

THE FUTURE COMMUNITY

Al-Jawhara Al-Muhanna¹, Aida Nayer², Mohammed Fekry³

^{1,2,3}College of Architecture and Design, Effat University, Qasr Khuzam St., Kilo. 2, Old Mecca Road. P.O.BOX 34689, Jeddah 21478, Saudi Arabia

E-mail: ¹aalmuhanna@effatuniversity.edu.sa, ²anayer@effatuniversity.edu.sa, ³mfekry@effatuniversity.edu.sa

Received: 12.04.2020

Revised: 11.05.2020

Accepted: 08.06.2020

Abstract

Sustainable architecture is design that seeks to limit the negative natural effect of structures by skill and balance in the use of ecosystem, materials, vitality, and space for advancement. This work has therefore proposed the development of a residential community based on sustainability and urbanization in Saudi Arabia. In this work, two case studies for the development of the proposed residential community were analysed. Based on the case study analysis, the estimated total site area is 30000 m², and the gross floor area (50%) is 15420 m². The proposed residential community consists of several areas, including housing unit, green area, piazza and market, mosque, primary school, health clinic, solar farm and future expansion. For this work, 2 site areas were compared and Site 1 located in Buraydah, Al Qassim, Saudi Arabia, AlIskan District was selected as the proposed site as it achieved the highest evaluation score of 32. The proposed residential community can operate using renewable resources such as solar power and green space, thus enabling long-term sustainability in the future.

Keywords--Residential community, energy consumption, smart system, self efficient, Saudi Arabia

© 2020 by Advance Scientific Research. This is an open-access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>)
DOI: <http://dx.doi.org/10.31838/jcr.07.08.66>

INTRODUCTION

More than half of the world's population lives in towns and many of them live in housing communities, especially in high density countries like Saudi Arabia [1]. A residential community is a topographical area in which people live close to each other with integration and harmony. There are several dimensions of residential culture. It is defined from an architectural or urban perspective as physical structures that focus on households and families, living patterns and lifestyles [2].

Saudi neighbourhood design has witnessed a dramatic change in physical arrangement, mostly influenced by US and European urbanization [3]. While modernization brought many benefits to the neighbourhood, sustaining the urbanization remains a challenge for the Saudi community [4]. Sustainable cities can only be achieved when the urbanization process is also sustainable. Urbanization sustainability is the process of improving the quality of life in urban conditions for present and future generations by addressing ecological, monetary, social and administrative issues [4].

The Kingdom of Saudi Arabia is a noteworthy oil-producing nation and has delivered 15.7% of the worldwide oil supply [5]. Fast population development in Saudi Arabia has expanded its development industry, resulting in increased interest in new residential community structures. Thus, the Saudi government has encouraged the Saudi Green Building Council (SGBC) to apply the idea of green structures to residential community development ventures [6,7]. These structures are expected to utilize the available energy source such as solar power, wind power, hydroelectric power and other form of renewable energy. Alwaer et al. [8] has reported that King Abdullah City for Atomic and Renewable Energy (KACARE) construction project was intended to achieve a high feasible urban plan standard. Furthermore, Dehwah et al. [9] demonstrated the use of a hybrid power system for residential community development that applied sustainability design to minimize energy consumption, reduce greenhouse gas emissions and enhance indoor air quality. Thus, this work proposes the development of a residential community that offers people the right to live in a high standard of smart communities.

CASE STUDIES

For this work, two case studies were analysed. The chosen case studies are :

- King Abdullah Petroleum Studies And Research Center Residential Community (KAPSARC) In Saudi Arabia
- Earth Song Eco Neighbourhood in New Zealand.

King Abdullah Petroleum Studies And Research Center Residential Community (KAPSARC) In Saudi Arabia

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is an independent, nonprofit institution located at Riyadh, Saudi Arabia. It was designed by HOK architect firm. The area of the site is 30 hectares. The build area is 190,240 sq. m. It is a world-class community that serves staff and their families as shown in Figure 1. This community offers the best services to its inhabitants and a mosque as a focal point surrounded by retail shops, library, dining hall, recreation centre, swimming pool, supermarket and bowling alley. For its residential community, which is the first outside North America and is unique in terms of size, KAPSARC's sustainable and pedestrian-friendly design has recently been LEED certified (188 Gold, one Silver and two Certified). The principle building of KAPSARC will be a crystalline structure made of secluded six-sided cells and associations between them. The improvement will also include indoor and outdoor greenery enclosures, shaded open-air regions and underground passages. The gathering building will incorporate an expansive multi-purpose lobby and various littler corridors, meeting rooms, and private structures. For housing, the level sunshade structures of these advanced, stone-clad structures complete the liner that characterizes the focal square. The condo gives as extensive rooftop decks a plenitude of individual outdoor space with liberally estimated galleries and also open outdoor space. For the mosque, the primary plea to God's lobby is composed as sheathed in a dynamic coated skin. The outer layer of glass is isolated from an inner layer of 1 meter cement clad in stone. The tall minaret is intended to complement the mosque in its comparable examples of stone cladding and windows. The outsides of both structures are future to speak to a dreamy variant of a customary Arabic design and make a constantly changing knowledge of light and shadow. Wrapping its dividers and roof is a present-day exhibition of an Arabic

