



## MOROCCAN NEW GREEN CITIES, TOWARDS A GREEN URBAN TRANSITION

| Received August, 2<sup>nd</sup> 2022 | Accepted November, 14<sup>th</sup> 2022 | Available online December, 15<sup>th</sup> 2022 |  
| DOI <http://dx.doi.org/10.18860/jia.v7i2.17222> |

**Noussaiba Rharbi**  
Eskisehir Technic University  
Turkey  
Corresponding Author  
[noussaiba.rharbi17@gmail.com](mailto:noussaiba.rharbi17@gmail.com)

**Mehmet INCEOĞLU**  
Eskisehir Technic University  
Turkey

### ABSTRACT

Morocco is living in a sustainable transition that touches all the fields. The urban transition seems to take a quick turn, especially after 2014, with the establishment of various eco-cities research projects, eco-neighborhoods, and the construction of green cities such as Benguerir, Bouskoura, and Zenata. This paper describes some research into sustainability, the parameters behind green urbanism, and the transition effects. It also explains the Moroccan urbanism transition witnessed after colonization and the sustainability introduction to the country. This research compares two green cities, Benguerir in the south and Zenata on the Atlantic coast. Both cities are constructed by publicly owned and funded companies, providing a common ground for comparison. This paper analyses sustainability parameters targeted by the study cases.

### KEYWORDS:

Green cities; Transition; Green Urbanism; Morocco; Zenata; Benguerir

### INTRODUCTION

Sustainability's meaning comes from the word "sustain" it was first mentioned in the Forestry field as the growing forest chopping in Europe had become harmful to the system, and concerns about regenerating forests had risen. The world then was introduced to us as a sustainable method for forestry in the late nineteenth century [1]. The world since then has integrated several fields. The concept has long been glued to the green term and environment field. One of the earliest pieces of the literature mentions it was by Ebenezer Howard; the author described the problem of the spread of industrial cities in contrast to farming fields. The book Garden Cities has been a reference for multiple urban designers and planners [2]. The fantasies about integrating gardens into every corner of the city inspired by the book faded away due to the excessive garden suburbs that spread like fungus surrounding American cities. Mumford [3], had been vocalizing the same problem of the scary spread of the cities' size and population with no breathing space. The growth of the cities was not the only problem; the growth was uncontrollable, with many compacted buildings disregarding the dwellers' interests. After a second worldwide, the fight between nature and humans seems not to subside yet, [4]. It was not until the sixtieth that it was realized that the cities should emphasize the relationship between buildings and users. The cities should no longer be

economy boosters but also a place of belongings and living. Small neighborhoods with streets encouraging pedestrian usage were more favorable [5]. Another book had made a sensation in the seventieth was the optimistic approach of Ian L. McHarg in "Design with nature" [6].

Since then, the concept of sustainability has shifted from the simple integration of nature and greenery to the design and going beyond it. This shift could be clearly stated in the book "Limits to growth". It was a quantitative study that put sustainability in the mainstream again. It stated all the current problems with the overgrowing economy while disregarding the limitations of the resources, the excessive population growth, and the wide gap between rich and poor [7]. "Sustainability [...] It speaks of the greatest change in human thought and behavior for 3000 years." [8], has marked by this expression the turning point in human history. It is no longer a matter of surviving by any means but of survival globally. Thus, new models for economy and development were needed after the predicted failure of past growth. New measures for development should be introduced, measures that take into consideration the human well-being factor. The progress was finally glued to the world's sustainability [9]. The oppressing climate change consequences also played a big role in attracting international attention to the dilemma between economic progress and human well-being decline, which led to the launching of the United Nations

Governmental panel in 1987 [10]. Since then, the United Nations and the committed countries have taken sustainability seriously. Rio declaration had set 27 principles to consider and the famous eight United Nations Millennium Development Goals [11].

The 125 committed nations must give a five-year report on their progress. Despite the progress made, ongoing efforts are still lacking to save the world. The cities had decided to join the trend, especially since buildings seemed to be the sector that consumed the most after transportation [12]. Over the years, the trend of sustainability has been even more reinforced and prominent, making the term lose its vitality. The claim has long been to seek the best balance between nature and man-made, as some extremists could find that returning to the starting point of evolution is a must [13]. However, sustainability is about moving forward for a better future. In the following years, the eight-millennium goals were revised into 17 Sustainable Development Goals, which were more global and targeted the pressing matters of the world [14]. Green and sustainable designs shared nine of these goals.

**Sustainability Parameters**

A few models for Sustainable Green cities were developed, such as the McGeough model (Figure 1) that classified the parameters into Natural Systems, Land Use Systems, Mobility Systems, Energy Systems, Environmental Management Systems, Building Systems, and Governance Systems [15]. These systems were translated into more experimental parameters to be analyzed by later architects.

