

Green building



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The environment has been a substantial topic of discussion lately. This is due to the lack of energy efficient products in our cars, homes, buildings, and construction. Healthcare facilities are one of the largest energy consumers in the country. There is so much need to keep up with life safety and health standards that the healthcare industry doesn't look at the big picture of the effects of energy conservation and the risks it could cause in the future.

The purpose of this report is to inform healthcare officials and any individual that could be effected by not building green, the benefits of energy efficiency, environmental and social benefits, and last but not least Leadership in Energy and Environmental Design certification, or LEED certification. Energy efficiency plays the most important roll in building green. In order to save the environment in the future we must save energy. There are several different ways to do this.

Using solar power energy would reduce the use of electricity by burning less coal, designing roofs to grow plans to reduce heat loss in the winter months and keep cool in the summer months and at the same time creating an eco-friendly habitat for nature, controlling the use of water efficiency, lighting efficiency by using natural light instead of artificial, using specific materials during building and everyday uses to be efficient, and using proper heating and cooling techniques. Environmental benefits help to increase to life expectancy of our environment by reducing our emissions output and control our waste management.

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Involving more people into green building consists of social efficiency. Social efficiency creates a healthier lifestyle and improved health by adding a bike rack to the entrance of a building to encourage the idea of riding bikes to and from the building. Finally LEED certification regulates the way we build green to make sure it is regulated correctly. There are many incentives through LEED certification to build green. Green building in healthcare facilities is rapidly growing in both popularity and importance.

There are many businesses that are taking advantage of this change, while at the same time encouraging more change. Introduction Green building in healthcare facilities is a significant start to making the environment healthy. Green building refers to using a process that is eco friendly throughout a building's life cycle. This begins from sitting to design, then construction, operation, maintenance, renovation, and eventually demolition. Green buildings are designed to reduce the impact on the environment and human health by using resources efficiently, reducing waste and pollution, and improving employee productivity.

The main economic issue with hospitals is that they are not very environmentally friendly. With new technology there are many different ways to make a hospital environmentally friendly. It has been estimated that 30 percent of the health sectors energy use could be reduced by switching to renewable and more energy efficient sources at no cost to quality of care. (EPA) The Energy Star program has free energy audits for health care facilities as well as energy evaluation tools and information on how to purchase more energy efficient products.

It also provides information on how to make your facility more efficient through simple steps like calibrating thermostats, turning off machines when not in use, and periodically checking for leaks in the hot water system. I. Improving Energy Efficiency Energy use in healthcare facilities is higher than nearly all other building types. With rising energy costs and climate change concerns energy efficiency is financially prudent and increasingly expected. Efficiency can be gained from integrated design practices, including systems to control heat gain, and increase the efficiency of

heating, ventilation, and air conditioning systems. Eco-Building Products) A few reasons why energy efficiency is important are it increases energy efficiency and reduces climate impact. It also demonstrates environmental awareness, and improves patient and staff comfort with a green indoor environment. As well as improves facilities overall operational efficiency and reduces operational costs. Less than \$2. 50| 12%| \$2. 51 to \$3. 00| 17%| \$3. 01 to \$4. 00| 28%| \$4. 01 to \$5. 00| 21%| \$5. 01 to \$6. 00| 11%| \$6. 01 to \$7. 00| 5%| \$7. 01 to \$8. 00| 3%| More than \$8. 00| 3%|

New developments are made everyday in the field of engineering that are meant to save energy and protect the environment. This is a very important time to be conscious of energy consumption, due to global warming. Naturally there will be experts constantly creating new technologies in this field, but another big question is whether there should be rules and regulations that force people to create or use green-engineered products. (History of the Refinements) While green building construction may appear costly for consumers, new developments in the engineering field are providing increasingly cost-effective solutions. Simple, Smart, Sustaining Solutions) Even though green engineering is coming to the forefront of society now, it has been around and developing for many years. Table I - Energy Costs Source: Slotten Annual Energy Costs Per Square Foot (estimated) A. Solar Energy Figure 1: Microsoft Solar energy is most definitely the greatest known form of energy conservation. Solar panels can decrease the energy consumption of a health facility drastically by producing their own energy from the sun. In some cases, hospitals can even give back

excess energy to the power grid. Solar panels gather and directly convert the sun's energy into electricity.

During the daylight hours, the photovoltaic cells which are arranged on a grid pattern on the solar panels surface collect the sunlight and turn it into electricity, the charger controller regulates the amount of energy sent to the batteries to avoid being overcharged. (Simple, Smart, Sustaining Solutions) Batteries store the energy to be used at night or when there is a blackout. However, solar power is only ideal for certain regions. While some areas get lots of direct sunlight every day, like Arizona, others get less sunlight or are often cloudy, like Alaska.

