Green Mosques in South Africa

A comparison between three facilities in Cape Town

Gaathier Mahed, Raaghieb Najjaar

Abstract: We present the environmental sustainability initiatives undertaken by three mosques in Cape Town, South Africa. These houses of worship are located in close proximity to one another yet represent completely different socio-economic sectors of society. The water- and energy-saving activities undertaken at these facilities are primarily focused on minimising the reliance on municipal resources and cutting costs related to mosques' daily operations. It is clear that socio-economic standing plays an integral role in terms of the ability to execute environmental initiatives, as the available funding dictates the extent of projects undertaken. Water use reduction and energy saving are the most important factors, primarily forming the backbone of the operational costs. Grey water re-use and rainwater harvesting were also options explored, as well as the installation of boreholes to minimise reliance on municipal water supply. Future projects should include solar installations and possibilities for composting, including subsequent business opportunities stemming from on-site activities to create revenue for the Masjid facility so that it can be sustainable in its long-term operations. It is shown that sustainable investing through the use of waqf is also an excellent tool for greening.
Keywords: awqaf, South Africa, green mosques, sustainable investing, water saving

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Introduction

Resources have always played an important role in determining the location of major civilisations, especially water. This can be seen from the strategic placement of the city of Cairo in Egypt along the Nile River (Pavan, 2006) and the location of Detroit city along the major lakes in North America (Miller, 2002). One South African example is the city of Bloemfontein (translated as 'fountain of flowers'), which was chosen due to its proximity to the spring after which the city was named (Woodford and Chevallier, 2002). It can be said that water is truly the source of life, without which we would not be able to survive. In line with the strategic placement of settlements is the economic principle of supply and demand. Water is important in the functioning of industries, as irrigation for crops, and for daily human consumption. Therefore, the quality and quantity at specific locations is important for the designated use (Hem, 1986). This is complimented by land and soil as a critical resource, as well as access to power and strategic locations, all of which play a major role in the success of any civilisation. Furthermore, our energy consumption and carbon emissions are also major factors influencing our planet (Figure 1).

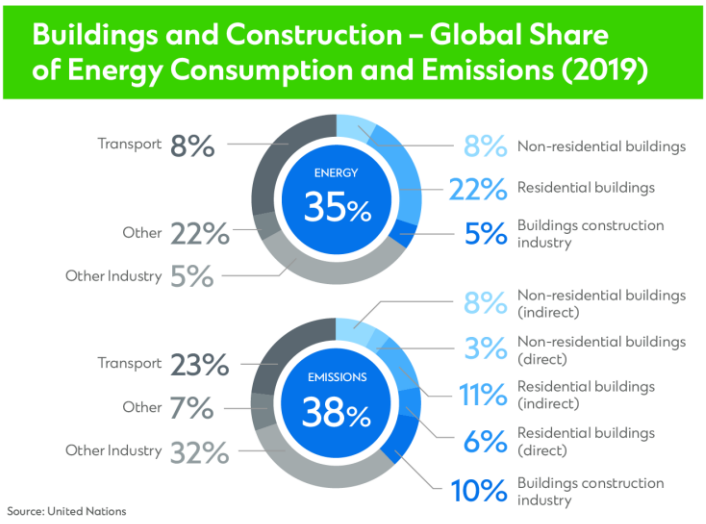

Figure 1 Energy and emissions from built structures (U.N. 2019)

Rainfall is the major driver in the hydrological cycle, contributing to the recharging of almost all freshwater reserves that we utilise (Stephens et al., 2020). On a global scale, relatively recent historic data sets point to the changes in rainfall patterns due to climatic variability. Some argue that this is cyclical and bound to the laws of nature, while others believe that it is anthropogenic, with humans causing a largely proportion of global warming and climate change. The changes in climate patterns will affect the previous distribution of rainfall and in turn the available run-off and groundwater (Beekman and Xu, 2003). This means that the available amount of water will also be affected, and strategies related to increasing supply or limiting demand have to be implemented (Butler and Memon, 2006). A prime example of this is the construction of the largest man-made canal in Libya, linked to a network of pipes extending all across the country (Salem, 2007). Water is piped from the Kufra basin in the south to towns on the coast. These fossil waters – which are not being recharged and are out of contact with the atmosphere – have been mined for crop irrigation (Wright et al., 1982).

