

VI. Morocco



Majorelle Garden (Source: https://commons.wikimedia.org/wiki/File:Le_jardin_de_majorelle_02.JPG)

6.1 Context

6.1.1 Sustainable Cities

Morocco imports around 95% of its energy to meet demand and is looking forward to improve sustainable national energy production. Sustainable “Smart cities” are in the heart of research and innovation challenges for several sectors including transportation, waste, and energy production among others with the objective of providing a healthy, safe, and efficient living environment for the population.

There are several national initiatives aiming at the integration and implementation of sustainability practices at the national and city levels. Most are based on King Mohammed VI’s addresses and signed resolutions that constitute the nation’s foundation for generating 42% of electric power from renewable sources by 2020, 52% by 2030 as was agreed following COP21. Hence, and to ensure the achievement of these objectives, several institutions were established.

The National Agency for Development of Renewable Energy and Energy Efficiency (ADEREE) was created with a mission to “Implement government policies aimed at reducing energy dependence, through the democratization of renewable energy (RE) and the promotion of energy efficiency (EE)”.

The Moroccan Agency for Solar Energy (MASEN) was also initiated as a national initiative implemented through law 57-09 while adopting the national strategy to develop integrated projects generating a minimum of 2,000 MW electric power from solar energy.

Additionally, an Energy Investment Company was established as the financial arm of the State with the objective of facilitating the achievement of an energy mix of 42% by 2020 and is at the heart of the national energy strategy.

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of 42% by 2020 and is at the heart of the national energy strategy. The Research Institute for Solar Energy and New Energies (IRESEN) was also launched under the umbrella of the energy strategy as an organization dedicated to research and development with a national objective of assisting the Kingdom meet its growing energy demands from renewable energy sources and become more energy efficient and self-sufficient.

Moreover, Morocco has become a member state of **The Regional Centre for Renewable Energy and Energy Efficiency (RCREEE)** since 2008. The Centre is a regional not-for-profit organization that includes 16 Arab countries promoting energy efficiency and renewable energy in the region.

Furthermore, in the sustainable cities’ domain; the **GIZ** is assisting the government implement “Integrated Water Resource Management” (IWRM) as well as the introduction of a model for developing a sustainable energy production and supply systems that mitigate climate change. The GIZ has also instigated a campus of knowledge center promoting green industrial development in Morocco named IFMEREE (Institute for High-Performance Training on Renewable Energy and Energy Efficiency).

Other government initiatives to enhance the advancement of the city on a sustainable basis include, the Casablanca Development Plan 2015–2020 which was launched based on four strategic pillars targeting four development goals. The first is directed at optimizing citizens’ and visitors’ mobility in terms of time, cost, and quality through the development of the transportation sector and has allocated a large part of the budget in the framework of the PDGC conventions. The public transport network will be enhanced to cover 80 kilometers, a second tram-line will be implemented, and several relay parking lots will be installed. The other pillars are dedicated to the improvement of: social housing in particular the implementation of a thermal regulation; water; electricity; and sanitation management. The proposed strategy

aims at transforming Casablanca into a more livable and greener city by tackling different components of the city's metabolism including: water, waste, energy, and transportation.

Another major government initiative at national scale which is considered a national achievement, is the Noor Project. It is the world's largest concentrated solar power plant, with the objective of providing 2,000 MW or 42% of the country's electric energy by 2020. The first phase of the project, Noor 1, with its 500,000 crescent-shaped solar mirrors, has been inaugurated and is anticipated to provide 160 MW.

It is apparent that the Kingdom has gone beyond incentives for energy efficiency through a synergy between laws, decrees, institutional programs and the use of international voluntary green building certification tools (HQE, LEED, and BREEAM) to promote and generalize sustainable city practices across the country. Initiated programs have led to the adoption and implementation of several practices and procedures such as thermal isolation, LED lighting, solar water heaters, efficient construction materials, rainwater harvesting, as well as waste management thus demonstrating the progress in the concept of sustainable building in the country.

Now that projects at city level are being implemented, it is important to introduce procedures and mechanisms to link critical components together including: water, energy, and food with the objective of reaching a holistic synergy for city metabolism. It would also be beneficial to enhance knowledge transfer and cross border collaboration as well as alliances. Public-private partnerships are thus essential if the government is to share implementation responsibilities with industries closer to the market. Finally, COP22 should be considered an opportunity to increase awareness, sensitize the population and enhance sustainable projects.

6.1.2 Sustainable Buildings

Within the framework of its development strategy, Morocco has adopted the concept of sustainable development in order to achieve a balance between environmental,

social and economic spheres. The country aims at improving its citizen's living environment, strengthening sustainable management of natural resources and promoting environmentally friendly economic activities. Accordingly, it established several steppingstones to achieve a sustainable development vision that drives political, institutional, legal and socio-economic reforms forward. This process was strengthened by the adoption of the National Charter of Environment and Sustainable Development in 2009.

