

Towards Sustainable Villa Architecture Design: A Case Study Of Selected Areas In Kuwait's Mishrif Region.



Faheem Aslam	MSc SED student, Department of Nutritional Sciences & Environmental Design AIOU Islamabad
Omer Shujat Bhatti (Corresponding Author)	Associate Professor, Department of Architecture, School of Architecture & Planning, University of Management & Technology, Lahore. omer.shujat@umt.edu.pk
Rifza Zahid	Lecturer, Department of Architecture, Lahore College for Women University, Lahore

Abstract: *Introduction:* An essential component in shaping societies, housing has an effect on social cohesiveness, economic stability, and personal well-being, among other areas of existence today. In the context of architectural design, the villa architecture has distinguished itself which delivers functionality and aesthetic at a higher level. Kuwait's Mishrif region faces extreme climatic conditions while climatic change is impacting the region significantly towards change in weather and climate patterns. **Objective:** With high end HVAC dependence, rise in costing of energy and non-prioritization of sustainable practices have resulted in environmental degradation of the region. Hence innovative design interventions and public prioritization were needed to enhance sustainability by mitigating environmental impact, improving energy efficiency, and promoting occupant well-being. **Methodology:** Respondents data was collected using developed questionnaire for sensitization and awareness. **Results:** It was concluded that the knowledge and the level of awareness amongst the respondents about the sustainable design practices with reference to climate change and allied energy crisis is ample. Though due to lavish life style and ample resources availability, these have not been considered as design priorities. 52% of the respondents pointed out that green design aspects are 'not used' in their homes, 25% of the respondents said these are 'partially used' and 7% said they are 'fully used'. **Recommendations:** Allied aspects were also highlighted. Future recommendations with respect to interventions were also proposed.

Keywords: Climate Change, Kuwait, Villa Architecture, Sustainable Design

Introduction

An essential component in shaping societies, housing has an effect on social cohesiveness, economic stability, and personal well-being, among other areas of existence today. Essentially, housing meets one of the most fundamental needs of humans by offering protection and security (Alraouf & Clarke, 2014). A house provides shelter from the weather, guaranteeing people's safety and comfort, whether they are alone or with family.

In addition to being psychologically safe, this stability comes from a stable home environment, which lowers stress and promotes mental health. Better health outcomes are directly associated with high-quality housing (Mokhtar, 2010). To avoid illnesses and promote health, adequate living conditions are crucial. These circumstances must include clean water, sanitary facilities, and adequate ventilation. Furthermore, in order to reduce health inequalities, vulnerable groups including the

elderly and children must have access to secure and healthy living conditions (Ardalan, 2014).

A major factor in maintaining economic stability is housing. For both individuals and families, investing in real estate and accumulating money are important steps toward achieving financial stability. Furthermore, worker mobility—the ability to relocate for work opportunities without having to worry about insecure housing—is made possible by the availability of cheap housing alternatives. Stable housing provides a solid base for communities to flourish (Knudstrup, Ring Hansen, & Brunsgaard, 2009). Through the creation of dynamic, varied communities, accessible and inclusive housing policies support social cohesiveness (Bhatti & Iftakhar, 2023). In addition, carefully thought-out housing complexes help to provide the social infrastructure—schools, parks, and community centers, for example—that is necessary for fostering contact and community involvement. The quality of schooling is directly correlated with housing stability. Due to the favorable learning environment, children who live in stable housing situations are more likely to achieve academic success (Alfalah & Ali, 2010).

The protection of the environment is greatly aided by the use of sustainable housing techniques. Energy-efficient design and the incorporation of renewable energy sources are two examples of green construction practices that lower carbon footprints and lessen environmental effect (Shoohanizad, Yalda. Haghiri, 2019). In addition to saving money on utilities for individual homes, sustainable building advances more general environmental objectives like mitigating climate change. Identity and cultural preservation are closely related to housing. A sense of continuity and belonging is fostered by traditional community structures and dwelling types, which represent cultural heritage and values (Al-Sallal et al., 2013). Maintaining different cultures and upholding ancestor traditions depend on the preservation of cultural housing practices. The housing industry plays a major role in both urban development and economic expansion. Regarding possible employment opportunities it can be stated that investments in housing

construction and real estate as well as accompanying facilities creates employment possibilities (Khalfan & Sharples, 2016).

In the context of architectural design, the villa architecture has distinguished itself from other designs in a way that delivers functionality and aesthetic to construct areas competent with the need of people as well as every community (AL-Mohannadi & Furlan, 2018). Residential villas have prehistoric origins that started at the time of ancient Greeks and Romans who initially utilized them as rural homes or holiday homes to wealthy individuals. A ‘villa’ concept thus underwent a change due to the progress made in technology, culture and society (Wiedmann, Salama, & Ibrahim, 2016). Villas developed became emblems of creative and architectural sophistication, which is evidenced by the style and magnificent features implemented throughout the renaissance. The outer appearance of the doors also reflects the renaissance era through displayed flamboyance and integration with the environment. Transitioning from symbols of nobility, to the modern day where villa aims mainly at being environmentally friendly, practical and accessible to everyone, the progressive development of the villa architecture signifies progression towards the better (Taleb & Sharples, 2011).

When it comes to the issues of sustainability the Mishrif area in Kuwait is quite an interesting example. Interventions in the architecture of villa due to the potential environmental differences of the same rich cultural legacy. The importance of addressing the conflict of interest of the modern world and its avarice for comfort and freedom when it comes to ecological and environmental issues. It is still necessary to mention conscience because it is an urgent issue in the context of the climate in the described country and high summer temperature. By looking at creative methods for improving sustainability and livability in villa design in the Mishrif region, our research aimed to meet this demand.

With rise in climatic change challenges across the globe, Gulf is no exception. Kuwait’s Mishrif region faces extreme climatic conditions

while climatic change is impacting the region significantly towards change in weather and climate patterns. With high end HVAC dependence, rise in costing of energy and non-prioritization of sustainable practices would result in environmental degradation of the region. Hence innovative design interventions were needed to enhance sustainability by mitigating environmental impact, improving energy efficiency, and promoting occupant well-being. Following major research objectives were set forth:

1. To evaluate awareness and knowledge of climate change and sustainable architectural design practices amongst the Villa end users in selected vicinity.
2. To identify their existing practices and how it has been negatively impacting the environment.
3. To propose strategies facilitating the future line of actions for environmental design of villa architecture in selected sites.

