

# Green Building Development in Jordan

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Royal Scientific Society



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## Forewords

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The future of our sustainable energy supply is a concern that unites developed and developing countries. Although the political focus has largely been fixed on the issue of energy security, rather than on sustainability and the environment, science and public opinion are having an impact on longer-term thinking. Our global reliance on fossil fuels may still remain, but the desire to apply a more sustainable, resource-efficient approach has taken shape and is rapidly gathering momentum. In this context, countries and trading blocs around the world are developing energy efficient mechanisms across particular sectors, one of which is the buildings and construction sector.

Data on the building sector reveals an intense and often wasteful use of scarce resources. Buildings account for 40 % of global energy use, 40 % of waste products, 12 % of potable water and 38 % of all global GHG emissions. As buildings are physical structures with long life spans, the potential for savings in this sector is enormous. Improvements in both new and existing buildings are needed to tackle pressure on resources.

For Jordan, this issue arises at a time when the built environment is failing to meet the increasing demands on scarce resources. The construction sector is under increasing pressure to meet a rapidly growing need for housing and commercial space. However, so far the focus with regard to efficiency has been on raising the awareness of households regarding water and energy efficiency. These are minor measures that will not produce large-scale improvements in efficiency, unless they are complemented by sustainable design practices that cover the entire life cycle of buildings. Green building techniques and construction materials, together with sustainable energy technologies, have evolved quickly in recent years and their potential for savings and efficiency must be incorporated into construction and buildings management codes in Jordan.

Given Jordan's limited and costly supply of natural resources, our future must be a sustainable one. Encouraging and providing incentives for green building practices in Jordan goes beyond economics. It benefits and preserves our delicate environment and provides us with the first and vital step towards a sustainable future.

Scarcity of resources and a subsequent unsteady energy supply are two serious challenges, which Jordan faces today. Developing sustainability practices for both industry and private households, for example regarding improved energy efficiency and resource recycling, could show far-reaching results in tackling these challenges.

The practice of green building can be a pillar of progress in this field by committing construction projects to responsibility towards the environment and to the efficient use of resources throughout the lifecycle of a building. Green building concepts can be applied to newly built houses as well as to existing ones through retrofitting.

The benefits of green building practices include a lower and more efficient use of energy, water and other resources, improved health and safety standards for the buildings' residents, as well as a reduced environmental impact, through less waste-production and pollution.

With the following study, the Friedrich-Ebert-Stiftung (FES) and the Royal Scientific Society (RSS) would like to contribute to furthering the discussion on sustainability practices in Jordan. Both organizations are joined in a close partnership and have been continuously cooperating for three decades now. Together, FES and RSS have published numerous studies and organized several conferences on a broad spectrum of topics, with energy policy being the most prominent.

The office of FES in Amman serves as a regional link for the energy and climate policy activities, which FES organizes in the Middle East. This program supports the search for suitable policies to promote energy saving and energy efficiency, and encourages a transition towards an energy supply based on renewable energy sources. FES strives to contribute to new energy policies, which could generate green and fair jobs, promote economic development and energy justice, as well as lead to a solution to the many water issues and air pollution in the region.

We wish you an inspiring read of our study and thank you for your interest in the activities and publications of FES Amman.



## Acknowledgments

This research study was prepared with the support of the National Building Council at the Ministry of Public Works and Housing, the Building Research Center at the Royal Scientific Society (RSS), Greater Amman Municipality, the Jordan Green Building Council, A/E Business Council, the Jordan Engineering Association, the Contractor's Association and the Housing Investors Association and several other experts in the field. In addition, special thanks go to Professor Odeh Jayyousi and Florentine Visser for offering feedback on the draft report.

The team of the Economic and Social Research Department at RSS namely Jihan Haddad, Atheel Louzi and Njoud Batayneh also assisted in the attainment of this research.



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## Key Findings

The objective of this study was to assess the perceptions, barriers, and knowledge level of various engineering firms in Jordan with regards to green building and to gather some engineering insights into the future of green construction. Results of this survey were analyzed together with an in depth desk review of the status of green buildings in Jordan.

Green buildings are viewed as the cornerstone of sustainable development since the construction sector is central to economic development and employment. Green buildings provide a set of added benefits in terms of water and energy saving but they suffer from certain market barriers and lack of professional expertise. The construction sector has the potential for water and energy saving which will contribute to environmental sustainability.

The key findings of the survey are as outlined below:

- 1. The level of knowledge about green building varies between Amman and the governorates:** The survey showed that there are salient variations in the level of knowledge about green building between Amman and other governorates, namely, Irbid and Kerak. The survey revealed that 88.9 % of respondents in Amman have knowledge about green building. There is a correlation between the engineering firm category and commitment to green practices and concepts. The higher the firm's rank, the more is the willingness to adopt green approaches for design and construction.
- 2. Limited demonstration sites exist in Jordan but there is a realization of the positive impact of green building on water and energy savings:** The concept of what constitutes green building varies among respondents. Concepts stated by respondents include: I) green buildings take advantage of the surrounding environment and weather conditions; II) they are energy efficient and constructed in accordance to specific building codes; III) they minimize the production of waste and use environmentally friendly materials. In order to embody a societal change in green building, it is useful to promote pilot projects for action learning in order to highlight the water and energy savings.
- 3. There is sound awareness about green building codes in Jordan:** Most of the respondents expressed that their knowledge of green buildings was acquired through the Internet training or awareness sessions. Al-
- most half of the respondents demonstrated knowledge of the voluntary green building codes and of the entities responsible for their preparation (Engineering Association, RSS, National Building Council and Jordan Green Building Council). However, the respondents' assessment of the contractors' knowledge on green buildings is weak. It should be noted that changing the mental model for contractors and design engineers about the added value of green building is a prerequisite for a transition into a low carbon economy.**
- 4. Reasonable knowledge exists about water and energy saving because of green building development:** Approximately 44 out of the sample group responded positively about their knowledge of specific water and energy saving mechanisms with only 22 % of them working on engineering plans that have such systems. There is a correlation between geographical area and level of awareness; firms located in urban areas are keen to adopt and apply green building concepts. The discussions during the focus group with the Jordan Green Building Council reveal that first class contractors are compliant to push for a transition to green building under the condition there are adequate incentives and market barriers are addressed at the public policy domain.
- 5. Economic incentives are limited for green building practices and applications:** The survey reveals that only 33 % of respondents are aware of water and energy saving devices. The survey showed that around 55 % of respondents' view that green applications in housing are costly and not competitive. The role of the government in promoting green building is undeniable and would prove to be effective. Market based incentives are effective in improving the situation of green building in Jordan. However, there is evidence in the international domain, which states that financial incentives are not able to overcome the high upfront cost (new design, new technology, and new construction methods) of green building construction. Re-thinking incentives to be effective is essential to move forward in green building development.
- 6. There is limited availability of trained human capital in green building:** The survey revealed that the number of trained and licensed professionals in the field is limited. More than half of the respondents divulged the fact that they do not have professional training in green applications. Other barriers to green building in Jordan



## 1. The Global Context

include lack of credit resources to cover initial cost, lack of customer demand, and high initial cost. Investing in certified vocational and professional training in green technology, eco-design, and eco-construction is essential to promoting new green jobs for an emerging market.

**7. Diverse entities are reported responsible for the awareness of green building:** Respondents pointed out that the key entities responsible for green building practices are the Jordan Green Building Council, followed by the Engineering Association and Greater Amman Municipality. The media together with various universities around the country play a limited role in green awareness. Elevating the scientific discourse of green building to a policy arena can be achieved through transformative media and education. Hence, education and media need to have an enhanced capacity to make the adequate transition into a green economy.

**8. Multiple actors with different roles are engaged in green building adoption:** The survey revealed that a set of actors have specific roles in green building. These include the Jordan Engineering Association, the Green Building Council, Engineering Offices, and Greater Amman Municipality. The lack of clear roles and responsibilities at higher policy levels and the competition among various actors made it hard to enforce codes and move forward with green construction.