These changes in climate have major implications not only for water resources but also the use and distribution of resources in general. We find that they have even created climate refugees, who are no longer able to survive in the regions from which they originate and are forced to relocate due to dwindling resources from the impacts of climate change. It is thus clearly evident that we need to judiciously manage our resources and optimise the spaces in which we operate.

1. Background

In recent years, green buildings have been deemed as a solution to aid in combating climate change and helping to minimise our carbon footprint (Ali et al., 2020). The World Green Building Council – which is focused on catalysing the uptake of sustainable buildings and associated practices – has stated that multiple factors are required for a building to be considered "green", including:

- Efficient use of energy, water and other resources
- Use of renewable energy, such as solar energy
- Pollution and waste reduction measures, and the enabling of re-use and recycling
- Good indoor environmental air quality
- Use of materials that are non-toxic, ethical and sustainable
- Consideration of the environment in design, construction and operation
- Consideration of the quality of life of occupants in design, construction and operation
- A design that enables adaptation to a changing environment

Thus, a substantial amount of thought and energy is required to design and construct a green building. This is critical, as the Quran says in Surah 6, verse 165:
"For He it is Who has appointed you vicegerent over the earth."
This concept of being a representative of the Almighty on the Earth and taking care of the resources appointed to us is critical for the long-term sustainable management of the planet in its entirety. Furthermore, the green building revolution has also been seen as a major investment opportunity (Figure 2).

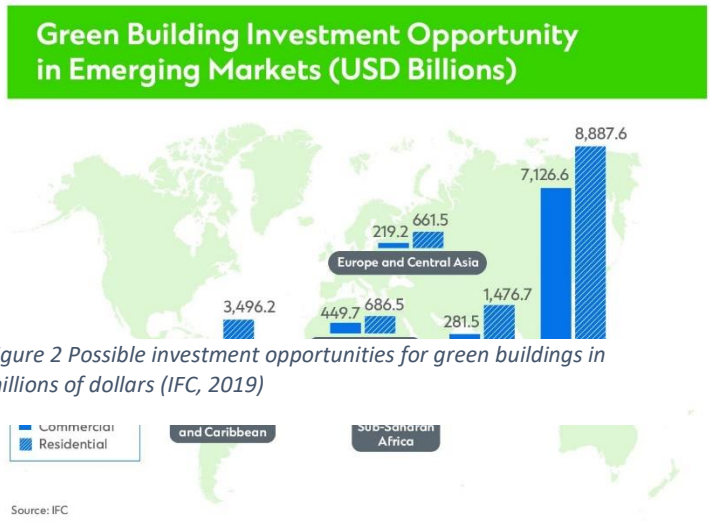

Figure 2 Possible investment opportunities for green buildings in millions of dollars (IFC, 2019)

In the South African context, the government has released a policy under the Department of Public Works, aiming to achieve the following goals:

- Sustainable development within South Africa
- Job creation and the development of green jobs
- Developing improved working and living conditions
- Developing cost-effective solutions and the efficient use of resources during the life of buildings

Furthermore, the main drivers for going green in the South African context were studied by Windapo (2014) and can be divided into economic and ecological drivers, with a further sub-