screen divider (*mashrabiya*) that shines with characteristic light from windows and windows facing the sky to illuminate the existing space. Covering shapes breathe life into the walls, while the roof displays a more usual outline. The material used in the mosque is: Evenos Black and Mosaic Tiles.



Figure 1. KAPSARC Residential Community

Earth Song Eco Neighbourhood

Earth song is a project that aims to make a different and change towards a cooperative society and a sustainable environment. It is located at Auckland, New Zealand. It was designed by the collaboration of Earth song member with architect Bill Algie. The area of the site is 3.5 hectares. The community has a variety of people to learn and live together in different ages and experiences of life. Earth song manufactured both independent homes and large basic offices. However, the minimized space around the planned houses includes open-plan living, dining and kitchen areas, rooms, lavatories and lofts, allowing a range of indoor employers. Earth song employed passive solar design consisting of preserving heat\cool, assembling sunlight by the north-facing opinions, storing heat, distributing heat into the house, protecting the house from winter winds and summer heat, and dispersing unwanted heat through ventilation. Houses at Earth song are designed for natural climate control and are thermally comfortable for most of the year without the need for additional heating or cooling. Figure 2 shows the Earth song eco neighborhood house. The structure consists of structure of rammed earth walls and visible concrete bond beam. The materials are selected based on renewable energy, low embodied energy, low toxicity to manufacturers, builders and occupants, reusable, durable and cost and availability.

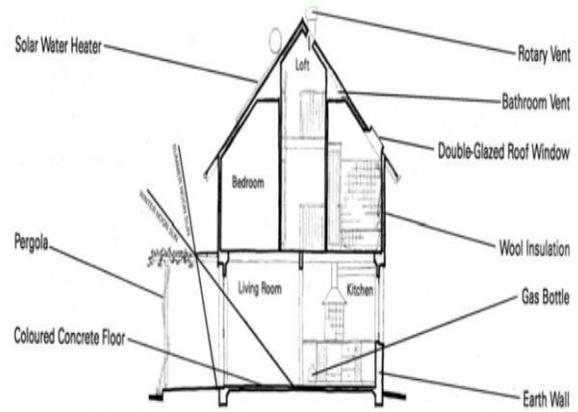


Figure 2. Earth Song Eco Neighborhood Passive Solar Design

PROGRAM ASSUMPTION AND SPACE DETAILS

Based on the case studies, the following program assumption was done for the proposed residential community development. Based on Figure 3, the zone percentage assumption comprises of 40% for housing, 20 % for green area, 10 % for solar farm, 5 % of mosque, 14% for piazza and market and 3 % for health and safety. The estimated total site area is 30000 m², and the gross floor area (50%) is 15420 m². Table 1 shows the proposed residential community project zone assumption with details of gross floor area and net floor area. The estimated user of this project zone is 1680 users. The estimated net floor area is 13500 m²

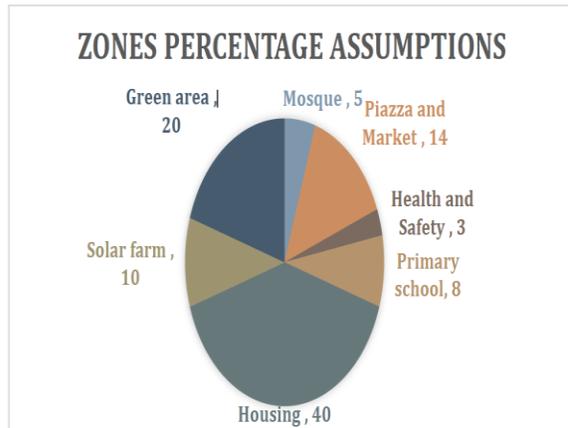


Figure 3. Zone percentage assumptions

Table 1. Project zones assumptions and details

Zone	Gross Floor Area (m ²)	Net Floor Area (m ²)	Users	Floors
Mosque	900	675	330	1 Floor + Mezzanine Floor
Piazza and Market	2520	1890	945	1 Floor
Health Clinic	540	405	80	1 Floor
Primary School	1440	1080	320	2 Floors
Housing	7720	5400	300	2 Floors + 4 Floors
Greenhouse	640	-	-	1 Floor
Community Council and Workshop	540	405	-	1 Floor
Green area	-	-	-	-
Activity Area	1120	-	-	-
Pedestrian walkway	-	-	-	-
Solar Farm	-	-	-	-
Total	15420	13500	1680	