The existing study was able to contribute to existing body of knowledge to identify the existing awareness and sensitization of climate change phenomena amongst the end users living in the Mashrif area of Kuwait with focus on Villa architectural typology. Their existing

preferences and practices have highlighted the issues and concerns with respect to sustainability of the built form in the explored region. Documentation of these gaps and later proposed strategies to intervene in the current timeline to manage the negative environmental impacts would help similar context across the Gulf region to help better demonstrate the sustainable design practices and future of Villa design integration environmental design considerations.

REVIEW OF LITERATURE

Climate change is one of the prevailing crises in the present century, influencing all the geographic territories, including the Arab states. It is, however, important to point out that the social construction of climate change has undergone a process of social construction in the last few decades (Pretlove & Oreszczyn, 1998). In the beginning, climate change was just a research topic mainly studied by scientists, whereas at present it is a critical policy concern and a top priority of the environmentalist. The Arab region specifically has slowly begun to draw awareness toward this and mainly due to changes in weather patterns and consequently on normal life (Sijakovic & Peric, 2020).

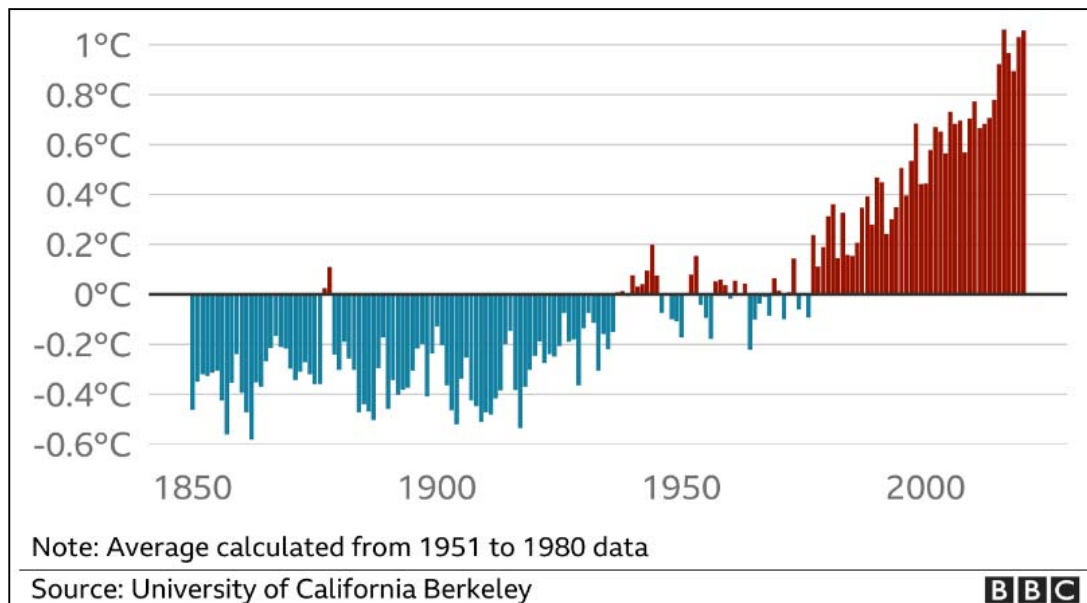


Figure 01 Average temperature change calculated from 1850 to 2010 (BBC, 2021) Climate change challenges in the Arab region

present themselves in environmental, economic and social implications that the region has to endure. The effects of climate change are

evidence based and are all related to people’s activity needing reduction of fossil fuel consumption, deforestation, and emission of greenhouse gases. Sustainable solutions to these challenges can only be resolved under the framework that requires commitment from the political leadership, economic investment, technological advancement, and public

participation (Abraham, 2018). It is therefore the hope of this paper that, through over-arching collaborative efforts and regional cooperation, the Arab countries will keep building their ability to mitigate the effects of climate change and support the global sustainability agenda (Alzahrani et al., 2016).

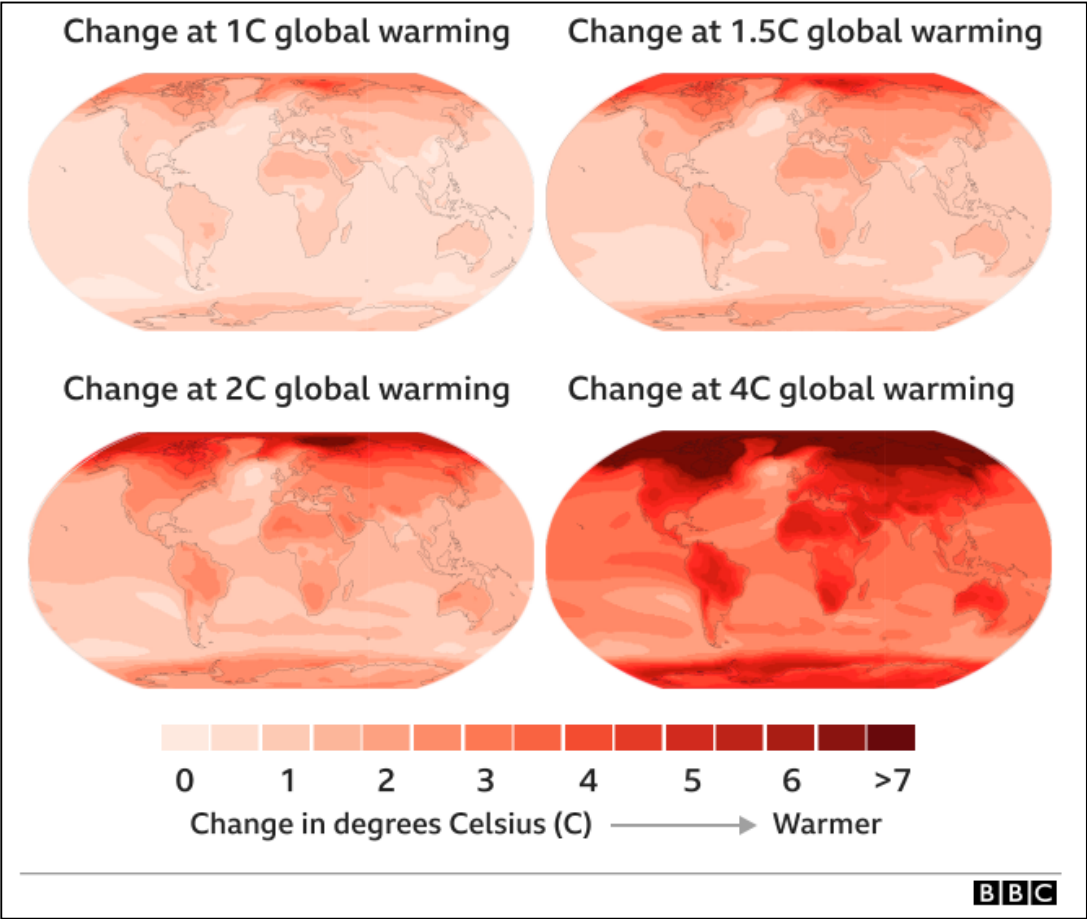


Figure 02 Impact of temperature change globally for 1-4 degree Celsius (BBC,2021)