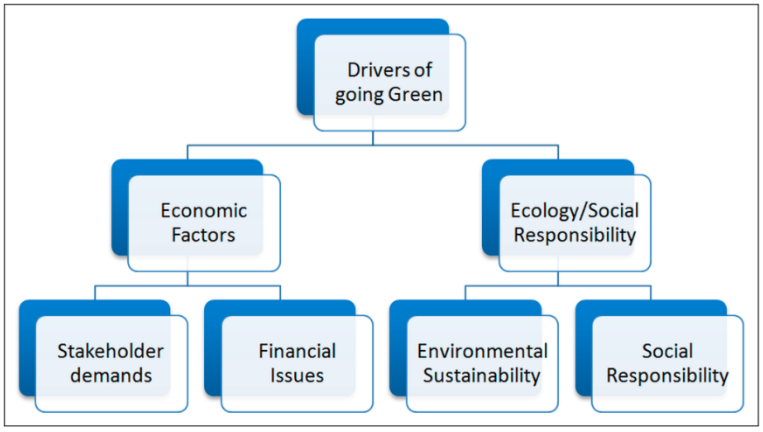

Figure 3 Main drivers of greening in South Africa (Windapo, 2014)

division into financial and stakeholder issues, as well environmental sustainability and social responsibility (Figure 3).

In line with this, the drive for funding mosques to go green has been a major initiative in many majority-Muslim countries. For example, the Moroccan government has partnered with GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) and aims to "green" 600 mosques with millions of euros set aside for funding (Aramcoworld.com). GIZ operates on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).

One other example that could set the trend for *waqf* (charitable endowments) globally stems from Jordan. The Ministry of Awqaf has helped multiple mosques with funding for solar cells to reduce their energy consumption, which also positively influences the economy in the form of job creation in the green sector (GIZ, 2019). This principle of awqaf – the return on investment from an asset for the benefit of the community in perpetuity – stems from the time of the Prophet Muhammed (Singer, 2009).

2. South African perspective on green mosques

South Africa can be classified as a largely semi-arid nation with extensive warming occurring over recent years (Jury, 2013). The vegetation types have been classified by Rutherford and Westfall (1994) as grassland, savanna, succulent karoo, nama karoo, forest, and fynbos. Many of these vegetation types – particularly fynbos – are indigenous to South Africa.

A recent drought has devastated South Africa and continues to play a role in the major water shortages in larger cities. Cape Town was particularly hit hard, with speculation of the dams running completely dry and limited water supply of only 50 litres of water per person per day (Sousa et al., 2018). This situation has since eased due to an abundance of rain and the subsequent filling of dams in 2019 and 2020.

2.1. Research methodology

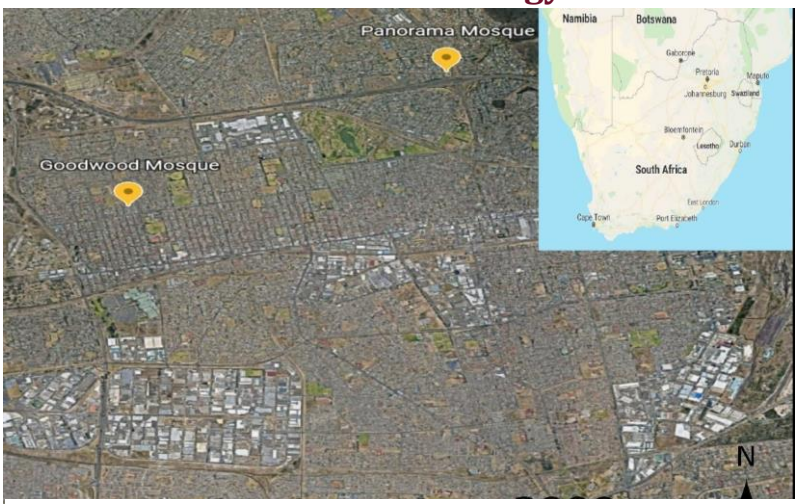

Figure 4 Location of the mosques that formed part of the study in the city of Cape Town, South Africa

Three mosques formed the basis for this work, were chosen based on their representation of socio-economic conditions and their proximity to one another. These mosques are located within a 10km radius of one another on the outskirts of Cape Town (Figure 4). The Kalksteenfontein mosque could be seen as a representation of a lower-income area, while Goodwood

can be viewed as a middle- to upper-income suburb. On the other hand, Panorama is representative of an upper-income residential area.
The water-saving and environmental activities on site were closely examined by analysing annual reports and extracting information from the mosque websites, where possible. Furthermore, site visits were undertaken where possible, and inspections of the mosque facilities were undertaken.
The major aim was to understand the status quo in terms of the activities undertaken at local mosque facilities across the socio-economic spectrum in Cape Town. This was done

