

SOSB

Smart Operators for Smart Buildings

An integrated approach to human resource development for sustainable facilities

Smart Operators for Smart Buildings was created by the City University of New York's Building Performance Lab and its Steven L. Newman Real Estate Institute to support property management firms in pursuit of near- and long-term sustainability goals through an integrated approach to human resources development.

Why This Now?

Last year, the decision to improve your properties' energy efficiency was a smart move: it promised to save money and underscore your company's commitment to sustainability. This year, it's the law. In December 2009, the City Council of New York passed the Greener, Greater Buildings Plan, a package of legislation that will reduce energy consumption in large-scale commercial properties through changes to the energy code and mandated lighting upgrades, sub-metering, energy benchmarking, and audits and retrofits.¹ In order to meet the requirements of the Plan, real estate companies are going to have to change how they do business in New York City – and change quickly.



How do you get from here to there? How do you bridge the knowledge gap, train your building operators, and benchmark all that square footage – *and then make good use of what is learned?* **Smart Operators for Smart Buildings** can help set your company on the road not only to compliance but also to other measures of sustainability, such as LEED for Existing Buildings certification, while improving the energy efficiency of your properties and saving money. The skills of your workforce are key to moving in this direction.

A Commitment to Training and Education

The goal of SOSB is to help you transition your management and engineering teams to the next generation of building performance, property by property. Property Managers (PMs) and Building Engineers (BEs) enter a dual-track training program that provides them with a common language and framework for attaining results. They implement action with the support of trained CUNY interns who can become part of the next generation of staff.

You could – and probably do – train your staff piecemeal. We want to help you get onto another path, one plotted out with a roadmap for new knowledge, new skills, and even a next generation of young people in tune with your sustainability goals. SOSB will help you plot out this roadmap and then implement it.

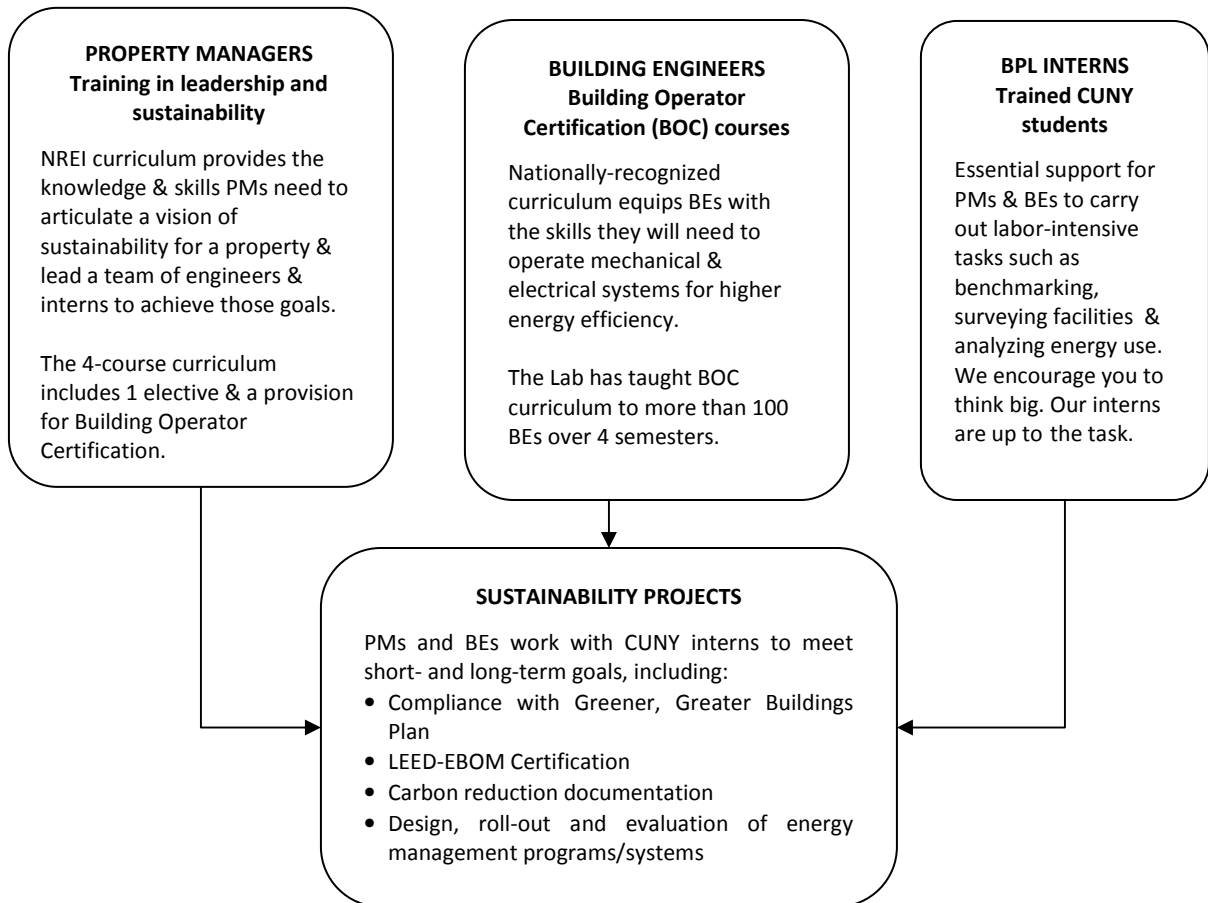
¹ A copy of the legislation can be found online:
http://www.nyc.gov/html/planyc2030/html/plan/buildings_plan.shtml