Global warming is the progressive rise in the climatic temperature globally associated with human activities, in particular the emission of greenhouse gases such as Carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). It exactly describes how these gases prevent heat from escaping into the space, thus warming up the planet (Society, 2021). This rise has been a progressive process over the past century or so, with the acceleration to the current levels noted in the last few decades. Some of the major greenhouse gases include carbon dioxide, nitrous oxide, methane and fluorocarbons and

some of their causes include the burning of fossil fuels for electricity and heat, deforestation for lumbering, and other industrial uses (Rasul, Dahe, & Chaudhry, 2008).

Global warming is the process of gradual increase in average temperatures on the surface of the Earth over the century or longer due to various human activities and usage of some gases referred to as green house effect such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). These gases retain heat in the atmosphere, notably in the lower atmosphere, rather than allowing it to out to the outer space, thereby warming the planet (Abouelfadl, 2012). This process has been going

on for the past century, although the climaxing has been realized in the recent decades. Some of the leading causes of these gases include the use

of fossil energy, lack of vegetation cover, or the combustion of fossil fuel for heat and electricity purposes and industrial uses (bbc.co.uk, 2020).

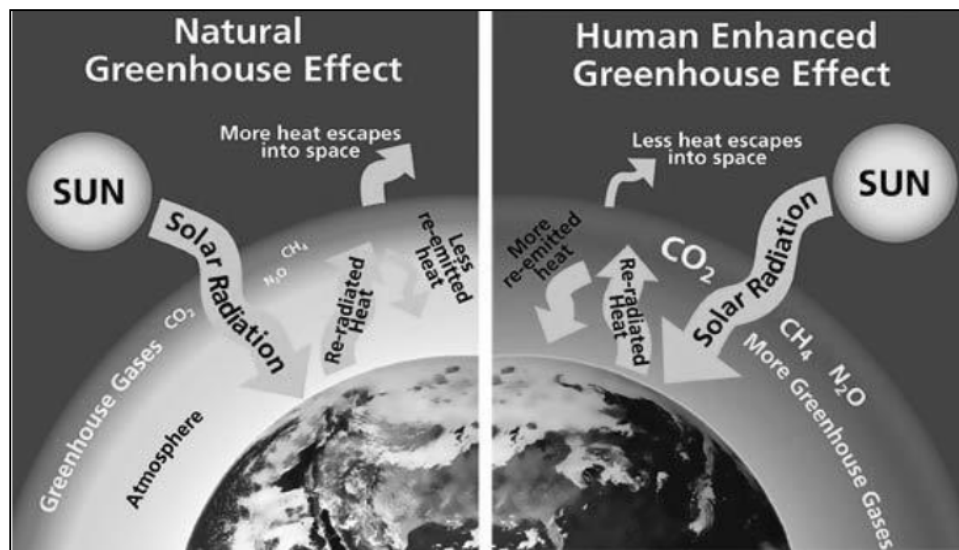


Figure 03 – Natural & Human induced green house effects (Abouelfadl, 2012)

It has been apparent that instances of global warming and climate change are in the process of escalation and the incidences are likely to occur with more force in subsequent years. As a result, it causes an increase in temperatures leading to the melting of the polar ice caps and glaciers that leads to the rise in sea level. This is expected to worsen the already existing flood and erosion problems along the coastal line. Also, it is making changes in climate system in such a way that the structure of ecosystem is changed including characteristics of plants and animals (Bardecki, 1991). They pointed that democracy necessitates that some specie is unable to alter substantially within a short period, which will lead to less species and sometimes, even extinction. The burning of fossil fuels, deforestation, and other related activities by human beings have been blamed for global warming. Listing of greenhouse gases As seen above, the burning of fossil fuels in electric power production, space heating, and as a mean of transport is by far the prime source of emissions. Another major cause is industrialization, and other anthropogenic factors like agriculture and changes in land use, especially deforestation, among others (Iqbal et al., 2022).

Particularly, building and infrastructure spaces, structures, and the various urban development contribute to global warming. These facets contribute to a significant proportion of the energy used on heating, cooling, lighting, appliances, and other building related uses, which in most cases relies on power produced from fossil energy (Abuelgasim & Daiban, 2017). Congestion is also evident in that they consumptions of energy besides emissions that arise from transport in urban areas. The construction materials that have to be used, like cement or steel, are infamous for their high levels of embedded carbon, as their production demands a lot of energy (Lin, 2015).

One of the significant aspects of the built environment is the management of environmental issues, a task that is handled by the field of urban planning. Thus, urban changes toward energy efficient cities, less emitting transportation and availability of green space will assist to deal with global warming (Singh & Mishra, 2021). Some of the strategies in urban design involve making the environment conducive for walking, enhancing social transports, and adding green capital that has the ability to pull in CO₂ and cool (Raza, Ifikhar, Raza, & Lindgren, 2012).

As the study shows, the implementation of the measures aimed at preventing the detrimental

effect of buildings on global warming is quite problematic. Another implication is that financial input is always limited, and this means that users of green building technologies and practices are likely to fail to make the necessary financial input to acquire these technologies and practices, and this be a limiting factor to the implementation of these technologies. But there are also opportunities, so it is seen less as a strictly negative concept (Akhtar, 2020). The reasons towards improved more sustainable built environments can be informed by modern developments in technology or enhanced recognition by the public or supportive policies. The main thing here is that these breakthroughs, challenges, and threats can only be managed with the help of governments, businesses, and communities collectively working together to find the ways to take advantage of the opportunities for creating a better future (Kennedy et al., 2009).