2.2. Results and discussion

Kalksteenfontein – the location of the first mosque – is a sub-economic area situated east of Cape Town's central business district. The area was established during the Apartheid period to remove people of colour from the central city area in terms of the forced removal law called the Group Areas Act. The suburb has 1,060 households and is home to around 5,500 people (Stats SA, 2012). The area has an Islamic centre that hosts a mosque and a *madrassah* (Islamic school), and it is managed by a volunteer team. With over 20% of people in the area unemployed, it is funded by donations received from the greater Cape Town Muslim community.
In 2010, the centre started with a humble greening programme. A tank with water pumps was constructed to collect all ablution water used by visitors to the mosque. This ablution water stems from the cleansing occurring prior to the daily prayers, also known as wudhu. The grey water is used for gardening the complex and resulted in some food gardening. The intention is to plant vegetables that will be used in the complex soup kitchen to help to feed the poor in the area. Management is currently working on directing the grey water towards the toilets' cisterns to avoid using clean water for toilet flushing purposes. Management is embarking on an alteration of the complex to add a fully fitted modern education section. The building plans to reveal an environmentally friendly complex that will have fully fitted solar panels to create an independent energy-saving building. At the same time, water tanks will be fitted to harvest rainwater.
The second mosque is located in the middle- to upper-income area of Goodwood. This suburb is north of Kalksteenfontein and has approximately 15,456 households (Stats SA, 2012). The suburb was named after Goodwood racing course in England, and it initially had a racecourse constructed, although it was abandoned after only one event.
The Muslim community in Goodwood was established in the 1920s, with the construction of the Mosque completed in 1935. Due to the legislation of the past, we find that people of colour – excluding caucasians – were forcibly removed from the area during the 1960s due to the Group Area Act of the former Apartheid government being enforced. In 2011, the Mosque Committee – together with Awqaf SA, a South African organisation managing waqf (Mahed, 2009) – installed rainwater harvesting tanks and a water pump so that rainwater could be collected and used for irrigation of vegetation around the mosque. The water was also used to wash ablution towels and for the laundry purposes of employees on site.
In 2018, at the height of the drought in the Western Cape, water flow restrictors were installed on all ablution tapes to limit water usage. Signs were also appropriately displayed, highlighting water scarcity in the region and the need for saving. Thereafter, in 2019, a partnership with the Gift of the Givers Foundation was undertaken to install a borehole on site. The intention was to use the borehole water for ablution purposes and sewerage, and for the community to have access to it on a free basis. The borehole was drilled to 120 metres, although heavily

saline water was encountered. Unfortunately, this project was abandoned due to the poor quality of the resources.

More recently, acquired land is in the process of being rezoned for the extension of the mosque. In line with this, the possibility of employing green construction material and principles is being explored. This includes the use of solar panels on the mosque roof for electricity generation and thus limiting the impact of power cuts on the mosque operations. Furthermore, it is envisaged that the new building will have limited heating requirements and little or no use of a sound amplification system due to the use of natural acoustics in the construction process.

The final mosque facility is the most recently constructed one, with current renovations occurring to complete the mosque structure and *madrassah*. This project is currently being undertaken to complete a new community centre, and its design and building attempts to optimise lighting and heating to reduce energy costs.

The final study site is located furthest north in the area, situated in an area classified in the upper-income bracket. The mosque is in the process of being constructed, and plans highlight the use of design aspects to aid in optimising cooling and heating. Furthermore, minor water saving and energy reduction have been embedded in the historical facility, with a view to transferring these ideas into the new design. A borehole is also available on site, with a view to utilising it for supply into the newly constructed premises. Storage tanks compliment the borehole pump with the possibility of a water treatment plant being examined due to the poor quality of groundwater.

