LEED, GREEN, and MEAN: Security Versus Sustainability

While the focus of many architecture courses and practice is on the sustainability of architecture and the built environment, emerging trends in the practice of LEED is resulting in litigation against the architect because the architect did not properly understand the security concerns of their client.

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Keeping academia relevant is sometimes difficult to achieve. What is relevant today is quickly history tomorrow. Florida Atlantic University offers a multi-disciplinary class that challenges architecture, urban planning and design, criminal justice, and public administration students the opportunity to understand the threats to our public safety in a course called Designing Safe Communities with Crime Prevention Through Environmental Design (CPTED). The course is an undergraduate course that is taught as a face-to-face hybrid, and as an e-learning course. The teaching methodology used to motivate students is based on the Therapeutic Community Teaching Concept (TCTC – W. Glasser, A. Bassin, H. Mower). Originally used as a method to motivate prison inmates to comply with rules and regulations, and take accountability for their actions (Alexander Machenochie), TCTC evolved into modern day corrections therapy that is used in many rehabilitation centers around the world to deal with addictive and criminal behaviors. This concept is based on a token economy of receiving earned credits after the inmate accomplishes identified, clearly defined tasks. If the inmate completes the tasks without incident, they are given rewards and additional freedoms that reward their responsible behavior. The same concepts are used with students, to define the goals of what is needed to achieve the all-illusive "A" in a course. Students in the Designing Safe Communities course control half of their grade with a series of small, manageable, achievable tasks, that build up confidence and knowledge in topical areas, while rewarding them with points that help them self actualize a high grade. Students that complete the course receive certification as a CPTED Practitioner, which is recognized in the State of Florida as an important credential in the law enforcement community, and in the architectural and planning communities, because many counties and/or cities in the state have passed security and/or CPTED regulations, resolutions, codes, or

ordinances that require architects to include security and CPTED features in new facilities and critical infrastructure for those city and county governments. As a result, the students see a potential job market advantage in receiving their CPTED certification, which opens up doors for CPTED plan review, or inclusion of CPTED in design and planning firms.

CPTED is the field which believes that through the proper use and design of the built environment, you can reduce the opportunity and fear of predatory stranger-to-stranger type crime, and as a result improve the quality of life (the experience of how one chooses to live, work, and play). CPTED can be used to reduce street crime, workplace violence, terrorism, and uses an all-hazard approach to deal with critical infrastructure protection, as well as natural and man made disasters.

One of the most relevant topic areas presented in the course is on designing secure, yet sustainable buildings, and the impact the LEED and Green Building Design is having on the security community. What is not often understood is the impact that sustainable buildings are having on security of those buildings and users. It is assumed that sustainable and Green projects are always in the best interest of the planet and the building users; but what is becoming apparent is that there are often conflicting goals that must be resolved, so that the buildings are sustainable, yet secure. Security is presented as crime prevention through environmental design (CPTED), and sustainability is presented by the goals of the U.S. Green Building Council (USGBC) and the Leadership in Energy and Environmental Design (LEED) rating systems. Both of these design approaches have considerable merit, but do CPTED and LEED share compatible goals?

This article will examine the goals of sustainability and LEED rating systems comparing areas of potential conflict and areas of compatibility along with some possible conflict resolution. Essential to the discussion is the understanding that the LEED process has priorities, which sometimes need to be weighed in order to select the highest and best use. The LEED credits may sometimes be at odds with security objectives. This weighing in of sustainability as applied to security, is yet another layer of considerations that needs to be included from the beginning of the design process. Contemporary buildings seek LEED certification because of requirements of the client (private and public government sectors), emerging codes and industry standards, economy of savings from decreased energy consumptions, and status as a certified building. Therefore, if buildings are going to seek out sustainability, energy efficient goals, and certifications as major design and management directives, then protecting the assets of these buildings is a symbiotic and equally important goal. If addressed properly, the goals of LEED and CPTED can be compatible with each other, and find mutual ground, creating true building synergy.

CPTED GOAL: IMPROVE THE QUALITY OF LIFE

Finding the balance between CPTED and LEED will improve development and the quality of life for persons living, working, or playing in the cities. It is important to follow the process of finding the balance between CPTED and LEED by first: identifying energy efficiency goals; then identifying security goals; and lastly, using this information to mitigate the conflicts through design or technology.