Thus the climate change and the global warming issues calls for a complex solution that involves emission reduction, increased climate and socioeconomic, and engineering of improved climate resilient practices in all facets of society. It could be ventured that the built environment is one of the areas that has massive potential for improvement. Through careful planning and implementation of energy efficiency and green energy, more sustainable urbanization and design of new buildings can help decrease the carbon emissions of our cities (Khalid et al., 2021).

Climate change and global warming are two highly related issues of importance that require utmost attention. The use of energy in the built environment presents great potential of emission reduction since it is one of the main contributors of green house carbon emissions. By enclosing the buildings and structures in sustainable ways, the utilization of renewable energy and in orderly laying of towns, cities and other regions, it is possible to minimize the effects of global warming by the built environment and embodied a better sustainable and liveable world. We and the next generations are the future inhabitants of this planet and it is only fitting that we should take measures to safeguard the earth and put

measures in place to be able to support life in the future.

Kuwait, with a small area of approximately 17,818 sq dues, but rich and one of the most developed countries in the Persian Gulf region, is very affected by climate Change. This arid continental country has received a foreclosure check in the disguise of global warming where heat and drought are already endemic in the regions. Climate change in Kuwait is not simply a unique and localized environmental condition, because there are social, economic, health, and quality of life impacts of the changing climate (Al-Ansari & AlKhaled, 2023).

As it is now considered to be one of the topmost countries with high temperature standards of living, climate change has added more to Kuwait's hot temperatures. Wilhite and Dearing (2010) found that, over the last few decades, average temperatures have been rising, and summer temperatures regularly rising above 50°C (122°F. Not only does this rise in temperature impact people in their everyday routines but also has dire consequences as it concerns human health (Munawwar & Ghedira, 2014). Staying out too long in hot environments or physical exercises in a hot country can cause issues such as heatstroke or heat exhaustion and dehydration. The elderly and people who work outdoors are especially at risk, which is one of the reasons for enhanced vulnerability of such groups. Public health implications of heat waves have become more frequent and severe, requiring elevation in the healthcare and contingency planning as well as necessitating improvements in long term health and wellness. In response to these challenges, the Kuwait Public Authority for Manpower (PAM) has announced that administrative decision No. 535/2015, which bans working in open areas during the noon hours from 11:00 am to 4:00 pm, will be enforced from the beginning of June to the end of August. This measure aims to protect workers from the extreme heat and its associated health risks (Damani et al., 2012).

According to assessment made, water scarcity is one of the climate change vulnerability factors in Kuwait. There are not much freshwater reserves in the country and thus the supply of

fresh water is mainly done through desalination plants. Global warming extends the emissions and thus water scarcity is likely to worsen by raising evaporation level and decreasing the accessibility of groundwater (Powl & Skitmore, 2005). Higher temperatures and less rain results in poor water reserves and already limited sources are further strained additional pressure on the desalination plants. This is because, as water demand is likely to go up in future to meet increasing needs, greenhouse gas emissions due to energy intensive desalination processes is also likely to rise in a less favorable cycle. For Kuwait to harness sufficient water supplies for use in the future, efficient water management and more investments in green technologies are needed now (Rupp et al., 2015).

Kuwait has provocative shores that can experience increased or high sea levels due to another effect of the climate change. The attendant problems relate to global warming, which has caused corresponding global risks evident in the world's map, including increasing sea levels that may soon immerse low-coastal areas, which are inhabited by large population densities and influences strategic infrastructure (Rafique, Rehman, & Alhems, 2020). These include the ports, oil refineries residential, and many other activities will be affected by flooding. Seawater is not only a factor that deteriorates the quality of water resources already available, but it also deepens the problem of water scarcity through the intrusion of the fresh water aquifers. There are also undesirable effects of sea water intruding ashore and the loss of more land which are a major hurdle in urban planning and growth. The ramifications of not taking further precautions and building barriers for protecting the coastal regions and the adoption of the adaptive measures to combat sea surges are highly damaging to Kuwait's city structures and its population (Zhang & Fan, n.d.).

The environment in Kuwait's marine has been greatly affected by climate change. Irrespective of the fact that ocean temperatures rise slowly compared to air temperatures, the increase in temperatures in seas together with acidification is facing the challenges of marine life. Some of

the habitats that provide homes for the marine life as well as serve as coastal barriers include coral reefs and sand beaches and beaches, which are threatened by bleaching and destruction caused by increased sea temperatures (Alalouch, Saleh, & Al-Saadi, 2016). This in turn means that the coral reefs are lost and thus the fish which are also very important due to the roles they play in lives of people and also in the environment are also affected. Also, altered sea temperature and salinity affects the breeding systems or movement of marine lives, hence, increasing further gaps in the ecosystem. Which will make the difference to overturn certain attitudes that in the mean time are slowly eradicating the entire ocean's fauna (Wiedmann et al., 2016).

The economic effects of climatic change as witnessed in Kuwait are many and complex. Oil exports remain the principal source of wealth and at the same time a menace to the world's climate through emissions of Greenhouse gases. Some threats of climate change are manifested in potential impacts on the oil industry such as; weather risks: such as increased vulnerability to extreme weather events, increased operational costs as a result of infrastructure for adapting to climate change impacts (Alfalah & Ali, 2010). Moreover, with the world shifting toward more sustainable energy resources, the consumption of oil, which remains a major product of Kuwait, may be significantly reduced in the near future, an indicator that its economy may not be future-proof (AL-Mohannadi & Furlan, 2018).

One of the best ways to manage this poor relationship towards reducing the climate change impacts is through environmental and green design development and integration in housing and Villa architecture. To reduce the influence of housing architecture on climate change, it is critical to use sustainable and ecologically friendly design principles. These measures are intended to minimize energy consumption, cut emissions, and increase resource efficiency throughout the building's life cycle (Maliene, Howe, & Malys, 2008).

Housing architecture has a considerable influence on climate change by increasing greenhouse gas emissions through energy use,

poor design, urban sprawl, and building waste. But with proper utilization of sustainable and environment friendly approaches in designing, possibly we can counter these effects and establish more stable and energy efficient house structures. Energy-efficient and green practices, environmentally friendly systems, and materials can also reduce residential buildings' CO2 emissions (Muhaisen & Abed, 2015). Moreover, increasing water usability, designing urban premises with greater eco-friendliness, and green zones are also effective when it comes to enhancing environmental quality regarding residents. Despite these solutions posing challenges like; cost and awareness, adequate support from the law, knowledge, and enhancing the technicality can help counter these challenges. If house designing is considered anew, it can possibly play a huge role in wiping out climate change (Nadal et al., 2017).

