building. There is nothing pretty or sexy about the cistern, it is a kit-of-parts, but it saves hundreds of thousands of gallons of water per year by not having to tap into the public, potable water supply. Filters (WISY Vortex Fine Filters) in the Terrace level of the garage (1st level) capture the water first before it is sent to the actual cistern, two levels below.

It was agreeable from a code standpoint, it eliminated the need for a beefed-up structure and since the roof already had drains, it would not significantly impact the project cost other than adding the cistern and the cistern filters. Even so, the overall increase for these items was still less than the additional structural steel.

The important lesson here was that if the students had not been involved in the project and felt that their input was important, this solution might never have surfaced. Because they were an integral part of the project committee and involved in the process, they realized their input was valuable and they weren't afraid to research this important component of the building. These successes led the students to look at other issues like social justice among the construction trades and the viability of alternate products in the building.

STORMY WEATHER

As the building was nearing completion, we learned about an opportunity to serve as a pilot project in the new Sustainable Sites Initiative (SITES). Since the building had already incorporated many features that reduced negative impacts on the grounds, and many of the requirements of the SITES program mirrored, enhanced, or duplicated the LEED requirement, we decided to apply to the SITES program. Our application was accepted and we are now nearing completion of the pilot while waiting for a former work-study student, who has been an integral part of the process, to expand on the information already gathered. Features include two bio-retention ponds, 3,600-square-feet of vegetated roof, 60,000-gallon underground rainwater cistern, drought tolerant plants, partial pervious paving, and the roof rainwater system previously explained.

We realized that the parking garage roof, because it extended beyond the boundaries of the building, was not only a sustainable site, but a green roof and could be treated as such through vegetation and storm water runoff. We treated the whole garage roof as a seamless planting area such that the boundaries of the parking garage integrated with the landscape beyond the garage. Surface storm water runoff was directed toward the bio-retention areas or

FIGURE 6. Looking across the SIS ellipse.

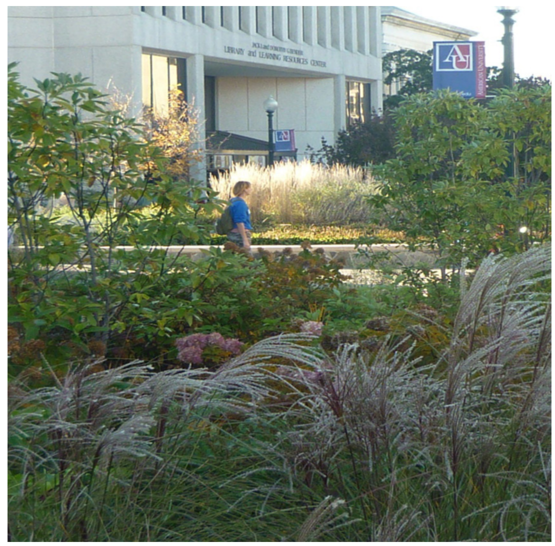


FIGURE 7. Looking across the parking roof at Nebraska Ave.

across rocky paths, so it went where it was needed. Native plants and drought-tolerant species have made the cistern-based irrigation system unnecessary, at least for now and the foreseeable future.

SHINE ON

The solar features on SIS ultimately included a 27-kW PV installation; an 80-square-foot solar hot water panel that provides hot water to the Davenport Lounge, the building's student-run coffee shop; and two solar pre-heating walls, which are essentially black, hollow, south-facing walls that pre-heat outside air. These solar successes helped inspire what has now become one megawatt of installed solar power on campus; including what the US EPA says may be the largest urban solar hot water system on the east coast. Solar hot water is now becoming a standard feature in the university's residence halls, the buildings where the most domestic hot water is consumed.

The School of International Service, something that started out as a dream so many years ago, is now American University's flagship green building and has really helped focus the university's attention on sustainability in general. The focus on sustainability in this building project contributed to the adoption of a climate plan targeting carbon neutrality by 2020 and adoption of policies on green building, green cleaning, sustainable purchasing, and zero waste. This vigorous attention to sustainability has resulted in accolades and a desire for every new building on campus to follow in its footsteps. This year the Princeton Review named AU to their Green Honor Role—a list of the sixteen greenest campuses. We earned the STARS Gold rating and were included in the Sierra Club's list of "Cool Schools."

So the question arises as to whether or not it was worth it. Building a green building—a truly sustainable building—is a lot of hard work and amid tight budgets and impossible schedules, it can seem like a daunting task. In many states, legislatures are mandating it and yet many institutions don't know where to start. The paperwork is prodigious, but if you look at the requirements for LEED as a checklist—an extensive checklist of building activity—it makes more sense. But, you can't treat it like your timesheet and wait until the end. You have to stay after it day after day after day. The process is not new anymore, but it is new to many and it takes some getting used to doing. The SIS building was an ambitious project for an initial LEED-certified building and required that everyone on the team buy into the process and the outcome.

The University Library is next door to SIS and is about 35 years old. It is about 8,000 square feet bigger that the School of International Service, with old systems and inefficient ductwork, great lighting with old bulbs, and cavernous amounts of space. It is the closest building on campus in size to the SIS building. The School of International Service uses just about half the energy as the library and energy savings will increase when the lighting in the corridors at SIS is rectified.

Just imagine: half the energy usage. Expand this to the rest of our campus and even if the efficiency is only 25%, we will save millions in energy costs over the coming years. The telling thing is that when students, parents and alumni see these savings, students will get involved in their school, parents will contribute to the University, and the Alumnae will raise money for the institution. The real benefit is that the SIS building has measurable results that people can see and will show others it can be done. We don't want to go backward and the only way to go forward is to make the next project just as good, if not better.

It was definitely worth it and we'll get better with every project!