The Kingdom is more than ever encouraging green building initiatives and establishing intrinsic sustainability parameters positioning green building as a topic of national importance. Currently, there are two parts to the legislation related to Green Buildings and Energy Efficiency, the Sustainable Development Policy and the National Energy Strategy, both are discussed in detail in the sections to follow.

6.2 Baseline

6.2.1 Policies, Laws, Decrees and Technical Standards

The Kingdom's Sustainable Development Policy is founded on the following axes:

- **Law 99-12**, known as the "Environmental Charter" setting the rights and duties pertaining to the environment and sustainable development, with the objective of engaging the state, authorities, and public institutions; protecting natural resources; and assessing and mitigating negative environmental, economic, and/or social impacts.
- **The Sustainable Development Plan**, targeting energy efficiency in the energy intensive sectors including construction, industry, and transport and the promotion of renewable energy.

In parallel, a National Energy Strategy is in operation with the objective of guaranteeing the availability of energy supply at affordable costs, controlling rise in energy demand, and

protecting the environment. In order to achieve these goals several guidelines were set. These include:

- having a diversified and optimized energy mix linked to reliable and competitive technology choices;
- mobilization of national resources to augment renewable energies; and
- making energy efficiency and regional bintegration a national priority.

The strategy aims at consolidating the reduction of energy consumption and energy production through two laws and decrees:

Law 47-09 relates to energy efficiency in energy intensive sectors, with the aim of establishing an institutionalized system of governance, legislative and regulatory frameworks, as well as standard norms. It regulates inspection, and sets violation penalties at 15,000 to 300,000 Moroccan Dirhams (MAD). The objective is to reduce energy consumption considerably by adopting new practices and energy efficient solutions. This includes adopting the Code for Energy Efficiency in Buildings (CEEb), and the promotion of thermal isolation, solar water heaters, low energy consumption light bulbs, energy audits for industry, as well as low-power car-fleets for transport.

Law 13-09 on renewable energy, promotes renewable energy sources and provides a legal framework for the development of renewable energy projects in Morocco. The law prioritises the development of renewable sources in order to promote energy security, access to energy, sustainable development, reduction of GHG emissions, reduction of deforestation, and integration/harmonisation of Morocco's renewable energy production with other Euro-Mediterranean markets.

Decree No. 2-13-874 of October 15th 2014 relates to construction, sets regulations pertaining to buildings' energy performance, and establishes the national committee for energy efficiency in buildings.

Decree No. 2-10-578 of April 11th 2011 relates to the application of the law 13-09 on renewable energies.

Furthermore, as part of the National Energy Strategy, the media is communicating the Kingdom's objectives to produce 42% of electric power from renewable sources by 2020 and decrease energy consumption by 25% by 2030.

6.2.2 Institutional Programs

To achieve the set goals, the Kingdom is engaged in the launching of several institutional programs to help realize its targets.

Code for Energy Efficiency in Buildings (CEEb): The program was launched by ADEREE in partnership with the GEF-UNDP (Global Environment Facility - United Nations Development Program) and GIZ to decrease energy consumption in the building sector. It regulates energy efficiency through adoption of the Thermal Regulation of Construction in Morocco (TRCM) and provides energy labeling for household appliances. The thermal regulation is applied following two different approaches: a prescriptive one based on validation using Binayate software or a functional one with a Dynamic Simulation Model. The choice of one or the other is based on the complexity of the evaluated building through its glazing rate. Thresholds are set following the defined climatic zones prescribed by the ADEREE.

6.3 Case Studies

Éco-Cité Zenata is a key urban planning and sustainable metabolism project. The proposed plan includes three main concepts: the "territorial city", "ventilated city", and the "lived city". The first concept refers to a mixed development plan that addresses territorial mobility networks within the city, while the second targets integrating environmental and climatological determinants in the city plan; and finally the third is directed at providing independent pedestrian oriented neighborhoods affording resident needed amenities while minimizing the use of the car. The plan capitalizes on existing natural resources to meet set objectives including natural cooling of neighborhoods during summer - by aligning streets to prevailing wind directions (NW-SE); implementing a water resource management system - by collecting rainwater in retention

basins before discharging into the sea thus minimizing the size of discharge pipes and structures; and linking the commercial hub with the tourist center associated with the coastal park by a green network. Such provisions serve to improve the resilience of the city and contribute to the development of an environment friendly green living conditions.

Taghazout Bay urban development project, undertaken by SAPST (Société d'Aménagement et de Promotion de la Station de Taghazout) is also following a green building development model. The high end eco-resort sits on an area of 615 hectares with over 4.5 km of beaches and incorporates diversified activities including hotels, lofts, apartments, a golf course, and a surf village. SAPST succeeded in becoming the first HQE certified urban planning project internationally and is committed to a High Environmental Quality sustainable approach to achieve triple certification in: urban planning, residential buildings, and non-residential buildings. Moreover, to further enhance recognition as operating within an environmental, social, and cultural responsive approach, the company incorporated both its golf and tourism components Golf Hotel not Gold Hotel into the international "Green Globe" program. This program works on improving environmental, social, and economic performance through implementing 41 point criteria that cover areas such as water and energy consumption, greenhouse gases, biodiversity, ecosystems and waste management.