RESEARCH METHODOLOGY

Since, to implement the research project it necessitated the formulation of a research methodology in the present scenario to continue the research work and gather data for its assessment and to arrive at the conclusion of the research. This led to the development of Literature review extensively, and based on the existing knowledge base explored in relation to the topic of research exploration, multiple approaches were then examined which culminated into a thorough systematic approach for data collection through Questionnaire, mainly by face to face physical sitting, online and structured interview method was chosen as a feasible method mainly due to restricted accessibility, stringent time boundary as well as resource restrictions. The research methodology ensured prior information disclosed with the respondents and permission sought for the accomplishment of the data collection process in selected places as detailed in the later part of this report.

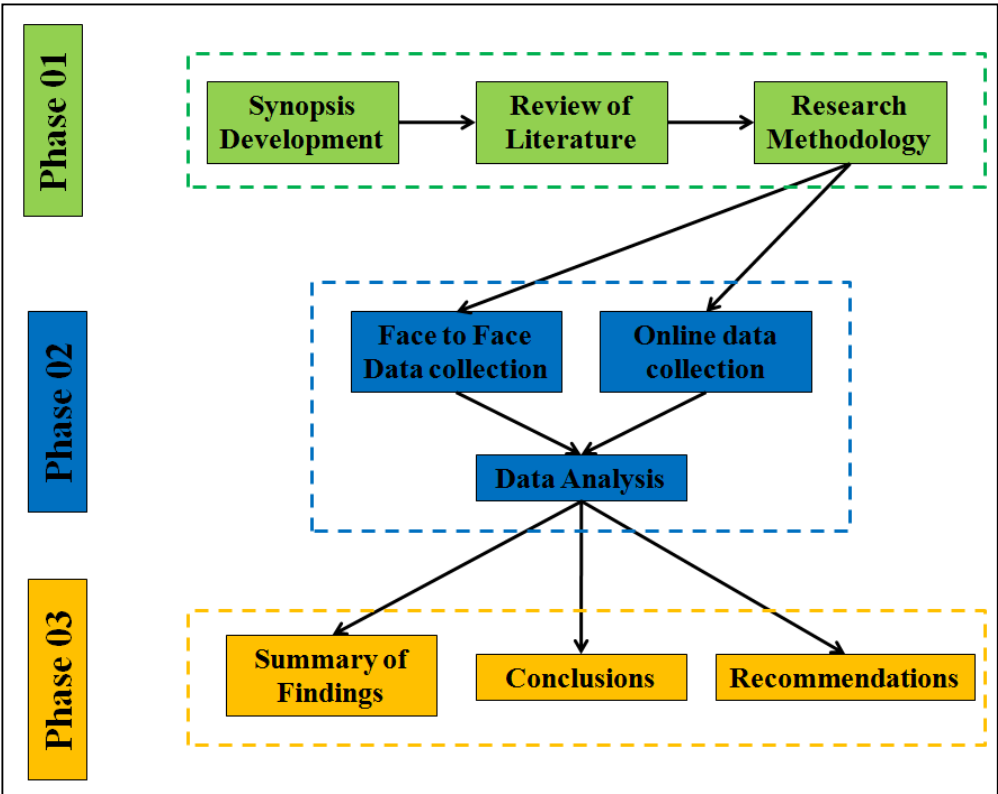


Figure 04 Research Design

As further illustrated in the above figure, to make the work more manageable multi phase multi stage research steps were developed. Face

to face onsite and online data collection was used as a two way approach using the devised data collection tool in the form of questionnaire of which briefing about it was given to the respondents. Since it was not possible to get a

response from all of our targeted population because of accessibility, timing and cost issues, a minimum sample size of 60 and above respondents was followed. Due to the current scope of the study, purposive sampling was used to gather data.

DATA COLLECTION & ANALYSIS

Two major forms of data collection approaches were used. First one focused on the observational study of the researcher and the second one based on the data collection from diverse respondents of multiple residences who agreed to participate in the information sharing from the selected site. Both approaches were based on the aspects explored through review of literature and then were formulated in the forms of questions to be asked and observed. Following were the major aspects:

1. Knowledge about the green and sustainable architecture.

2. Information about local transportation and community accessibility.
3. Water efficiency.
4. Energy efficiency.
5. Materials and resources optimization.
6. Indoor environmental quality of living.
7. Regional and climate responsive architectural design.

On the basis of these highlighted aspects, an observational sheet and Data collection Questionnaire were developed and later used for observational study and respondents data collection respectively. In order to carry out the observational study using the checklist developed, it was important to understand the context of the area and its overall zoning /planning. Below is the Google Earth images of the site:



Figure 05 Location of Kuwait with highlighted site

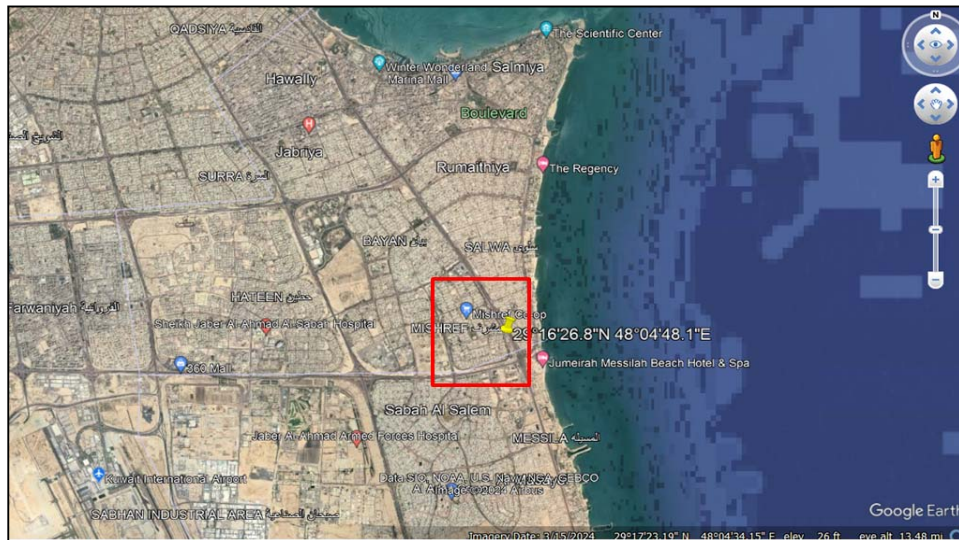


Figure 06 Location of site in Kuwait



Figure 07 Mishref Area – Selected Site



Figure 08 Rotated view of Site with diversified Villa houses

As evident from the figure 05-08, the context of the site is very diversified with close water body in the context which makes the site very beautiful while also has variations in the weather patterns. Since with sea side right next to the site

context, air movements change during the days hours and also at night times which bring in the weather, climate and temperature variations trends across all the seasons.