Making this program work requires **organizational commitment**. We encourage firms to

- Commit to the principle that training and the costs associated with it are necessary and valuable;
- Make a specific person in the organization responsible for this staff development function;
- Initially commit at least three buildings to the program, training at least two engineers and two property managers from each, so that they, with the assistance of Lab interns, can quickly make meaningful strides toward sustainability;
- Make a three-year commitment to the program so that results can be realized, tracked and documented while additional buildings and individuals enter the process.

How Does the Program Work?

Training for PMs and BEs is tied to actual projects and on-going improvement processes within your properties. We know that people learn best when their new knowledge can be directly applied, with results acting as feedback and reinforcement of the learning process.



A Closer Look at What Participants Will Learn

Property Managers

In the current marketplace, a smart PM is not only a good manager but should become well-versed in metrics of energy performance, a full gamut of sustainability metrics and appropriate project development. PMs enrolled in SOSB will take three courses plus an elective course through NREI that provide them with the skills and opportunity to establish baselines and project plans for their properties. Each course will be 15 hours:

1. Sustainability for Existing Buildings covers fundamentals of legal compliance, LEED-EBOM, energy use in building systems, indoor environmental quality, measures of energy performance, benchmarking and common energy efficiency measures.
2. Sustainable Process Management is based on the principles of Experienced-Based Learning. Participants will learn how to articulate a vision for sustainability, design a results-oriented project, lead a team of building engineers and interns, and quantify results. They'll have the opportunity to apply lessons learned in-class immediately to their on-the-job responsibilities.
3. Sustainable Project Finance examines how energy projects can be structured under various financing methods, specialized sources of funds, contract terms, and mechanisms for overcoming owner-tenant split incentives. All students develop a sample project.
4. Elective: one course will include provision for BOC for Property Managers certification, another will cover curriculum aimed at the brokerage side of the business.

PMs who take part in SOSB will have the option of taking additional NREI classes at a reduced tuition.

Building Engineers

Over the past two years, the Lab has partnered with the International Union of Operating Engineers Local 94, the NYC Department of Citywide Administrative Services, and others to offer the nationally recognized Building Operator Certification (BOC) to more than a hundred NYC building engineers. This offering will be expanded under SOSB, with opportunity for more organizations to participate.

The two-course curriculum includes:

1. Building Systems: An Energy Perspective covers energy use in HVAC and electrical systems and equipment, how it can be improved through operations, and what kinds of new technologies operators can expect to see, such as heat recovery and cogeneration.
2. Principles of Energy Management and Green Building Practice looks at energy data, including benchmarking, energy audits and relevant calculations, and maintenance and energy management.

In both courses students perform practical projects in their own facilities that start them down the road of recognizing energy performance improvements. This is great basic training that is incentivized by NYSERDA. Get as many of your people through this training as soon as possible.

Interns

Once PMs and BEs advance in their training, they will be able to define projects that can effectively utilize interns. We encourage you to think big. Our interns are up to the task.

Interns are CUNY undergraduates and graduates pursuing degrees in areas such as engineering, facilities management, and real estate who are trained by Lab staff in benchmarking with EPA Portfolio Manager, HVAC systems, energy analysis, sub-metering, and customer service. Over the past three years, Lab interns have benchmarked and analyzed all NYC Department of Education facilities; worked with property owners to secure NYSERDA incentives for efficiency improvements; designed and implemented research projects on topics such as indoor environmental quality and financing for energy efficiency improvements; helped a property management firm teach and promote a new energy information management platform for clients; and much more.

