Civil and Environmental Research
ISSN 2224-5790 (Paper) ISSN 2225-0514 (Online)
Vol.7, No.8, 2015

The impact of using Green Buildings on the rationalization of consumption of energy resources, water and building materials in the Hashemite Kingdom of Jordan

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Abstract
This paper aimed to study the environmentally friendly buildings(green building), especially in the State of Jordan, also the benefits of these buildings have been identified, and through the research, it shows that regular buildings are characterized by three major Characters, which are the drain energy and resources, polluting the environment through emissions and fumes, liquid or solid waste, and the negative impact on the health of the users of buildings as a result of the use of different chemicals and other pollutants. The study also shows the impact of constructing an ordinary building on the amount of using energy, water and building materials resources which has lead to the fear of depletion of these resources, and based on these negatives, the principles of the environmentally friendly buildings carry ideas and theses which are able to overcome the drawbacks mentioned above**.**
Jordan has provided several facilities in order to stimulate the construction of green buildings; the research found that the use of green building in the building regulations will reduce energy consumption rates by (20-50%), and the ratios of water resources to (40%), and rates of building materials to (70%).

1.0 Introduction

Sustainability and a better life for future generations, are one of the basic concepts that interest people in the field of construction who are trying to apply its technology and strategy according to the architect and industrial progress which are accompanied by greater consumption of natural resources, which will reflect negatively on the ability of the planet to be replenished, and thus presents the future of life at risk.

Green and sustainable building techniques seek to strike a balance between energy and the consumption of resources and the preservation of the natural environment within the platforms and plans of global and local action to achieve sustainable development, buildings may be simple in design compared to a lot of creative designs that we see at the moment, but its beauty lies in its objective; these buildings combine the creation of designer and splendor of nature and greenery, which gives the design the beauty of the scene. Environmentally friendly buildings or sustainable buildings are the practice of creating structures and the use of responsible operations and environmentally efficient in terms of resources used in construction through the building's life cycle, through determining the construction sites, design, construction, operation, maintenance and renewal and disassembly. This practice expands and complements the classical design of the building with respect to the economy, benefit, and the durability and comfort (Zaid, 2011).

Jordan faces a unique set of challenges, particularly in the area of environmental sustainability, according to Ministry of Energy and Electricity Regulatory Commission statistics, the construction sector consumes more than (37)% of the total energy consumption in the Kingdom, while the residential sector consumes (21)%, and with the raising of fuel and electricity prices, it means that it will directly affect the cost of the energy bill of the citizen and increases the workload, the construction processes use large amounts of energy excessively, water and raw materials, and tend to generate a lot of waste and emissions, also it consumes a lot of land that may be green fields or farmland. The solid and non-porous surfaces in buildings affect on the amount of runoff of rain water and so increase their speed ones, which constitute a significant burden on rainwater drainage networks and increase the effect of the thermal load on the region (Katkhuda, 2014).
Figure (1) shows the goals of sustainable design (Green Buildings) (Jo-Green 2013).