This technology has been around for quite a long time, but it is still growing in popularity, as well as quality. An unusual and expensive technology ten years ago is now a cheaper, more common energy alternative. (History of the Refinements) While most of these green engineering techniques give back to the environment by decreasing the amount of energy usage, some techniques can help the local habitat more directly. Another way to harness the sunlight is by using solar thermal energy. This is commonly used for heating and providing hot water. The other way to harness solar energy is through passive solar.

Passive solar is known as direct gain and uses specific materials that can store the sun's energy for future use. Although solar energy has its disadvantages, these will be outweighed by its advantages. Some of the solar advantages are solar energy is a renewable energy source, solar energy is no cost after the initial install, solar cells do not require much maintenance, they produce no noise unlike any other energy sources, solar

panels are very reliable, and solar energy is clean it does not produce any pollution. B. Green Roofs Green roofs or “healing gardens” are becoming more popular and effective.

A green roof is one with a layer of soil and vegetation growing on top of it. Having green roofs benefits the health facility as well as the patients' recovery and the habitat in many ways. This helps the environment, in that it provides a habitat for wildlife that was likely there before the building was built. The water runoff from the top of a green roof also drains cleaner than it was before it hit the roof. With green roofs water is stored by the substrate and then taken up by the plants and then released back into the atmosphere through evaporation.

In the summer green roofs can retain 70-90% of the precipitation that falls on them. (Going Green in America's Hospitals) In the winter they retain between 25-40%. (Green Building Services) Green roofs also reduce the amount of stormwater runoff and also delay the time at which runoff occurs. This results in less stress on the sewer system during a storm. Green roofs also benefit the building, in that they are a great insulation, blocking out the hot sun in the summer, or keeping the heat from leaving the building in the winter. (Green Building Services) C. Water Efficiency

Figure 3: Slotted Figure 2: Slotted Water is an increasingly visible and expensive resource. Process water used to operate building systems including (figure 4) boilers/chillers, (figure 3) cooling towers, and sterilizers comprise about 75 percent of hospital water use. (Green Building Elements) Reducing water use can lower operational costs and should be part of an integrative design process for construction. Another way to improve water

efficiency would be to install flow control fixtures on all faucets. The average faucet puts out five gallons of water per minute.

After installing flow control fixtures this would result in a water savings of 88 gallons per day, or 32, 000 gallons of heated water per year, which would save \$280 annually per sink. (History of the Refinements) You could also install higher consumption toilets and urinals with ultra low flush toilets and urinals, which use 1. 6 gallons per flush. (Massachusetts Water Resources Authority) Some reasons why processing water efficiently is important are it reduces environmental impact, saves money and lowers the impact on drinking water sources and water ways receiving waste water.

D. Lighting Efficiency People intuitively prefer natural light to artificial light. Daylight and optimized artificial lighting can benefit hospital employees, patients and visitors. With rising energy costs and climate change concerns, using energy efficiency is financially important and expected. (California Energy Commission) In addition, evidence suggests quantifiable benefits for staff retention, patient healing, and customer satisfaction. Some reasons why lighting efficiency is important is that it improves building aesthetics and the facilities overall operational efficiency.

Studies show that it can potentially reduce staff error rates, increase staff retention, and help patient recovery. (Health Facilities Management) The use of natural light is becoming very popular in new large facilities. In figure 5 hospitals can have many skylights and windows to get natural light deep into the interior. The artificial lights in Figure 4: Slotten the building could then dim or turn off when there is a sufficient amount of natural light. There are many windows and skylights emitting natural light. Most of these windows

face the north, when possible, for the least amount of direct light. Simple, Smart, Sustaining Solutions) Direct sunlight into a building could lead to unwanted heating of the interior. There are also small overhangs outside the vertical windows in order to block direct sunlight as well as reflect sunlight onto the slightly angled ceiling. (Going Green in America's Hospitals) This ceiling then directs the light further into the building. Graham Construction is currently working on sectioning off ceiling lights to put separate sensors and dimmers on them so that they adjust to different levels of natural light. E. Materials Efficiency

Selecting sustainable construction materials is an important aspect of building a green hospital. The concept of sustainable building incorporates and integrates a variety of strategies during the design, construction and operation of building projects. Green building materials offer specific benefits to the building owner and its occupants. * Reduced maintenance/replacement costs over the life of the building. * Energy conservation. * Improved occupant health and productivity. * Lower costs associated with changing space configurations. * Greater design flexibility.

Figure 5: Microsoft

Building and construction activities worldwide consume 3 billion tons of raw materials each year. (CalRecycle) Using green building materials and products promotes conservation of dwindling nonrenewable resources internationally. Integrating green building materials into building projects can help reduce the environmental impact associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal

of these building industry source materials. (CalRecycle) Green building materials are composed of renewable, rather than nonrenewable resources.

