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Urban sustainability through green building

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URBAN SUSTAINABILITY
THROUGH GREEN BUILDING

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ABSTRACT

URBAN SUSTAINABILITY THROUGH GREEN BUILDING

This analysis is presented on urban sustainability through the use of "green building" in the City of Las Vegas, Nevada. This paper discusses the current practices used by the City of Las Vegas and compares them to the top 5 sustainable cities throughout the United States (as identified by the U.S. Green Building Council). Through comparison of nationwide initiatives and policies, this paper outlines recommendations the City of Las Vegas can adopt to increase their position as one of the leading sustainable cities.
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Introduction

Green Building

The built environment has a profound impact on our natural environment, economy, health, and productivity. In the United States alone, buildings account for:

- 65% of electricity consumption,
- 36% of energy use,
- 30% of greenhouse gas emissions,
- 30% of raw materials use,
- 30% of waste output (136 million tons annually), and
- 12% of potable water consumption (USGBC, 2006).

The Office of the Federal Environmental Executive defines green building as “the practice of increasing the efficiency with which buildings and their sites use energy, water, and materials, and reducing building impacts on human health and the environment, through better siting, design, construction, operation, maintenance, and removal — the complete building life cycle.”

Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high performance building (US Environmental Protection Agency, 2007).

History of Green Building

In 1969, the United States established the first national policy for environmental sustainability called National Environmental Policy Act (NEPA). Seeking to promote general

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1 Sustainable Las Vegas 2007 - City of Las Vegas Planning Department – www.lasvegasnevada.gov
welfare, environment preservation and fulfill social and economic needs for the present and future (www.usgbc.org). It wasn’t until oil prices increased in the 1970’s, however, that significant research to discover improved energy efficiency and renewable energy sources became a priority. This newfound environmental movement led to early experimentation with contemporary green building. (www.greenerbuildings.com)

In the late 1980’s, NASA scientist James Hansen, published a study on global warming, which the New York Times quickly published on its front-page. The article discussed how the world’s climate had been getting progressively warmer over time, due in large part to increasing chemical production and pollution. The public attention generated by the Times, pressured, then President Ronald Reagan to sign the “Global Climate Protection Act,” a move that required his administration to prepare a plan to examine and combat the effects of greenhouse gases (http://www.aip.org/history/climate/Govt.htm).

By 1987, environmental concern had grown so strong in the scientific and public arenas, that the United States and several other countries around the world signed the “Montreal Protocol,” an international treaty restricting the production of chemicals and other products that destroy the ozone. In 1988, treaty members formed the Intergovernmental Panel on Climate Change and after joining the National Academy of Science, they served as the official climate adviser to the U.S. government (http://www.aip.org/history/climate/Govt.htm).

During the 1990’s, the United States government began taking a more active approach to sustainability in a myriad of ways. The Environmental Protection Agency and the U.S. Department of Energy launched the residential “Energy Star Program” in 1992. In 1993 the non-profit, U.S. Green Building Council (USGBC) was founded, and 5 years later the agency
introduced its Leadership in Energy and Environmental Design (LEED) program, designed to advance sustainable building practices throughout the U.S. (www.epa.gov).

In 1997, then Vice President Al Gore began championing environmental issues at a conference held in Kyoto, Japan. Gore worked with international leaders to broker an international agreement called the “Kyoto Protocol.” The agreement set binding targets for 37 industrialized countries and the European Union, for reducing greenhouse gas emissions. To date, 180 nations have since ratified the treaty and many have set standards and benchmarks to track their achievements (http://www.aip.org/history/climate/govt.htm).

Why Do Cities Pursue Green Building

While many cities around the world have adopted strong policies and programs to reduce pollution, more action is needed at the local, state and federal level to meet the ever growing challenge. The task of how to approach this need for local involvement was decided upon by the U.S. Conference of Mayors (Garcia, 2007). At their annual meeting in 2005, and following in the footsteps of the Kyoto Protocol, 141 mayors developed, ratified and signed the U.S. Conference of Mayors Climate Protection Agreement. The agreement, where supporting mayors pledged to reduce carbon dioxide emissions and strengthen local efforts to become more environmentally conscious by 2012, currently bears the signatures of many elected officials from around the country, including Mayor Oscar Goodman of Las Vegas.