Figure 09 Road and street network of Site



Figure 10 Perspective view of the Mishref Area

As evident from figure 09-10, the context also has some green spaces available in the context which makes it more attractive as well as defined landscape design which brings more attraction to the usage of the site for domestic housing and dwellings.

In order to carry out the research work ahead, physical data collection was done using on site visits and using questionnaires. The demographic details are shown below in Figure 11.

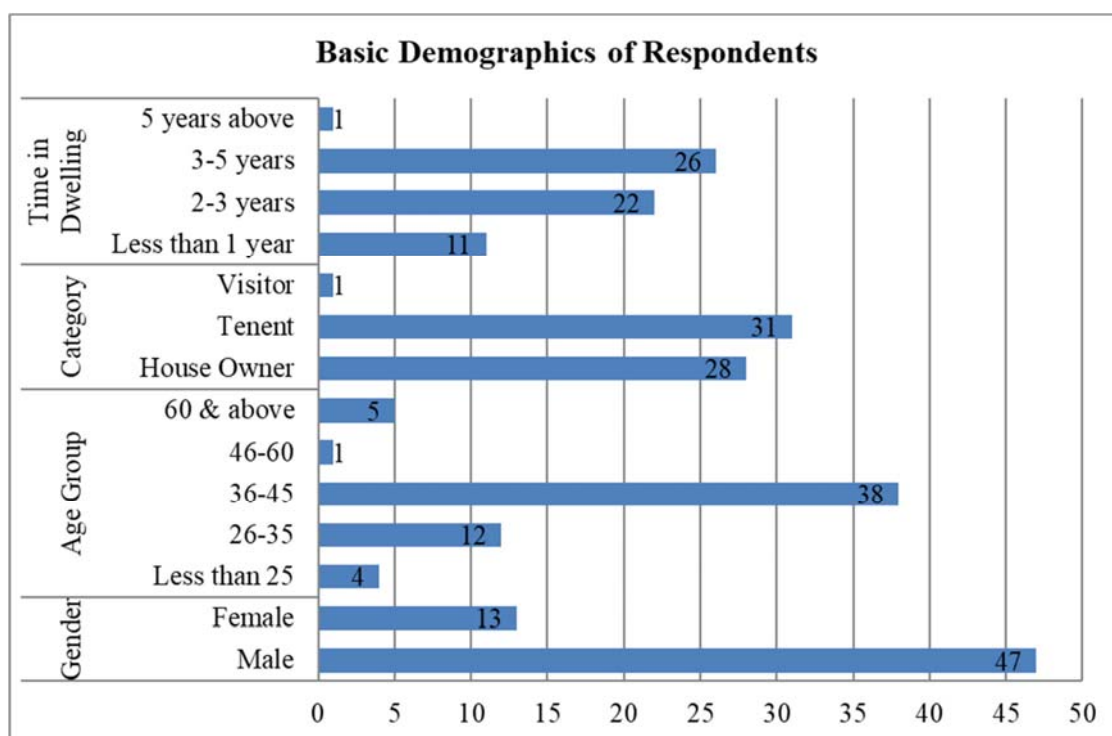


Figure 11 Basic demographic of respondents

As shown above in the figure 11, the overall count of respondents as a sample size was 60. Based on gender basis, 47 were Male i.e. 78% while 22 % were female i.e. 13. Major age group of the respondents was 36-45 with 38 respondents i.e. 63%. Two major category of occupants were tenets and house owners i.e. 31 and 28 respectively out of 60. With respect of

time of occupancy in these dwellings, major category in 3-5 years with count of 26 i.e. 43% followed by 2-3 years with count of 22 representing 37% of the sample. The detailed data collection with respect to the sustainable Villa design elements and aspects are shown below in Table 01.

Table 02 Respondents data of Sustainable Villa design and aspects

S.No	Key Aspects related to Sustainable Villa	Responses							
		Not clear about	%	Not Used	%	Partially Used	%	Used	%
1	Green design aspects used in house	31	52%	15	25%	10	17%	4	7%
2	Green spaces present in house	15	25%	6	10%	31	52%	8	13%
3	Light pollution managed	5	8%	8	13%	11	18%	36	60%
4	Compact, Mixed Use and Transit Oriented Development	2	3%	44	73%	12	20%	2	3%
5	Walkability and Bikeability	6	10%	12	20%	7	12%	35	58%
6	Access to Quality Transit	2	3%	4	7%	15	25%	39	65%
7	Integrated Water Management	8	13%	3	5%	23	38%	26	43%

8	Water Access and Quality	1	2%	0	0%	5	8%	54	90%
9	Stormwater Management	2	3%	2	3%	5	8%	51	85%
10	Wastewater Management	3	5%	1	2%	8	13%	48	80%
11	Smart Water Systems	6	10%	3	5%	12	20%	39	65%
12	Power Access, Reliability and Resiliency	2	3%	17	28%	18	30%	23	38%
13	Energy and Greenhouse Gas Emissions Management	21	35%	3	5%	28	47%	8	13%
14	Energy Efficiency	3	5%	8	13%	23	38%	26	43%
15	Renewable Energy	3	5%	6	10%	29	48%	22	37%
16	Low Carbon Economy	45	75%	2	3%	6	10%	7	12%
17	Grid Harmonization	31	52%	1	2%	18	30%	10	17%
18	Solid Waste Management	2	3%	2	3%	31	52%	25	42%
19	Organic Waste Treatment	8	13%	3	5%	41	68%	8	13%
20	Recycling Infrastructure	31	52%	4	7%	23	38%	2	3%
21	Responsible Sourcing for Infrastructure	41	68%	1	2%	6	10%	12	20%
22	Smart Waste Management Systems	18	30%	1	2%	3	5%	38	63%
23	Public Health	3	5%	3	5%	28	47%	26	43%
24	Emergency Management and Response	6	10%	1	2%	33	55%	20	33%
25	Innovation	18	30%	8	13%	23	38%	11	18%
26	Regional Priority	23	38%	3	5%	26	43%	8	13%

