Built Environment Project

Sustainability Task Force, summer 2008

Melissa Enoch menoch@indiana.edu

Project Mentors:

Jeff Kaden jkaden@indiana.edu
Charlie Matson cmatson@indiana.edu

Table of Contents

Executive Summary 3
Introduction 4
Part I: LEED™ Certification of MSB II 4
Leadership in Energy and Environmental Design™ 4
LEED™ and MSB II 5
Sustainable Sites 6
Water Efficiency 6
Energy & Atmosphere 6
Materials & Resources 7
Indoor Environmental Quality 8
Innovation & Design Process 8
Recommendations 8
LEED™ Accredited Professionals Needed at Indiana University 8
Sustainable Design Checklist for New Buildings and Major Renovation Projects 8
Campus-wide Policies versus Building Specific Policies 9
Life-cycle Cost Benefit Analyses 9
Part II: Simon Hall (MSB I) Energy Analysis 9
Methods 10
Preliminary Findings 10
Recommendations 11
Further Analysis of Simon and Myers Halls 11
Meter Specification and Installation Protocol 11
Analyze Energy & Water Use Data Relative to Design Estimates and IU Budget Goals 11
Appendix A: Indiana Governor's Letter on Energy Efficient State Building Initiative 12
Appendix B: LEED NC 2.2 Scorecard for MSBII- Last updated July 08 14
Special Thanks 18
Works Cited 19

Executive Summary

Indiana University, Bloomington has approximately 520 buildings totaling over 15 million gross square feet. The impacts of these buildings on the environment and on human health are significant and with more building projects on the horizon comes the need for an in-depth analysis of 1) how the University can build environmentally sustainable buildings and 2) how the efficiency of these buildings can be measured and improved. The first component of this project has been to monitor and record the accomplishments and setbacks of the Leadership in Energy and Environmental Design (LEED™) certification progress of phase two of the Multi-disciplinary Science Buildings (MSB II). The result of this component of the project is a list of LEED™ credits that the University should be able to attain on future projects as well as an overview of the setbacks and organizational issues involved in obtaining LEED™ certification. The second part of this project is an energy analysis of two major science buildings on the campus, Simon and Myers Halls. While Simon Hall houses more labs than Myers Hall, several energy efficient design standards were implemented in the building that should make its total energy use per square foot smaller than that of Myers'. Data was collected from all utilities feeding into the building including water, electricity, condensate, and gas from both buildings over a sample week from this summer. Initial results of a chilled water analysis suggest that Simon Hall may actually be using more energy per square foot than Myers Hall. The purpose of this component of the project is to develop a way to measure the efficiency of a building post-construction/occupancy and to determine a plan of action if necessary.

Introduction

The built environment and its impacts on ecosystems, human health, and the global environment are tremendous. According to the United States Green Building Council (USGBC), buildings in the U.S. account for “70% of electricity consumption, 39% of electricity use, 39% of all carbon dioxide (CO2) emissions, 40% of raw materials use, 30% of waste output (136 million tons annually), and 12% of potable water consumption” (U.S. Green Building Council, 2008). Sustainability efforts within organizations usually begin with their built environment as this area has such a large and visible impact. In fact, sustainable, or “green,” building design has become increasingly popular over the past decade or so as private and public entities have recognized the importance of reducing the environmental impacts of buildings.

With approximately 520 buildings, totaling over 15 million gross square feet, and over 25 new building and major renovation projects on the horizon, the impact of Indiana University’s built environment on the natural and human environment is significant. The summer 2008 built environment project had two major components: LEED™ certification at IU’s new Multidisciplinary Science Building Phase II and an energy analysis of IU’s Simon Hall. The following report is divided in two by these components. Concluding remarks are included in the final sections of each part, titled ‘Recommendations.’

Part I: LEED™ Certification of MSB II

The first component of this project has been to monitor the LEED™ certification process of IU’s new Multidisciplinary Science Building, Phase II, referred to hereon as MSB II. This section will include an introduction to LEED™ and an overview of how LEED™ is being applied to MSB II. It will conclude with a few recommendations on how IU should proceed with sustainable building.