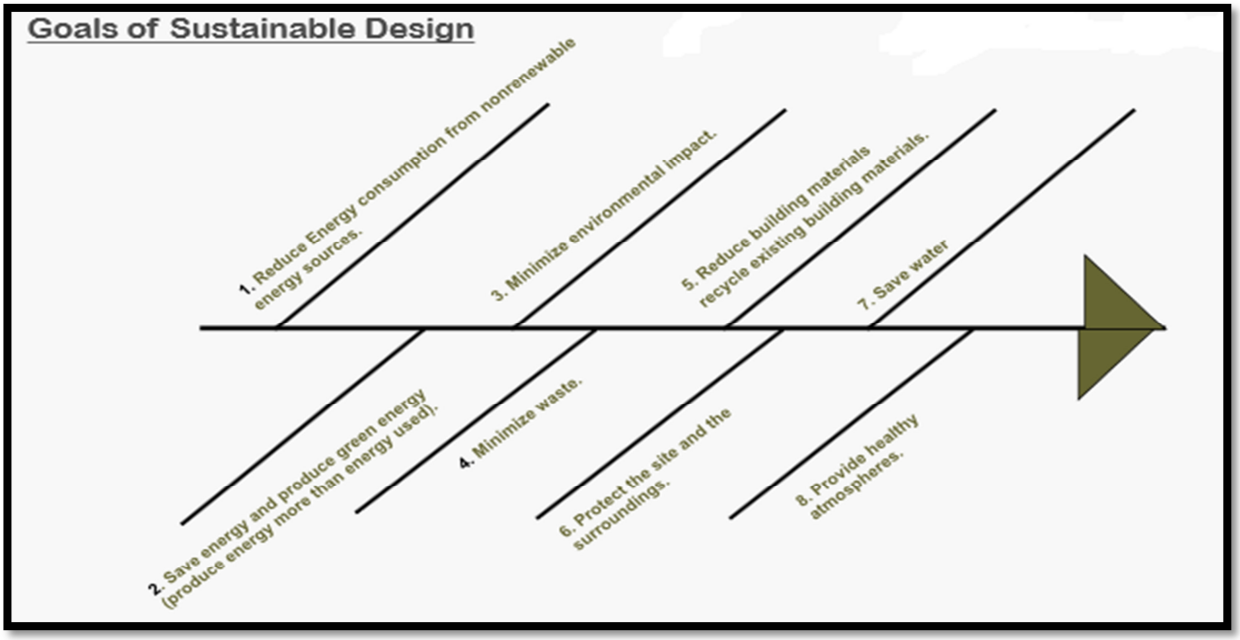


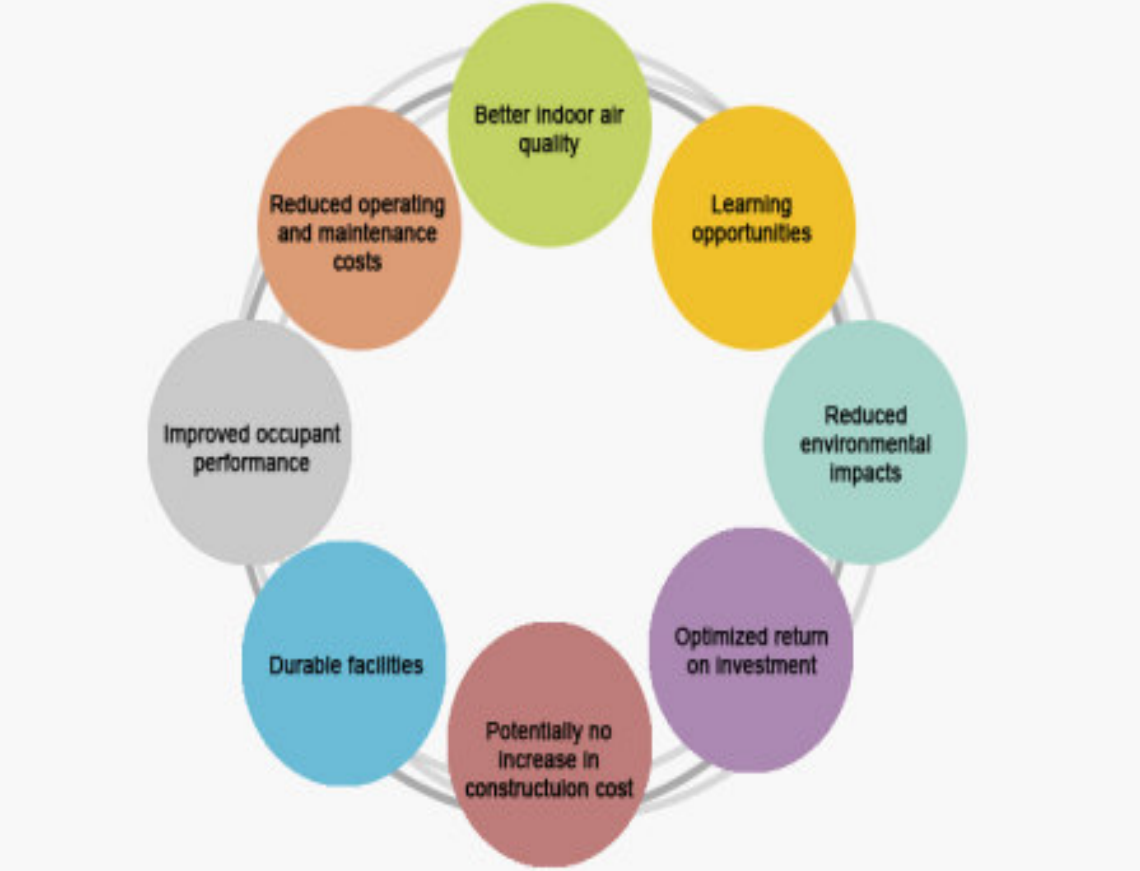
Figure (1): Goals of Sustainable design

This paper aims to illustrate the importance of green building at all levels, and to clarify the economic and environmental benefits from its use, and in order to reduce the negative impacts of the construction process effects; the concept of green building was invented, which has become widely popular worldwide, including the Middle District East. Green building is the building that takes into account environmental considerations into each stage of construction, a design, implementation, operation and maintenance. Green buildings do not require complex operations or expensive mechanisms, and their benefits are not only environmental, but also economic and social; where they reduce the operating costs on the long term through the rationalization of energy and water consumption, reducing emissions, maintaining the temperature and reducing waste.

1.1 What are the green buildings?

Green Building term (green building) refers to the "building designed and constructed and turned around in a sustainable and effective manner", Where there are some international standards that granted by the competent institutions to measure the compatibility of the building with the environment and the possibility classifies within green buildings, also the green buildings rely on construction techniques that take into account the environment in the materials used and the consumption of energy and sustainability, and it depends on raw materials in construction and is keen to use