The study concluded that the lack of knowledge about sustainable design, perceived high cost, laws and regulations, construction costs, lack of demand, and the limited number of demonstration sites are the primary obstacles. The study therefore recommends that it is imperative to build a system of incentives for contractors to ensure the cost-effectiveness of green buildings and to develop client knowledge and product information services through credible professional sources like the Ministries of Public Works and Housing, Energy and Environment, Jordan Green Building Council and Jordan Engineering Association. The study recommends the strengthening of governmental incentives through subsidy, rebate program, tax incentive schemes, rating systems and technical assistance.

Energy crisis, climate change, and environmental pollution have positioned sustainability high on the global agenda (EPA, 2008). Studies had shown that the construction industry is one of the top polluters of natural environment (Horvath, 1999). The barriers for developing green building were investigated by Samam, et al. (2013). They include a lack of effective and sufficient market-based incentives for contractors and lack of product information and awareness about sustainable buildings. This study intends to identify and analyze barriers and incentives to green building development in Jordan.

Research reveals that understanding the obstacles to green building development will help to find ways to promote a green building market (Chan et al., 2009). The lack of expert knowledge in green building creates an environment that lengthens the development timeframe (Choi, 2009). Expertise is a key factor in promoting sustainable building (Miyatake, 1996). However, green buildings should be considered as an opportunity for development since they minimize the use of resources (water and energy), reduce the harmful impact on the ecology, and provide better indoor environment. Xing et al. (2011) stated that buildings account for almost half of the energy consumption in European countries as well as in the Middle East. To cope with the possible impacts of "peak oil" due to a high standard of living, high rate of water and energy consumption and the model of economic development in the MENA region, the transition to a low carbon economy and the adoption of green approaches is a logical and wise step as manifested in the promotion of the following:

- Low-energy building design;
- Net zero energy buildings;
- Passive buildings;
- Integrated technologies associated with green buildings.

Kats et al (2003) concluded that the average cost premium for building in accordance with the code is less than 2 %, but results in life cycle savings of 20 % of the total construction cost. To develop green building in the construction industry, we need to identify the barriers that hinder green building development.

Sustainability implies that the supply of 'natural capital' is maintained and it mandates that the use of renewable sources should not exceed the rate of renewal. The use of

**Green building** is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's lifecycle from siting to design, construction, operation, maintenance, renovation and deconstruction.

Green buildings are designed to reduce the overall impact of the man-made environment on human health and the natural environment by (a) efficiently using energy, water, and other resources, (b) protecting occupant health and improving employee productivity, and (c) reducing waste, pollution and environmental degradation.

Source: <http://www.epa.gov/greenbuilding/pubs/about.htm>

non-renewable resources should be such that they will not be exhausted before alternative sources are available. Green building notion emerged as a response to meet these sustainability principles. Green building is a process and concept of design and construction that adopts environment-friendly practices. It uses local eco-sources to facilitate eco-construction based on eco-design (Samer, 2013).

The various types of buildings for residential, institutional, industrial, and commercial uses require careful assessment and audit of water and energy use to ensure compliance with green codes and principles. The notion of green, eco-construction, and sustainable buildings emerged as a response to the global environmental crisis as manifested through climate change and the water and energy crisis. Although the concept of green building is relatively new to Jordan, the concept has acquired significant attention and acquiescence on a global and regional level. Statistics show that the operation cost for buildings and urban transportation takes up over half of the total energy consumption in the city (UNEP, 2011a).<sup>1</sup> In addition, at a global level, the International Energy Agency (IEA) (2009) estimates that nearly 60 % of the world's electricity is consumed in residential and commercial buildings.<sup>2</sup> The

1 "Buildings: investing in energy and resource efficiency." In Towards a Green Economy: Pathways to Sustainable Development and Poverty Reduction. United Nations Environment Program (UNEP), 2011. ([http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER\\_9\\_Buildings.pdf](http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_9_Buildings.pdf)).

2 Building Design and Construction: Forging Resource Efficiency and Sustainable Development, UNEP-Sustainable Buildings and Climate Initiative; Promoting Policies and Practices for Sustainability, 2012.

Figure 1: **The Contribution of Buildings to Global Energy Use, Potable Water Use and GHG Emissions**



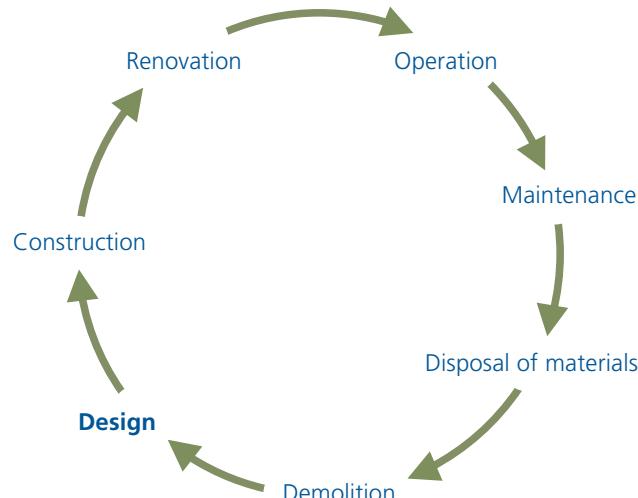
Source: Building Design and Construction: Forging Resource Efficiency and Sustainable Development, UNEP-Sustainable Buildings and Climate Initiative; Promoting Policies and Practices for Sustainability, 2012

Intergovernmental Panel on Climate Change (IPCC) estimates that by 2030, greenhouse gas (GHG) emissions from buildings will account for over one-third of total emissions.<sup>3</sup> Hence, the transformation to green economy and mainstreaming green practices in infrastructure and development sectors (water, energy, construction, transport) will yield positive results in terms of energy savings and waste minimization. Figure 1 below illustrates the contribution of buildings to global energy use and green house carbon (GHC) emissions.

The above statistics reveal the potential and long-term savings of the transformation to green buildings. Besides, green applications include existing buildings, where retrofitting can have significant energy and water savings as such buildings constitute the bulk of the building stock.

Furthermore, as urbanization is increasing rapidly worldwide, this will intensify the demand for natural resources. By 2030, it is expected that an additional 1.4 billion people will live in

3 Building Design and Construction: Forging Resource Efficiency and Sustainable Development, UNEP-Sustainable Buildings and Climate Initiative; Promoting Policies and Practices for Sustainability, 2012.



cities, of which 1.3 billion will dwell in cities of developing countries.<sup>4</sup> This implies more construction and hence more pressure on natural resources. Therefore, a transition to green building concepts and low carbon economy becomes an integral component for achieving sustainable development.

The state of environment and the pressures imposed on the ecosystems, species, people and economy resulted in the development of new initiatives as outlined below:

- **UNEP-SBCI (UNEP-Sustainable Buildings and Climate Initiative)** is a partnership of major public and private sector stakeholders in the construction sector, working to promote sustainable building policies and practices worldwide and linking the impact on climate change.
- **The US Green Building Council** is a nonprofit organization that promotes a sustainable future through cost-efficient and energy-saving green buildings supported by its LEED green building program, with focus on advocacy in support of public policy that provides a favorable environment for green buildings and communities.

Green building aims to achieve efficient and environmentally sound use of resources during the complete life cycle of construction as depicted in Figure 2 below. Green buildings drastically reduce negative environmental impact through the implementation of various practices such as using natural sunlight, various photovoltaic techniques, insulation, indoor air quality, green roofs, and the utilization of green building materials.

#### **Examples of Green Building Rating Systems with Third Party Verification – Global and Regional (Annex I)**

**LEED** – Leadership in Energy and Environmental Design

**BREEAM** – British Research Establishment's Environmental Assessment Method

**Qatar GSAS** – Global Sustainability Assessment System

**Figure 2: Life Cycle of Building Construction**

Green buildings considerably improve indoor and outdoor environments. The interior of green buildings employ the use of high-quality filtered air, efficient use of energy and water, and sustainable building materials. The exterior component then addresses measures that can range from green roofs to using public transit modes, bicycling and walking.