WHAT DOES IT MEAN TO BE GREEN

There are numerous alternatives to LEED that can be sought after to gain a green building certification as well as more under development, including Green Globes, LEED and another rating system rising in popularity, is the Living Building Challenge. LEED is the rating system that is usually looked to as the leader in rating systems that defines, promotes, and certifies what is a sustainable building. It is a requirement for all federal, some state, and county and municipal buildings.

THE LEED RATING SYSTEM

LEED or Leadership in Energy and Environmental Design has become the driving force behind the green building movement in America. LEED has become a global powerhouse constantly revising and improving its definition, assessment, and promotion of green buildings. The LEED certification program is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. The originators of this standard, The U. S. Green Building Council, or USGBC, describes LEED as "a national standard that aims to improve environmental, health and economic performance of buildings using established and / or advanced industry principals, practices, materials, and standards". The LEED program promotes a whole-building approach by recognizing performance in key areas of human and environmental health as well as environmental design. These areas include: sustainable sites, water conservation, energy efficiency, materials selection, indoor environmental quality, and regional prioritization.

There are numerous LEED rating systems for almost every type of construction: New Construction; Existing Buildings, Commercial Interiors, Core and Shell, Schools, Retail, Healthcare, Homes, and Neighborhood Development with additional rating systems under development.

Currently there are six LEED rating systems, version 3.0 (2010), that address commercial construction:

- LEED-NC for new construction and major renovations
- LEED-EB O&M for existing buildings operations and maintenance
- LEED-CI for commercial interiors projects
- LEED-C&S for core and shell development projects
- LEED-HC for healthcare
- LEED-ND for neighborhood development

Within each of these systems, there are four levels of certification that can be achieved, (in order from lowest to highest): certified, silver, gold, and platinum. LEED-NC 3.0 outlines 110 potential credits than can be granted, which is consistent with all of the rating systems, except for Homes, which are 136 credits. A project gains a higher level of certification according to how many credits are granted, with a minimum of 40 needed for certification. Prerequisites credits, which provide no points, must be satisfied in each credit category before a credit can be awarded points.

The LEED rating system development schedule is currently undergoing an updating and the next version is expected in November 2013. The new

LEED number of prerequisites will be increased from 9 to 15. The number of credit categories will also increase from seven in the LEED 2009 version to ten in the new LEED draft version. The current credit categories are:

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation in Design (innovation in Operations for LEED EB O&M)
- Regional Priority

Specific to the rating system LEED ND – Neighborhood Development are three additional categories:

- Smart Location and Linkage
- Neighborhood Pattern and Design
- Green Infrastructure and Buildings

Added to the credit categories are:

- "Integrated Process" category
- "Location and Transportation" category
- "Performance" category

THE PROCESS TO FINDING COMPATIBILITY

The key to making CPTED compatible with the sustainability goals of LEED standards is to balance energy consumption, resource conservation and sustainable communities with emerging security needs. For example, with properly planned lighting, building owners can adhere to light pollution or-dinances while maintaining uniformity on the site, thus creating a safe environment.

Although costs for energy can be great, the architects and clients must not underestimate the costs associated with a functionally integrated security and sustainability system. LEED goals do not directly take into account security considerations. Therefore, the identification of security goals is extremely important to ensure that product selection does not make the property more vulnerable to criminal acts and jeopardize LEED certifications. The most effective way to balance sustainability and security is to address the identified sustainability goals and security goals during the predesign phase known as architectural programming. CPTED and LEED are alike in the fact that they both based on environmental design and become economically skewed when implementing either concept as a retrofit.

POTENTIAL LEED CREDITS AND SYNERGISTIC OPPORTUNITIES

Credit NPD Prerequisite 1: Walkable Streets, required

A prerequisite is a required element or additional credits cannot be obtained in that credit category. Addressing the building in relation to the street, "90%

of new building frontage, a principal functional entry on the front façade faces a public square…the square…must be at least 50 feet wide at a point perpendicular to each entry." It further states that "Continuous sidewalks …for walking are provided along both sides of 90% of streets or frontage within the project…new sidewalks, whether adjacent to streets or not, must be at least 8 feet wide on retail or mixed-use blocks and at least 4 feet wide on all other blocks". This prerequisite is compatible with CPTED and security strategies of natural surveillance and legitimate activity support.