Site Selection

Proposal site: Site 1

The first site is located at Buraydah, Al Qassim, Saudi Arabia (Figure 4). The coordinate of the site is 26°23'01.4"N 43°57'10.9"E. The estimated area of the site is 3 hectare. The district of the site is Allskan. The site was evaluated on the basis of a few criteria, including accessibility, clear exposure to the north, land for growing food, near commercial facilities, near health facilities, near educational facilities and future expansion. Table 2 shows the details of the evaluation of the criteria and the points achieved for each criteria. The overall evaluation point attained by site 1 is 32.



Figure 4. Site 1

Table 2. Site 1 Selection Criteria and Evaluation

Site Criteria	Evaluation Point	Note
Accessibility	5	The site's access point is considered great, as it is located between 2 main roads in Buraydah
Clear exposure to north	3	The north side is exposed 150 m from the next land
Land for growing food	5	The land in Buraydah has the potential to grow local food
Near commercial facilities	5	The area of this site is full of shopping facilities (shops, market, shopping center and etc, within 2 km, and King Abdulla Sport City).
Near health facility	5	AlQassim National Hospital is within a radius of less than 1.5 km
Near educational facility	5	With a radius of less than 2 km, there are 2 schools and a 2 college.
Future expansion	4	The site has the potential to expand north

Proposal site: Site 2

The first site is located at Buraydah, Al Qassim, Saudi Arabia (Figure 5). The coordinate of the site is 26°25'08.4"N 43°55'17.8"E. The estimated area of the site is 3 hectare. The district of the site is ArRihab. The street of the site begins from South Northern Ring Road. The site was evaluated based on few criteria's and the outcome is shown in Table 3. The total evaluation point attained by site 2 is 27.



Figure 5. Site 2

Table 3. Site 2 Selection Criteria and Evaluation

Site Criteria	Evaluation Point	Note
Accessibility	3	The site has a main access from the highway road
Clear exposure to north	5	The site was exposed from the north and east
Land for growing food	5	The land in Buraydah has the potential to grow local food
Near commercial facilities	3	The site surrounded by some shops and a lot of wedding hall
Near health facility	3	The nearest health facility is 4 km from the site
Near educational facility	3	The nearest 2 school is 0.5 km from the site.
Future expansion	5	The site has the potential to expand north and east

SITE EVALUATION

The selection of the site considers the multi-criteria. Both site 1 and site 2 were compared and evaluated on the basis of a few criteria: accessibility, clear exposure to the north, land for growing food, near commercial facilities, near health facilities, near educational facilities and future expansion. Based on Table 4, the highest score was attained by site 1. According to the evaluation, the land is under the mix-use area surrounded by mix-use, residential, sport, religious, entertainment, and public sectors. The neighbourhood has the potential for development in Buraydah's new plan, and all the necessary utilities are provided.

Table 4. Site 2 Selection Criteria and Evaluation

Site Criteria	Site 1	Site 2
Accessibility	5	3
Clear exposure to north	3	5
Land for growing food	5	5
Near commercial facilities	5	3
Near health facility	5	3
Near educational facility	5	3
Future expansion	4	5
Total	32	27

SITE ANALYSIS

Figure 6 shows the zoning of the selected site 1. Based on Figure 6, the site is separated into 8 zones comprising of housing unit, green area, piazza and market, mosque, primary school, health clinic, solar farm and future expansion.

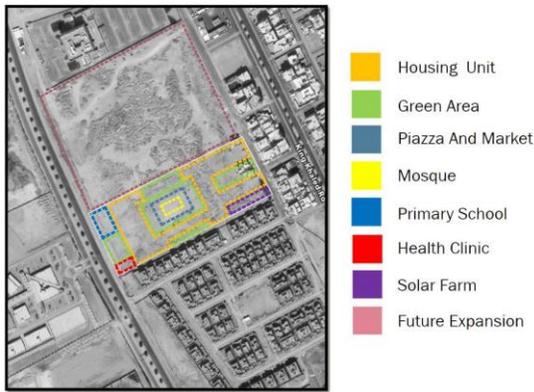


Figure 6. Zoning Arrangements Diagrams (Site one)

Figure 7 shows the master plan of the proposed residential community. Based on Figure 7, the red zone depicts the social sector, whereas the yellow zone depicts residential sector. The blue region represents the streets within the residential community. The purple region represents the pedestrian connection.