Green materials are environmentally responsible because impacts are considered over the life of the product. Depending upon project specific goals, an assessment of green materials may involve an evaluation of materials. (Simple, Smart, Sustaining Solutions) Resource efficiency can be accomplished by using materials that are of recycled content, natural, plentiful, renewable, resource efficient manufacturing process, locally available, salvaged, refurbished, reusable, and durable. (EPA) Table II - Top 10 Energy Saving Design Strategies 8%| Commissioning of building energy systems| 34%| Integration of low-energy strategies into building design| 32%| Day lighting| 24%| Load-reduction strategies| 24%| Low-energy design consulting services| 21%| Energy modeling programs| 19%| Use of LEED certifications| 17%| Spectrally selective glazing| 7%| Renewable energy sources| 5%| Use of EPA's Target Finder to assess the energy performance of the construction process| Source: Sloten F. Heating and Cooling One technique that is still developing is the conservation of clean hot or cold air.

The California Academy of Sciences building has vents that open on the domes to let out hot air as well as motorized windows to let in cool air. (Green Building Services) There is a constant battle between keeping a constant temperature while using the least amount of energy Figure 6: Sloten and keeping the air fresh. Most home heating and air conditioning (figure 7) systems advertise providing accurate temperature control as well as filtering mold, moisture, dust, and pollen. There is not yet technology that can meet the same standards while using much less energy.

Another way to improve heating and cooling of a hospital would be to incorporate refrigeration and air conditioning units. By incorporating these units into a cooling loop, the facility can reduce its amount of water consumption by 3 million gallons per year, which would save over \$20, 000 in annual water and sewer costs. (Massachusetts Water Resources Authority)

II. Environmental Benefits of Building Green The environmental benefits include conservation of natural resources, waste reduction, improvement of air and water quality, and protection of the ecosystem. According to the Environmental Protection Agency (EPA), U.

S. buildings are responsible for 39% of total energy use, 12% of total water consumption, 68% of total electricity consumption and 38% of carbon dioxide emissions. (Going Green in America's Hospitals) A. Emission Reduction Figure 7: Slotten Pollutants released by fossil fuels contribute to global climate change, cause air quality issues such as acid rain and smog, and pose risks to human health. Green building techniques like solar powering, daylight, and public transport increase energy efficiency and reduce harmful emissions. Every Alegent Health hospital in Omaha and Council Bluffs has diesel-powered generators.

Diesel fuel can be very harmful to your system when emitted into the air. Diesel exhaust (figure 8) has been found to contain many toxic air contaminants. Exposure to diesel exhaust can cause short-term symptoms such as headaches, dizziness, nausea, coughing, tightness of the chest, and irritation of the eyes. Although these generators rarely run they need to be tested weekly to ensure they are in proper working condition. Luckily there are now certain filters for this type of emission, yet many health facilities

have not adopted the idea. B. Waste Reduction Figure 8: Sloten U. S. hospitals generate approximately 6, 600 tons of waste daily and 85 percent of this is non hazardous waste such as cardboard, food, glass, paper, and plastics that can be recycled. (Simple, Smart, Sustaining Solutions) Hazardous waste disposal is also a major problem in U. S. hospitals. Hazardous waste from hospitals must undergo at least four treatment processes before it arrives at the disposal site. A huge portion of solid waste in the United States is from construction and demolition. (Simple, Smart, Sustaining Solutions) Building deconstruction is the dismantlement of a building with intention of salvaging and recycling materials. (Going Green in America's Hospitals) This can be used as an alternative to full-scale demolition, which results in a decrease of waste reduction. Several construction sites now have different dumpsters designated for specific materials this was it is easier to recycle the unused materials and all scrap materials such as metals, plastic, wood, and normal trash. Green construction can be implemented through choice of building materials as well. Seeking quickly renewable resources to build with decreases the amount of polluting manufacturing and slows the depletion of non-renewable resources.

It is also environmentally, economically, and energy efficient to use materials that are close to the building site, decreasing the amount of oil use as well as air pollution. It would actually be very green, not to mention economically beneficial, to renovate an existing building rather than build a whole new one. This would prevent the production of all new materials and save the ecosystem that the building would be destroying. C. Indoor Air Quality Indoor

air quality is very important. People in industrialized nations spend about 90% of their time indoors. (EPA) The bad thing is that most modern buildings can contain substances that are potentially hazardous to our health. These range from dust, to major irritants like chemical vapor off-gassing. (Healthy Air) Indoor air quality can be 10 times worse than outdoor air on smoggy days in big cities. (EPA) Many chemicals and Volatile Organic Compounds (VOC's) found as contaminants in buildings are known to cause adverse effects on human health. (Simple, Smart, Sustaining Solutions) Though molds can cause allergic reactions, they can also cause chronic illness in humans.