what is in the vicinity of the place environment such as construction compacted soil or sand bags, some of which depends on the modern techniques of energy conservation and generation and recycling using advanced solutions based on solar energy, reclaimed water, and energy sources renewable (Aboteer, 2013).

Figure (2) shows the integrative approach: Benefits of Green Buildings (Jo-Green, 2013).



Figure(2): The integrative approach: Benifits of Green Building

Jordan has provided many incentives in order to stimulate the construction of green buildings, and these incentives increase the floor area ratio, tax exemptions, raise engineering quotas, tax exemptions and service facilities one place (Jo-Green, 2014).

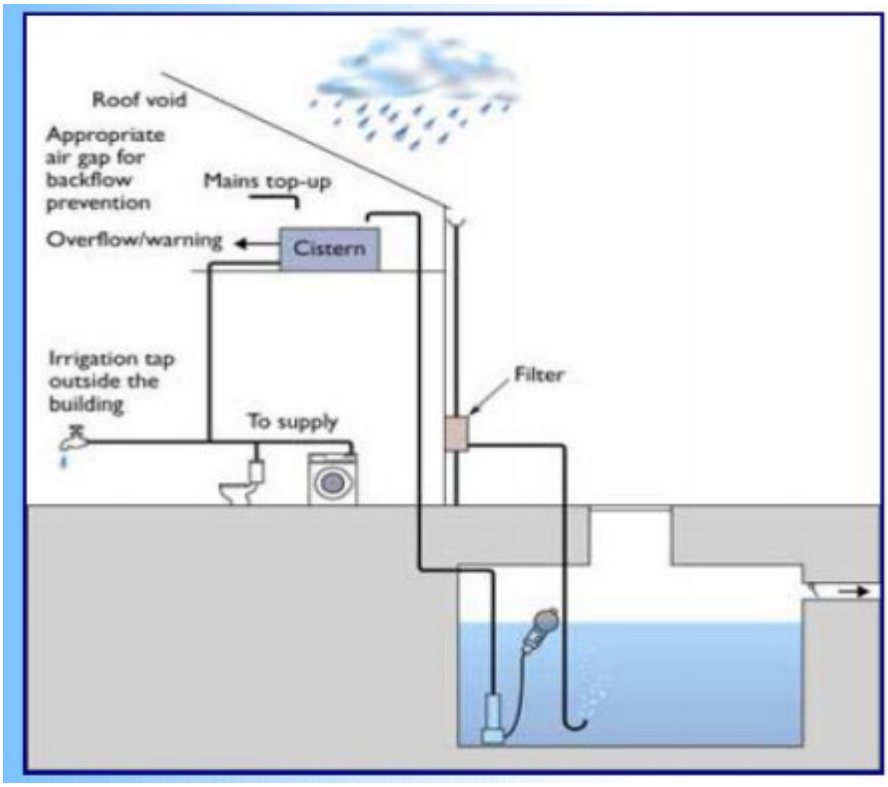
1.2 Water efficiency

Reducing water consumption and protecting water quality is one of the main objectives in the sustainable construction, the critical issue of water consumption in many parts of the country is increasing demand for groundwater beyond the ability to regenerate itself, as a result, the facilities must increase dependence on water which is collected, used and purified, and reused on-site to the maximum extent possible, also the water can be protected and conserved during the life of the building through the work of the dual plumbing that re-circulating water in the toilet to clean design, as well as the water waste can be reduced to a minimum by taking advantage of plumbing water conservation equipment such as reduced flow toilets and reducing the speed and volume of water flow from the shower(Mohammad, 2011).