There has been much debate on the economics of green building compared to conventional building. Recent studies show that there is a consensus that green building reduces the negative impacts that conventional building have on both human health and the natural environment. In terms of energy savings, there is evidence that new green buildings are more energy-efficient by about 75 % compared to conventional ones. Such substantial savings can be realized through system design and value engineering from all engineering disciplines. This integrated design process involves architects, engineers, contractors and clients to develop an optimal design in terms of technology, materials, and energy savings.<sup>5</sup>

The rating of green buildings is based on certain criteria, which includes water and energy conservation, efficient use of resources, waste management, pollution, and environmental degradation. Design strategies for green buildings adopt either passive or active design. Passive design incorporates strategies that leverage natural characteristics such as the location of the building to harness natural and appropriate lighting, heating and cooling measures. Conversely, active design includes strategies that leverage green technologies such as solar panels and energy efficient appliances.

4 State of the World 2012: Moving Toward Sustainable Prosperity, Worldwatch Institute.

5 <http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter6.pdf>

## 2. The Regional and Local Context

The traditional way of life, urban planning, and building construction prevalent in the Arab world generally have followed what would qualify as green practices.<sup>6</sup> These practices, inspired by local knowledge, have continued until the 1970s, with examples found in urban transportation, energy consumption in buildings, water consumption, and waste generation.<sup>7</sup> The limited resources in the last five decades made it imperative to decrease usage and optimize resources. Unfortunately, after the oil boom in the last 1970s, this trend was reversed due to increased wealth and consumerism in the region. In the last decade, however, there is a shift towards more sustainable practices in the region due to awareness of the ecological footprints of human activity as reflected in levels of energy consumption, environmental degradation, waste generation, land use practices, and pollution. The investment in the construction and infrastructure sectors in the Arab region represents a high portion of GNP. Consequently, green buildings are likely to have a positive impact in terms of water and energy savings and reductions of waste and carbon emissions.

Although the Middle East lags far behind the United States, Europe and Asia in terms of green structures, it is among the international leaders of buildings applying for LEED status with 1,348 LEED-registered sites, which surpasses all but Asia and the United States.<sup>8</sup> Among the Gulf countries, recognition of the fact that dependence on fossil fuels is unsustainable is increasing, especially considering that these countries have high ecological footprints. For this reason, plans are being made for a transition into a lower carbon economy through the implementation and promotion of green buildings. This transformation at both the public policy and the private sector domain is logical due to the high use of water and energy in an arid climate. These proposals are visible in new green initiatives as follows:

- **Masdar City in Abu Dhabi**, UAE, is intended to be a zero-carbon and zero-waste community with a cost under

6 Arab Environment •4 Green Economy, Sustainable Transition in a Changing Arab World, Report of the Arab Forum for Environment and Development, 2011.

7 Arab Environment •4 Green Economy, Sustainable Transition in a Changing Arab World, Report of the Arab Forum for Environment and Development, 2011.

8 [http://www.huffingtonpost.com/2012/10/23/persian-gulf-green-buildings\\_n\\_2004267.html](http://www.huffingtonpost.com/2012/10/23/persian-gulf-green-buildings_n_2004267.html)

\$20 billion. The first phase is to be completed by 2016, and the final phase from 2020–2025. The city's buildings are built by taking into consideration direct sunlight, wind towers, shading devices and other aspects of sustainable green design.

- **King Abdullah University of Science and Technology**, Saudi Arabia, has a 26-building campus with recycled wastewater and high efficiency energy use.

The above analysis reflects a growing trend and interest in green construction and implementation in the region, specifically in Gulf countries. This transition to green economy is likely to create demand for green jobs, which should be viewed as an opportunity for the Jordanian labor market.

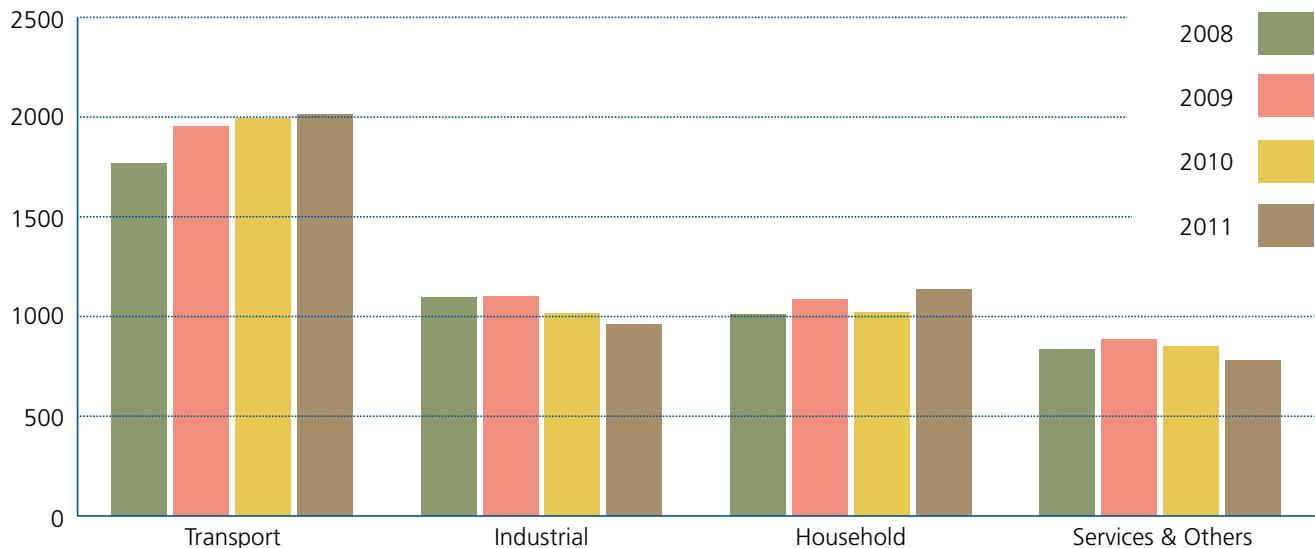
In the context of Jordan, traditional buildings were built with concentration given to the incorporation of natural lighting, wind direction, shadowing effects and insulation material. However, due to urbanization and population growth, there was a shift in building patterns, land use, zoning, and technology. Realizing the spillover effects of economic growth, a shift towards green building concepts and sustainability took place. This shift in the way buildings are designed, constructed and operated is crucial in minimizing the negative impact on the natural environment. In Jordan, a transition to green economy is highly favorable due to the water and energy constraints.

To better understand the social and market forces that shape and define the demand for green buildings, the following is a summary of the key indicators about Jordan in general, and the construction sector in particular. In order to assess the status and local context of green construction and design in Jordan, a macro-economic review of the Jordanian economy, especially with indicators relevant to construction, would be insightful.

According to the UN classification, Jordan is considered an Upper Middle Income country.<sup>9</sup> In the period between 2005 and 2011, per capita gross domestic product (GDP) increased from 1630 JD to 3275 JD.<sup>10</sup> Population in Jordan has increased from over a million and a half in 1970, to more than six million by 2011, with over 80 % of Jordanians living

9 According to the latest: <http://data.worldbank.org/country/jordan>

10 Department of Statistics, Jordan in Figures, 2005 and 2011



**Figure 3: Final Energy Consumption (000 Tons)**

Source: Energy 2012 – Facts & Figures, Ministry of Energy and Mineral Resources, Hashemite Kingdom of Jordan.

in urban areas. Urban population as a percentage of total population was 78.7 % in 2001 and 82.6 % in 2011. Jordan has a young population with over 60 % under the age of 30. By 2011, the population within the age group of 0–14 years old represented 37.32 % of the total population, and that of the age group 15–54 years old is expected to be 59.44 %.<sup>11</sup> For the same age groups, the corresponding percentages in 1979 were 50 % and 47 % respectively.<sup>12</sup>

Furthermore, by 2010, most Jordanians owned modern conveniences with 98 % of households owning a washing machine, 98 % owning a TV, 97 % owning a satellite receiver, 42 % a personal computer and 98 % owning a mobile phone.<sup>13</sup> This reflects an increasing trend towards consumerism and especially towards electricity based appliances in homes.

