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Sustainable Design and Water Resources Management

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ABSTRACT

Among the direct environmental consequences of construction,the most significant is its consumption of water and other resources. Water is the origin of every form of life. It is a habitat,an aliment ,a means of production and transport,and a commodity.By its very nature, water creates networks: it is linked to other natural resources, land, forests, biodiversity, etc. Aquatic systems are interconnected; environmental problems have repercussions from one end to the other of a hydrographic basin. Various groups and stakeholders use water for their needs. Construction is believed to consume around half of all the resources humans take from nature. Sustainable building and construction, is a holistic, multidisciplinary approach.This approach is increasingly being advocated for buildingsandinfrastructure. Energy efficiency in buildings has become a key factor that has a great impact of energy security,optimization of energy of structure and energy efficiency improvement. Furthermore, this Article is aimed to initiate implementing sustainable design of building construction in reduction of consumption of energy resources specially water and present suggestions for conservation of water resources.

Keywords: Sustainable building; Management; Water resources; construction.

INTRODUCTION

Difinition of sustainable building design

No single definition of sustainable construction or sustainable buildings is accepted worldwide. The European Union defines the former as the use and/or promotion of a)environmentally friendly materials,b) energy efficiency in buildings, and c) management of construction and demolition waste [1]. Sustainable building design and operation strategies demonstrate commitment to energy efficiency,environmentalstewardship and conservation. These approaches result in an optimal balance of energy, cost, environmental and societal benefits, while still meeting the mission of the agency and the function of the facility or infrastructure. Common synonyms for sustainable buildings include "green buildings"and"high performance buildings [2]. Sustainable building, also referred to as a green building , is a structure that is designed built, renovated, operated, or reused in an ecological and resource-efficient manner.Sustainable buildings are designed to meet certain life cycle based objectives. These objectives include: protecting the health of building occupants; improving employee productivity; using energy, water and materials more efficiently; incorporating recycled-content building materials; adding compost and yard waste prevention practices into the landscape design; and reducing the environmental impacts associated with the production of raw materials, building construction and building maintenance and operations. The results: enhanced occupant health and productivity, significant cost savings and a better environment [3]. In fact, sustainable construction focuses on green building. It applies to large commercial as well as institutional buildings. One should reallyrealize the ecological and economic benefits of green building. Furthermore, innovation in construction should always exist. In any project one must address the environmental impact of construction, the sustainable civil engineering, including sustaining resources, controlling or coping with environmental change and developing sustainable civil engineering[4].

Fundamental principles of sustainable design

Optimize Site/Existing Structure Potential

Creating sustainable buildings starts with proper site selection, including consideration of the reuse or rehabilitation of existing buildings. The location, orientation and landscaping of a building affect the local ecosystems transportation methods and energy use.

Optimize Energy Use

With America's supply of fossil fuel dwindling, concerns for energy independence and security increasing,and the impacts of global climate change arising, it is essential to find ways to reduce load, increase efficiency and utilize renewable energy resources in federal facilities.

Protect and Conserve Water

A sustainable building should reduce, control, and/or treat site runoff, use water efficiently, and reuse or Recycle water for on-site use, when feasible

Use Environmentally Preferable Products

A sustainable building is constructed of materials that minimize life-cycle environmental impacts such as global warming, resource depletion, and human toxicity. Environmentally preferable materials have a reduced effect on human health and the environment and contributetoimprovedworker safety and health, reduced liabilities, reduced disposal costs, and contribute to improved worker safety and health, reduced liabilities, reduced disposal costs, and achievement of environmental goals[5].

The Value of water resources

We are all beneficiaries of this magnificent network of treatment plants, pump stations and pipes that was handed down to us by generations before. Yet because our water infrastructure has lasted so long, we haven' t had to worry about the expense of replacing it. However, in the next few decades, much of that network is going to need upgrading or replacement. We can therefore be sure that tap water service will cost more in the future than it does today. We have arrived at a turning point.The choice we face the turning point is either to adopt strategies to renew our water infrastructure, or accept the erosion over time of reliable water service. If we begin to move toward rate structures and financing plans that reflect the full cost of water service, we will avoid rate shock in the in the years ahead. When you consider the critical needs addressed by water service, tap water will always be a tremendous value. In fact, it will be a bargain. Simply cannot put a price on a service that delivers public health, fireprotection, economic develop and quality of life [6].

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- The world population tripled during the 20th century, its water needs have multiplied by six.
- 1/6 of the world population has no access to drinking water; 1/3 is not connected to a waste water treatment system.
- 7 million persons die each year from diseases transmitted by water.
- Irrigated areas have multiplied by five during the last century, and 70–80% of the water used worldwide serves the agricultural sector.
- 70% of industrial sewage in developing countries is fed into water ways without any form of waste treatment.
- 50% of the world's wet zones have disappeared during the 20th century.
- 1/3 of catchment areas have lost up to 75% of their forests.
- There are over 47,000 major dams worldwide.