The community in this final study area of Panorama has been in existence since 1996, making it the youngest established Muslim community in this study due to the fact that the suburb was mainly occupied by white Afrikaans-speaking individuals, based on Apartheid laws. The initial property was used as a prayer room and *madrassah* and was purchased in 2000. The construction of the mosque was undertaken in 2008 on a separate property, which was purchased and made *waqf* in 2010. The recent acquisition of a neighbouring property has led to the construction of a larger facility in 2020, as previously mentioned.

3. Conclusions

These highlighted case studies show the move towards greening mosques in the South African context. The multi-pronged approach to conserving energy and saving water is critical for minimising the carbon footprint of buildings and people in general. This also has implications for finances, as many of these facilities receive funding from general public donations. The major strategies focused around utilising the mosque as a hub include:

- Energy saving
- Water conservation and re-use
- Urban agriculture
- Recycling

The combination of these sustainability initiatives is critical for the longevity of the local communities and their mosques. The aspect of energy production could hold greater interest in the South African context considering that legislation could enable the sale of excess electricity produced by independent service providers. This means that mosques could act as electricity generation points if they are able to produce excess power and then return this to the national grid, as shown by a case study in Morocco (GIZ, 2019).

The aspect of recycling and using the mosque as a hub for the collection of recyclable goods has not been fully highlighted in the South African context. Anecdotal evidence of the

deployment of waste collection bins at various mosques has been erratic in nature. This includes the collection of newspapers and cooking oil used for the production of bio-diesel. This could be further complimented with the collection of waste and a composting facility utilising the aforementioned discarded material to help to plant urban gardens in the immediate vicinity of the mosque for food security.

However, it seems that economics is the main driving factor due to mosques trying to save money in every form possible. This is particularly true for those in the sub-economic and middle-income areas, while the upper-income areas have funding to implement measures. This is based on the fact that borehole installation – which can be costly – has only been undertaken in the middle- and upper-income sites.

The committees of mosques should be cognisant of the fact that we are operating at a delicate water, energy, and food nexus point. The hadith related to resource-saving comes to mind for Muslim believers in this context:

"Do not waste water even if performing ablution on the bank of a fast-flowing (large) river." (Ibn Majah)

The interaction between these three variables of water, energy and food needs to be taken into consideration when planning and building future mosques, as well as when retrofitting devices to save water and energy in older establishments. This should in turn have spin-off effects, such as using the wudhu water – which was previously explained – and recycling it for irrigation purposes to grow vegetables. These goods can then be sold to the local community at a discounted price, and the profits can be used for maintenance of the mosque.

It should also be noted that multiple factors are necessary to implement a successful green mosque programme, including:

- Sustainability information drives and awareness
- Training of imams
- Effective audits of mosques (water, energy and waste)
- Political will
- Buy in from communities (social capital)

These have proven critical for project implementation and success, particularly in Morocco (GIZ, 2019). It is even more important to undertake activities of this nature in Muslim minority countries as directives for mosque greening are not necessarily led by the government or ministries but instead by NGOs, community initiatives, or even the mosques themselves.

The entire value chain opens opportunities for sustainable investing and financing, like waqf. This can be seen in case studies from Morocco and Jordan, where the Ministry of Awqaf is heavily involved in mosque greening projects. It should be noted that projects of this nature have been undertaken in the past under the ruling of the Ottoman empire and the smaller awqaf – like water fountains around mosques – have actually been the ones to stand the test of time (Singer, 2008). Larger water supply projects have also been noted throughout history, many of which have also been funded by waqf (Mahed and Xu, 2009). It should thus be encouraged for individuals to make waqfs of this nature and work in conjunction with mosques and community organisations to effectively implement them, as seen in the cases presented in this study.

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was extracted from Statistics South Africa Census of 2011 and the websites of the mosques, where available.