The construction sector in Jordan has contributed to 4.3 % of the GDP (in current prices) in 2011 and had a value added in the same year of 888 million JD in current prices, which was an increase of 174 % from its 2004 value of 324 million JD and a 0.9 % decrease from its 2010 value.<sup>14</sup> In terms of employment of Jordanians, the construction sector employed around 6 % of the total workforce in 2011 a decrease from its 7.1 % value in 2004, mainly due to the increasing number of foreign workers in the sector.<sup>15</sup> In terms of building permits for residential buildings, there was an increase from 10,191

11 Jordan Statistical Yearbook, Department of Statistics, 2011

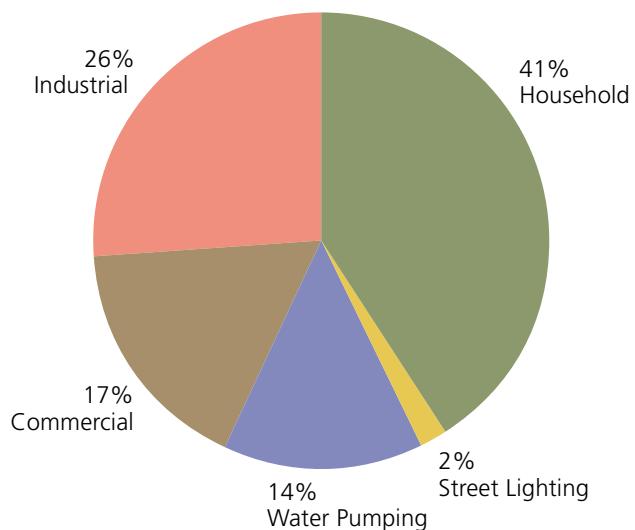
12 Population Report, Higher Population Council, 2010

13 Department of Statistics, Jordan in Figures, 2010

14 Department of Statistics, Yearly Statistical Yearbook, 2009 and 2010. Housing and Urban Development Corporation, Housing Sector - Achievements and Performance Evaluation(2004–2012), 2012. Value added of 2010 and 2011 are based on quarterly projections.

15 Housing and Urban Development Corporation, Housing Sector - Achievements and Performance Evaluation (2004–2012), 2012.

**Figure 4: Electrical Energy Consumption by Sector,**



Source: Energy 2012 – Facts & Figures, Ministry of Energy and Mineral Resources, Hashemite Kingdom of Jordan.

in 2007 to 10,677 in 2009.<sup>16</sup> In terms of the structure of housing units, in 2010, apartment units constituted 69 % of total housing units.<sup>17</sup> The total number of housing units in 2010 reached 1,395,000 and is expected to increase for the period of 2012–2015 to 1,507,322.<sup>18</sup>

16 Jordan in figures 2009, Department of Statistics, Hashemite Kingdom of Jordan

17 Housing and Urban Development Corporation, Housing Sector - Achievements and Performance Evaluation (2004–2012), 2012.

18 Housing and Urban Development Corporation, Housing Sector - Achievements and Performance Evaluation (2004–2012), 2012.

According to an Income and Expenditure survey, spending on housing was on top of the list of total spending on non-food items by Jordanian families reaching 62 % of total spending followed by transportation and education with a 10 % increase in spending on housing between 2006 and 2008.<sup>19</sup> In 2011, total housing loans extended to individuals constituted 41.4 % of the total extended to the construction sector representing a rise of 6.4 % from its 2010 value.<sup>20</sup>

In terms of energy, more than 96 % of Jordan's energy is imported in the form of crude oil products. In 2011, the cost of consumed energy represented 71 % of exports, 31 % of imports and 20 % of GDP.<sup>21</sup> Furthermore, during the period 2008–2011, per capita primary energy consumption increased from 1254 kwh to 1193 kwh and per capita consumption of electricity increased from 1967 kwh to 2166 kwh.<sup>22</sup> The transport sector consumes the most energy, followed by the household and industrial sectors.

As for electricity consumption, in 2011, the household sector, recorded the highest share at 41 %.

Interestingly, given the solar power potential in Jordan, only 11 % of households in Jordan currently use solar water heaters.

The water situation in Jordan is just as critical as that of energy. Jordan is considered the fourth poorest country in the world in terms of water per capita (147 ltr/day in 2010<sup>23</sup>) with its per capita share far below the international water poverty line. At 115 m<sup>3</sup> per capita, Jordan has one of the least renewable internal freshwater resources according to 2009 data. This compares to a regional average of 400 m<sup>3</sup> and a world average of 6,300 m<sup>3</sup>.<sup>24</sup>

Hence, in light of the above indicators and challenges, and in relation to the subject matter of this research study, the need to adopt green measures in building is crucial for the following reasons:

- The household sector is the highest sector in terms of electricity consumption;
- Increasing share of expenditure on housing, and rapid growth of construction of housing units reflects increasing demand for housing;
- Population and demographic dynamics reflect an increasing share of the population within the age of either acquiring their first homes or demanding homes.

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19 Department of Statistics, Jordan in Figures, 2010

20 Housing and Urban Development Corporation, Housing Sector -Achievements and Performance Evaluation (2004–2012), 2012.

21 Energy 2012 - Facts & Figures, Ministry of Energy and Mineral Resources, Hashemite Kingdom of Jordan.

22 Energy 2012 - Facts & Figures, Ministry of Energy and Mineral Resources, Hashemite Kingdom of Jordan.

23 Annual Report 2010, Ministry of Water & Irrigation, Water Authority of Jordan-Jordan Valley Authority, Hashemite Kingdom of Jordan.

24 Renewable internal freshwater resources per capita, World Bank Data, 2009.

### 3. Survey Findings

The methodology for this study was based on an online survey and focus group targeting engineering offices in Jordan. A sample of engineering offices was obtained from Jordan's Engineering Association. A representative sample was determined, with the assistance of the Department of Statistics, of engineering offices in Amman, Irbid and Karak<sup>25</sup>.

The objective of the questionnaire was to assess the level of general knowledge and barriers for green construction, assess gaps in the level of knowledge, and provide feedback on the most suitable ways to increase the level of knowledge. As such, questions were grouped under 6 headings; general information about the engineering office, general knowledge on green building, specific knowledge on the aspects of green building that pertain to energy and water, training, awareness, and recommendations. The following is a synthesis of the findings:

- **The level of knowledge about green building varies between Amman and the governorates:** The survey showed that there are salient variations in the level of knowledge about green building between Amman and other governorates, namely, Irbid and Karak. The survey reveals that 88.9 % of respondents in Amman have some knowledge about green building. Observably, there exists a correlation between the engineering firm category and commitment to green practices and concepts. The higher the firm's rank, the more likely they are to adopt green approaches for design and construction. In the city of Irbid, around 77.8 % of the sampled engineering offices expressed having knowledge in green buildings and 11.1 % expressed lack of knowledge (the remaining respondents did not answer the question). In Irbid city, most respondents' assessment of the level of knowledge of green construction by households is weak, and is practically nonexistent for contractors.

25 Sample – Process – Group engineering offices according to their classification, calculating the weights for each group, and choosing the sample from each group depending on the proportional size of each group.

- **Limited demonstration sites exist in Jordan but there is a realization of the positive impact of green building on water and energy savings:** The concept of what constitutes green building varies among respondents. Concepts stated by respondents in Amman, Irbid and Karak include: I) green buildings take advantage of the surrounding environment and weather conditions; II) they are energy efficient and constructed in accordance to specific building codes; III) they minimize the production of waste and promote use of environmentally friendly materials. In order to endorse a societal change in the general knowledge of green construction, it is useful to promote pilot projects for action learning to highlight the water and energy savings. Additionally, the study reveals a set of barriers for the promotion of green building. These include:
  - Lack of building code regulation;
  - Lack of incentives;
  - High investment cost;
  - Risk of investment;
  - Higher final price;
  - Lack of credit resource to cover up front cost;
  - Lack of public awareness;
  - Lack of demand;
  - Lack of a clear and integrated strategy to promote green building;
  - Lack of design and construction teams;
  - Lack of professional/ vocational expertise and knowledge;
  - Limited number of pilot or demonstration sites and case studies for knowledge management;
  - Limited government support (regulatory, incentives).