As evident from Table 02, multiple aspects explored through review of literature were integrated in the developed questionnaire for the respondents based data collection. Each aspects is explored and its details are discussed below. The major values have been colored grey to highlight them. As shared above, there are 26 major aspects which were explored based on the review of literature and were found to be critical towards opting for sustainability in the context of the selected site and Villa design for the local climate and weather conditions. These aspects clearly show a mix response from the respondents. In few areas like green design

aspects used in the house, low carbon economy, grid harmonization, recycling infrastructure and responsible sourcing for infrastructure, people were not much clear about the current aspects and the functional aspects to be considered. Though they were briefed about it yet they were unclear and lacked information about these aspects in their existing dwellings. With respect to not used aspects, major were identified as Compact, Mixed Use and Transit Oriented Development. With respect of partial usage, aspects included Green spaces present in house, Energy and Greenhouse Gas Emissions Management, Renewable energy, Solid Waste

Management, Organic Waste Treatment, Public Health, Emergency Management and Response, Innovation and Regional Priority were mainly responded. With respect to Used aspects, mainly Light pollution managed, Walkability and Bikeability, Access to Quality Transit, Integrated Water Management, Water Access and Quality, Storm water Management, Wastewater Management, Smart Water Systems, Power Access, Reliability and Resiliency, Energy efficiency and Smart waste management systems were reported by the respondents.

DISCUSSION & ANALYSIS

As per the defined research methodology, the overall steps were followed with respect to observational study and respondents data collection from the selected sample and site. Sample size mainly consisted of 60 respondents and each villa had only one respondent available for representation of each dwelling. The overall respondents were mainly male i.e. 47 out of 60 and 13 were females. Females were mainly house wives from the explored houses where data was collected. With respect to age group, majority of the respondents i.e. 38 out of 60 were from the 36-45 age group which clearly shows that the majority of the respondents have sufficient level of maturity to understand and respond back to the questions. With respect to the category of respondents, three main categories were identified i.e. house owner living in the villa, tenant and visitor or guest inside the house. 31 out of 60 respondents were tenants while 28 were owners with one respondent as a visitor or guest in the house. Hence majority of the respondents fall into the groups where they have been associated with the house as an end user or owner and have much affection as well as details about the villa. With respect to the time spent in the villa, 26 out of 60 have spent between 3-5 years followed by 22 who have spent 2-3 years. This aspects shows that most of the villa designed and developed were not very old or the end users have been in the place for occupancy recently. Since these settings and physical structures were mainly recently built over the last 10 years, respondents have been using them for the last mainly 3-5

years.

Cities of the contemporary world have their own peculiarities of the development, which impact the concept of sustainable development. As a city develops over time the embracing of green design becomes critical in ensuring the reduction of adverse effects on the environment, improvement of the quality of life and promoting equality in the society. Sustainable housing design is a process that involves several tactics to address concerns in the natural surroundings of homes, besides enhancing inhabitants' well-being. Regarding the collected data, 52% of the respondents pointed out that green design aspects are 'not used' in their homes, 25% of the respondents said these are 'partially used' and 7% said they are 'fully used.' This explains why there is a large gap that shows the adoption of green building practices is low. Green design aims at the efficient use of energy, use of sustainable resources, the manner in which an item is constructed in such a way that causes the destruction of the environment.

In this regard, squares, gardens, parks, and vegetation-covered rooftops constitute some of the significant urban green zones. These services include purification of air and water, regulation of temperature and support of bio diversity. Concerning the use of green spaces, out of 60 respondents, 52 percent said that they are 'partially used' for living environments while only 25 percent said that green spaces are 'not used'. This explains why there is call for improvement of the level of incorporation of green spaces in the current planning practices in urban areas. Green spaces also have social values which include recreation, health through the promotion of mental health and social since they bring people together.

The negative environmental impact of light pollution, relatively new problem in big cities, is damaging for human health, wildlife and increases energy consumption. Some measures include; using lamps that do not emit excess light such as the led bulbs, and the use of smart features like the dimmers and the motion sensors. Of the respondents who were asked how they perceive light pollution, 60% said it is 'managed' in their areas, a sign of growing

consciousness about the issue and related actions. Transit-Oriented Development (TOD): People, work and facilities are integrated in the neighbourhoods that are accessible by public transport. This approach makes people dependent less on private cars, decreases the emission of greenhouse gases, and promotes more vigorous types of transport, such as walking and cycling. Analysis of the respondents data indicated that 73 % of the respondents perceived that TOD is “not used” in their areas, therefore implying that cities have the potential of applying this model to improve mobility whilst at the same time eradicating negative impact on the environment.

Encouraging people to walk or bicycle within and/or to work within urban areas does not only solve transportation problems in terms of traffic congestion and pollution, but also affect the people physically. Looking at the percentage of people who think their areas are walkable and bikeable, the survey showed that 58% of respondents agreed. Things like broader sidewalks, bike friendly lanes and safe crossing are some of the desirable components of the city for walkers and cyclists. Access to quality public transit is one of the fundamentals of utilizing transportation for sustainable development in urban areas. They offer an affordable, efficient, and low-impact transport substitute while decreasing the utilization of personal automobiles. Conducted survey also showed that 65% of respondents identified that that “Access to quality transit is used” in their regions thus showing the importance of public transit in urban sustainability. When talking about sustainable development, increasing the coverage of public transportation systems, increasing the frequency of transportation and making transportation accessible are important processes.

Urban water management entails the use, treatment and supply of water in the cities. Sustainable water management focuses on the whole water cycle and includes the prevention of wastage, storm water and waste water management. Thus, the survey revealed that 43% of the respondents claimed that integrated water management is “used” in their areas,

showing improvement but with still some way to go. Rainwater harvesting, green roofs and urban pavements are some of the ways that can be used improve the management of urban water. The management of energy resources and the minimization of Green House Gas (GHG) discharge are also the essence of green design. These are such measures as energy-saving equipment, the development of renewable energy, and increasing the thermal resistance of buildings. Asked about energy management practices, the result indicated that the options of ‘partially used’ was 47% while the ‘not used’ was 35%. This implicates the call to further strengthen energy intensity and GHG reduction in cities.