According to "guide green building in Jordan", which was released in (2013), Jordan is one of the countries that suffers from scarcity of water resources, and ranks among the five poorest countries in the world, especially those water resources which are available for the purposes of drinking and agriculture; and due to the location of the Hashemite Kingdom of Jordan, in the arid and semi-arid regions which suffer from a lack of rainfall which is the main source of nutrition sources of water, so the water requires careful planning based on long-term data about water resources which are available from surface and groundwater in addition to the water in the deep layers and wastewater which should be treatment in an appropriate manner. Some of the systems that can be used in green buildings for water recycling and the use of rainwater:

1- Using the treated sewage water as a source of sterile water to rinse the toilets and urinals Lori Foreign parks and green areas.
2- Using a health pieces such as infrared flushing and Dual flush tank.

Figure (3) shows s schematic of an indirectly pumped system, and figure (4) shows the infrared flushing and Dual flush tank (Jo-Green, 2013).



Figure(3) : A schematic of an indirectly pumped system

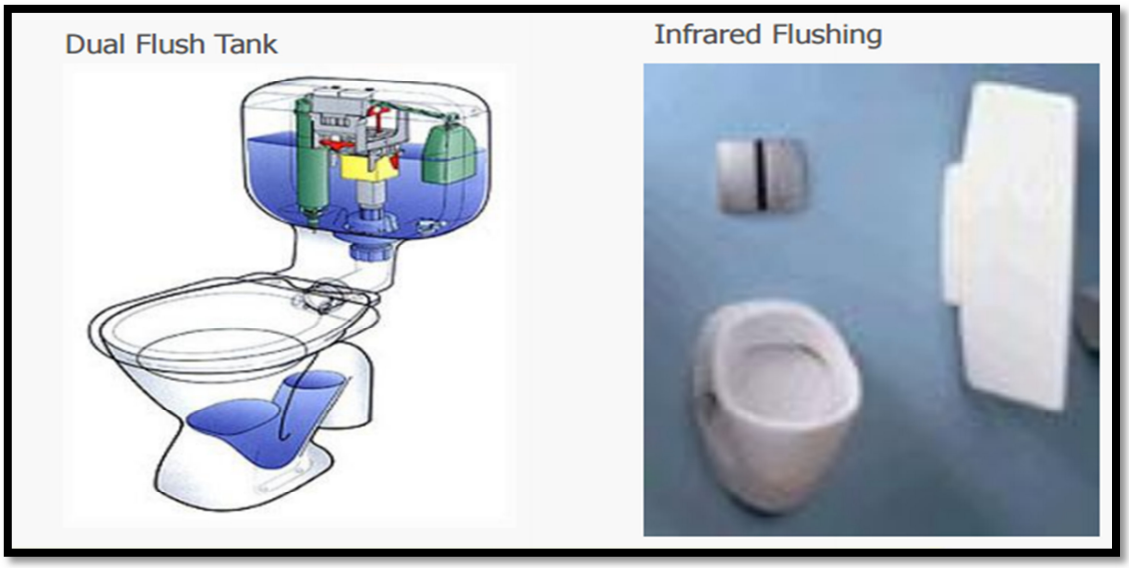


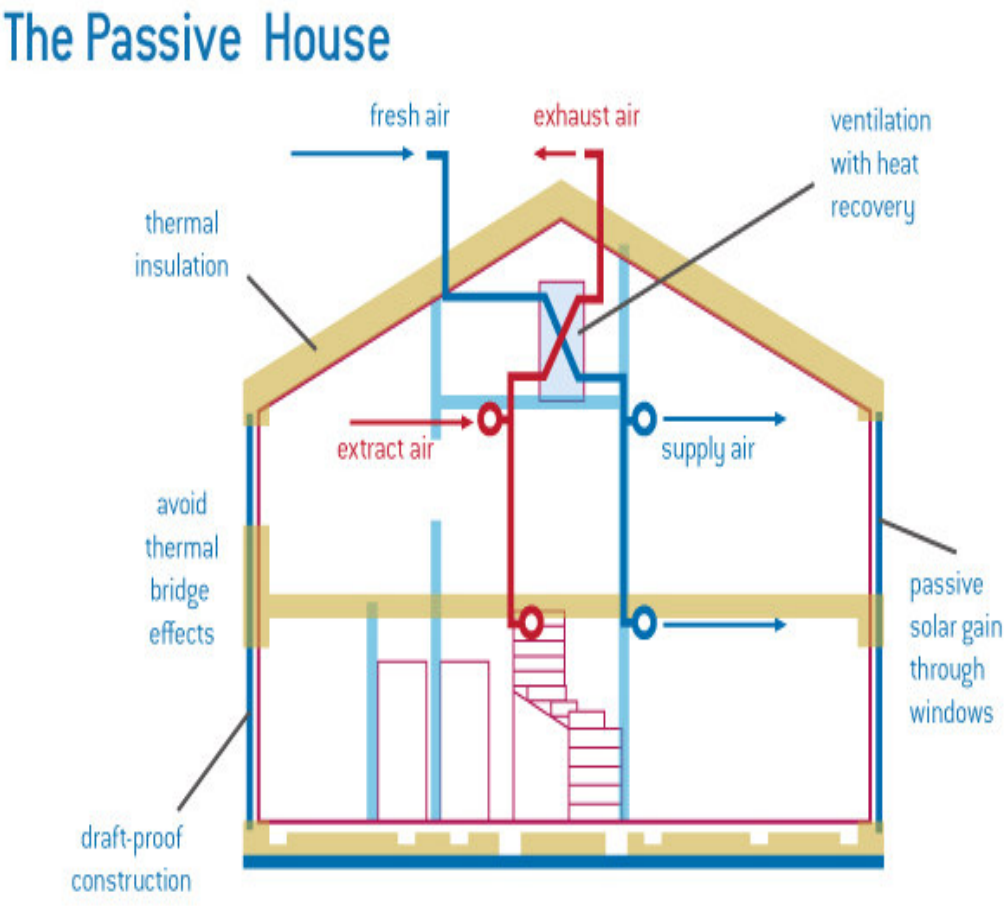
Figure (4) : Infrared flushing and dual flush tank

1.3 Eco-friendly buildings in terms of energy issues