- **There is sound awareness about green building codes in Jordan:** Most of the respondents in Amman city expressed that their knowledge of green buildings was acquired through the Internet, training or awareness sessions. Almost half of the respondents demonstrated knowledge of the voluntary green building codes and of the entities responsible for their preparation (Engineering Association, RSS, National Building Council and Jordan Green Building Council). The respondents' own assessment of the knowledge of households and contractors on green building is that it is weak (over 50 % citing weakness with regard to both groups).
- **Reasonable knowledge exists about water and energy saving as a result of green building development:** Around 44 of the sample responded positively about their knowledge of specific water and energy saving mechanisms with only 22 % of them working on engineering plans that have such systems. There is a positive correlation between geographical area and level of awareness; firms located in urban areas are keen to adopt and apply green building concepts. The Jordan Green Building Council focus group discussions reveal that there is readiness among first class contractors to push for a transition to green building under the condition that there will be sufficient incentives and that market barriers are addressed at the public policy domain. In the city of Irbid, around 22 % of the sample responded positively about their knowledge of specific water and energy saving mechanisms. In regards to their use of such methods, 11.1 % of them are not developing engineering plans inclusive of said mechanisms, with the remaining respondents not answering the question. These respondents cited that "an advice given to them" was the reason behind the adoption of such mechanisms.
- **Limited economic incentives exist for green building practices and applications:** The survey reveals that only 33 % of respondents are aware of water and energy saving devices. The survey also showed that around 55 % of the respondents in Amman view that green applications in housing are costly and not reasonably priced. The role of the government in promoting green building is undeniable, and would prove highly effective. Market based incentives are crucial in improving the situation of green buildings in Jordan. However, there is evidence in the international domain that states that eventual financial incentives are not able to overcome the high upfront cost (new design, new technology, new construction methods) of green building construction. Re-thinking incentives to be more effective is essential in moving forward in green building development. In Irbid city, 22 % of the respondents expressed that market mechanisms are not available (with the remaining respondents not answering this question) with around 11 % only citing that their prices are not competitive enough. In terms of the main challenges facing the application of such mechanisms, respondents ranked awareness and financial means as the main challenges followed by their unavailability in the local market.
- **There is limited availability of trained human capital in green building:** The survey showed that there is a limited number of professionals who are trained and licensed in the field of green building. More than half of the respondents pointed to the fact that they do not have professional training in green applications. Other barriers to green building in Jordan include lack of credit resources to cover initial cost, lack of customer demand, and high initial cost. Investing in certified vocational and professional training in green technology, eco-design, and eco-construction is necessary to promote new green jobs for a new emerging market. For Irbid city, in terms of the availability of trained and licensed personal in the field of green buildings, 11 % attested to the fact that they do not possess such expertise, with 22 % of respondents answering negatively about being trained in this field.



## 4. Conclusions and Recommendations

- **Diverse entities are reported responsible for green building awareness:** Respondents pointed out that the key entities being responsible for green building practices are the Jordan Green Building Council followed by the Engineering Association and Greater Amman Municipality. The media and various universities play an insignificant role in green awareness. Elevating the scientific discourse of green building to a policy arena can be achieved through transformative media and education. Hence, education and media need to achieve greater capacity in order to make the adequate transition into a green economy.
- **Multiple actors with different roles are engaged in green building adoption:** The survey revealed that a set of actors have specific roles in green building. These include the Jordan Engineering Association, the Green Building Council, Engineering Offices, and Greater Amman Municipality. The lack of defined roles and responsibilities at higher policy levels and the competition among various actors made it difficult to enforce codes and move forward with green construction. Respondents identified the following roles of the various stakeholders:

### Role of Various Stakeholders

#### **Engineering offices:**

Offer clients information on available systems and costs and offer incentives for offices in order to produce creative concepts and engage in competitions;

#### **Jordan Green Building Council:**

Influences local media to distribute information on various eco concepts, support necessary research and conduct awareness sessions and trainings;

#### **Jordan Engineering Association:**

Offers training courses and leverages the media;

#### **Greater Amman Municipality:**

Reduces license fees and controls aspects of the media;

#### **Media:**

Raises awareness and increases knowledge of citizens;

The man-made aspect of the environment has a substantial impact on the economy, society, and natural environment. The development of green building is a function of market demand, customer behavior, and willingness to pay. A transition towards a low carbon economy requires much convincing to justify sustainable building design. This implies the need to mainstream the concept of environmental performance and eco-system services in the evaluation of development projects in all sectors (water, energy, transport, and construction). The economic and social value of green buildings will be evident when environmental performance is measured using the life cycle assessment (LCA) method. This can be attained when the carbon footprints of buildings are taken into account and we are able to develop science-based measures of the relative worth of green buildings. Hence, there is a need to go beyond the normative technical view by shifting to a perspective that integrates technical and social aspects of environmental management. This implies a shift from a product-centered to a process-centered plan of green construction.

In addition, the impending threats of global climate change are a critical factor in the need for the transition into a more eco-friendly policy discourse in the region. Raising awareness on climate change may help to encourage a 'culture of conservation and efficiency' in the region. Awareness of climate change is low, and adapting to climate change is not seen as a high priority. By investing in green infrastructure and enhancing the efficiency in buildings, a substantial saving in water and energy can be achieved. Developing adaptive capacity to climate change and green building are inherently linked. The transition to a green economy implies improving water and energy management systems, enhancing water conservation and energy efficiency, and adopting and enforcing green building and regulations. The following are the main conclusions and recommendations of the study:

### **CONCLUSION I:**

Jordan currently is at a **defining moment** in terms of its energy and water security, making green building now more relevant and important than ever. **Current efforts** to adopt and enforce water and energy efficient measures in buildings are central and should be seen as the first important step towards more green sustainable buildings. **In light of the projected increase in the demand for buildings** due to the demographic situation in Jordan, green building is an opportunity to move forward with the green agenda in Jordan.

### **RECOMMENDATIONS:**

- Work with public and private universities to **integrate green building and life cycle concepts in the curriculum** of traditional and non-traditional discourses (i.e. architecture, civil engineering but also civic engagement). The objective of such an activity would be to target potential engineers and possible potential homeowners while they are still at the universities and enhance their knowledge on green building at an early stage.
- Create a yearly competition for “**green design**” at a university level (similar to the one created by the A/E Business Council) and at an engineering offices level.
- Create and fund a **study tour** for students in universities to visit local/regional green building projects. Students would be chosen across the engineering stream based on academic merit.

### **CONCLUSION II:**

Green buildings should be viewed as an element of an **integrated and multi-disciplinary approach** towards the environment and national challenges. Green buildings have to be tackled within a wider strategy that addresses sustainable development, as part of a package that also targets renewable energy, green financing etc. This would support building up the value chain for green buildings and would reflect the holistic approach to sustainable development.

### **RECOMMENDATION:**

Promote integration of green construction in relevant national strategies and plans (such as the Energy law that specified the new renewable mix by 2020 to be 10 %) with local NGOs in the environment field.

### **CONCLUSION III:**

Importance of addressing both the supply and demand of green buildings.

### **RECOMMENDATION:**

- **On the supply side: Accreditation of green building consultants** on a rating system such as LEED or the future Green Building Guidelines of Jordan is vital in addressing the knowledge gap. However, such accreditation should

be viewed as a tool to address the complete value chain of constructing green buildings as opposed to an end in itself. Also, localizing this tool and supporting the Green Building Guidelines for Jordan is a must.