Credit NPD Credit 1: Walkable Streets 1-12 pts.
The Neighborhood Development rating system was developed with the collaborative efforts of the USGBC, the Natural Resources Defense Council, and the Congress for the New Urbanism. Walkable streets are one on their main tenets for viable and sustainable communities. Maintaining building edges close to street edges while fostering greater socialization can be problematical for security concerns especially when it is desirable to maintain a standoff distance away from the street. Blast setbacks are utilized to prevent an explosion compromising the structural integrity of the building. This can be accomplished in a variety of ways including creating wide buffer zones with perimeter barriers that could obstruct a vehicle from compromising the standoff distance. Of the 12 points available, there are 16 options from which to choose from to satisfy this credit.

With these kinds of requirements, security and sustainability are in direct conflict. Resolution could involve designing a core building within a building to create a setback distance. Structural systems utilizing poured-in-place reinforced concrete structures, and facades constructed using local aggregate provide mass and ductility may provide for excellent blast resistance. A trombe wall, which is typically found in a desert climate is a thick wall that is designed to absorb heat by day to be released at night. It also provides excellent blast mitigation simultaneously providing for reduced energy use. The use of recycled steel, which can be as high as 90%, also adds structural integrity.

The inclusion of a square or plaza in front of the building would provide an adequate stand-off distance, as well as, providing a place for community gatherings, providing there are vehicle barriers or bollards that are in place to prevent unauthorized vehicle traffic on the plazas or courtyards. The placement of a monumental fountain can provide a focal point, as well as, provide an additional layer of vehicle intrusion protection. Installing structurally anchored planters can be used both for seating, as well as, serving as a vehicle barrier. Using soft beds of soil can be a "tiger trap" for vehicles. (See Figure 1) A truck's wheels would become engaged in the soft soil preventing it from moving forward. Including partially buried structures reinforced with earth, which is a natural and highly efficient method for providing blast mitigation could serve as wonderful public space.

The additional requirement of a punctuated facade with fenestration either by windows and/or doors is another issue for security. Hurricane impact windows and glazing systems used in areas prone to high wind storms and hurricanes is an energy efficient choice, as well as, providing for security against forced entry protection (burglary resistance), as the glazing is designed for wind impact of up to 115 mph, and higher making it nearly impenetrable. While this