The energy efficiency is one of the most important factors in green building design, starting from the careful selections of windows, good insulation to maintain the temperature of the air, isolated air-conditioning pipes, the correct position of the insulation of steam and air and the use of clean energy in heating and cooling lead to the conservation of energy in the building. The use of renewable energy, such as wind power, solar energy or vital energy to meet the energy needs significantly can reduce the carbon footprint of these buildings (Zaini, 2015).

There are two types for designing the green buildings in terms of energy issues, which are the Passive Design and the Active Design. Passive Design includes the design of the form and fabric of buildings in a manner which can take the advantage of daylight and natural ventilation to reduce the need for electric lighting, heating, ventilation and mechanical cooling, this type of design depends on the light of the sun to preservation the internal thermal in all terms during the day and the annual cycle, and there are special attention to identifying the

building site, the prevailing climate, design and construction, the orientation of Energy Solar, and the position of the Glass-elements and shading, figure (5) shows the general design system in the Passive design (Boake, 2011).



Figure(5): The genaral design system in Passive Design

In order to achieve passive design goals in energy conservation the design must depend on the seasonal changes in the sun's path throughout the day, and this is shown in Figure(6). Figure (7) shows the necessary thermal insulation method in a section of a wall and a section of a slap (Jo-Green, 2013).