Renewable energy resources utilization like solar, wind and geothermal energy resources are crucial for diminishing carbon footprint of cities. For instance, in the survey conducted among respondents, 48% of the respondents indicated that renewable energy is “partially used” to demonstrate awareness and the extent of the integration of renewable energy into society. To some degree it is possible to lessen dependence on conventional resources and contribute to the preservation of nature by installing renewable power systems in constructions. The concept of low carbon economy entails system transformation at the physical energy sources level as well as the transport and the manufacturing sectors and the ways in which goods and services are utilised. According to the survey results, only 25% of the respondents’ perceived that a low carbon economy is ‘used’ in their areas meaning that the authorities require policy and infrastructure transformations to make this possible. Promoting energy saving, investing into clean energy and creation of low carbon environment in all spheres of economic activity are the important prerequisites on the way to creating a new economy with low carbon emissions. Long-lasting waste management strategies such as the recycling, composting, and sourcing are essential in minimizing the occurrences of ecological problems. Regarding the issue of responsible sourcing for infrastructures, 68% of the respondents believed that it is “used” in their areas and therefore,

depicting the current trend of sustainable material utilisation. Although, 52% of respondents availed effective solid waste managing; this called for enhancement of waste collection, sorting and processing.

Shaping the city is possible only by developing sustainable urban planning where the concepts of public health and emergency management are key. Interestingly, the survey findings showed that 43% of the participants believe that 'public health considerations,' which should be given primacy in the plans, are 'used' in the areas, and 55% pointed towards the effectiveness of the 'emergency management and response. Prescribing universal primary healthcare, clean air, and safety from toxic environments, focused preparedness for emergencies is a part of sustainable cities. Therefore, it is vital to review innovative strategies on sustainable design and urban planning to avert the multifaceted issues of sustainability. This study showed that in their perception, only 38% regarded regional priorities as 'used' in their areas of operation and this suggested that most organizations require more specific and localized solutions. This shows that advancing research, development and the use of new technologies holds the key to improving the prospects of sustainable urbanism.

The sustainability of building designs in urban development can only be attained through implementation of green design in the construction of cities. If integrated into urban planning, aspects like accessibility to parklands, natural and artificial lighting, focus on the use of public transport, water and energy conservation, and efficient waste disposal minimize environmental footprint, improve people's welfare, and establish social justice. The results drawn from data accrued point to increased assessment and implementation of sustainable practices but still reveal areas that require more conviction and creative solutions in constructing the sustainable urban future.

RESEARCH FINDINGS

With respect to each objective, defined research methodology based on the review of literature was followed and completed. For first objective,

evaluation of the end users and respondents of selected site people about awareness and knowledge of climate change and sustainable architectural design practices were explored. With respect to second objective of the research, it was observed that the current architectural practices were focused on issues pertaining to climate change but due to lavish life style, the aspects related to climate change and energy efficiency were ignored. With respect to the third research objective of the study, strategies have been proposed based on the respondents data collected during research exploration and it has been formulated as a set of strategies for future villa and architectural design in the Mishrif area of Kuwait.

RESEARCH CONCLUSIONS

Following were the major conclusions of the research exploration:

1. It was concluded that the knowledge and the level of awareness amongst the respondents about the sustainable design practices with reference to climate change and allied energy crisis is ample. Though due to lavish life style and ample resources availability, these have not been considered as design priorities.
2. It was also concluded that with recent rise in awareness as well as cost of living and energy, people in the Mishrif area of Kuwait have now been opting for transition towards sustainable design practices for design development, construction as well as operations in the buildings.
3. It was concluded that respondents believe that there is a strong need to shift to these practices of sustainable design approaches in Villa architecture as it will help manage natural resources as well as energy needs.
4. Based on the recent transformation in practices as well as over the last few years, respondents data about their current dwellings was collected.
5. 52% of the respondents pointed out that green design aspects are 'not used' in their homes, 25% of the respondents said these are 'partially used' and 7% said they are

‘fully used’.

6. Concerning the use of green spaces, out of 60 respondents, 52 percent said that they are ‘partially used’ for living environments while only 25 percent said that green spaces are ‘not used’.
7. Of the respondents who were asked how they perceive light pollution, 60% said it is ‘managed’ in their areas, a sign of growing consciousness about the issue and related actions.
8. Looking at the percentage of people who think their areas are walkable and bikeable, the survey showed that 58% of respondents agreed.
9. The survey revealed that 43% of the respondents claimed that integrated water management is “used” in their areas, showing improvement but with still some way to go.
10. Asked about energy management practices, the result indicated that the options of ‘partially used’ was 47% while the ‘not used’ was 35%. This implicates the call to further strengthen energy intensity and GHG reduction in cities.
11. 48% of the respondents indicated that renewable energy is “partially used” to demonstrate awareness and the extent of the integration of renewable energy into society.
12. According to the survey results, only 25% of the respondents’ perceived that a low carbon economy is ‘used’ in their areas meaning that the authorities require policy and infrastructure transformations to make this possible.
13. Interestingly, the survey findings showed that 43% of the participants believe that ‘public health considerations,’ which should be given primacy in the plans, are ‘used’ in the areas, and 55% pointed towards the effectiveness of the ‘emergency management and response.
14. Only 38% regarded regional priorities as ‘used’ in their areas of operation and this

suggested that most organizations require more specific and localized solutions.

RECOMMENDATIONS FOR FUTURE:

Following major recommendations have been proposed:

1. Climate change must be part of the diverse design and architectural design services from the very first step with focus on environmental study of the site and its concerns.
2. There is need to increase the adoption of green building practices.
3. There is also a need to increase open spaces within the villa design while incorporating water, landscape and allied elements to enable better cross ventilation, natural lighting and energy management.
4. It also calls for incorporation of the green open spaces at the community level which have social values including recreation, health through the promotion of mental health and social since they bring people together.
5. Smart lighting and energy efficient lighting design for indoor and outdoor spaces of villas to be incorporated in the architecture as well as the overall community design must incorporate the Transit Oriented development to reduce the carbon foot print of the community.
6. There is need to increase bikeable and walkable spaces within the community.
7. Improve storm water, rain water and waste management practices through rain water harvesting, rain water ponds creating and irrigation ponds development within the society area explored.
8. With extensive exposed area, solar energy could be harnessed at a very extensive scale.
9. Urban and environmental health must be prioritized in the future design of villa architecture and must incorporate with standards which may help yield better environmental and energy benefits through certification programs like LEED or BREEAM.
10. Detailed climatic and environmental data collection and analysis must also be made

publically available to enable better design analysis at the earlier design stage.

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