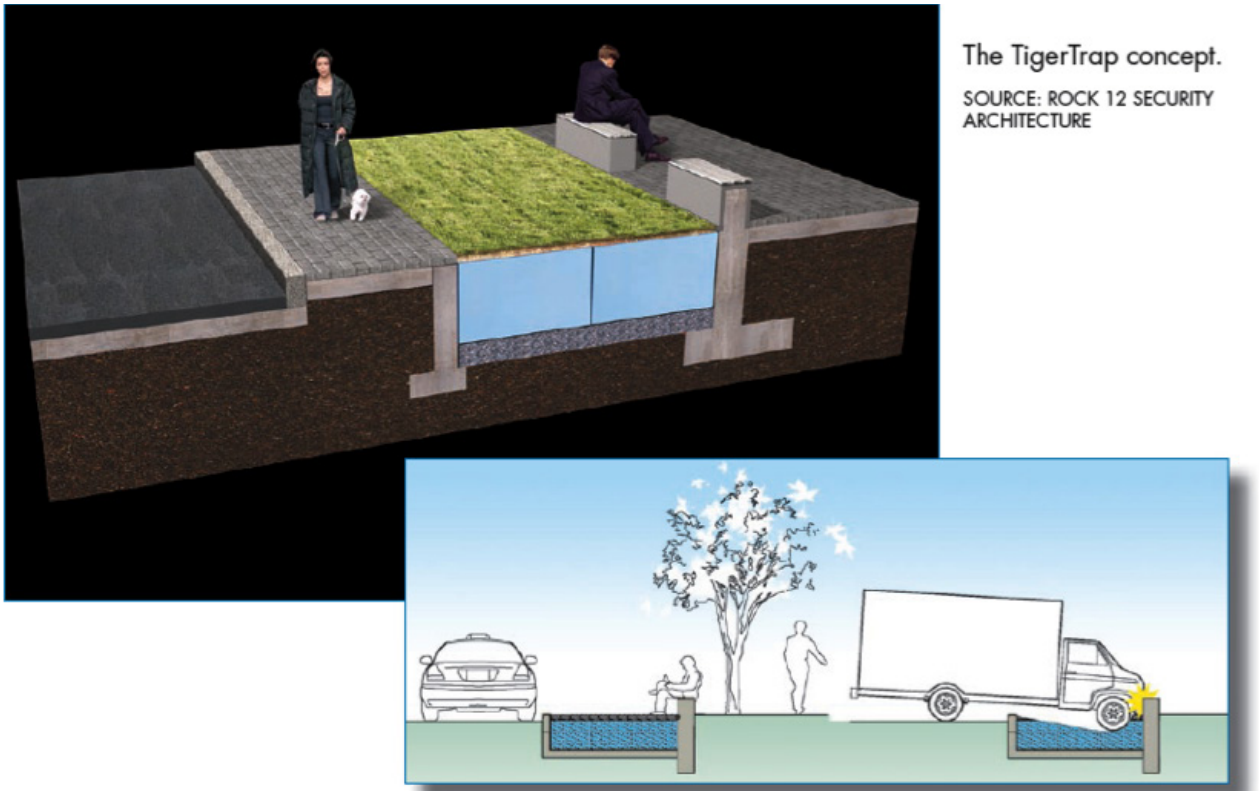

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Figure 1: A Tiger Trap acts as a vehicle barrier and entrapment for potential car bombs. Source: Rock 12 Security Architecture

does not work well with a naturally ventilated building, for ground floor window protection, the goals are compatible for security and sustainability.

Having a raised level could be advantageous in that it creates a natural boundary to stop or slow down an approaching vehicle, as well as, serving as a protection from potential flooding. However, all level changes must be compliant and compatible with accessibility requirements. The approach of building a core building within a building could also serve as an opportunity to create mixed-use projects flanking the building with retail and/or dwelling units, serving as a physical standoff distance. Green vegetative living walls, and water walls, that could both capture storm-water and prepare grey water for re-use, could be brought into the building's design disguising blast walls or vehicle barriers. Water features and living walls have the additional benefit of absorbing CO2 simultaneously reducing greenhouse gas emissions while providing for an enhanced pedestrian experience.

It is clear that a building requiring a high level of security would need to address these issues from the very beginning of the project. It is anticipated that municipalities considering LEED as a voluntary or mandatory guiding rating system by which they will require compliance will probably move away from the stand alone building to the interaction of multiple buildings, and move toward the utilization of the Neighborhood Development Rating (NDR) system.

SS Credit 1: Site Selection states,

> "Avoid the development of inappropriate sites and reduce the environmental impact from the location of a building on a site."

LEED asks for taking measures to preserve a site's natural features by incorporating them into the design for thermal, acoustic, and aesthetic benefit.

Security is a critical feature that should be added to this list. The building footprint should be minimized and integrated into the site, thus maximizing the natural elements that already exist for sustainability and security purposes. Municipalities that give incentives for sustainable development with increased floor area ratios (FAR) are counter to the goal of security.

Providing landscape controls that aid storm-water design directly contribute to exterior building safety by providing a perfect opportunity to set the building back away from the street providing for a standoff distance for blast control. However, this is in conflict with some current urban design guidelines that encourage buildings being set closer to the street's edge to encourage greater street interaction which builds a sense of community and encourages natural surveillance and legitimate activity support.

CPTED can create natural vehicle barriers with Tiger Traps, arroyos, and ha-ha walls that are not obvious to the eye but provide their level of security when intruded upon. Tiger Traps are clever in design; it allows for the "planned" collapse of physical elements designed to provide a vehicle barrier, impeding or stopping an intruding vehicle.

SS Credit 7.1 Heat Island Effect – Non-roof

> "Intent: Reduce heat islands to minimize impacts on microclimates and human and wildlife habitats."

Sustainability goals call for reducing heat islands impact by utilizing shade from trees, or architectural shades, or even a green roof. This credit encourages reducing ground coverage of open parking lots by placing parking underground to minimize the heat island effect, however this can be problematic for building security. A bomb blast under the building would be far more destructive than one detonated outside the building. An excellent way to resolve this is to utilize solar panels as shading devices for ground parking. In this way the solar panels provide for electricity, as well as effectively shading the cars reducing the heat island effect. Vehicle shading will also have the residual effect of providing a cooler car interior during the warmer months reducing the need to immediately crank up the A/C, reducing fuel usage, and releasing less CO2 emissions into the air, a wonderful multi synergistic opportunity. The solar panels can also incorporate solar lighting further reducing energy consumption and costs.