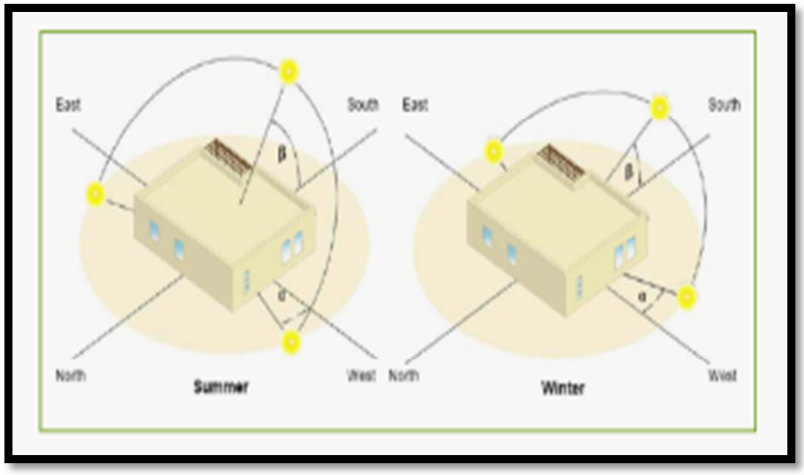
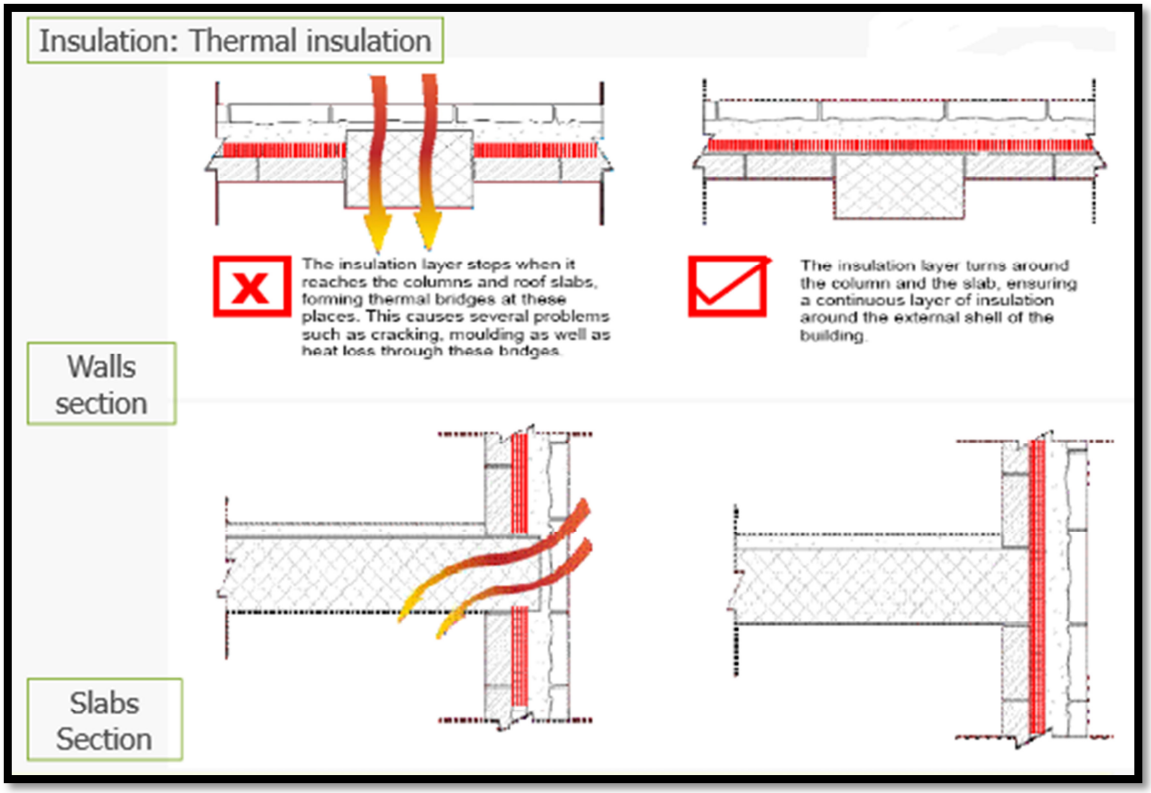


Figure (6) :The sun's path in Passive design



Figure(7): The thermal isolation in Passive Design

Green Building which use the Active Design are buildings that rely on new technological systems to control the internal environment of the building and using the system **"HVAC"** which depends on the heating, ventilation and air conditioning systems, these systems also used as electrical engines by solar energy, such as photovoltaic systems. The active design includes many features such as provide thermal comfort, reduce air infiltration operations and maintain pressure relationships between various spaces (Uhlig et al, 2015).
Figure (8) shows using the "Photovoltaic cells" in Active Design (Jo-Green, 2013).