An intern can provide valuable support on short- and long-term projects and ideally will stay with your firm for several years, gaining experience in your sustainability agenda across buildings. He or she may even join the next generation of your workforce.



What It Will Cost

Costs will vary based on your organization's specifics. But we do ask for a minimum multi-year commitment so that our effort – and yours – can reach scale quickly and dependably, based on predictable participation.

Costs of what might be a typical program are shown below. Every partnership will be different, so we will tailor your package to your needs and budget.

We are presently able to apply NYSEDA incentives to write-down at least 50% of the direct training costs. We are also presently able to share costs of internships through the CUNY Workforce Development Initiative. This results in costs much lower than if you were underwriting training and certification for individual property managers, building engineers, and hiring new employees to carry out sustainability projects.

SCHEDULE OF UNIT COSTS		
Tuition + texts, BOC training per building engineer		1375
Tuition + texts, Sustainability training per Property Manager		1780
In-kind contribution of labor cost for class time @ \$100 per hour		
Property managers, 60 hours		6000
Engineers, 90 hours		9000
Interns, 2 per semester p/t + summer f/t		10440
(2 semesters, 15 wks each at 15 hrs/wk + 12 wks summer at 35 hrs/wk, \$12/hour)		
BPL administration, mentoring and support, per building per year		2000

THREE-YEAR BUDGET					
Integrated SOSB training commitment - SAMPLE BUDGET					
		Year 1	Year 2	Year 3	3- year total
Buildings in Program		3	5	7	
Property Managers, per building	2	\$ 10,680	\$ 7,120	\$ 7,120	\$ 24,920
Building Engineers, per building	4	\$ 16,500	\$ 11,000	\$ 11,000	\$ 38,500
Interns per building, full year (1/2 1st year)	.5 - 1	\$ 15,660	\$ 39,150	\$ 36,540	\$ 91,350
BPL/NREI administration, mentoring, support		\$ 6,000	\$ 10,000	\$ 14,000	\$ 30,000
In-kind contribution of labor-time in training		\$ 144,000	\$ 144,000	\$ 144,000	\$ 432,000
Total sample program costs		\$ 192,843	\$ 211,275	\$ 212,667	\$ 616,770
INCENTIVES					
NYSEDA (tuition share)	50%	\$ 13,590	\$ 9,060	\$ 9,060	\$ 31,710
CUNY WDI (intern share)	50%	\$ 7,830	\$ 19,575	\$ 18,270	\$ 45,675
Program cost net of incentives		\$ 171,423	\$ 182,640	\$ 185,337	\$ 539,400
NET CASH OUTLAY		\$ 27,423	\$ 38,640	\$ 41,337	\$ 107,400
(net program cost - in-kind contribution)					

Smart Operators, Smart Buildings is based on three successful programs run by the Lab in partnership with NREI:

Continuing Education

The Lab has trained more than a hundred operators in a series of Building Operator Certification courses. Students have come from organizations including the NYC Department of Citywide Administrative Services, Cushman Wakefield, and the International Union of Operating Engineers Local 94. SOSB represents a scaling up of this program.



Intern Energy Program

Over the past three years, Lab interns – CUNY students from a variety of disciplines – have helped to launch Vornado Realty Trust’s Energy Information Portal system, benchmarked part of Time Equities’ portfolio, and designed Smart Roofs for Sustainable South Bronx. Two Lab interns benchmarked and analyzed energy data for the entire NYC Department of Education – the largest data-set that the EPA Energy Star Portfolio Manager has handled. Interns are trained and mentored by CUNY staff and engineer professionals.

Building Performance Stakeholder Consortium

Finally, NREI and the Lab have worked closely with the city’s sustainable real estate community through a Stakeholder Consortium process that began in 2007. The group has grown to more than 200 members, including major property owners and managers, utilities, government agencies, labor unions, educators, and nonprofits. Input from members has shaped Lab and NREI programs and directed our growth. We’ve created SOSB because we’ve heard their calls for more training opportunities for the green building workforce.