The use of exterior trellis and other exterior structures to support vegetative shading, as well as canopy trees contribute positively to reducing temperatures and carbon sequestration. Placement must be coordinated with exterior security measures so as not to block the view of security cameras, or provide hiding spots that can support criminal behavior. An additional benefit to using a mature tree is that it provides shade that can reduce a building's energy use. It should also have a diameter over 8" that could stop ramming by a vehicle and serve as a vehicle barrier. Every effort should be made to utilize and maintain any existing trees that already exist on this site.

Vegetative roofs affect storm-water retention for both quantity and quality. By providing a cool, non-reflective surface it reduces the heat island effect contributing to minimizing the climatic wear on the roof resulting in a longer system lifetime. This saves the cost of repair and early replacement. The vegetation also serves to clean the air absorbing CO2 and provides for a

visually appealing surface, something with which a white roof cannot compete. It is also critical in protecting wildlife that can be confused and damaged by highly reflective surfaces.

From an aerial perspective, a vegetative roof can look similar and blend into the rest of the landscape area. With no visible distinction between building rooftop and the ground plane, it provides a camouflage that protects it from aerial terrorist attacks. While sustainability calls for a green roof, security has concerns for access control. Most green roofs become accessible spaces by building patrons or guests with access to the roofs, the probability for planting contraband, suicide jumpers, snipers, bombers, or sabotage to mechanical systems is greatly increased. Therefore, careful decisions must be made as to whom, and when persons gain access to the roof and how they are supervised.

SS Credit 8: Light Pollution Reduction

> "Intent: minimize light trespass from the building and site, reduce skyglow to increase night sky access, improve nighttime visibility through glare reduction and reduce development impact from lighting on nocturnal environments."

This is perhaps the one credit looked at as the most challenging in balancing sustainability goals with security requirements. The purpose of security lighting is to deter illegal behavior, make users feel and be safe, maximize the probability of visual identification of intruders and trespassers, support and enhance CCTV operation while denying criminals camouflage. Security calls for increased outdoor lighting in order to deter crime, while sustainability calls for minimal outdoor lighting and minimizing indoor lighting that escapes from the building reducing light pollution and conserving en-ergy. This includes no decorative facade lighting.

One goal in LEED standards is that a sustainable building should minimize light pollution from both interior and exterior light sources. CPTED concepts typically require exterior environments to be generously lit in order to maintain a safe and secure environment at night. With such conflicting goals, is there a way to approach both LEED and CPTED requirements so that they agree with one another?

Buildings can receive LEED credits by decreasing nighttime light, glare, and overall light pollution. Light trespass and pollution is defined as light that illuminates areas beyond the property, and up skyward, contributing to sky glow. Parking lot lights are often a cause of light pollution. Many security professionals worry that reducing light in parking lots to meet LEED guidelines could make the areas more vulnerable to crime. Improvements in low-light camera technology require less necessary light. However, attaching an infrared illuminator to a camera lenses can compensate for the difference in light levels. Using variable intensity lighting systems, such as LED, can be adjusted according to the ambient light, in order to achieve the level of lighting selected by the user via a sensor-control system.

Most parking lots and garages have a constant level of lighting for all of its users. However, if the employee parking lots are separated from visitor sites, they can be closed at night if they are not being used. For example, shopping mall parking areas can power down after 10 p.m. when the malls close. Motion sensors can be used to activate the lights in the event

someone enters the area after the lots are closed and dark, or trespass without authorization, and thus would trigger exterior lights and an alarm condition for security cameras to record and security to respond.

It may be difficult, but LEED Credit 8 can be achieved by using these critical methods in planning the design:

1. Using proper placement and orientation of all interior and exterior lighting,
2. Eliminating exterior uplights, and
3. The use of full-cutoff luminaries.

Light fixtures should be designed with cutoffs, reflectors, deflectors, or covers to direct light only where it is necessary. This credit is currently being reviewed to address particular circumstances such as security lighting for buildings with zero lot lines, or in an urban setting.