- **Build a capacity** of maintenance workers in the areas of plumbing, installing and fixing solar panels, etc. in order to ensure adoption of green measures.
- **Package green building** as a potential job opportunity in the Gulf countries where the demand is growing and hence expertise is demanded. This can be achieved through hosting a regional green building conference where demand meets supply.
- **On the demand side:** Harness social media to communicate key messages of green practices and eco-construction that address all sectors involved including potential homeowners, contractors, engineers, students and housing companies, etc. The ad would highlight the cost efficiency of green measures and the contribution to national challenges.

### **CONCLUSION IV:**

Enforcing existing building codes (besides the ones that relate to structural aspects and the safety of buildings) in order to create the culture within the engineering sector that meeting standards itself is a must. This ensures that at least minimum requirements are met across the various sectors of society (high, middle and low income) and across the various types of buildings (public, residential, etc.). In order to address the weakest link in the value chain, a supervisory entity has to be sanctioned and the construction sector needs to be positioned as a significant agent of change in achieving sustainable development in Jordan.

### **RECOMMENDATION:**

Identify a **third party administrative entity** that would ensure supervision and enforcement, hence forming the strongest link in the value chain of constructing green buildings. Research and interviews exhibit that the rate of green construction in Jordan is slowly increasing, with particular attention geared towards energy and water efficiency.

Despite the narrow lens, with primary focus being on water and energy efficiency, a solid entry point to build on into



## Bibliography

the next phase is developing. Considering the process as segmented allows for a proper buildup along the value chain of green buildings.

### CONCLUSION V:

Offering incentives (financial and non-financial) to developers in order to adopt more green measures is a safe option for more dissemination of green building measures.

### RECOMMENDATION:

- Conduct a study on (a) the top inputs/products imported, their costs and their custom exemptions status, (b) the opportunities of creating local supporting industries for green buildings.
- Work with the Ministry of Public Works and Housing on a **"green building index"** where targets and indicators for green buildings are devised.

The study concludes that the impediments to developing sustainable green buildings are a lack of awareness and education about sustainable design and construction, perceived high cost, laws and regulations, lack of demand, and the limited number of pilot/ demonstration sites. The study recommends that it is imperative to build a system of incentives for contractors to ensure cost-effectiveness for green buildings. It is also advised to build client knowledge and product information service through credible professional sources like the Ministries of Public Works and Housing, Energy and Environment, Jordan Green Building Council and Jordan Engineering Association. The study recommends the strengthening of governmental incentives through subsidy, rebate program, tax incentive schemes, rating systems and technical assistance.

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## Annexes

### Annex 1: Green Building Rating Systems with Third-Party Verification

#### **LEED: Leadership in Energy and Environmental Design** ([http://www.sustainablecitiesinstitute.org/view/page.basic/class/feature.class/Lesson\\_LEED\\_Rating\\_System](http://www.sustainablecitiesinstitute.org/view/page.basic/class/feature.class/Lesson_LEED_Rating_System))

The Leadership in Energy and Environmental Design (LEED) Rating System is a program managed by the US Green Building Council, which is a non-profit organization. LEED is a points-based system where a rating level is achieved once a project meets all of the prerequisites and a minimum number of points. Depending on the number of points earned, a project may be designated with a LEED Certified, LEED Silver, LEED Gold, or LEED Platinum designation.

#### **BREEAM: British Research Establishment's Environmental Assessment Method** (<http://www.breeam.org/about.jsp?id=66>)

BREEAM is a rating system for buildings, with 250,000 buildings with certified BREEAM assessment ratings and over a million registered for assessment since it was first launched in 1990.

BREEAM sets the standard for best practice in sustainable building design, construction and operation, and has become one of the most comprehensive and widely recognized measures of a building's environmental performance. It encourages designers, clients and others to think about low carbon and low impact design, minimizing the energy demands created by a building before considering energy efficiency and low carbon technologies.

#### **Qatar GSAS: Global Sustainability Assessment System** (<http://gord.qa/index.php?page=qsas>)

The Global Sustainability Assessment System (GSAS/QSAS) is the first of its kind with a performance-based sustainability rating system in the MENA region. In addition to addressing all locally relevant aspects of sustainability, ecological impact, and green building design criteria, GSAS/QSAS developed an independent building energy standard to support Qatar's building energy ratings.

## Annex 2: Questionnaire

### Questionnaire

Measure the awareness of engineering offices regarding the optimal use of energy and water in green building concepts

### Notification

All information given will be classified and will be used by The Royal Scientific Society Research Team for research aims only. The final report will not mention the names of the engineering companies or offices who participated in this research.

### Research Aim:

The primary aim of this research is to measure the engineering offices' awareness of the concept of green building, with specific regards to the optimal use of water and energy.

*Please put (x) in the right place*

### General Information of the engineering office:

Name:	Graduation Year:	Years Of Experience:
Granted practice license date:	Engineering office classification:	No. of engineers in office: ..... and specialization: Architect: ..... years of experience ..... Electrical: ..... years of experience ..... Mechanical: ..... years of experience ..... Civil: ..... years of experience ..... Others: ..... years of experience .....

- No. of sketches that were prepared and executed in 2011/2012:

Villa .....

Residential building .....

Commercial complex .....

Offices .....

Other .....

- Do you cooperate with other engineering offices to complete sketches? Yes  No

If yes, what are the parts that require completion externally

- .....
- Who are your costumers (Targeted Group)?
- .....

### Green building:

1. Do you have any information regarding green building? Yes  No

If yes, What is the concept of green building on your point of view?

.....

Do you have any projects of green building? Yes  No

If no, please go to question no. 20.

2. How did you get your information on Green Building?

Workshops and training courses

Lectures

Educational curriculum

Daily newspaper

Internet

Others

.....

3. If your source of information was Workshops and training courses:

Training Executing Agency

.....  
Training Location

.....  
Last received training

.....  
Did the training cover the concept and its applications?

.....  
What was your feedback on the training course?

.....  
Do you intend to conduct training courses to your employees?

4. What is the situation of green building in Jordan? Region? From your point of view?

.....  
5. What is the green building effect on the environment?

.....  
6. What are the return benefits to citizens to use green building techniques?

.....  
7. Do you have any information regarding Jordanian building codes? Yes  No

8. Do you know the official bodies that prepare building codes? Yes  No

If yes, Who are those organizations?

#### **Green building-energy-water saving technologies:**

9. Are aware of energy/water saving technologies in building? Yes  No

If the answer is yes:

How did you know about those technologies?

.....  
What is the concept of those technologies?

.....  
What other alternatives do you use?

10. Have you executed any sketch that uses the new building techniques that save water and energy?

No. of houses, buildings, offices .....

What are the techniques/alternatives for the customer?

11. Was the use of these designs based on:

- The client's request
- The condition of the design requirements
- Tip provided to you

12. What is the motivation behind the use of these techniques:

- financial benefits
- tax incentives
- national dimension
- other (specify)

13. Are the techniques available in the Jordanian local market of? Yes  No

14. Are their prices competitive? Yes  No

15. What are the methods used to educate your customers on the need for the acquisition of water and energy saving technologies in their homes?

16. What are the barriers to the application of those techniques:

- awareness
  - not available in the local market
  - financial resources
  - other (mention) \_\_\_\_\_
- 

#### Training:

17. Do you have qualified and licensed team members on the field of green building methods? Or on the part concerning energy and water saving Building techniques? Yes  No

If yes, what are the qualifications:

- holds a certificate (LEED) from the U.S. Green Building Council
  - holds a certificate as a consultant from other green building councils (specify)
- 

- trained to design or to participate in the design of green building in Jordan

18. Have you received any training inside or outside Jordan to work on green building? Yes  No

If the answer is yes:

What financier was used for this training?

---

19. Have you used the information that you obtained from the training programs, workshops and conferences on designs implemented by the office? Yes  No

If yes, what are the most important concepts that have been made to the designs?

---

#### Awareness:

20. Who is involved in providing awareness of green building and energy and water-saving technologies?

- union
  - Secretariat
  - engineering offices
  - Jordanian Council for Green Building
- 

21. What is the role/support/service required of these bodies?

- union
  - Secretariat
  - engineering offices
  - Jordanian Council for Green Building
- 

22. Awareness level of homeowners in subjects of green building and efficient use of water and energy in designed facilities?