Model: Vornado Realty Trust

We’re forging new ground with SOSB, but we’re modeling it on our partnership with Vornado Realty Trust. Representatives of the real estate firm were among the original members of the Stakeholder Consortium. In 2009, we worked with Vornado to offer two continuing education courses, Principles of Energy Management and Building Systems, to (NUMBER) of its building operators. That fall, Vornado sponsored two interns, both Baruch College MBA candidates, for the 2009-2010 academic year. The students are helping to launch the company’s Energy Information Portal system and are building relationships with Vornado clients.

For more information on SOSB, please contact Nora Sherman, Deputy Director of the CIUS Building Performance Lab at 646.660.6978 or nora.sherman@baruch.cuny.edu.

About Us

The Steven L. Newman Real Estate Institute

The Steven L. Newman Real Estate Institute, located at Baruch College, provides applied research, professional and continuing education, and conferences to the real estate industry, as well as organizations focused on public policy. Since its founding in 1996, the Institute has pursued and provided timely insight on critical urban issues beyond those traditionally associated with core real estate topics. Focus areas include sustainability, historic preservation, asset repositioning, energy efficiency, comparative market analysis, econometrics, property remediation, building retrofits, and public transportation needs to name but a few. The professional and continuing education offerings are New York State-approved and include certificate programs in real estate, sustainability, construction management, and facilities management. In all efforts, the Institute's approach is to identify pivotal theoretical knowledge and research and convert it into a clarified form for immediate assimilation by industry and related organizations, agencies, and professional organizations.

The CIUS Building Performance Lab

The Lab, a program of the CUNY Institute for Urban Systems, was founded in 2006 with the support of NYSERDA. Our mission is to help improve the energy efficiency and performance of New York City's stock of commercial and public buildings. We focus on workforce development initiatives, including training for building operators and an internship program that places CUNY student in sustainability projects with property management firms, city agencies, and nonprofit organizations, as well as student-led research. Since 2007, we have convened the NYC Building Performance Stakeholder Consortium, a 200-strong (and growing) cross-section of the city's real estate sector, including management firms, government agencies, labor unions, and nonprofit organizations.

BACKGROUND ON THE PROGRAM MODEL

Introduction

Being based in an academic institution our program has intellectual and pedagogical roots underlying its practical nature. This section explains this background. We hope it will encourage your engagement and commitment by demonstrating the quality of thought that informs the program.

STEM for Sustainability in the Built Environment

The program is based upon a practice-based learning model for the transfer of Science, Technology, Engineering and Mathematics (STEM) knowledge around Sustainability in the built environment. It is targeted at the professional community that manages the complex of structures and systems in which we work and live and at students who could productively enter this field. Success of the project will lead to significant acceleration of carbon reduction and sustainability work in a sector responsible for upwards of 40% of national energy use and carbon emissions.² Radical reduction of existing buildings' energy use is a major element in addressing the nation's carbon footprint, a prominent national policy goal with global consequences.³ Just small improvements in health and productivity, via improving the indoor environment in our buildings, can have enormous economic impacts.⁴

The project's STEM content is grounded in a "sustainability science" knowledge-set that includes physics-based building science⁵, building systems engineering, quantitative building performance evaluation,⁶ and science-based understanding of indoor environments, human health and productivity.⁷

Abstract STEM knowledge is made accessible and usable through concrete activities with hands-on learning-by-doing, reinforced by mentoring. The project applies a practice-based learning approach⁸ set in the workplace and within work teams to drive science-learning through science-application. Periodic public exhibition of on-going findings will reinforce the process. To evaluate the effectiveness of the approach, participants will be regularly assessed, based on defined objectives and multiple evaluation methods. We expect to show that a well-designed practice-based learning approach can make a huge difference in progress toward sustainability. The project provides long-term impact in helping provide the human resource that is needed for transformed building operations.

University-Industry Collaboration

² US Green Buildings Council <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1718>

³ "NYC Greener Greater Buildings" 4/21/09.

⁴ US Green Buildings Council, *op.cit.* and references in Note 4.