Under the Agreement, participating cities commit to take following three actions:

• Strive to meet or beat Kyoto Protocol targets in their communities, through actions ranging from anti-sprawl land-use policies, to urban forest restoration projects and public information campaigns;
• Urge their state and the federal governments, to enact policies and programs to meet or
beat the greenhouse gas emission reduction target suggested for the United States by 7
percent; and

• Urge the U.S. Congress to pass the bipartisan greenhouse gas reduction legislation, which
would establish a national emission trading system (Garcia, 2007).

Following the signing of this agreement, the Las Vegas City Council took steps to further
the green initiative within Nevada, by approving the Green Building Program resolution on
October 18, 2006. According to the City of Las Vegas planning department, “green building is
about implementing construction practices to design, construct and operate a comprehensive
systems approach to reduce current environmental, social and economic impacts on government,
while safeguarding natural resources (City of Las Vegas, 2007).”

Within the city’s Green Building Program is a commitment that all new city facilities will
be Leadership in Energy and Environmental Design (LEED) certified. The city is further
committing 25 percent of any incremental annual increase in power, natural gas and solid waste
franchise fees, not to exceed $2.5 million per year, for its sustainability initiative (City of Las
Vegas, 2007).

Green Building Efficiencies

The City of Las Vegas has identified green building efficiencies to include energy reduction
of residences, manufacturers, and various building components and appliances. Efficiencies will
be reported as they relate to energy consumption, water usage, waste and toxic reduction, indoor
air quality and sustainable development. The city’s focus is as follows:
Energy Efficiency

- Develop strategies to provide natural lighting. Studies have shown that it has a positive impact on productivity and well being.
- Install high-efficiency lighting systems with advanced lighting controls. Include motion sensors tied to dimmable lighting controls. Task lighting reduces general overhead light levels.
- Use a properly sized and energy-efficient heat/cooling system in conjunction with a thermally efficient building shell. Maximize light colors for roofing and wall finish materials; install high R-value wall and ceiling insulation; and use minimal glass on east and west exposures.
- Minimize the electric loads from lighting, equipment, and appliances.
- Consider alternative energy sources such as photovoltaics and fuel cells that are now available in new products and applications. Renewable energy sources provide a great symbol of emerging technologies for the future.

Materials Efficiency

- Select sustainable construction materials and products by evaluating several characteristics such as reused and recycled content, zero or low off gassing of harmful air emissions, zero or low toxicity, sustainably harvested materials, high recyclability, durability, longevity, and local production. Such products promote resource conservation and efficiency. Using recycled-content products also helps develop markets for recycled materials that are being diverted from California's landfills, as mandated by the Integrated Waste Management Act.
• Reuse and recycle construction and demolition materials. For example, using inert demolition materials as a base course for a parking lot keeps materials out of landfills and costs less.
• Require plans for managing materials through deconstruction, demolition, and construction.
• Design with adequate space to facilitate recycling collection and to incorporate a solid waste management program that prevents waste generation.

**Water Efficiency**

• Design for dual plumbing to use recycled water for toilet flushing or a gray water system that recovers rainwater or other non-potable water for site irrigation.
• Minimize wastewater by using ultra low-flush toilets, low-flow shower heads, and other water conserving fixtures.
• Meter the landscape separately from buildings. Use micro-irrigation (which excludes sprinklers and high-pressure sprayers) to supply water in non-turf areas.

**Occupant Health and Safety**

• Recent studies reveal that buildings with good overall environmental quality can reduce the rate of respiratory disease, allergy, asthma, sick building symptoms, and enhance worker performance. (CIWMB, 2008)

• Choose construction materials and interior finish products with zero or low emissions to improve indoor air quality. Many building materials and cleaning/maintenance products
emit toxic gases, such as volatile organic compounds (VOC) and formaldehyde. These gases can have a detrimental impact on occupants' health and productivity.

- Provide adequate ventilation and a high-efficiency, in-duct filtration system. Heating and cooling systems that ensure adequate ventilation and proper filtration can have a dramatic and positive impact on indoor air quality.

- Prevent indoor microbial contamination through selection of materials resistant to microbial growth, provide effective drainage from the roof and surrounding landscape, install adequate ventilation in bathrooms, allow proper drainage of air-conditioning coils, and design other building systems to control humidity.

**Building Operation and Maintenance**

- Green building measures cannot achieve their goals unless they work as intended. Building commissioning includes testing and adjusting the mechanical, electrical, and plumbing systems to ensure that all equipment meets design criteria. It also includes instructing the staff on the operation and maintenance of equipment.