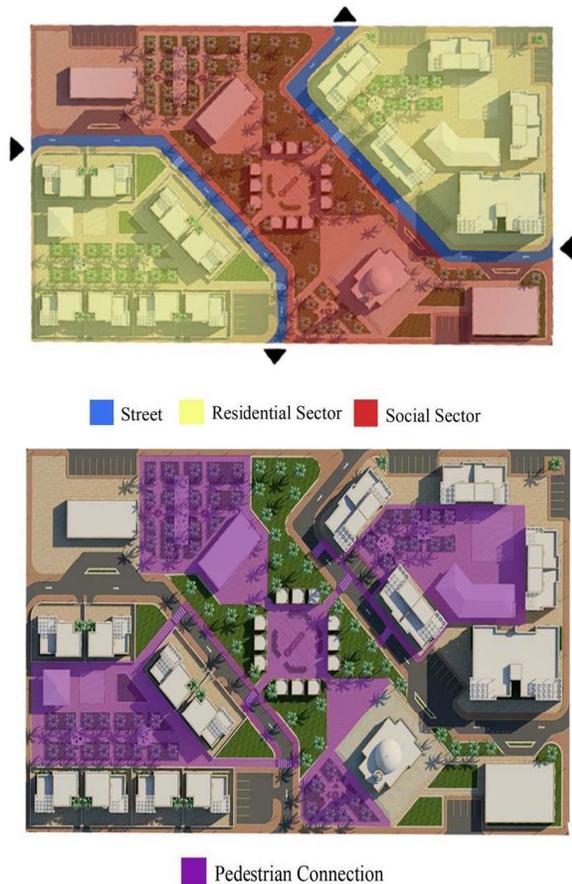


Figure 7. Final project master plan

Figure 8 shows the main perspective of the proposed residential community master plan. Based on Figure 8, the overall overview of the proposed residential community is observed.



Figure 8. Project overall perspective view

CONCLUSION

This work has proposed a residential community design plan in Buraydah, Al Qassim, Saudi Arabia. The proposed residential community will consist of several elements including housing unit, green area, piazza and market, mosque, primary school, health clinic, solar farm and future expansion. This designed was proposed with idea of urbanization and sustainability. This residential community will be able to operate by utilizing renewable recourses such as solar power and green area. Thus, this residential community will be beneficial for the Saudi nation due to its sustainable design.

REFERENCES

1. Alhazzani AA, Alqahtani AM, Abouelyazid A, Alqahtani AM, Alqahtani NA, Asiri KM, Muhaya AA, Alamri HA. Public awareness, knowledge, and attitudes toward epilepsy in the Aseer region, Saudi Arabia—a community-based cross-sectional study. *Epilepsy & Behavior*. 2016 Oct 1;63:63-6.
2. Alyami SH, Rezgui Y, Kwan A. The development of sustainable assessment method for Saudi Arabia built environment: weighting system. *Sustainability Science*. 2015 Jan 1;10(1):167-78.
3. Mulliner E, Algrnas M. Preferences for housing attributes in Saudi Arabia: A comparison between consumers' and property practitioners' views. *Cities*. 2018 Dec 31;83:152-64.
4. Fatani K, Mohamed M, Al-Khateeb S. Sustainable Socio-cultural Guidelines for Neighborhood Design in Jeddah. *Procedia Environmental Sciences*. 2017 Jan 1;37:584-93.
5. Khondaker AN, Rahman SM, Malik K, Hossain N, Abdur Razzak S, Khan RA. Dynamics of energy sector and GHG emissions in Saudi Arabia. *Climate Policy*. 2015 Jul 4;15(4):517-41.
6. Banani R, Vahdati MM, Shahrestani M, Clements-Croome D. The development of building assessment criteria framework for sustainable non-residential buildings in Saudi Arabia. *Sustainable Cities and Society*. 2016 Oct 1;26:289-305.
7. Hussain, A., Mkpjojogu, E.O.C., Jamaludin, N.H., Moh, S.T.L. (2017). A usability evaluation of Lazada mobile application. *AIP Conference Proceedings*, 1891, art. no. 020059,
8. Alwaer, H., Clements-Croome, D., 2010. Building sustainability awards 2010- sustainable innovation of the year. *Hilson Moran*.
9. Dehwah, A. H., & Krarti, M. (2019). Optimal Hybrid Power Energy Systems For Residential Communities In Saudi Arabia. *Journal of Solar Energy Engineering*, 1-19.