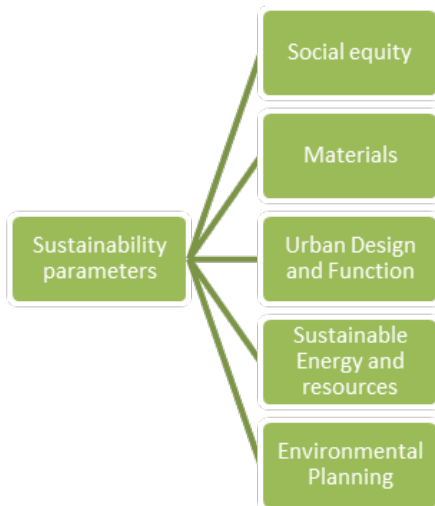


Figure 1. Sustainability common parameters inspired by Beatley, 2014; Una McGeough Doug, 2004; Fraker, 2013. [Authors].

**Social Equity:** The city should be able to provide an infrastructure for all mix, and opportunities for all classes, be it immigrants, middle class, or poor. The social aspect is essential; social equity is considered an important point for the quality of life in the cities [16].

**Sustainable energy and resources:** Sustainability essentially touches the construction's immediate impact on the environment. Thus, any measure that

could minimize greenhouse gases is primordial. Limitations to energy consumption for cooling and heating needs are imposed by kWh/m<sup>2</sup> yearly, depending on the building usage. The calculation methods could differ according to which simulation software is used, and the occupant behavior could change the expected consumption. To answer those needs, sustainable green cities should provide a clean resource that would at least partially cover a part of the demand, such as solar panels. It also refers to self-energy production by integrating green energy resources: Solar, wind, etc.

**Materials:** Even though it was not considered a primordial parameter by some researchers, however following our study, Construction materials should be as local as possible to prevent transportation fees and energy waste. The longevity of materials is primordial as well as their life cycle.

**Environmental Planning:** Integration of nature in the best way possible. The greenery should be planned where to be put and how to be used. It is not just for aesthetic purposes only.

**Urban Design and Function/ Land Use:** It is the most important parameter that generally determines the choices made to integrate sustainability and the city's identity. To do so, the involvement of people in urban design choices is essential. It should be a place for people that ensures mixed use for a wider range of the society to settle down, diversity of form and functions, and good management for the community [17].

**METHODS**

There are a few methodologies for architectural research, such as historical research, narrative research, qualitative research, correlational research, experimental and quasi experimental research, logical argumentation, case studies and combined case studies [18]. This study combines Literature research and correlational research methodologies.

**Literature research:** Using the keywords, research on the previous literature works about Sustainability, Identity, Sustainable green cities principles and parameters, Moroccan transition was conducted using engines such as Science Direct, ProQuest, Google scholar, etc. The works were collected, categorized, and analyzed accordingly to find a link between sustainability and identity.

**Correlation research** focuses on naturally occurring patterns and uses statistics to clarify relationship patterns. We can identify two types of correlational research: relationship studies and casual comparative studies. The latter type was deemed suitable for evaluating the case studies using tactics such as mapping and field observations to compare Benguerir city and Zenata city, examples of sustainable Moroccan green cities. It also gives grounded analytic results to the sustainability parameters integrated or missing.

## RESULT AND DISCUSSION

### TRANSITION AND IDENTITY

Transition is a state change, going from one phase to another, a progressive matter [19]. It is a natural phenomenon that ensures that matters cannot stagnate [20]. Transition or any form of transformation in architecture is essential for continuity [21]. The case is that architecture needs to keep up with time. To ensure that, various elements must change, be it architecture styles, forms that reflect how we live our lives, etc. If identity ensures the continuity and the link between architecture and people, then we can conclude that transition holistically does not conflict with identity.

Architectural transitions usually try to consolidate, reorganize or revitalize history to keep the identity [22]. The aim is to keep the memory as it makes people realize their identity [23]. It helps to serve continuity by reviving the lot link [24]. Some transitions need time to be crafted on the memory of people. Some other changes can be instant and transform the identity immediately or create it. Still, even the immediate change does take some time since identity is about continuity and accumulation through time. The architectural transition may state a new identity or continue an existing one, that is why it is important to know the context of implication, its' past and present, and try to develop new opportunities for new architectural narratives that would contribute to the development of the place, [25].

According to world urbanization prospects back in 2014, the urbanization rate is the fastest and is estimated to increase, especially in developing countries worldwide. The African continent is not an exception to these changes. This fast rate has various reasons, be it the demographic growth not matching the country's economic growth leading to internal migration to the cities for better opportunities. It leads to a housing shortage and, thus, fast urbanization. The fast economic growth also causes it, thus fast market changes and the need for new infrastructure and lifestyle, as we witnessed in the golf countries. Regardless of why urbanization is increasing, it is known that it is not only an expansion of urban footprint but also the spatial transformation of society and therefore represents a cultural evolution [1]. In a way, urbanization itself is a transition.