- Over time, building performance can be assured through measurement, adjustment, and upgrading. Proper maintenance ensures that a building continues to perform as designed and commissioned.

**Benefits of Green Building**

The Las Vegas Springs Preserve and the award-winning Lied Animal Campus have been designed with some of the most advanced and comprehensive green building practices, methods and systems to date. In addition to water and energy conservation, the city advocates using
building materials efficiently, incorporating recycled and renewable products and improving the overall indoor environment (City of Las Vegas, 2007).

**Figure 1**

![Average Savings of Green Buildings](image)

Some of the advantages the City of Las Vegas has identified for building green include environmental, social and economic benefits as follows:

**Environmental**
- enhancing and protecting biodiversity and ecosystems
- improving air and water quality
- reducing waste streams; conserving energy and water; and
- restoring natural resources

**Social**
- enhancing occupant comfort and health
- heightening aesthetic qualities; minimizing strain on local infrastructure; and
- improving overall quality of life, which allows for healthier places to live and work

**Economic**
- reducing operating costs
- creating, expanding and shaping markets for green product and services
improving occupant productivity; and

- optimizing life-cycle economic performance (Kirk, 2005)

**LEED Certification**

USGBC developed and implemented a green rating system that encourages best practices in design and contributes to advances in green building technologies, integrated design and operating practices. The Leadership in Energy & Environmental Design ® (LEED) Green Building Rating System is known for its credibility and integrity. LEED provides a well-respected standard of measurement for defining what constitutes a "green building" in both the United States and around the world.

LEED serves as a benchmark for the design, construction and operation of high-performance green buildings and promotes healthier human environments and environmental quality (US Green Building Council, 2006). Buildings are given a certification rating based on the number of points they receive through site evaluations².

The four levels of LEED certification are:

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

To reach a LEED certification level, developers must complete three principal requirements to earn point: predetermined prerequisites, core credits and innovation credits.

Prerequisites points require certain elements be met before a project can be considered for LEED certification (typically projects meeting these requirements fall under the LEED Certified level).

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² Based upon the U.S. Green Building Council's LEED for New Construction, Registered Project Checklist – www.usgbc.org
Core credits are awarded when specific actions are addressed or introduced on a project the any of the following five areas; water efficiency, energy and atmosphere, materials and resources indoor environmental quality and overall sustainable site. Finally, innovation credits are given for exemplary performance beyond core performance levels or for any action which may have a significant environmental benefit not covered in the rating system (US Green Building Council’s LEED, 2004).

**Defining the Problem**

Scientific evidence and agreement strengthen the idea that environmental trouble is an immediate threat to the social and economic health of communities (Garcia, 2007). The higher the increase of carbon dioxides and gases released into our environment, the more damaging the ozone becomes. Like many complex global problems, the initiatives to address and curtail the damaging effects of a lack of environmental sensitivity are complex in nature. A lack of efficient building and proper environmental stewardship has manifested over decades.

We will be examining what cities are doing to contribute in sustaining our environment. This paper will particularly focus on the top five sustainable cities nationwide and compare them to the City of Las Vegas. As the figure below depicts, Las Vegas is currently ranked 11th in green buildings (sustainable advances) nationally. Although there are many ways to sustain our environment by provide cleaner air, water, and improve healthy living; we are looking for ways to improve the City of Las Vegas’ green building initiatives and standards. To determine what strategies will strengthen green building practices in Las Vegas, the municipality was compared to five of the most progressive sustainable design cities in the United States. The data gathered from this research will be used to identify and recommend specific proposals to make Las Vegas one of the most progressive “green” cities in the world.

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3 According to USGBC LEED rankings – www.usgbc.org
Methodology

Extensive research was conducted on how Las Vegas and 5 leading cities across the country focus their attention and resources on sustainable development. The research included literature and website reviews, questionnaires and interviews with various department members tasked with sustainable design and development.

Literature / Website Review

- Substantial data exists regarding sustainable design and green building. Each of the 6 cities researched, contain information discussing how they are supporting and furthering green building practices in their jurisdictions. In all cities, specific departments or divisions exist and provide information about their strategic plans and sustainable resources online. The main research task focused on sorting through pages of information; both printed and electronically; and finding supporting responses to many of the questions we sought to answer.