Leadership in Energy and Environmental Design™

Leadership in Energy and Environmental Design™ (LEED™) is a green building rating system which was created by the United States Green Building Council (USGBC) in 1998. What makes the USGBC’s system more unique than some of the other approaches is that LEED™ is a whole-building approach, which starts at site selection and ends well past building occupancy. The rating system is created by volunteer groups made up of various stakeholders within the building industry. These stakeholders include real estate developers, architects, engineers, facility managers, government agencies, nonprofit organizations, and so forth.

Indiana University has been a member of the USGBC since 2001 and has since recognized LEED™ as a credible green building rating system. The University does not currently have a LEED™ mandate in place, though there has been some consideration by the administration in creating one ever since the release of Indiana Governor Mitch Daniels’ letter for the “Establishment of Energy Efficient State

Building Initiative." While this letter appears to make LEED™ Silver, or a similar approach, mandatory for all state projects, the occurrence of phrases such as "to the extent this can be accomplished on a cost effective basis," allow a significant loop hole in the mandate. One has to wonder, how enforcement of such a mandate at the state level can occur, especially when life-cycle cost analyses are not currently being used on a widespread basis. A copy of the Governor's letter can be found in Appendix A of this report for reference purposes.

Six categories make up the LEED™ rating system: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation & Design Process. Each category has its own set of prerequisites that need to be achieved before points for actual credits can be awarded. For example, prerequisites in the Energy & Atmosphere category require that a project undergo fundamental commissioning of the building's energy systems, meet a minimum level of energy performance, and meet a zero-level use of CFC-based refrigerants in HVAC&R systems. These prerequisites ensure that, at a minimum, a certain level of sustainable design features are implemented in every project attempting LEED™ certification. The creators of LEED™ have determined that these prerequisites are feasible for all projects.

The USGBC awards four certification levels under the LEED™ system. The first level is "Certified" and requires a project meeting between 26 and 32 points. The second level is "Silver" and requires between 33 and 38 points. The third level is "Gold" and requires between 39 and 51 points in order to achieve status. The final, and highest, level of certification is "Platinum" and requires between 52 and 69 points. Platinum LEED™ certified buildings are considered top-of-the-line "green buildings." Currently, there is only one platinum-certified project in Indiana. The project is Rieth Village and is part of Goshen College's Merry Lea Environmental Learning Center, located in Wolf Lake, Indiana. Rieth Village scored 55 points on their LEED™ scorecard, earning them the maximum level of certification.

LEED™ and MSB II

Construction for MSB II started in July of 2007 and is projected to end in July of 2009. Upon its completion, MSB II will be a five-story, 130,000 gross square foot multidisciplinary science building housing laboratories and offices for researchers across the many different sciences in place at IU. Currently, the University is seeking LEED™ Silver certification, while Gold certification seems highly likely. The University chose to pursue LEED™ certification for MSB II at the start of the design process. The significance of MSB II being the first LEED™ certified building at IU is great. A state-of-the-art science building at such a research-intensive campus as IU Bloomington is quite energy intensive. Meeting the criteria for the Energy & Atmosphere credits for MSB II is that much harder. While the difficulty of achieving some of the credits will be higher based on the type of building that MSB II is, the energy and costs savings potential for the building are also greater compared to less energy intensive projects.

The following sections are broken down by the six LEED™ categories and highlight some of the achievements and difficulties of the certification process within each. The following provides only an overview of a sample of the points being pursued at MSB II. For a full list of points being sought for MSB II, see Appendix B of this report.

Sustainable Sites

The Sustainable Sites category contains prerequisites and credits that deal with the overall site of the project during the design and construction phases. The credits range from alternative vehicle parking and transportation opportunities on/near the site to the reflectance values of sidewalks, paving, and roofing materials. The benefits of these credits include habitat restoration, green space protection, urban sprawl aversion, incentives for low-emission and fuel-efficient vehicles, and much more.