### MOROCCAN SUSTAINABLE TRANSITION CONTEXT

The end of colonization in 1956 marked the end of French cultural interference. Politically, the new king Hassan II had strived to revive the origin of the Moroccan identity, and what better tool to do it than architecturally and physically displaying it. The country was thrown into chaos with the independence announced. The need to stabilize the throne and create an identity for Moroccans to hang on to and forget the half-century of colonization was pressing,

[26]. The announcement of Mosque Hassan II (Figure 2) was the step needed. The mosque displayed the new power and the remanence? of Morocco's true identity. It was built on the Casablanca waterfront with the help of original Moroccan craftsmanship and with most materials imported from the country's different regions [27]. The new king took this policy seriously, French modernism was long forgotten, and only a "neo-Moroccan classicism" movement would take place. The movement did not shy away from using modern materials such as concrete or establishing more modern urban systems while still incorporating classic principles. Morocco had struggled in the post-colonial period as the effect of long wars had drenched its' economy, socially and politically [28]. Thus, such reform in policies was much needed



Figure 2. a) Hassan II Mosque, the announcement of neo-Moroccan architecture, (b) Aerial view of the city Casablanca [Google image]

An intense shift and city growth have been noticed since the 50th. The new centers and neighborhoods abandoned by the French were occupied by the well-off Moroccans, leaving their old medinas to the new rural comers. Consequently, the population in historic centers decreased drastically, shifting the cities' identity towards the French centers [29]. It made it suffer from intense segregation. The experimentation led by Ecochard, "Ecochard housing grid 1950" promoted a social housing plan. After 2004, an intense development program was made to bridge the different parts of the cities and minimize the gap [30]. Morocco embarked on an ambitious program to create new towns to achieve this policy. A true national strategy for urban planning, it was originally fifteen cities to be created to decongest the big cities, rebalance the territory, and accommodate more than one million inhabitants. However, there is a significant gap between the initial expectations of the program and the results recorded. In 2015, less than a third of the projects announced passed the test of implementation<sup>4</sup>, and the projects in progress largely show a delay in the construction of housing, public facilities, infrastructure for access, and settlement. This discrepancy is partly explained by the extension of so-called "opportunity" and "catch-up" urban planning in urban planning practices in Morocco [31].

Opportunity town planning in the sense that the location, size, and surface area of these new towns have mainly been dictated according to the availability of land and private investment put at the service of the program. No territorial planning study or feasibility study was requested upstream.

Catch-up town planning since the main challenge of this New Towns Program is to reduce 80% of the

deficit in social housing in a fairly short time. In this context of “emergency housing”, the focus was primarily on housing construction and not on local facilities or access infrastructure to the mother city. These large urban projects are therefore reduced to becoming so-called “dormitory” cities, struggling to become attractive territories.

The country's politics made it clear that sustainable development is the only solution for a country [32]. Unlike other MENA region, do not have a Gaz of Oil. More slums were eliminated, especially after 2010, with the intense redevelopment of the segregated areas of the city (Table 1) [33]. The consequences of such fact remedy to regulate the social problems were much more severe [34]. The displacement of slum dwellers into places further away from the city in social quarters created ghettos neighborhoods. The program's continuity seems as if it just contributed to the city's gentrification investor while hiding the source of the social housing programs benefited the middle class instead of the vulnerable. The reality showcased the segregation and social problems of the displaced habitant of the slums [35]. Another phenomenon started, especially with the country's policies to sustain and promote the tourism industry. More and more foreign settlements in the old Medina had risen. Artists or retired Europeans could easily afford the maintenance of the historical parts of the city [36]

Apart from the social housing movement, general reforms were imposed, including opening the general policies [37]. It is reflected in urbanism by creating different state companies that promote the planning of the new cities. These companies, such as “Alomrane”, take care of social housing, “CDG”, funds mega projects, “OCP”, take care of mining sites, and fund the new green sustainable city of Benguerir [38]. The state companies were also competing with the private sector as new policies allowed them to enter the market of urbanism.

**Moroccan green cities Projects: Zenata Eco-city**

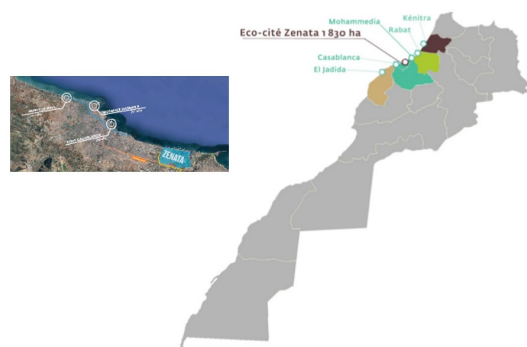
The Grand Casablanca region, which has 3.7 million inhabitants, is particularly affected by the environmental issues that Morocco and the African continent face. While its west side has developed particularly well in terms of facilities, the city's east side Casablanca's wastewater collection network is not fully connected, leading to common discharges into nature or the sea. The region also faces another problem: uncontrolled dumps polluting and groundwater around the city.

However, these urban issues are increasingly considered in prospective debates on the city. The notion of sustainability is at the heart of discourses on the country's urban strategy. Morocco is proving to be a “champion” of urban projects labeled “sustainable” [39]. Especially since this new benchmark for action echoes Morocco's diplomatic ambitions: to position itself on the African continent as a leader in sustainable development. However, in many

cases for Moroccan projects, the concept of sustainability is often used to communicate and attract investors and future buyers rather than describe reality.