References

Beekman Hans E./ Xu Yongxin (2003). Review of groundwater recharge estimation in arid and semi-arid Southern Africa. In Xu, Y.& H.E. Beekman (eds.), *Groundwater Recharge Estimation in Southern Africa.* Cape Town: UNESCO.

Butler, David/ Memon, Fayyaz.Ali (2006). Water Demand Management. London: Caxton Publishing.

GIZ (2019). Morocco: Green Mosques and Buildings. Federal Ministry for Economic Co-operation and Development. Berlin. https://www.giz.de/en/downloads/1909-Factsheet-Green-Mosques-Buildings-EN.pdf [Accessed am 04.04.2022].

Goodwood Mosque. 2015. https://www.goodwoodmosque.org.za/ [Accessed 18.12.2021].

Hem, John D. (1986). Study and interpretation of the chemical characteristics of natural water (3rd Edition). Washington: United States Government Printing Office.

IFC 2019. Green buildings: Finance and policy blueprint for emerging markets. International Finance Corporation. World Bank Group. Washington.

Jury, Mark R. (2013) Climate trends in southern Africa (with erratum). South African Journal of Science, 109 /1/2, [111]. https://doi.org/10.1590/sajs.2013/980

Khozema, Ahmed Ali/ Mardiana, Idayu/ Yusri Yusup (2020) Issues, Impacts and Mitigations of Carbon Dioxide Emissions in the Building Sector, Sustainability, 12/18. [7427]. https://doi.org/10.3390/su12187427

Mahed, Gaathier (2009). The Corporate Governance of an organisation managing Islamic Charitable Endowments (waqf). Corporate Governance in Africa Case Study Series, 2, University of Stellenbosch.

Mahed, Gaathier/ Xu, Yongxin (2009). Charitable endowments as an institute for sustainable groundwater development and management. In Xu, Y. and Braune, E. (ed.), Sustainable Groundwater Resources in Africa, CRC Press.

Miller, G. Tyler (2002). Living in the Environment (12th Edition). California: Brooks/Cole Publishing.

Panaroma Mosque (2021). https://panoramamasjid.co.za/ [Accessed am 18.12.2022].

Pavan, Aldo (2006). The Nile. From the mountains to the Mediterranean. London: Thames and Hudson.

Rutherford, M.C./ Westfall, R.H. (1994) Biomes of southern Africa. An objective characterization. Mem. Bot. Surv. South Africa, 63.

Salem O. (2007.) Management of shared groundwater basins in Libya. African Water Journal 1/1. [106 -117].

Singer, Amy (2009). Charity in Islamic Societies. Cambridge, UK: Cambridge University Press

U.N. 2019. World Urbanization Prospects: The 2018 Revision. United Nations: Department of Economic and Social Affairs.

Sousa, Pedro. M./ Blamey, Ross C./ Reason, Chris J. C. et al. (2018) The "Day Zero" Cape Town drought and the poleward migration of moisture corridors. Environmental Research letters. 13/12. doi: 10.1088/1748-9326/aaebc7

Stats S.A. (2012). Census 2011. Statistics South Africa (2012). https://www.statssa.gov.za/publications/P03014/P030142011.pdf

Stephens, Graeme. L./ Slingo, Julia. M./ Rignot, Eric et al. (2020) Earth's water reservoirs in a changing climate. Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences, 476/2236, 20190458. https://doi.org/10.1098/RSPA.2019.0458

Windapo Abimbola Olukemi (2014). Examination of Green building drivers in the South African Construction Industry: Ecology vs Economics. Sustainability. 6/9, [6088-6106]. https://doi.org/10.3390/su6096088

Woodford, A.C. & Chevallier L. (2002). Hydrogeology of the Main Karoo Basin: Current Knowledge and Future Research Needs. Pretoria: Water Research Commission

Wright, E.P./ Benfield, A./ Edmunds, W. et al. (1982). Hydrogeology of the Kufra and Sirte Basins, Eastern Libya. Quarterly Journal of Engineering Geology and Hydrogeology, 15. [83-103].