Currently, the University is seeking eight of the 14 potential points available in this category for MSB II. Credit 1: Site selection was achieved during the design phase by choosing a previously developed site for the project. MSB II is being constructed on the site where the previous IU Service building sat and before that, where the IU Motor Pool resided. Credit 3: Brownfield Redevelopment is being sought due to the condition of the site before MSB II construction began. While the site was operating as the IU Motor Pool, it was discovered that several underground fuel storage tanks were leaking. The University has undergone extensive cleanup and remediation of the site and will attempt to get special consideration for this under the LEED™ system. While the site was never officially declared a Brownfield by a state agency or never underwent an official Phase II Environmental Site Assessment as deemed necessary under LEED™ requirements, the University has decided to pursue the credit under a different compliance approach and will provide full documentation of the remediation.

Water Efficiency

The Water Efficiency category contains perquisites and credits that deal with increasing the overall water efficiency of a project during the design phase. The addressed efficiencies can occur in landscaping, wastewater, and water use. The benefits of these credits are many. First, reducing the overall amount of water used in a building reduces costs in terms of payments made for purchasing and disposing of the water and even maintenance costs. Second, reducing the amount of water used and wasted in a project alleviates part of the strain placed on the global water supply, which is increasingly becoming a major issue.

The University set out to achieve three of the five possible points under this category and has already fulfilled the requirements for each of them. These credits were Credit 1.1: Water Efficient Landscaping, Credit 3.1: Water Use Reduction, 20% and Credit 3.2: Water Use Reduction, 30% and were all achieved during the design phase of MSB II. These credits were easily achieved by incorporating sustainable landscaping practices and water efficient equipment into MSB II's design.

Energy & Atmosphere

The Energy and Atmosphere category deals with increasing the energy efficiency of a project and decreasing the amount and severity of any atmospheric pollution. This category is perhaps the more data intensive of all the categories and requires several different types of analyses. Issues addressed by the credits range from the commissioning of the project to generating on-site renewable energy. The potential benefits of credits achieved in this category are great, especially in an energy intensive building like MSB II.

The University is currently seeking eight of the possible 17 points in this category. One breakthrough for the University from this summer was the purchasing of renewable energy certificates (RECs) to offset 70% of MSB II's energy consumption for two years. These RECs were purchased from a reputable supplier who will be using a combination of small hydro and wind power to fulfill the certificates. Purchasing these RECs has fulfilled Credit 6: Green Power under the Energy and Atmosphere category. An additional credit from the Innovation and Design Process category was achieved by purchasing an extra year of green power for MSB II.

One of the more significant, and perhaps more controversial, credits in the Energy and Atmosphere category is Credit 5: Measurement and Verification. This credit seeks to verify the energy efficiency of a building by comparing the predicted performance of the building to the actual performance of the building post-occupancy. Critics of LEED™ and of other green building rating system often question the actual performance of these "green" buildings, and rightfully so. This credit not only addresses these critiques but also requires the project owner to have a plan in place to fix any issues revealed by analyses. The University is currently exploring its options in pursuing this credit. Part II of this report can be thought of as a rudimentary measurement and verification case study as it seeks to compare the predicted energy efficiency of Simon Hall to its actual performance.

Materials & Resources

The Materials & Resources category seeks to reduce the environmental impacts created by extracting, processing, transporting, and disposing of building materials. The prerequisites and credits in this category range from recycling design for building occupants to the use of rapidly renewable materials in building design. The benefits of this category include diverting or reducing waste to landfills, reducing the exploitation of natural resources, encouraging the use of recycled materials and so forth.

The University is currently seeking six of the 13 possible credits in this category. Credit 2.1: Construction Waste Management- Divert 50% of waste from disposal seems to be achievable. The project is currently at 67% and documentation has not even been completed yet. Credits 5.1 and 5.2: Regional Materials: 10 and 20%, respectively, extracted, processed and manufactured regionally have been met as well. In fact, the project is currently at 47% regional materials due to all of the local limestone and local lumber that has been used in the project's design. The contractors responsible for handling the documentation for these credits have stated repeatedly that these credits have been easily achieved by IU Bloomington because of its location and should be easy to achieve in future projects.