**Table 1. Morocco's urban development policies project [Authors]**

1990-1991	Riots leading to change of policies: open access economy
1992	Political reforms without any urbanism reform
2000	Shortage of housing estimated by 1.24million unit Slums spread 42-00 Law reform related to the upgrading of human settlement Adoption of notational territory planning blueprint (Shema National d'Aménagement du Territoire)
2001	50 local workshops, 16 regional forums for Casablanca conference, illegal housing in Rabat, and the urban heritage of Fez Action Plan to reduce unsanitary housing: Get rid of 860000 shanty houses, creation of new zones for social housing
2003-2009	Public involvement in urbanism changes
2004	6 urban planning agencies were established under the Ministry of planning to produce accelerated master plans. Cities without slums project
2005	Private sector involvement in urbanism and city planification 15 new cities launched supported by the government (the project was halted as it was not feasible)
2012	4 new towns were implemented: Tamsna, Tamansourt, Chrafat, Lakhyayta Mega Projects were launched: Rabat Bouregrag valley, Tangier port “Tanger-Med”, Casablanca “Casa-Marina”
2013-2017	23 town projects launched for urban development, renovation of old medinas, reinforcement of urban hubs



**Figure 3. Zenata position besides the two metropolis, Rabat and Casablanca**

Located at the crossroads of the operations of new towns and sustainable towns, the Zenata eco-city was able to take advantage of this first feedback so as not to repeat the mistakes of the old operations. Considered as one of the most promising projects in Morocco and on the African continent, supported by international donors (AFD, EIB), subsidized by the

European Union, and labeled HQE Eco-city, Zenata eco-city as a test platform in Morocco for a paradigm shift in urban planning strategy: from a new town logic to a new sustainable town logic. The city of Zenata is located halfway between the capital Rabat and the Metropolis Casablanca (Figure 3). It is part of the Casablanca region and has an Atlantic waterfront extended to 5.35 km. The city's general surface area is 1830 ha which was conceived to be a sustainable development with 1/3 of its area allocated for green space [40]. This distribution corresponds to approximately 15 m<sup>2</sup> of green spaces per inhabitant, knowing that the WHO (World Health Organization) recommends 9m<sup>2</sup>/inhabitant. The city has 40000 inhabitants and was built favoring human scale.

## ZENATA CITY SUSTAINABILITY PARAMETERS

### ENVIRONMENTAL PLANNING

Zenata seeks to optimize natural resources at the city level through a bioclimatic strategy. The air is used by an oblique aeraulic grid which creates islands of freshness, thanks to the orientation of the future elements of the building according to the winds. The city is, therefore, naturally ventilated, allowing cooling (2 to 3 degrees) in summer and humidity regulation in winter. Also, the water is drained towards retention basins on the surface, thanks to the natural unevenness and the canals. This development allows groundwater regeneration, reducing the capacity of underground conduits, and minimizing the size of the discharge structures towards the sea. In 2016, the eco-city was labeled HQE Aménagement by the certification body Cerway. It is also ISO 14001 certified for the environment. Although the Zenata eco-city has not yet established a precise strategy concerning renewable energies, the "green corridor" aims to become an area for experimenting with the energy mix in the territory (Figure 4).

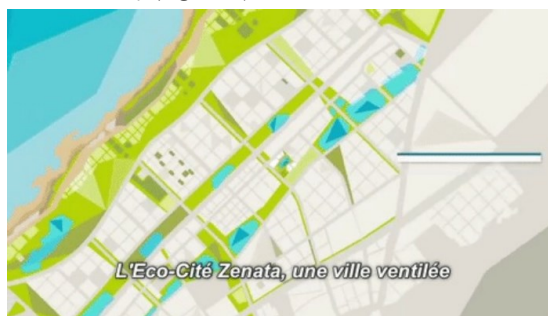


Figure 4. Zenata's main Design, a green main axe with transversal corridors from the west Atlantic Sea. Source: Société Développement de Zenata, SAZ

### SOCIAL EQUITY

The Zenata eco-city aims to meet the social challenges of the area and the project. This planning is led by the Resettlement Action Plan (RAP). In 2013, the first rehousing plan for slum families was launched, without consulting the population, as part of the

government program "Cities without Slums". The habitats built for rehousing were not accepted by the population and has been settled in the territory for generations.

In order to meet the demands of slum households, the SAZ, accompanied by the social contracting authority, has started a resettlement plan. This system aimed at granting plots of land to slum families is preferred, because in addition to offering them the possibility of remaining on their land, resettlement can be free, thanks to the associated third-party system. The associated third party allows slum families to be exempted from financing their new accommodation. Two shantytown families called "pairs", beneficiaries of the same plot of land can associate by contract with a third party not eligible for the program (developer, investor, etc.). This associated third party then undertakes by this contract to finance and ensure the construction of a building with several levels of housing, the delivery of housing to each family, as well as the assumption of the cost of the land normally returning to slum dwellers. In return, he gets the two remaining floors, which he can live in himself, rent, or sell.