Figure(1): Amount of water consumption in the world [7]

Water Efficiency

Water conservation and efficiency programs have begun to lead to substantial decreases in the use of water within buildings. Water-efficient appliances and fixtures, behavioral changes and changes in irrigation methods can reduce consumption by up to 30 percent or more. Investment in such measures can yield payback in one to three years. Some water utilities offer fixture rebates and other incentives, as well as complimentary water surveys, which can lead to even higher returns .For a typical 100,000-square-foot office building, a 30 percent reduction in water usage through the installation of efficiency measures can result in annual savings of $4,393. The payback period is 2.5 years on the installed conservation a efficiency measures. In addition to providing a 40 percent return on investment, the measures result in annual conservation of 975,000 gallons of water. As demand on water increases with urban growth, the economic impact of water conservation and efficiency will increase proportionately. Water efficiency not only can lead to substantial water savings, as shown in the above example, it also can reduce the requirement for expansion of water treatment facilities.

Water Conservation

Water is a limited natural resource that should be used efficiently indoors and out. Conserving water saves money, but the ramifications of water efficiency go far beyond lower water bills. For example, at the community level, water conservation can help to eliminate or defer the need for more dams, treatment facilities, and expensive water rights. Water treatment consumes a great deal of energy and a large percentage of the treated water ends up being flushed down toilets and used to water landscape. Installing water-efficient appliances and fixtures and changing snow making practices can reduce water consumption by significant amounts. To conserve water to the greatest extent possible, the following steps should be applied to the sustainable design process :

.Minimize the amount of water required to operate inside and outside the building.

.Distinguish between water needs that can be met using raw (untreated) water, and those that must be met using treated water and have separate water supplies and distribution system.

.Evaluate methods for obtaining the required raw water supply using on-site resources such as streams or pounds[8].

Water Reclaimation

Reclaimed or reused water is waste water effluent from a centralized water treatmen plant that is reused in a variety of ways : for fire protection, in outdoor water features, water, boiler-feeder water, or process water.

Check local regulations on use of reclaimed water. No federal regulations regarding water-reuse practices currently exist, although the EPA has published a manual on the subject. Many states have adopted water- use regulations, but these vary considerably. According to a survey conducted in 1992, 18 states had adopted regulations for reclaimed water reuse,18 states had guidelines or design standards, and 14 states had no regulations or guidelines. Most of the standards in place pertain to urban or agricultural irrigation.Regulations in some states (Arizona , California , Florida ,and Texas) strongly encourage water reclamation as a conservation strategy.Regulatory guidelines for water reclamation usually pertain to reclaimed water-quality and treatment requirements water-monitoring requirements, reliability of treatment facilities, storage requirements, irrigation application rates, groundwater monitoring and property- line setback distances for applications.The objective of these regulations is usually to maximize resource benefits while protecting environmental and public health.

Water Harvesting

Water harvesting means collecting run off from the soils surface, paved surfaces, and other sources,and storing it for future use such as irrigation.Harvested water caninclude stormwater and irrigation runoff ,water from cooling towers and heating, ventilating, and air-conditioning (HVAC) systems,and water from swales and other drainage structures directed into collection areas.After collection in a storage tank or pond, harvested runoff must be pressurized in order to be used in an irrigation system.

Graywater Systems

Many public and commercial facilities generate relatively small amounts of graywater, other types of commercial and industrial facilities may generate large quantities.For example, a vehicle-maintenance facility that uses large quantities of water to wash trucks can realize considerable savings by recycling washwater. Therefore,volume should be considered in deciding whether it is cost-effective to treat graywater and blackwater separately. Usually, irrigation with graywater is required to be subsurface,although some areas permit above-ground irrigation.Factors affecting the approval and use of graywater irrigation systems include soil depth and characteristics as well as drainage and flooding patterns. Other guidelines include setbacks for graywater irrigation lines from property or potable- water lines. Each state has individualized standards for graywater irrigation systems. Two states that have standards encouraging graywater use are Texas and California [9].

CONCLUSION

. Install dual plumbing lines in building interiors. Dual plumbing separates graywater from blackwater. Dual plumbing is not difficult to install, but is most-cost effective if done during initial construction. If dual plumbing lines are not installed initially, adding a graywater treatment system later can be quite expensive.For this reason, install dual distribution lines in new facilities if a graywater system may be incorporated in the future.

. Separate and use graywater generated from indoor uses such as laundries, showers, and sinks

. Reduce overall water use.

. Perform a water budget analysis to project the amount and configuration of daily wastewater flows

. Estimate water usage and wastewater generation based on standard use patterns and the number of building occupants, then analyze the figures to determine opportunities for conservation, sources and amounts of graywateravailable, and other opportunities for efficiency.

. Apply reclaimed effluent to land

. Use reclaimed water for purposes such as toilet- flushing if dual distribution lines are in place.Minimize the amount of water required to operate inside and outside the building.

. Distinguish between water needs that can be met using raw (untreated) water, and those that must be met Using treated water and have separate water supplies and distribution systems.

. Evaluate methods for obtaining the required raw water supply using on-site resources such as streams or ponds[8],[9].

. Insulate of cold and hot water pipes in buildings.

. Saving and storing of rainwater in barrels, tanks, or cisterns for irrigation of gardens and trees ,specially in dry climate zones (Usage of an underground cistern or gravel-filled dry well connected to irrigation pipes).

. Usage of moisture sensors for start and stop of irrigation.

. Usage of A graywater system ,consists of draining waste from sinks,showers, and laundry to a holding tank; a filtration or treatment system.

. Use of Household appliances such as front-loading washing machines for maintenance of water and saving of costs.

. Selecting of sustainable materials for reducing of pollution of water that prevents of more consumption of water

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