One issue that has come up in this category is the ability to reach the requirements of Credit 2.2: Construction Waste Management- Divert 75% of waste from disposal. Drywall is the one thing standing in the way of the University achieving this credit because a drywall recycler within a reasonable distance from Bloomington has not yet been found. The University is beginning talks with a local non-profit organization to see if they would be willing to incorporate drywall into their successful paper recycling venture but it is still unclear as to whether or not this organization will be able to do this.

Indoor Environmental Quality

The Indoor Environmental Quality (IEQ) category seeks to reduce the amount and severity of pollutants found inside a building. The prerequisites and credits range from tobacco-free policies to the controllability of thermal comfort systems. Benefits in this category pertain to both the natural environment and to human health and include better ventilation, cleaner, more comfortable air, healthier work environments and so forth.

The University is currently seeking 12 of the 15 possible credits in this category. Credits 4.1 through 4.4: Low-Emitting Materials have already been achieved by incorporating adhesives, sealants, paints, coatings, carpets, and other materials that have zero or low volatile organic compounds (VOCs). Credit 7.2: Thermal Comfort Verification will be achieved by creating and implementing a survey to building occupants about the comfort level of their building. Results from the surveys will be analyzed and a plan created, if necessary, to deal with any issues.

What is worth noting about the (IEQ) category is that the architectural design standards at the University already address much of these IEQ issues. Therefore, these credits have been relatively easy to achieve, have not added much cost to the project and will result in a high performance building.

Innovation & Design Process

The Innovation and Design Process category earns projects extra credits for going above and beyond in specific areas. The credits vary from project to project depending on what areas the specific project is able to expand upon. The University is currently seeking the full amount of credits possible under this category, five. These credits include exemplary green power, exemplary parking capacity reduction, process water reduction, green housekeeping and a credit for having a LEED™ accredited professional on the team.

Recommendations

LEED™ Accredited Professionals Needed at Indiana University

Regardless of whether the University seeks to pursue LEED™ certification in future building projects, it is evident that LEED™ accredited professional are needed in-house. First, LEED™ training provides a multidisciplinary approach and allows those pursuing accreditation to become effectively fluent in sustainable design practices in each of the six categories, not just their area of expertise. This helps to ensure that as one member of the project team is carrying out their responsibilities, they are aware of how the effects on another member of the team's area. Second, the LEED™ accredited professionals on the MSB II project are all outside the University. At times, none of these professionals attended the meetings, which made it difficult to address issues. Finally, having LEED™ professionals at the University would give the opportunity for sustainable design features to take a higher precedent in the design process than if there were no such professionals involved.

Sustainable Design Checklist for New Buildings and Major Renovation Projects

It is recommended that the University create and implement a sustainable design checklist to be completed at the design phase for all new buildings and major renovation projects. The University of Cincinnati currently uses such a checklist to determine whether or not a new building or major renovation project will 1) incorporate certain sustainable features and 2) be LEED™ certified. The use of such a checklist will stress the importance of sustainable building at the University as well as provide designers with a list of mandatory sustainable features to include in all projects.

Campus-wide Policies versus Building Specific Policies

At times throughout the LEED™ certification process at MSB II, the issue of campus-wide policies versus building specific policies has arisen. For example, Credit 4.3 under Sustainable Sites is being sought for MSB II. This credit requires the University to provide low emissions / high efficiency vehicle preferred parking for 5% of the total vehicle parking capacity of the site. While this will prove to be a popular sustainable feature of MSB II, the question of 'Why not the entire campus?' arises. The University must be careful and distinguish its projects from those which simply seek to "buy" their LEED™ credits. If a building-specific policy arises that can apply to the entire campus then the University should take the necessary steps to do so.