Figure(8) : Using the photovoltaic in Active Design

The fourth annual conference of the Green Building, which was held in Jordan in (2012) clarified that green building is the best possible solutions to reduce the oil bill, which lost the state budget, where (96) % of Jordan's needs for energy are import from outside, and the Minister of Energy and Mineral Resources Engineering "Qutaiba Abu Qura" explained that green building are one of the most important solutions to provide the consumption of electrical energy in buildings, where the cost of imported energy has reached in the year (2011) about (4) billion dinars and accounted for about (16)% of GDP, also the Minister of Energy shows that Green Building provide about (40)% of the energy consumption by relying on alternative energy and the use of thermal insulation. The most important energy strategy axes which the Jordanian government seeks to achieve is to reach contribution of renewable energy in the energy mix entirely to (7) % in (2015) and (10)% in (2020), the increasing growth of the real estate and construction coincided with an increasing growth in demand sector energy which requires the state pays to look for a quick and effective solutions to reduce the demand for water, energy and environmental conservation (Alhemede, 2012).

1.4 The construction materials in Green Buildings

Building industries around the world consume about (40)% of the total raw materials, this consumption is estimated at about (3) billions of tons annually, in the United States buildings consume about (65)% of the total energy consumption of all kinds, these facts make operations establishment and operation of urban buildings one of the most energy-consuming and materials world industries. Pollutants that are harmful to the environment are caused as a result of bad design of the buildings in the construction and operation and maintenance, and when it becomes unhealthy biological systems as a result of these pollutants, it means there are no safe environments for users (Arafe, 2015).

eco-friendly building materials usually include plant materials which are renewable quickly such as bamboo (bamboo because grows quickly), straw, wood from certified that sustainably managed forests, recycled stone, metals recycled, non-toxic products that can be reused, renewable materials or those which can be recycled (e.g. sheep wool, panels made from paper flakes, construction units (milk), mud-baked, soil broken, clay, flax and seaweed and cork grains, coconut and slabs of wood fibers, etc.) and EPA, Environmental Protection Agency, suggests to recycle the industrial goods and reuse it, such as the burning of coal products, and the remnants of the demolition in construction projects. Also building materials should be extracted and manufactured locally for building sites in order to reduce the loss of energy which is an integral part of the transfer. Where possible, they should build elements manufactured off-site and deliver to the site. To maximize the benefits of off-site production, including reducing waste, maximizing recycling (because manufacturing in one location), developing the high-quality components, improving the Occupational Safety and Health Administration and decreasing the noise and dust (Mohammad, 2011).

From the economic terms, spur green building materials and new technologies industry in Jordan are required in construction operations, which could provide job opportunities for many citizens. Likely the rise of oil prices in the future and thus will help green buildings to reduce consumption and reduce costs related to electricity and fuel (Katkhuda, 2014).

1.5 Research Methodology

The descriptive qualitative method will be used to gain an accurate and detailed knowledge of the green buildings as a subject of study, and to achieve a better and more accurate understanding of the content related to it and determining their significances. Data collection would be from primary and secondary sources, collecting secondary resources will be from books, Arabic and foreign references, journals, articles, published researches and scientific proposals.

The present paper is mainly concerned with clarifying the results of the application of the concept of green buildings in the world in general and in the Hashemite Kingdom of Jordan in particular, the search handle with the protection of energy, water and building materials issues and the way to reduce their use and protect them from drying up. Also the paper included the methods that can be used in order to preserve these resources and reduce pollution caused to the environment.

1.6 Conclusion

Jordan has made progress in the field of green buildings; as there are points of constant work to establish and apply the concept of green building in earnest institutions. "Commission green building guide in Jordan" is a specialized committee which has formed in the Ministry of Public Works and Housing, in addition to the national Green Building Council and Jordan Green Building Council, and the efforts of these agencies concluded in the preparation of the Green Building Jordanian guide (Katkhuda, 2014).