- High
- Average
- Weak
- None

23. What is the level of awareness among contractors you have been dealing with on green building and efficient use of water and energy in designed facilities?

- High
- Average
- Weak
- None

24. How can we increase the awareness of different targeted groups?

---

25. Recommendations

What are your suggestions/recommendations to increase awareness of green building and energy-water saving technologies?

---

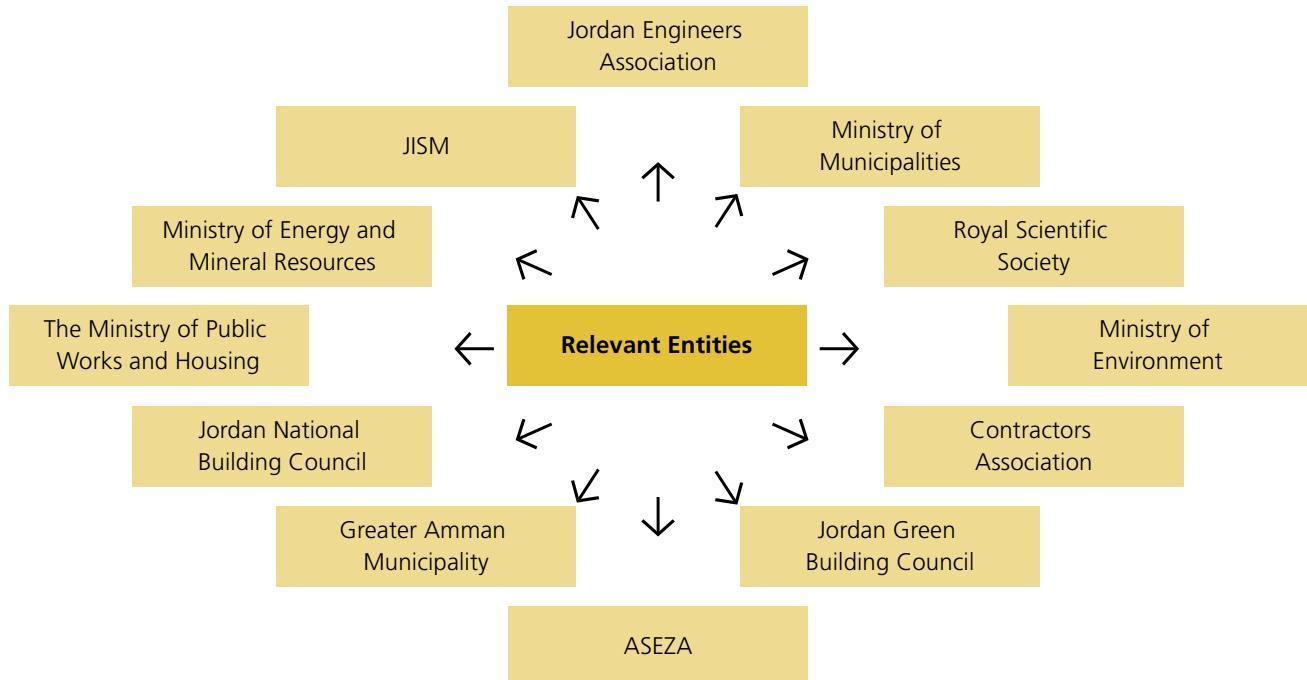


Figure 5: Major Stakeholders

### Annex 3: Institutional and Legal Framework

The following section presents the institutional and legal framework by which green building is governed.

In terms of institutional framework, a review of the local context in relation to the construction of buildings in general and green buildings in particular covers the major stakeholders involved in the process of construction, from the design phase to the construction phase.

In the process of conducting this research study, the major stakeholders were interviewed in order to paint a clearer picture of the local context.

Starting with the major player, the **Ministry of Public Works and Housing** and specifically the **National Building Council**, was formed within a National Building Law issued at the end of 1989 in accordance with the Temporary Law no. (31) for the year 1989. The law was then amended and issued in accordance with the Law no. (7) for the year 1993. The Council has developed the National Building Codes that should be observed and regulated throughout all phases of engineering work. The National Building Council has published (35) codes in the various fields of engineering for buildings, in addition to issuing guidelines thereon.

Hence, the mandate of the Jordan National Building Council covers the following functions:

- Provide the basis and principles related to the National Building Codes, taking into account the recommendations of the technical committee formed because of the National Building Law forming the Council.
- Endorse the National Building Codes and their submission to the Council of Ministers for their approval.
- Examine recommendations provided by the Technical Committee and make decisions accordingly.
- Finalize any objections on the approved codes or any amendment in accordance with the provisions of the National Building Law.
- Partner with any scientific party to issue a new code or modify an existing code.
- Publish and circulate the approved codes.
- Issue instructions pertaining to the application of codes during the design, execution, supervision, maintenance, operation, public safety works and about any other relevant engineering works.

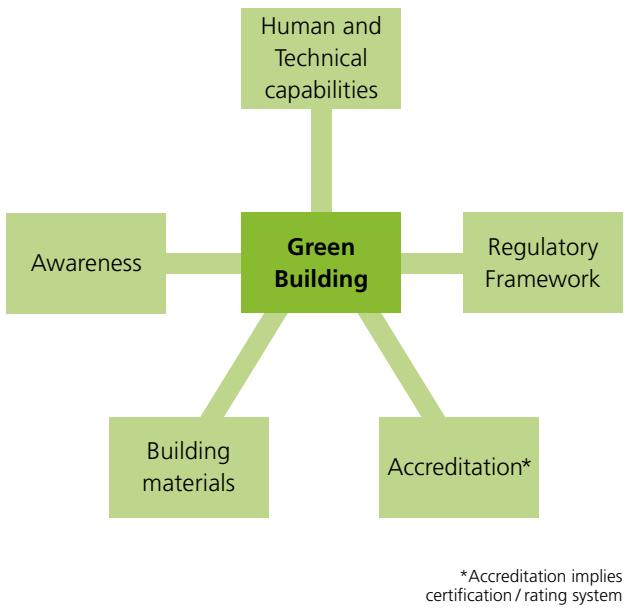


Figure 6: **Green Buildings-Value Chain**

Several local initiatives are happening that promote the use of especially renewable energy (not an exhaustive list):

- Petra Solar, project-funded by JEDCO which installed solar panels in the Governorate of Tafileh for hundreds of houses to save electricity costs.
- A recent decision backed by the Council of Ministers that entails that a construction permit will not be granted unless solar panels have been installed for a specified measurement of a dwelling, apartment and office space.
- Even **NGOs and private sector** companies in the telecom, industrial, banking and transportation have published their sustainability reports where they assess the environmental impacts of their operations. Major engineering companies, such as Arabtech Jardaneh, CC and Dar Al Omran have integrated sustainability into their operations as a cross cutting theme **as well as offering specialized services in this area**.

In order to address the complete value chain, the following should be tackled;

In terms of legal framework, some references relevant to building codes in general and green buildings in particular include:

- Provisions in the **National Building Law no. (7) for the year 1993** state that in order to proceed in any construction work, only engineering plans that (a) meet the rules and technical requirements presented in the approved codes and; (b) are issued by an authorized design or engi-

neering company registered with the Jordanian Engineers Association and is certified by it will be eligible to proceed. Furthermore, it is also stated that entities ensured with certifying engineering plans should not approve any engineering plan prior to ensuring compliance with the approved building codes, otherwise they will be subject to legal liability. In addition, those entities ensured with issuing building licenses must guarantee that engineering plans are certified by the relevant entity. Additionally, they must also supervise construction work from the design phase up until completion in order to ensure compliance in fulfilling requirements of the building codes. In terms of building permits, provisions entail that in order to issue a building permit by the relevant entity, a certificate of compliance by the authorized entity to supervise implementation should be attached with the request of a building permit and certified by the Engineering Association in case the supervision entity is an engineering company. The Law demands compliance to the building codes by engineering companies and contractors in the design, supervision, maintenance and implementation and states that in the event that a violation is found, the Engineering Association should be informed to take action accordingly.