This affects not only the patients in a hospital but the employees. There is also an illness called “ sick Building syndrome,” which is linked to poor indoor air quality and has even become an issue where lawsuits have been ensued. (Healthy Air) For over a decade product manufacturers in the building industry have been introducing products that reduce formaldehyde, VOC's and other potential harmful chemicals. There is a wide range of products available that replace existing adhesives, flooring, paints and other finishes that are much healthier.

Indoor air quality can be improved by using different types of materials that are non-toxic. These are materials that emit few or no carcinogens, or irritants. Fresh air is also a critical component to optimal health. Ventilation provides control over ventilation rates and helps prevent mold. III. Social Benefits A. Improved Health Studies have shown that poor indoor environmental quality from insufficient air circulation, poor lighting, varying temperatures, and toxic paints contribute to respiratory problems, headaches, and allergies.

Green building emphasizes ventilation and non-toxic materials that create healthier and more comfortable living environments. B. Healthier Lifestyle

Figure 9: Slotten A key element of sustainable design is the preservation of natural environments, which afford a variety of recreation and exercise opportunities. (Bloomington) Green buildings also seek to facilitate alternatives to driving, such as bicycling and public transport, which eases local traffic while encouraging personal health and fitness.

Having bicycle racks outside of health facilities, as well as and other building, will benefit from LEED credits among many others. This will encourage more employees and occupants to ride bicycles to and from the hospital. IV. LEED Certification A. What Does LEED Stand For LEED stands for leadership in energy and environmental design. LEED measures sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, locations and linkages, awareness and education, innovation and design, and regional priority. (U.

S. Green Building Council) There are currently many forms of accreditation existent today that encourage green construction, and that is what most of them do they encourage green construction, as opposed to mandating it. The largest one of these is the LEED certification. B. History of LEED Figure 10: Microsoft After the first five years of LEED being launched, more than 2, 700 buildings and projects registered for certification. (LEED Certification) 400 buildings have completed certification. This process usually takes 3+ years from the time of registration. LEED Certification) The number of certifications that are completed is expected to rise quickly as more projects complete construction. C. How to Become LEED Certified LEED

points are awarded on a one hundred point scales to reflect their environmental impacts. Buildings seeking LEED rating are subject to the cost of the certification process. Projects must be registered with the US Green Building Council. This costs \$450 for members. (U. S. Green Building Council) Many buildings today are striving to gain one of the few categories of LEED Certification.

Seventy percent of new LEED Certified buildings fall under the new construction or major renovations category. A LEED certification is widely respected, creating an encouragement and acceleration of the adoption of green building techniques. Federal and state public buildings encourage LEED projects. D. LEED Credentials The credentials of a LEED Certification for a new building are based off of six categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design process. LEED is even used as a standard in mandatory ordinances.

Boston was the first major city to mandate the use of green engineering in buildings. Starting in early 2007, any new building with over 50, 000 square feet and any existing building over 100, 000 square feet that is being renovated must obtain, at least, the minimum LEED Certification. (U. S. Green Building Council) Although the LEED Certification series backed by the US Green Building Council is by far the most recognized and used form of accreditation, there are others. Labs21 is an accreditation that is specifically for labs and high performance facilities. It is sponsored by the U. S.

Environmental Protection Agency and the U. S. Department of Energy. (U. S. Department of Energy) Energy Star is another program sponsored by these

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two government agencies, although Energy Star is more involved with advertising energy efficient products and practices. Although they vary in specific tasks, all of these organizations share the same challenging goal of making technologies more energy efficient and eco-friendly while still being cost efficient.

E. LEED Levels of Certification With each variety of certification, there come different levels: Certified, Silver, Gold, and Platinum. LEED Certification) Any of the levels of certification would gain the accredited building acknowledgment as well as the obvious environmental and economic benefits. LEED is a third-party certification program and the nationally accepted benchmark for the design, construction and operation of high performance green buildings. (U. S. Green Building Council)

F. Who Uses LEED The people that use LEED are professionals that include architects, interior designers, engineers, construction managers, and federal agencies.

Conclusion Green building has already proved to be successful in many large buildings.

Green building in healthcare facilities is rapidly growing in both popularity and importance. There are many businesses that are taking advantage of this change, while at the same time encouraging more change. There are all sorts of companies selling green products, taking part in environmental activities, and encouraging in every way possible for consumers to go green. There is no doubt that a change must come quickly to halt a disaster that is condemning our planet. People may have to alter their lifestyles in order to reverse the damage that has been done, and putting it off until tomorrow is not an option.

In addition to saving the environment, the growing intelligence of green engineering and building construction will help consumers save money by reducing their energy consumption. As soon as new technologies are created, there is a constant evolution of that technology until it is perfected, making it affordable and user friendly. If people harness these advances as they unfold and are proven sustainable, then they will be taking the road that leads back to a healthy prosperous earth as well as money in their wallet.