⁵ Handbook of Fundamentals American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

⁶ US EPA EnergyStar Portfolio Manager, www.energystar.us.gov, Federal Facilities Council of the National Research Council Learning from Our Buildings 2001

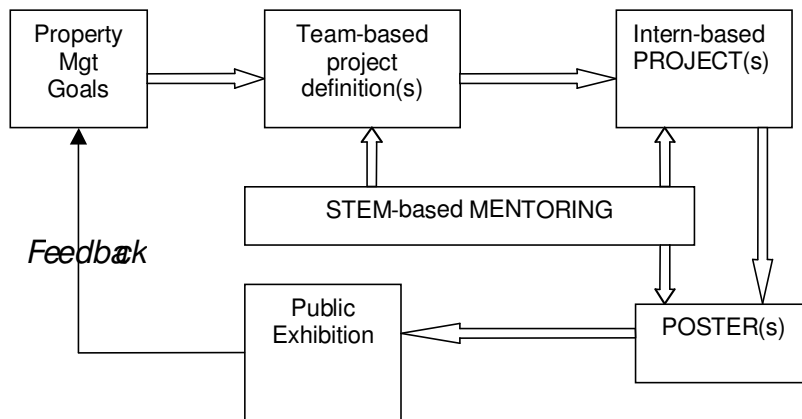
⁷ Wargoeki & Seppanen Indoor Climate and Productivity in Offices 2006; V.Loftness "Sustainable Design for Health and Productivity"

http://www.brown.edu/Departments/Environmental_Studies/documents/Loftness_BrownCES.pdf

⁸ incorporating Problem-based Learning and Case Method, see Project Design, below

The program is designed as an integrated collaboration between the local property management professional community and NYC’s public university. The project uses the university setting, in the form of its well-situated real estate institute, to develop the sense of a community “on the move” with localized continuing education courses and periodic exhibitions for showing progress and exchanging ideas. A combination of classroom and non-classroom transfer and application of new knowledge is at the heart of the program design, which consists of the following elements:

- Collaborative partnership that addresses the property management industry’s recognized need for progress on sustainable practices⁹
- Mentored internships¹⁰ that combine university-based technical resources with team-based projects in buildings managed by private sector partners,
- Student poster development for public exhibition
- Community feedback, contributing to further definition of evolving and new facility-level projects



The program builds on work that has been on-going at the Building Performance Lab since 2007 – maintaining a continuing dialogue with the local real estate industry through a stakeholder process called the NYC Building Performance Consortium, providing Building Operator Certification Training to building engineers, and developing internships with various property management and energy services firms and public agencies. The Lab provides technical expertise and connection with engineering professionals for the project development and mentoring aspect of the program.

Practice-based Learning in Property Management

The field of Property Management is at a potential tipping point for the widespread adoption of sustainable, science-based, “green” concepts. The private real estate and property

⁹ Defined as including energy and carbon-emission reductions through adoption of practices and technologies and improvements in indoor environmental quality, generally following the guidelines of the USGBC [LEED standard for Existing Buildings](#)

¹⁰ Applying a “coordinated model of School and Out-of-School Programs”, per Bell, op.cit. p.177

management sector understands that it must move in this direction but is just beginning to struggle with the mechanics of how to do so. The field has traditionally lacked STEM knowledge that would support this transformation. Our program aims to enhance both the near-term and long-term ability of property management *teams* to effectively take on this challenge.

From our pedagogical perspective, the workplace is an important setting for practice-based STEM learning. As organizational goals and objectives establish the need for quantitative, STEM-based improvement effort, they create a perfect opportunity for project-based learning, reinforced by practical, hands-on application. A university intervention in the private sector workplace can put learning into action, resulting in superior, documented outcomes along with superior learning by both property managers and interned students. Technically oriented students will provide useful skills to the property management team and property managers and building engineers will learn how to define projects that use STEM-based skills, utilizing interns and the mentoring and support resources available through the Building Performance Lab.

Unlike new building design and construction, the work conducted in existing buildings is largely invisible. A new green building provides a very public “iconic” positive feedback to the building owner, designer, and builder. For our project, student poster exhibitions will provide this positive feedback, reinforcing function. The student intern resource will make possible periodic exhibition of how facilities are changing their performance, so that the invisible progress will become visible through public exhibition and display. Where possible, we will seek to apply real-time “dashboards” that show building operating parameters and their broader implications. These are developed as front-end displays of building control systems and are graphically designed for the clear and powerful communication so that they can become focal points for heightened public awareness.

How the Program Works

The program teams student interns with pre-selected building managers and engineers, who are themselves engaged in sustainability education as part of the program. The long-term goal is, of course, to measurably increase building performance in terms of metrics that include energy targets, indoor air quality, lighting quality, acoustic quality and carbon footprinting. Closer-term goals are to create building managers who are able to define projects that will increase building performance, who are familiar with the associated technical analyses, and who can effectively deploy students in conducting projects, encouraging them to enter this field. The program will enhance building managers’ knowledge base and their sustainability project management capabilities while providing students with professional and practical experience.