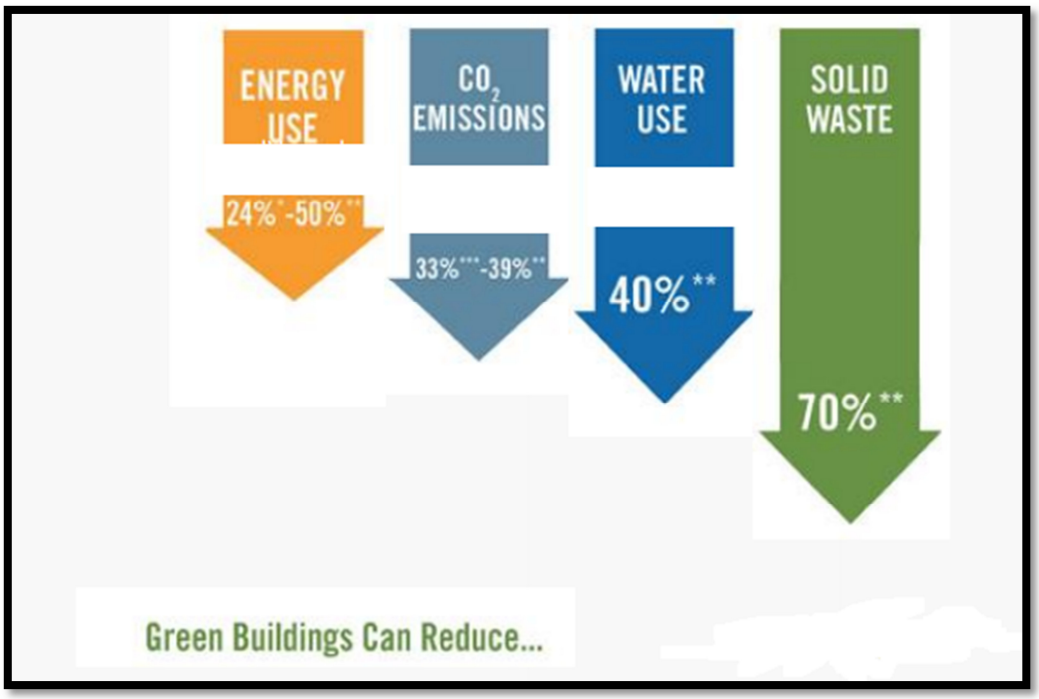
The concept of green building in Jordan can be promoted by increasing awareness about building green society and its importance over the community for the individual and the whole community, and to impose a formal laws dealing with construction matters for green buildings, and developing the capacities and

capabilities that will support green building projects in Jordan; through the assistance of providing the raw materials, spaces and the ways that promote the application of the concept of green building in Jordan easily.

If the industries in the Middle East adopted green building technologies rather than traditional technologies, they can significantly contribute to addressing environmental problems, as well as to get long-term financial returns. Although the Middle East is being late in keeping up with other markets in terms of overall sustainability, the situation is reason for optimism; where that (29) % of the workforce in this area companies have more than two million square feet of green projects planned over the next three years, higher than any region in the world. The technologies of green building systems can also act as catalysts for urban expansion; ensure energy security, the fight against climate change, and the opening of new diplomatic and economic prospects (Katkhuda, 2014).

The green buildings and sustainable buildings are not a luxury or a trend in theory; it represents a trend applied universally and professional practice and conscious which began to take shape among the architects involved in the construction sector in the advanced industrial countries, these countries have finished a long way in this area.

Figure (9) shows the proportions of water and energy resources and the proportion of second Carbon dioxide and the amount of construction materials that can be minimized through the use of green building systems in Jordan (Jo-Green, 2014).



Figure(9) : The proportions of water, energy, CO_2 and the construction materials by using Green buildings in Jordan

Green buildings do not require complex operations or expensive mechanisms, and their benefits are not only environmental, but also economic and social; where they are reduced operating costs in the long run through the rationalization of energy and water consumption, reduce emissions, maintaining the temperature, and reduce waste. Also, avoiding the use of scarce natural resources such as water resources and choosing re-refining can reduce construction costs by an estimated at 10% (Katkhuda, 2014).

1.7 References

- Zaid, S. M. (2011). Green Building Rating System.
- Katkhuda, N. (2014). The benefits of green buildings, Al Ghad Newspaper.
- Zaini, O. (2015). Future green homes .., Al-jazairah website.
- Boake, T. (2011). What is sustainable Design? Part three: The basic Principles of passive design.
- Aboteer, M. (2013). Green Building… houses vibrant health, Jordanian Constitution newspaper.
- Mohammad, A. (2011). The prospects for the establishment of green building eco-friendly.
- Alhemede, S. (2012). Experts offer the benefits of green building to meet the onerous energy bill.
- Uhlig, A. D., Lacasse, M. and Nienabar, S. (2015). Green build International Conference and Expo 2015.

- Arafe, A. (2015). ProMedia Forum launches green buildings in Cairo.
- Guide green building in Jordan,(2013). Applications and concepts of green building, Sustainable Design, Competition creative designs of green homes (Jo-Green 2013). http://qac.jo/Files/GreenHouseConcept.pdf

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