The Zenata eco-city tends to be part of an increasingly inclusive and participatory approach. The first inhabitants of the Zenata eco-city, the slum dwellers are consulted one day a month. The group participating in this consultation represents 20% of the total population, distributed according to a varied and egalitarian socio-spatial representation. During exchange workshops, citizens are informed of the progress of the eco-city project in general, as well as of the conditions, timetable, costs, procedures, etc... These discussions allow residents to share their questions and demands. In general, taking into account the social aspect in the project marks a change in the way of thinking and conducting development projects and public policies in Morocco.

### URBAN DESIGN AND FUNCTION

Land development supplies houses and residential areas and the infrastructure that would withstand the livable city motto that the city tries to push (Figure 5). It is why the first phase of the eco-city development is the development of a metropolitan axis, crossing the entire territory of Zenata from the road to the sea. The objective is to be able, from the departure, to enhance the territory by creating economic activity, developing local facilities, and accessing infrastructure. For this, three strategic poles, called "locomotive poles" were being built even before the development of the first residential complexes.

Urban planning follows an aeraulic grid showcasing nodes, such as noise pollution nodes that would be considered for sustainable land distributions. Zenata city can go beyond Moroccan regulations. For example, nothing obliged the SAZ (Zenata Development Agency) to draw up a resettlement plan for slum households living in the douars present on the

territory of the eco-city. Indeed, to date, no urban operation in Morocco has gone so far in a resettlement operation with so many constraints. In other projects, developers are content to expropriate and compensate households. Zenata meets the requirements of the World Bank related to the resettlement of slums.



Figure 5. Zenata Health center, multifunctional city. Source: Société Développement de Zenata, SAZ

The Zenata eco-city will be fully accessible. Its objective is to combine collective and soft mobility to reduce the city's ecological footprint. Thus, the joint mobility plan provides for establishing a multimodal station: train, RER, tram, and bus. The whole city is equipped with cycle paths. The Zenata eco-city aims to be a “walkable city” thanks to “a local network made up of “street gardens” [which] makes it possible to prioritize the different forms of mobility”. A plan of 13 km of autonomous pedestrian paths makes it possible to connect the various neuralgic points of the city (Figure 6).



Figure 6. Pedestrian Plan of Zenata city, source: Société Développement de Zenata, SAZ

In general, the eco-city promotes local mobility since the city is organized according to the principle of Moroccan medinas: each living unit is built around a public square, which offers all the necessary equipment (health, education, worship, trade). Each service must be accessible within a 10-minute walk.

The Zenata project, therefore, claims to be a test and demonstration platform for new urban practices. Planners of the city cannot push over planning decisions to impose urban regulation on Moroccan cities. Still, they can provide a working example of sustainable urbanism that can act as a reference for other green cities. Thus, new practices and suggestions are experimented with in the city ground. Zenata still displays the ambition to make a well-mixed city. Having 10,000 shantytown households is a good start. Afterward, the question is whether these families from the slums are seen as citizens in the same way as the others are. Zenata displays a certain ambition by resettling the slum dwellers in the heart of Zenata: it is to consider them stakeholders in the new city.

### MOROCCAN GREEN CITIES PROJECTS: BENGUERIR GREEN CITY

Benguerir city is not an imperial city. The settlement there had been mostly due to the military presence in the region. The city is 50km from Marrakech, one of the oldest imperial cities of Morocco. The city's development was only due to the necessity of the growth of the phosphate mining industry nearby. After riots in the region due to social problems and segregation between the Office Cherifien for Phosphate, more known as OCP (Moroccan state-owned phosphate mining company), and residents, the office decided to transition policies to change the mining cities into sustainable cities. One of their biggest targets was Benguerir city [41].

In 2012, OCP had the idea to create a new mining city that would also change the company's image [42]. Benguerir city's new vision was to create a green city centered around research, thus creating a research hub (Figure 7). The focus was to create a university to help start and boost the city.



Figure 7. Benguerir Green city main boulevard, Morocco. Source: Google image.

Benguerir is situated south of Morocco with a prevailing semi-arid climate [43]. It has long months of dry summer, when the temperature reaches its highest point in July, then followed by a short cold season. Figure 8 shows the grey area for adaptative comfort zone temperatures throughout the year. Benguerir means temperatures are mostly outside that zone, either too cold or too hot, with a maximum of 45° C in July.

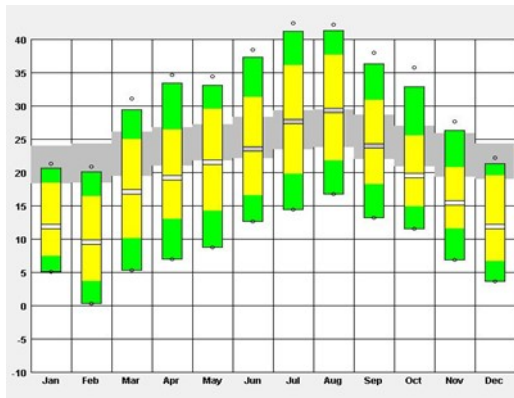


Figure 8. Temperature range of Benguerir using Climate Consultant Software

The city aims to hold 91000 inhabitants. The initial phase had been achieved containing Education Quarter (Figure 9): Excellency Highschool with the expectation of 1800 resident students in 2025, phase I of the University Mohammed VI polytechnic university having 6000 students in the horizon of 2025, Tech Park zone including Data center, Innovation incubator, Green Park energy center, Green smart houses park, with Solar decathlon 2018 prototype houses. Residential Quarters: Research villas neighborhood, Marguerite villas neighborhood