Mohammed VI Green City is located in Benguerir, a 30-minute drive from Marrakech and 90 minutes from Casablanca. The project was launched in 2009 by HM King Mohammed VI, as a major ecological project offering an exemplary attractive living environment. Project completion is expected in 2020.

The Green City of Benguerir is designed as a national laboratory where Office Chérifien des Phosphates (OCP) experiments with an ecological model that places nature, knowledge, energy efficiency and renewable energy, governance, as well as climatologically responsive architectural designs and materials, at the heart of the urban planning process. To achieve these goals, the city's implementation plan follows rigorous specifications to achieve

one of the highest certifications: LEED ND (Leadership in Energy and Environmental Design for Neighborhood Development). The project is considered by the CEO of the Urban Planning and Green Development Company (SADV) as "the first project of this magnitude that targets such certification in Africa".

The Eco-Park in Berrechid is a more recent urban development project undertaken by the French Chamber of Commerce and Industry in Morocco (CFCIM) as part of Franco-Moroccan cooperation to host 192 non-polluting industries on 60 hectares and is anticipated to be "the first High Environmental Quality (HQE) certified site".

Casa Finance City is another environmentally responsible development that has followed strict environmental guidelines to certify specific components of the project as part of the urban development of the Casa Anfa region. The project comprises several residential areas as well as office towers and is intended to support Africa's economic growth and development by attracting foreign investments.

Pilot Projects for Energy Efficiency and Thermal Regulation: In 2011, with financial support from the EU, ADEREE selected nine pilot projects for the implementation of energy efficiency standards that were integrated in the new Thermal Regulation of Construction in Morocco. The choice of projects was based on several criteria including: diversity of climatic zones; buildings type (institutional, housing, hotel, etc); and type of constructing organization (private or public). The projects introduced different energy efficiency measures focusing on insulation, double-glazing, efficient ventilation, and solar heating. The projects realized an average additional construction cost of 2.5% and a savings reaching up to 94% on heating, and 50% on cooling.

Five of the projects were carried out by a public institution "Al Omrane" and included 222 homes in Ouarzazate; 280 social houses in Tamansourt; 144 social houses in Al Aroui; 96 social houses in El Hajeb; and the institutions' headquarters in Chrafate. The other four projects were undertaken by private entities and included 637 medium standard apartments in Ain Sebaa, a hotel in Port Lixus and 584 touristic residential units in Marrakech that conform to the TRCM.

Projects Presented at the Green Building Solutions Awards of COP 21: Within the framework of the Green Building Solutions Awards organized by Construction 21; two Moroccan projects were selected to be presented at the Gallery of Solutions at the 21st Conference of Parties in Paris.

The first project awarded; the **International University of Rabat** for its adoption of an environmentally friendly initiative and its commitment to integrate environmental aspects in several stages of construction of its building “Enseignement 2.” Within this context the university engaged experts as well as engineers in bioclimatic architecture and environment to ensure conformance to the High Environmental Quality (HQE) approach. The project received certification as the first “HQE International – Nonresidential” building in Africa. Nonetheless, the university has yet to complete its initiatives by attaining certification for its swimming pool - which will be the first HQE certified indoor pool in the world, outside France.

The second project awarded; the **“Habitat Urbain Autonome”**, in the old Medina of Rabat, which includes the renovation of a former Riad into a bioclimatic, 100% autonomous urban housing (in terms of energy, water and waste) in Morocco. The project offers waste treatment (solid and liquid), production of potable water through storage and filtration of rainwater, as well as localized energy production and is thus off the grid. The project resembles an exemplar for future applications achievement and can be considered as trailer of an Autonomous City.

6.4 Future Actions

It is recommended that a government incentives program including lower taxes for green buildings be implemented to encourage the practice of such solutions. It would also be beneficial to establish a financial mechanism to

evaluate the performance of existing buildings and guarantee performance, savings, as well as benefits.

6.5 Lessons Learned

Given the fact that Morocco imports 95% of its energy to meet demand, the government has focused on implementing policies oriented towards the efficient use and production of energy. The building sector, being one of the most energy intensive, represents one of the foremost fields of action to mitigate climate change by implementing such policies.

The launch of national initiatives to configure the future development of sustainable building practices including the implementation of a National Energy Strategy through introducing energy efficiency and renewable energy laws, set in parallel to the Sustainable Development Policy, has advanced the concept of sustainability and prompted projects receive Green Building Solution Awards.

Moreover, “Mohammed VI's Foundation for Environmental Protection” critical initiative for assessing the performance of green buildings based on ISO 14001, the new regulatory framework, as well as HQE, LEED, and BREEAM is expected to represent a holistic approach for this domain.

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