Questionnaires / Interviews
• A list of questions was created to discuss important similarities and differences between the City of Las Vegas and the top 5 cities. The inquiry contained 14 questions which asked about green building policy, budget, department creation, number of green buildings, incentives offered, strategic objectives and known barriers (to name a few). The questions were open response and specifically tailored to elicit information specific responses. Our target audience for the questionnaire included administrators and project coordinators assigned to handle sustainability issues. We used city directories from the various locals, to identify email addresses and/or telephone numbers to contact our audience. Our questionnaire pool consisted of 6 people, of which only 3 provided research information. The answers to the questions facing the remaining cities were answered by using information provided on agency websites.

Limitations

• Not all information needed to answer the questionnaire was readily available. One question; which asked about cost effectiveness of leasing over constructing a green building, went universally unanswered, because cities had not investigated the issue on their own. Research was further hampered, when it was discovered some states would not provide budgetary information when queried. Although not true in all cities, many failed to share their budget information, stating department/division budget numbers were not “routinely public information.”

Overall the methodology used for this paper proved to be sound. The research provided a large amount of usable data which was then sorted and used to construct the
various alternatives and ultimately the policy recommendation provided at the conclusion of this paper.

**Potential Policy Recommendations**

1. Providing/Increasing Incentives – Research found that all of the top 5 LEED certified states had one thing in common (that Las Vegas was lacking) – attractive incentives for developers. Currently, the City of Las Vegas only provides developers and builders who embrace green building design, public promotion and recognition of their participation in sustainable development programs. While a valid marketing tool for companies to potentially develop additional business opportunities, it pales in comparison to the incentives provided by other municipalities. At the very least, all 5 cities provide builders with grant money to offset the cost of doing business with the city. Grants dramatically reduce overhead cost for developers and provide relief when trying to find and use green building products and techniques. Some cities go even further to entice builders, by giving tax deductions, utility credits and product subsidies as added motivation to build green.

2. Mandate the “greening” of Municipal Retrofits – The City of Las Vegas, like all other cities researched, currently has a policy in place to provide for newly constructed municipal buildings to be LEED certified as silver or better. The unfortunate part about this policy, however, is that it doesn’t address the number of older buildings currently slated for updates and retrofits. Some states, also facing this issue, have taken their policies a step further and made
it mandatory for all buildings, new or old, to conform to LEED standards of “green.” As a result, more municipalities are addressing their desire for increased sustainability, while not solely relying on new construction.

3. Mandate Green Building Training – All of the states researched provide ongoing training in sustainable design and construction to employees, citizens and contractors throughout their jurisdictions. Some make this training mandatory for all contractors, developers and builders who work on city owned projects. The result is a higher number of trained and certified individuals working in and on city property. This training provides increased buy-in of sustainable design and increases understanding of green building.

Selecting the Criteria

1. Cost Analysis

This analysis will include any documented costs associated with providing and obtaining “green” supplies and current economic issues facing the City of Las Vegas. The cost for recommending an alternative will be based on data obtained from other cities and local resource data we have collected.

2. Time Analysis

The City of Las Vegas is incredibly progressive in its desire to increase sustainable design standards throughout the municipality. As a result, their willingness and ability to enact policy and/or city ordinance, train and certify employees and provide
oversight to projects will have a large impact on how quickly our recommendation can be implemented.

3. Social Benefit

As much as green building must be cost effective and practical to a governmental agency, so too must it help preserve the environment and increasing health conditions of employees throughout an organization. Therefore, our research must weigh the social and environmental benefits of our recommendation against the practical needs of government.

Outcomes

**Outcome 1:** Providing incentives to developers and contractors who work on government buildings would require an increase in State funding, local budgetary changes, changes to tax law and increased partnerships with local utility companies.

**Cost Estimate:**

Actual figures are difficult to come by, but in most cases incentives seek to offset the cost of building a developer must face. Considering governmental agencies often do not receive incentives on municipal property, the City of Las Vegas would have to determine what the cost of green building supplies are in the State of Nevada and how much revenue would be lost to tax breaks.

**Time Analysis:**

The State legislature would not be able to appropriate grant or incentive money for local government until the 2009 session. Although capital improvement project funding is not usually
effected by government spending cuts, during the state’s current economic times, money might be allocated to more pressing projects and therefore not available until much later. As a result, fiscal incentives would not be available unless allocated by the City of Las Vegas.