Cities have been looking to solar and LED street lights as ways to reduce energy use, as well as turning off lights after midnight except at busy street intersections. There have been issues with LED street lights because they do not heat up as traditional lights, so in the winter where there is snow and freezing temperatures the lights are being covered with snow and remaining covered and not melting the snow in the traffic signal, hindering easy recognition of the signal color. The Energy Independence and Security Act of 2007, mandates the phase out of all incandescent lamps above 40 watts and below 150 watts by the year 2014, and will now require the use of alternative light bulbs such as LED or compact fluorescents.

IEQ Credit 8.1: Daylight and Views - Daylight

> "Intent: Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building."

This credit requires the building to provide daylight illumination levels of 25 footcandles for at least 75% of all regularly occupied spaces. If the building is a naturally ventilated, then operable window, louvers and vents will also be incorporated into the formula. Security directives would desire that skylights be alarmed and possibly translucent to protect privacy and potential proprietary information. While daylights and skylighting are beneficial for reducing the building's energy use, they pose a challenge for building security. Windows present more entry and exit points. They also allow pollutants, contaminants, and toxins to more readily enter the building. Strategic placement of the windows is critical to achieving both the goal of daylighting levels, sustainability and security. The design of the building could incorporate courtyards or exterior stepped conditions to allow for natural ventilation, operable windows, and skylights, yet coexist with security.

SUMMARY

It is important for architectural academia keep current with relevant topics that motivate and excite students to participate fully. This article has demonstrated that while there are many challenges that arise when attempting to design a building that is both secure and sustainable, there are new developments and technologies available today that make it possible to overcome these conflicts in cost-effective and efficient ways. The key is to consider both security and sustainability from the outset of the design process. By

doing so, it becomes possible to integrate systems and achieve goals that satisfy both objectives. If, however, sustainability alone is kept in mind throughout the design process and security is simply an afterthought, the safety of the building is sure to suffer. Indeed, if a balance of sustainability and security is not sought from the beginning of the design process, it is highly unlikely that the necessary steps for establishing adequate security levels will ever be taken, resulting in greater risk for the building's owners, occupants, and the entire community. If, however, security is brought to the table with other stakeholders early on in the building's design, it becomes possible to integrate security and sustainability so that both are maximized. The risk management and sustainability solutions that can be found through such integration will benefit all the stakeholders involved.

REFERENCES

"Chapter 4:Perimeter Security Design" FEMA (http://www.fema.gov/library/file?file=430_ch4.txt&fileid=9755cfa0-d0df-11dc-af98-001185636fb7&type=originalAccessibleFormatFile) retrieved: 5.22.2011

Colquhoun, Ian Design out Crime: Creating Safe and Sustainable Communities

Architectural Press Burlington, Ma 2004

Congress for the New Urbanism (CNU) website: (http://www.cnu.org)

Dixon, Chris. "LEED 2012," Walls & Ceilings Magazine. February 2011

Environmental Protection Agency (EPA) website: (http://www.epa.gov/)

"Federal Research and Development Agenda for Net-Zero Energy, High Performance Green Buildings" U.S. National Science and Technology Council October 2008

Gordon, Carey L. and W. Brill "The Expanding Role of Crime Prevention through Environmental De-sign in Premises Liability" National Institute of Justice, Research in Brief. April issue 1996

Green Building Certification Institute (GBCI) website: (http://www.gbci.org/homepage.aspx)

Green Globes website: (http://www.greenglobes.com/)

Illuminating Engineering Society of North America (IESNA) website: (http://www.iesna.org)

International Dark-Sky Association website: (http://www.darksky.org)

O'Neill, Dan, Roger Rueda, Jenna Savage "Security Design for Sustainable Buildings and Campuses" Applied Risk Management, LLC Massachusetts 2009

Spadanuta, Laura "The Greening of Security" Security Management Security's, Web Connection July 2008

Smith, Gayle. What is sustainable security? National Security Strategy 6/19/08. Center for American Progress.

U.S. Department of Energy (DOE) website: (http://www.energy.gov)

U.S. Department of Energy Efficiency and Renewable Energy ANSI/ASHRAE/IESNA Standard 90.1-2007

U.S. Green Building Council (USGBC) website: (http://www.usbgc.org)