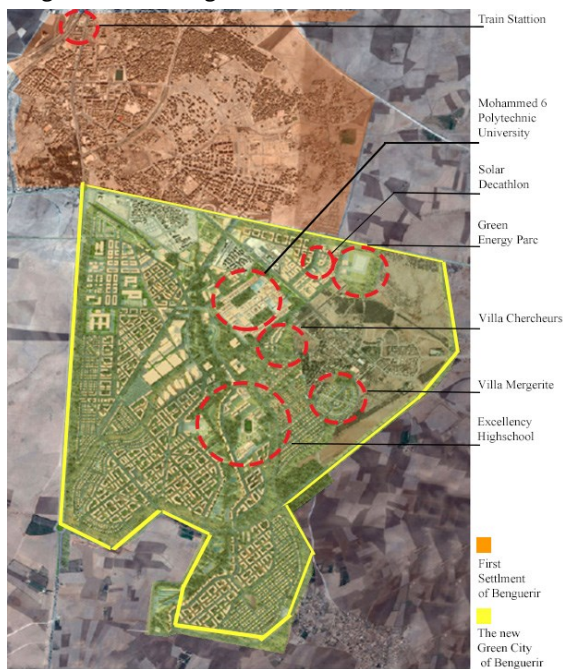


Figure 9. Benguerir City and two examples of the existing and new green city. Source: Authors

**BENGUERIR CITY SUSTAINABILITY PARAMETERS**

**SOCIAL EQUITY**

The university, funded by OCP, had been the focus of the social attribution of the company while providing various scholarships, local shopping centers,

Solidarity market, market Place Shops on the ground floor of residential buildings for a good mix in neighborhoods.

**ENVIRONMENTAL PLANNING**

The city was planned to be Oasis in this challenging climate. The city's main purpose of being centered around a university and research hub is to create innovative technologies to overcome the challenge of greenery and desert. The main laboratories that are set, such as; “Experiment farm”, which would innovate arrogation and other challenges, “Energy parc”, which provides clean energy and efficient solutions, etc are promoting research and keeping up with sustainability challenges.

12.5 ha urban park of greenery planned for Tech-park. Most environmental planning is focused on the CO2 cut down while planting olive trees for compensation. The city is also planning various Sports fields and playgrounds that provide interactive spaces for the residents.

A “Green Axe”, “Coulée Verte”, the true backbone of the urban center, which includes the city's major facilities, structure all the soft routes, and organizes the network of roads with all the districts and the site.

**URBAN DESIGN AND FUNCTION**

The initial plan for the city is to be experimental urbanism and an example of African sustainable cities. Quality living spaces coupled with a future real estate offer and attractive services (Figure 10). Designed as a privileged place of life for its inhabitants, the Green city of Benguerir project aims to offer an optimal quality of life, minimizing nuisances, promoting tranquility and harmonious cohabitation in the community. In order to achieve this objective, the city has been designed around: autonomous districts, each with the facilities necessary for its inhabitants (schools, public spaces, etc.) and providing accessibility for all. This modular design aims to guarantee residents local access to shops and services and thus reduces travel and CO2 emissions. Positioning sustainability and intelligence within its thinking, the city will be equipped with smart urban networks.



(a) (b) (c)

10. (a): Riad neighborhood in the existing old city of Benguerir. (b): OCP old social housing settlement nearby the green city of Benguerir. (c): Marguerite villas district for OCP engineers. Source: Author, Morocco 2021.

**MATERIALS**

The region was known for using earthen materials, especially clay, for housing to offer comfort inside the building. However, with years of quick urbanization, concrete spread, and easy manipulation. The buildings of those regions lost their thermal efficiency as concrete does not have the same thermal masses and insulation capacity as clay. The old original part of the city that originally was the initial settlement had continued its growth, especially with the economic boost of the green city and the creation of more job opportunities. New neighborhoods are still created in the North part of the city. Accompanying this growth is the continuation of the green city of Benguerir in the south.

**ENERGY EFFICIENCY**

The city stakeholders had decided to introduce a labialization system to the city buildings to promote sustainable awareness and competitiveness. LEED certification was chosen as it led to a more global audience, making Benguerir city the first to choose an English label instead of the French HQE. These days, two university buildings have been granted silver LEED certification (Figure 11). The sport pole building had improved by 14 % on baseline building performance and 7% onsite renewable energy usage. In 2015 the Learning building had also been certified silver by 18% of the baseline improvement [44].