**Social Benefit:**

The major benefit socially appears to be the increased buy-in by developers, based upon their financial benefit and relief. The result of their increased interest financially would result in an increase in environmentally sound design ideas.

**Outcome 2:** Mandating the incorporation of sustainable design into city retrofits would require council to pass new policy and identify funding sources and developers to meet the new standard.

**Cost Estimate:**

While slightly more expensive to use all green building products and techniques, the city already has a set budget in place for repairs and improvement projects. The city, using an annual forecast, could identify buildings in need of repair and refurbishing. These projects, funded through capital improvement money, can be used throughout the city to assist in maintenance or other infrastructure projects.

**Time Analysis:**

Capital improvement money is available for use at the beginning of every fiscal cycle, so the only time concern would relate to council’s ability to pass regulation and find eligible developers to work on projects.

**Social Benefit:**
The obvious benefit would be the increased interest in the well-being of building occupants. The City of Las Vegas can drastically improve health conditions in older buildings by retrofitting them with modern, environmental friendly alternatives. This in turn will provide social conscious building practices to be the norm throughout city projects and will publically show the City of Las Vegas' commitment to promoting sustainability.

**Outcome 3:** Mandating the training of city employees, developers and the public on sustainable design would require the city to increase the amount of currently trained employees (currently the city has only 2) and ensure their ability to accurately train others in green building.

**Cost Estimate:**

Costs would be associated with salary requirements of employee trainers. This cost should be nullified, however, once additional employees become certified trainers and can assist in instructing the public.

**Time Analysis:**

This mandate would be extremely time consuming. It would be a slow process to work through training employees and then in turn educating the public. As a result, benefits resulting from this recommendation might not be realized for a longer period of time.

**Social Benefit:**

The benefit here would be the increased buy-in that would accompany the training of others. By making training available to the citizenry within the City of Las Vegas, many would gain increased knowledge of how the city is focusing its efforts on the environment and a greater understanding of sustainability.
Proposal

Based upon the collected research, the recommended policy alternative is the mandating of all municipal retrofits to follow LEED certification ratings. Considering the City of Las Vegas already has put policy into place requiring newly built office space to be certified as silver or better, it only makes sense to also provide the same green building standards to older building updates.

The research collected clearly shows sustainable building produces several rewards for government agencies. While it makes sense to provide increased training to personnel and outside developers, the tangible benefit of training would not be observed for many years to come. In fact, research has not shown a direct correlation between the number of green building a community has and the number of certified professionals it employs. While training is one component on the LEED rating scale for a sustainable community, retro-fitting covers 8 of the 15 areas currently addressed on their point survey.

Retrofitting meets the City of Las Vegas needs in order to move up the LEED certification chart. Retrofits provide the obvious benefit of lower operating costs and greater utility conservation. The less obvious, however, come from an increase in employee productivity, resulting from an improved indoor environment. Studies have shown that employees in sustainable buildings consistently perform better than their counterparts in traditional offices because of better indoor air quality, comfort and lighting. Employer costs are lower because of fewer sick days and better worker retention.

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4 Based on the USGBC’s LEED Initiatives in Governments and Schools – www.usgbc.org
5 According to USGBC LEED rankings – www.usgbc.org
These are just some ways in which retrofitting to a LEED standard can provide substantial benefit to the City of Las Vegas. As previously stated, the benefits of going green while making improvements to existing city structures, makes the most sense and is arguably the greatest single impact on the future of sustainable design in Las Vegas. Economical, timely and socially acceptable, this recommendation would make important changes to the city’s current way of looking at green building and would provide for greater ownership and buy-in of the benefits sustainable design provides to the municipality.
References


http://www.usmayors.org/climateprotection/agreement.htm


Appendix

1. Green Building City Questionnaire
2. City Comparison of “Green Building” Chart
3. USGBC LEED for New Construction, Registered Project Checklist v.2.2
4. USGBC LEED Top 5 Sustainable Cities Ranking
5. Interview with Larry Merritt; City of Chicago, Department of Environment, Dated: July 16, 2008
6. City of Las Vegas Publication “The Green Sheet”
8. City of Las Vegas Publication “Sustainable Las Vegas 2007”
11. City of New York Department of Design & Construction Website
12. City of Seattle Department of Planning and Development Website
13. City of Portland Office of Sustainable Development Website
14. City of Chicago Department General Services Website
15. District of Columbia Department of Environment Website