Life-cycle Cost Benefit Analyses

Life-cycle cost benefit analyses take into consideration the entire life of a building, usually around 75 years, including construction and operating costs, when designing or renovating buildings. Currently, the University does not use this type of analysis when deciding what types of features or equipment to incorporate into a building; only capital costs are considered in these decisions. This is and will continue to be a major setback for the University as it pursues sustainable building design. For example, at this time, energy-efficient equipment and alternative energy sources do have higher up-front costs. These features often get "value-engineered out" if cheaper alternatives are available. However, when taking future savings into account, some of these features will pay for themselves, especially with the rapidly increasing prices of energy. Life-cycle cost benefit analyses would help the University determine which features of a project will pay for themselves and how quickly. Therefore, it is recommended that the University adopts a policy that it will find additional funding for projects in order to include features in which the energy & water savings (minus extra maintenance expenses) have paybacks that are shorter than eight years

Part II: Simon Hall (MSB I) Energy Analysis

The second component of the built environment project was an energy analysis of IU's Multidisciplinary Science Building, Phase I, which has been named Simon Hall. Simon Hall was completed in July 2007 and is an approximately 140,000 gross square foot science building housing laboratories, classrooms and offices across many disciplines. The implications of an energy analysis of Simon for MSB II are great. First, upon the completion of MSB II, the two buildings will share a lot of the same design features such as similar heat recovery systems and water efficient features. Moreover, the same design team and essentially the same architects and engineers have been involved in the two projects. Any issues arising from this analysis can be taken to the team members on MSB II in order to prevent similar problems happening there.

This section of the report will cover the methods of the Simon Hall energy analysis and a discussion of the findings. It will conclude with a few recommendations as to how the University can ensure efficiency of its buildings in the future.

Methods

Simon Hall has nine utility meters. The breakdown by utility is as follows: one gas meter, four water meters, two condensate meters, and two electricity meters. Each of these meters were identified with help from the University's Utility Information Group (UIG). Data was gathered from reports sent by t he UIG for condensate and electricity for the week of 7/4/08-7/10/08. Chilled water data was calculated from tonnage reports sent by Building Systems Group for the same time period. Gas data was not analyzed since Simon Hall uses a small amount.

In order to have data to make a comparison with, data was collected for the same utilities, same week, for Myers Hall. The data from Myers Hall also came from the UIG and the Building Systems Group. The idea to compare the two buildings came from the fact that they are similar in that they are both energy-intensive science buildings. Before comparisons were made, all data was adjusted for square footage.

The limitations of this analysis are great. First, accurate domestic water readings were not possible due to meter issues. Initial readings showed that the "lab" water meter was reading approximately 50,000 gallons higher than the "main domestic" water meter, which was against what was thought to be the design of the water system in the building. An inspection by Simon Hall's building manager revealed a by-pass valve positioned wrong which may have been leading to the inaccurate meter reads. Second, the condensate meters for both Simon and Myers seem to have inaccurate readings. One of the condensate meters specified and installed at Simon Hall is not used anywhere else on campus and has been deemed inaccurate by the UIG. This meter will likely be replaced within the next year. If the UIG were more involved in the design of meter specifications then this might have been prevented. Third, there is currently not a full year's worth of meter data for all utilities for the two buildings, which is one of the reasons only a week's worth of data was used to project yearly estimates. Despite these limitations preliminary findings were still made. Finally, there wasn't enough time devoted to this component of the project. The meter issues are starting to be addressed, but only after the initial analysis was conducted. Further analysis may be possible in future similar efforts.

Preliminary Findings

While exact numbers are being left out of this report due to many of the limitations mentioned above, the data shows that there are energy issues taking place at both Simon and Myers Halls. Simon seems to be using more chilled water per square foot than Meyers, when it was projected to use less due to its energy efficient equipment. Also, the condensate for Simon is higher than was expected. Overall, it seems that the annual energy use of Simon is tracking to a level higher than was anticipated.

Recommendations

Further Analysis of Simon and Myers Halls

It is evident there is a real need for more resources and more accountability to the matter of energy and water cost analysis and control at the University. These buildings are both energy intensive buildings that, upon initial analysis, are showing to have either significant energy efficiency issues or significant meter issues. Either way, a significant amount of energy is either being lost or is simply unaccounted for. Further analyses must be conducted with the utility data from both Simon and Myers Halls to address these concerns.