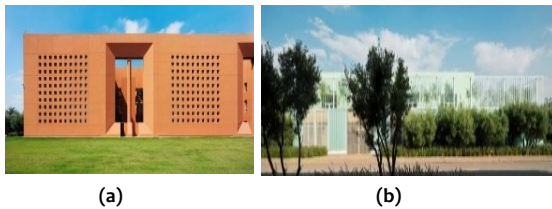


Figure 11. (a): University Polytechnic Mohammed VI, LEED silver certified buildings. (b): Learning building. Right: Pole Sport. Source: Recardobofill.com

Benguerir green city targeted the issues of excessive cooling needs in residential areas and tried to adopt more adequate solutions to create sustainable and green buildings. One of the executed projects is “Villas des chercheurs” in Moulay Rachid neighborhood. The project was to create villas that use mostly passive solutions to minimize energy usage (Figure 12). The villas are built traditionally with courtyards, stone and clay materials, and domes for the living spaces.

The heat is stored during summertime, helped by the greenhouse effect from the tower system installed on the roof of each villa. It is a simple chamber with captors and a plastic cover to maximize the heat stored. Then the system is linked to a packed bed layered underground with stones retaining heat for

winter months. In the winter, Temperature captors would activate the system to release the heat through the house if needed [45]. In summer, the thermal mass of the thick walls delays the heat access until nighttime when it is colder, and some heat would not harm.



Figure 12. Researcher villas, Gated neighborhood, Benguerir Green City, Morocco, 2021. Source: Author.



Figure 13. Urban Pergola, University design of integrated PV pergola and shade design. Source: Google image.

Other projects were designed with the same targets: reduce energy usage, integrate renewable energy, and spatially hold on to the region's identity (Figure 13). Even with bigger projects such as the Polytechnic University campus, the main targets, such as the usage of local building methods and typology, were still present.

**CONCLUSION**

Morocco seems to live a sustainable transition that has quickened its pace in recent years, especially with the risen awareness among the youth. This transition is taking a slow pace, allowing the identity to handle these changes. The examples of sustainable Moroccan cities are in two categories: Research projects, which have been studied, made into proposals, and yet wait to be applied in reality. Then there are funded government projects such as the two cities described in this article, Zenata and Benguerir city. These examples have already been constructed and are slowly being finished.

The two cities' main purposes vary; Zenata is a city that was designed to relieve the burden of the crowded Casablanca, providing a green-livable city with the same advantages that both Rabat and Casablanca can provide. Benguerir is a sustainable transition model for classic mining cities (Table 2).



Table 2. Sustainable parameters that are mainly targeted by Moroccan green cities, Zenata and Benguerir. Source: Author

	Benguerir	Zenata
Social Equity	√	√
Sustainable energy and resources	√	√
Materials	√	
Environmental Planning	√	
Urban Design and Function	√	√

Social equity is only targeted in the mix and functional diversity in Zenata. The neighborhoods are designed in the same way as the old medinas with human scale and the introduction of the misplaced slums habitants. However, one of the main problems that the city still cannot predict is the good integration of the different states that the city claims to support. Benguerir, on the other hand, has failed to achieve real progress even though it is just three years away from finishing all its phases. The old settlement is not only physically separated from the green city, but the segregation is also witnessed by the propagation of gated neighborhoods, schools, and functions that are limited to a certain income.

Benguerir having the opportunity to be fully funded by OCP and integrated by the research hub has permitted the city to find new innovative solutions to integrate. It has pushed forward innovative materials usage and designs in contrast to Zenata, which can struggle with such investment.

Zenata's climate, being a coastal city, had allowed it a certain resource that helped its green design purposes. In contrast, Benguerir is still finding solutions dealing with water shortage and greenery claims.

Both cities represent the failures and successes of sustainability progress in Moroccan cities. The cities' problems are due to their new establishment. More challenges will be resolved as they slowly integrate the rest of Moroccan territory. Morocco is paving its way for the green transition and learning from the problems it is facing to create better cities for the African context.

REFERENCES

[1] S. M. W. a. T. Beatley, *Origins of sustainability, The Sustainable Urban Development Reader*, 2014.

[2] E. Howard, *Garden cities of tomorrow, Garden Cities, The sustainable urban development reader*, 1898.

[3] L. Mumford, *Cities and the crisis of civilisation, Future of cities*, 1938.

[4] A. Leopold, *The land ethic, a sand County Almanac*, 1949

[5] J. Jacobs, *Orthodox planning and the North End, The death and life of Great American Cities*, 1961.

[6] I. L. McHarg, *Plight and Prospect, Design with nature*, 1969.

[7] D. L. M. J. R. a. W. W. Donella Meadows, *Perspective, problem and models, Limits to growth*, 1972

[8] a. V. M. Godwell Nhamo, *The Green Building Evolution*, 2019.

[9] H. Daly, *The steady state economy, Toward a steady-state Economy*, 1973.

[10] World Commission on Environment and Development, "Towards sustainable development, Our common future," 1987.

[11] "The rio declaration on Environment and Development," 1992.

[12] international Energy Agency, "Global Status Report for Buildings and Construction, Technical Report," 2019.

[13] S. Campbell, "Green Cities, Green Cities, Just Cities? Urban Planning and the Contradiction of Sustainable development," *Journal of the American Planning Association*, 1996

[14] U. Nations, "The 2030 Agenda for Sustainable Development," 2015.