- The **Renewable Energy and Energy Efficiency Law no. (13) for the year 2012** states that all systems, equipment of renewable energy and efficiency together with inputs, local production and imports are exempted from customs fees and sales taxes.
- **In terms of the regulatory framework**, multiple stakeholders are present putting at risk complementarities in roles. In order to push for greener buildings, stakeholders have to institute a process that covers regulation, supervision and enforcement. Hence, the presence of stakeholders covering these aspects is crucial in order to mitigate any gaps in the process. As shown in the figure below, lack of an enforcement body (an entity responsible for ensuring compliance with building codes after engineering plans are certified) poses a gap in this process. Although building codes are developed and mandatory, their enforcement has been weak (blue shaded in the following figure). This fact denotes a substantial challenge for those building codes that are relevant to green construction, especially those concerning water and energy conservation.

Stakeholders	Regulatory Body	Administrative/procedural body	Supervisory and Enforcing Body	Outreach, Awareness and Capacity Building	Technical Body
Ministry of Public Works and Housing/ National Building Council	✓ Develop Building Codes	✓ Construction permits			✓ Hosts the Technical Committee that oversaw the Green Building Guidelines
Greater Amman Municipality/Ministry of Municipalities (for work outside GAM jurisdiction)		✓ Construction permits-approval			
Jordan Green Building Council				✓ Awareness and policy advocacy	
A/E Business Council				✓ Outreach to major A/E companies	
Contractor's Association				✓ Organizes work of contractors for building	
Royal Scientific Society/Building Research Centre					✓ Participated in the Green Building Guidelines
Jordan's Engineering Association		✓ Certifies engineering plans		✓ Access and outreach to engineering offices training	✓ Participated in the Green Building Guidelines
Jordan Institute for Standards and Metrology (JISM)		✓ Develops standards for building materials and for energy and water saving devices (local and imported)			✓ Participated in the Green Building Guidelines
Ministry of Environment	✓ Tackles built-in environment				✓ Participated in the Green Building Guidelines
Ministry of Energy and Mineral Resources	✓ Provides energy efficiency targets				✓ Participated in the Green Building Guidelines
Customs Department	✓ Exempts customs fees and duties on imported products				

Table 1: Stakeholders and their Respective Roles

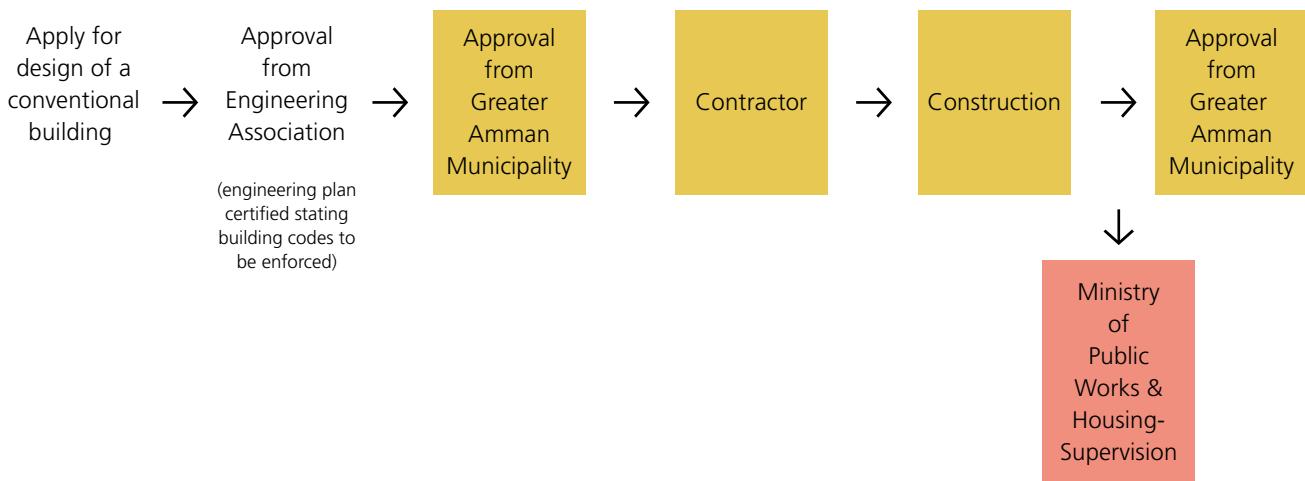


Figure 7: Process of Obtaining Building/Homes Permits

\* Greater Amman Municipality for Amman and the Ministry of Municipal Affairs for the other Governorates.

- This is also reflected in the process by which a permit is obtained for newly constructed buildings/homes, and offers insightful observations when applied to the green building concept.
- As is clear in the figure above, the process involves three different entities (Engineering Association, Greater Amman Municipality/Ministry of Municipal Affairs, Ministry of Public Works and Housing). Furthermore, supervision by the Ministry of Public Works and Housing is often lax. This figure highlights the gap in lack of supervision in the adoption of green engineering codes in building construction and engineering plans. As green buildings require supervision in order to gain accreditation, this poses a major challenge. This is compounded by the fact that green codes are still seen as voluntary in the Green Building Guidelines.
- In terms of **accreditation**, a Green Building Guideline was developed through the participation of several of the stakeholders mentioned above. Although the Guidelines are voluntary, it is envisioned that they would provide a blue print for green buildings in Jordan. The Technical Committee of building codes, formed in the National Building Council, has worked on Green Building Guidelines, which is yet to be published. The Guidelines are adapted to the local context and benchmarked with international rating systems. The Guidelines have three levels of codes; mandatory, obligatory and voluntary. The mandatory part relates to ensuring enforcement of the building codes issued by the National Building Council. The obligatory and the voluntary parts include a point system whereby points are allocated and can be grouped for the final mark. References to codes from the mandatory part are made in the areas of energy and water efficiency and the use of solar energy through solar PV systems and solar collectors. It is worth noting that in

#### Aqaba Residence Energy Efficiency in Jordan

In 2009, the first sustainable building in Jordan, designed by Dutch Architect Florentine Visser, opened to the public as part of the Aqaba Residence Energy Efficiency (AREE) project. AREE is not only a residential complex but also an information centre for sustainable building design and construction with a total floor area of 420 m<sup>2</sup>.

Some features of the design:

- The design is based on a passive cooling strategy that prevents heat accumulation in the summer and heat loss in the winter.
- AREE is the first residential project in Aqaba equipped with a dual plumbing system for grey and black waste.

the Guidelines, points allocated to energy and water efficiency codes comprise around 68 % with the remaining points allocated for solid waste and site selection.

- In terms of **building materials**, locally produced construction materials such as stone, cement, steel reinforcement bars (manufactured from imported steel), aggregates, aluminum profiles, paint, ceramic tiles, sanitary fixtures, and kitchen cabinets are available. However, the context is different for building materials that address energy and water efficiency and materials used, quality of indoor environment, sustainability of building targeting a comprehensive sustainable approach to design for green buildings.
- In terms of **human and technical capabilities**, so far LEED certification has increased in the past years and certified individuals aim to serve Gulf countries. According to

	Design	Construction	Renovation	Operation	Maintenance	Disposal of Materials	Demolition
Human and Technical capabilities	●					●	
Regulatory Framework						●	
Accreditation		●		●			
Building Materials		●					
Contractor's Association		●					
Awareness	●					●	

Figure 8: **Gaps in the Life Cycle of Construction of Buildings**

\*Circles reflect areas where gaps exist

the Green Building Council website, around 35 LEED APs in Jordan are Jordan GBC members. In Jordan, there are two LEED certified buildings (World Health Organization: gold, and the Netherlands Embassy: silver).

- Awareness of the importance of adopting energy and water saving measures is due to the increasing prices of electricity and water consumption. However, more information needs to be spread in terms of the importance of going beyond price and into market value of green buildings and the preservation of the environment. Given the above value chain and the above mentioned life cycle of construction of green buildings, the status can be observed in Jordan as according to Figure 8.

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