Meter Specification and Installation Protocol

As the University becomes more and more reliant on metering and as meter technology continues to rapidly evolve, the University must have something in place to ensure consistency in meter specification and installation so that the collected energy and water consumption data is useful. The only way to ensure this is through the use of detailed and updated meter schedules that ensure the data systems will work for the employees who will collect and analyze the data. Engineering Services, UIG & the Building Systems Group must all give the schedules their regular attention.

Moreover, it is recommended that the UIG and Building Systems Group are given the resources to promptly and thoroughly commission meter and data systems at the same time that new buildings reach completion. First year energy and water use analysis should be analyzed and reported to administrators responsible for design, operation and maintenance as well as utility budgeting. Any resulting notices in design or construction problems must be acted upon promptly.

Analyze Energy & Water Use Data Relative to Design Estimates and IU Budget Goals

It is recommended that the University analyze historical energy use data and use these statistics to compare to design estimates and IU budget goals. Although this effort will take more than one extra person on the staff to provide independent, timely and accurate analysis, the cost would be paid back quickly by helping move designs for energy efficiency closer to reality and by bringing needed enforcement of past operational directives that are gradually being ignored at a time when the growing costs of energy and water call for even tougher designs on operations.

Appendix A: Indiana Governor's Letter on Energy Efficient State Building Initiative

FOR: ESTABLISHMENT OF ENERGY EFFICIENT STATE BUILDING INITIATIVE

TO ALL TO WHOM THESE PRESENTS MAY COME, GREETINGS.

WHEREAS, The cost of energy continues to increase dramatically and consumers businesses, and the public sector must all continue to improve energy use and identify opportunities to reduce demand through energy-efficient practices;

WHEREAS, State government should set an example through efforts to increase the cost-effectiveness of government and its efficient use of resources;

WHEREAS, the construction and renovation of buildings utilizing energy efficient design and materials can serve the needs of citizens and promote the health, productivity, and safety of employees while reducing the operating costs of government;

WHEREAS, the use of local materials minimizes the transportation costs of raw materials and finished products while supporting the regional economy; and

WHEREAS, the Department of Administration (DOA) has demonstrated that new State buildings can be built cost effectively utilizing energy efficient design, having constructed five new buildings since 2005 which were certified by the U.S. Green Building Council as meeting Leadership in Energy and Environmental Design (LEED) standards;

NOW, THEREFORE, I, Mitchell E. Daniels, Jr., by virtue of the authority vested in me as Governor of the State of Indiana, do hereby order that:

1. All new State buildings, including all State agencies, departments, offices, boards, commissions, and public universities, shall henceforth be designed, constructed, operated, and maintained to achieve maximum energy efficiency to the extent this can be accomplished on a cost effective basis, considering construction and operating costs over the life cycle of the building.

2. The DOA shall develop design standards for all new State buildings which require the analysis of the cost effectiveness of building with the goal of achieving energy efficiency. “Efficiency” may be demonstrated through design which achieves:
   (1) The silver rating under the LEED rating system;

   (2) The two globes rating under the Green Globes rating system;

   (3) Environmental Protection Agency’s ENERGY STAR®; or

   (4) Equivalent under a rating system that is accredited by the American National Standards Institute.

3. Repair or renovation of all existing State buildings shall be designed to achieve maximum energy efficiency to the extent this can be accomplished on a cost effective basis, considering construction and operating costs over the life cycle of the building. Such design may be based on LEED, Green Globes, and/or other comparable guidelines and rating systems. Historic aesthetic and local sourced materials shall be afforded value in the cost analysis.

4. Indiana hardwood lumber, further, should be considered for use in all projects, where practicable, as a local source material. The 2006 study “Sustainability of Indiana's Forest Resources" indicates that Indiana timberland acreage and volume has steadily increased since 1967.