How this looks in practice. A partnering Property Management firm assigns one or more Property Managers and Building Engineers to work with the program. Dialogue is engaged with the Building Performance Lab to establish the needs, goals, and kind of projects under consideration. Both PMs and Engineers commit to their own study tracks. One or more interns and a STEM/engineering mentor are assigned. The new team meets to define the project and the work plan, which is written up by the interns. The work plan includes objectives for the subject property or properties and also the learning objectives for the students. Work could include procedures and analytical work such as:

- collection of energy and water data and development of benchmarking indices (EPA EnergyStar Portfolio Manager tool),
- equipment inventories for development of system-level energy analysis,
- data-logging of building conditions and subsequent analysis,

- trend-history “pull-down” from Building Automation Systems
- documentation of operating procedures, control sequences of operation etc

The tasks, tools, objectives would all be defined as appropriate for the specific project. The project team meets monthly with their STEM Mentor to review progress throughout the one-year project. A preliminary poster is developed at the end of the first semester; a more comprehensive one for exhibition at the end of the project.

Evaluation

To evaluate the effectiveness of the program, building managers and students will be regularly assessed. Four types of evaluations will be conducted:

- A front-end evaluation to determine the knowledge that participants bring to the program and refine the program to focus on the needs of the building managers and interests of the students,
- Multiple formative evaluations to iteratively determine the effectiveness of the PBL approach used by the program and any modifications that are made to it, to identify progress, successes and barriers towards meeting the short-term goals,
- One or more remedial evaluations of the project definitions and building performance analysis and summary poster presentations, and
- A summative evaluation of the poster presentations and perceived ability.

Evaluations will be two dimensional¹¹ and assess both the intellectual excitement and the interpersonal rapport of the engineering mentors and participants, as a means to improve the way the program is conducted.

The formative, remedial and summative evaluations will be based on learning objectives that use Bloom’s taxonomy¹² of cognitive educational objectives to query ability to (1) recall and recognize, (2) comprehend, (3) apply, (4) analyze, (5) synthesize and (6) evaluate the technical material presented in the program, and evaluate ability to perform critical thinking.¹³ Learning objectives will be developed in conjunction with the engineering mentors, and will use rubrics to establish clear expectations of poor, average, good, and excellent levels of performance. The objectives will vary depending on the participant, as the short-term goals of the program also vary by participant. They will be circulated in advance to the participants, to establish clear expectations to the participants. Considerable time will be spent developing the objectives so that they are clearly defined and so that they use language which reflects the field.

Defining Appropriate Outcomes

Target outcomes are defined for the various participants. Some of these will be common to all and some will be distinct for each kind of participant. For example, all participants can be evaluated in terms of how they “experience excitement, interest and motivation to learn about phenomena” in the built environment; similarly, the project design requires “participation in scientific activities and learning practices with others, using scientific language and tools.”¹⁴ More specific outcomes for projects will be defined through a team-based activity at the

¹¹ Lowman, J. Mastering the Techniques of Teaching, 2nd Ed. San Francisco: Jossey-Bass, p 22-31, 1995.

¹² Bloom B.S., Madaus, G.F. and Hastings, J.T. Evaluation to Improve Learning. New York: McGraw Hill, 1981.

¹³ Smith, F. To Think. New York: Teachers College Press, 1990.

¹⁴ P. Bell Learning Science in Informal Environments p.4

beginning of each annual cycle of internships. Outcomes by participant category generally follow a form of:

- Project Management firms: quantifiable progress towards articulated sustainability goals
- Individual Property Managers and Building Engineers: increasing ability to define projects using sustainability-science tools and methods and internship resources
- Student Interns: familiarity with sustainability-science methods in buildings, engagement with concepts, and evolving career interests and commitments

Program Management

Specific areas of program managerial responsibility are as follows:

Property Management outreach and relationships and mounting of exhibits
Jack Nyman, Emily Grace PE, Newman Real Estate Institute (NREI)
Nora Sherman (BPL)

Sustainable Practices project development, intern recruitment, mentoring and support
Michael Bobker CEM, Nora Sherman, Peter Weisner, CIUS Building Performance Lab (BPL)

Learning Objectives and Evaluation
Dr. Ann Elizabeth Wittig, Department of Civil Engineering, CCNY