[15] N. J. W. Una McGeough Doug, "Model for Sustainable Urban Design With Expanded Sections on Distributed Energy Resources," 2004

[16] M. Pacione, "Urban environmental quality of human well-being: a social geographical perspective. Land- scape and Urban Planning," 2003.

[17] I. d. yeang, "urban design compendium, homes and communities agency," in *English Partnerships*, 2000.

[18] L. n. G. a. d. WanG, *Architectural Research Methods*, Wiley, 2013.

[19] M. Haslett, *Pope to Burney, 1714-1779: Scriblerians to bluestockings*, Palgrave Macmillan, 2003.

- [20] S. Durmus, " Change and Transformation in Architecture: On the Concept of Zeitgeist,," *Global Built Environment Review*, 2012.
- [21] C. Abel, *Architecture and Identity, towards global eco-culture*, ArchitecturePress ITD, 1997.
- [22] H. B. Akkurt, "Reconstitution of the Place Identity within the Intervention Efforts in the Historic Built Environment," in *The Role of Place Identity in the Perception, Understanding, and Design of Built Environments*, 6456, pp. 07-77.
- [23] J. Tran, *Static Illusion: Architectural Identity, Meaning and History*, Curtin University , 2011.
- [24] A. J. H. Benswessi, *A Study of the Concept of Identity: Towards an Architecture as a Harmonious Identifiable Fabric*, Graduate School of Arts and Sciences, University of Pennsylvania, 1987.
- [25] M. & B. R. Bruzzone, *The Industrial Heritage and the New Architecture: Teaching, Researching, Designing the Place Identity*, David Publishing Company, 2013.
- [26] B. P. Arnaud, " Le Maroc à l'heure de l'éco-urbanisme : innovations et décalages sur le terrain des premiers projets urbains "verts",," *Dupret, Le Maroc au présent. D'une époque à l'autre, une société en mutation*, pp. 11-89, 2015.
- [27] J. Roberson, "The Changing Face of Morocco under King Hassan II," *Mediterranean studies*, 2014.
- [28] B. C. Mounia, "Le Maroc à l'épreuve du temps mondial," *Le temps mondiale*, 1997.
- [29] J. R. a. J. R. Duarte, "A GENERATIVE COMPUTATIONAL MODEL FOR THE REGENERATION OF MARRAKECH MEDINA," *Traditional Dwellings and Settlements Review*, 2008.
- [30] C. Myriam, " Le "social" : une affaire d'État dans le Maroc de Mohammed VI," *Confluences Méditerranée*, pp. 07-76, 2011.
- [31] H. Tarik, "Le programme des villes nouvelles au Maroc: rupture ou prolongement d'un urbanisme de rattrapage?," *Revue Internationale d'Urbanisme*, 2017.
- [32] P. Pascale, "Aménagement et développement durable au Maroc : une longue marche ou une nouvelle donne," *Dupret, Le Maroc au present*, 2015.
- [33] Kingdom of Morocco's Official Newsletter, "Dahir n°1-10-200 dated 23 moharrem 1432 (December 29, 2010) promulgating the Finance Act n° 43-10 for the budgetary year 2011," *Kingdom of Morocco's Official Gazette n° 5904*, p. 2157, 2010.
- [34] B. Koennard, "The problem of slums: shifting methods of neoliberal urban government in Morocco.," *Development and change*, 2011.
- [35] J. Le Tellier, "Programme Villes Sans Bidon villes et Ingénierie Sociale Urbaine au Maroc in Politiques d'Habitat Social au Maghreb et au Sénégal Gouvernance Urbaine et Participation en Questions," *L-Harmattan*, 2009.
- [36] A. Escher, "Rehabilitation old the Mediterranean Medina in Morocco," in *The Mediterranean Medina International Seminar*, 2016.
- [37] M. E. Ward Kevin, "Mobile Urbanism," *Cities and Policymaking in the Global Age*, 2011.
- [38] L. V. PIERRE-ARNAUD BARTHE, "Arab Mediterranean Megaprojects after the 'Spring': Business as Usual or a New Beginning," *Built environment*, 2014.
- [39] B. Pierre-Arnaud, "Premiers quartiers urbain «durables» dans les pays arabes: enseignements sur une génération spontanée," *Espaces et sociétés*, pp. 33-115, 2011.
- [40] B. Pierre-Arnaud, "L'exportation au Maroc de la « ville durable à la française," *Métropolitiques*, 2014.
- [41] A. Abdelaziz, "Les villes minières marocaines face au défi du développement durable," *GREGUMUMR ESO CNRS*, 2006.
- [42] S. M.-J. Boyer André, "Gouvernance d'entreprise et responsabilité sociale au Maroc: l'évolution de l'OCP," *Department of Research, Ipag Business School*, 2014.
- [43] Agence Nationale Pour le Development des energies renouvelables et de l'efficacite energetique, " Reglement thermique de la construction au Maroc," 2018.
- [44] Green Building Information Gateway, "gbig.org," [Online].
- [45] R. J. Harmeet Singh, " A review on packed bed solar energy storage systems," *Renewable and Sustainable Energy Reviews*, pp. 5493-1069, 2010.