IN TESTIMONY WHEREOF, I, Mitchell E. Daniels, Jr., have hereunto set my hand and caused to be affixed the Great Seal of the State of Indiana on this 20th day of June, 2008.

Mitchell E. Daniels, Jr.

Governor of Indiana

ATTEST: Todd Rokita

Secretary of State

Appendix B: LEED NC 2.2 Scorecard for MSBII- Last updated July 08

LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

Multidisciplinary Science Building- Phase II

Indiana University, Bloomington, IN

Yes	?	No			
8	1	5	**Sustainable Sites**		**14** Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
	?		Credit 2	**Development Density & Community Connectivity**	1
1			Credit 3	**Brownfield Redevelopment**	1
1			Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
		1	Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
1			Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles	1
1			Credit 4.4	**Alternative Transportation**, Parking Capacity	1
		1	Credit 5.1	**Site Development,** Protect of Restore Habitat	1
1			Credit 5.2	**Site Development,** Maximize Open Space	1
		1	Credit 6.1	**Stormwater Design,** Quantity Control	1
1			Credit 6.2	**Stormwater Design,** Quality Control	1
1			Credit 7.1	**Heat Island Effect,** Non-Roof	1
		1	Credit 7.2	**Heat Island Effect,** Roof	1
		1	Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
3		2	**Water Efficiency**		**5** Points

Yes	?	No			
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
		1	Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
		1	Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
1			Credit 3.2	**Water Use Reduction**, 30% Reduction	1

Yes	?	No			
8	1	8		**Energy & Atmosphere**	**17** Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
5		5	Credit 1	**Optimize Energy Performance**	1 to 10
		3	Credit 2	**On-Site Renewable Energy**	1 to 3
1			Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
	?		Credit 5	**Measurement & Verification**	1
1			Credit 6	**Green Power**	1

continued…

Yes	?	No			
6	1	6		**Materials & Resources**	**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
1			Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1

Yes	?	No	Credit	Description	Points
		1	Credit 3.1	**Materials Reuse**, 5%	1
		1	Credit 3.2	**Materials Reuse**,10%	1
1			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
	?		Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regionally	1
1			Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Regionally	1
		1	Credit 6	**Rapidly Renewable Materials**	1
1			Credit 7	**Certified Wood**	1

12	1	2	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
1			Credit 1	**Outdoor Air Delivery Monitoring**	1
1			Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
1			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems**, Lighting	1
		1	Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
1			Credit 7.1	**Thermal Comfort**, Design	1
1			Credit 7.2	**Thermal Comfort**, Verification	1

Yes	?	No	Credit	Description	Points
		1	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
	?		Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No		
5			**Innovation & Design Process**	**5** Points

Yes	?	No	Credit	Description	Points
1			Credit 1.1	**Innovation in Design**: Exemplary Green Power	1
1			Credit 1.2	**Innovation in Design**: Exemplary Parking Capacity Reduction	1
1			Credit 1.3	**Innovation in Design**: Process Water Reduction	1
1			Credit 1.4	**Innovation in Design**: Green Housekeeping	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
42	4		**Project Totals (pre-certification estimates)**	**69** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

Special Thanks

Jeff Kaden, University Engineer and Director of Engineering Services

Charlie Matson, Engineering Services

Glenn Moulton, Utility Information Group

Kenn Horracks, Building Systems Group

Doug Trueblood, Building Systems Group

Tom Fallwell, Building Services

Dan Derheimer, Environmental Health and Safety

Steve Miller, Building Manager- Simon Hall

The Indiana University Sustainability Task Force

Works Cited

Scheuer, C., Keoleian, G. A., & Reppe, P. (2003). Life Cycle Energy and Environmental Performance of a New University Building: Modeling Challenges and Design Implications. *Energy and Buildings* , 1049-1064.

U.S. Green Building Council. (2008). *Green Building Research*. Retrieved August 22, 2008, from U.S. Green Building Council: http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1718

U.S. Green Building Council. (2007). *New Construction & Major Rennovation Version 2.2 Reference Guide.* Washington, DC: U.S. Green Building Council.