SHAGARA

COMMUNICATION OF ENGAGEMENT

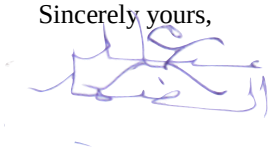
2020-2022

RENEWALE OF COMMITMENT TO THE PRINCIPLES THE UN GLOBAL COMPACT NETWORK

I am pleased to confirm that Shagara supports the ten principles of the UN Global Compact with respect to human rights, labor, environment and anti-corruption. With this commitment, we express our intent to support the Global Compact advancing these principles, and will make a clear statement of this commitment to our stakeholders and the general public.

We also pledge to participate in and engage with the UN Global Compact in the following way(s): Proposing partnership projects on corporate sustainability and engaging companies in Global Compact-related issues; specifically, those related to compacting global warming and achieving a positive social impact.

Sincerely yours,



Mohamed Abdel Sama

Impact Report

Shagara at School Green Roof Classroom

Al Shaymaa School for Girls

Inaugurated December 2021

Report Date: June 2022

Contents

01 Green Roof Classrooms Background

Shagara at School project was initiated 2013. The aim was to install rooftop farms and indigenous trees in schools. Based on the behavior of the school users the project has evolved to install Green Roof Classrooms as an attempt to offer a green approach towards the issue of overcrowded classrooms. The first Green Roof Classroom was installed in 2019.

The main differentiator of this project is that it offers an approach that tackles a local social issue, namely poor educational experience while also tackling the global environmental challenges represented in climate change.

02

Al Shaymaa School Project Phases and Design Choices

Project Phases

School Choice

- Structurally Sound Building
  - Arranged with the Building's Authority and field visits reports
- Proactive School Administration
  - Determined based on school visits and feedback from the ministry

Design

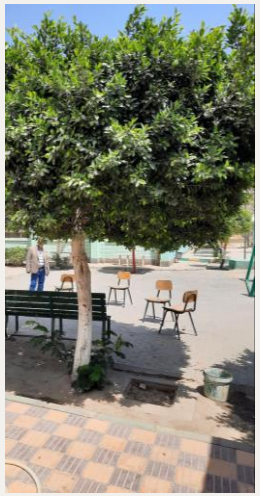
- Human centered design
  - Involves the school in the process
  - Assess the needs of the school
- Maximizes social and environmental Impact
- Essential to create a sense of ownership for long-term maintenance of the project
- Approved and revised by the educational building's authority

Implementation

- Renovation of the rooftop and construction of the design elements
- Involves the students and teachers through art and agricultural workshops

School Choice

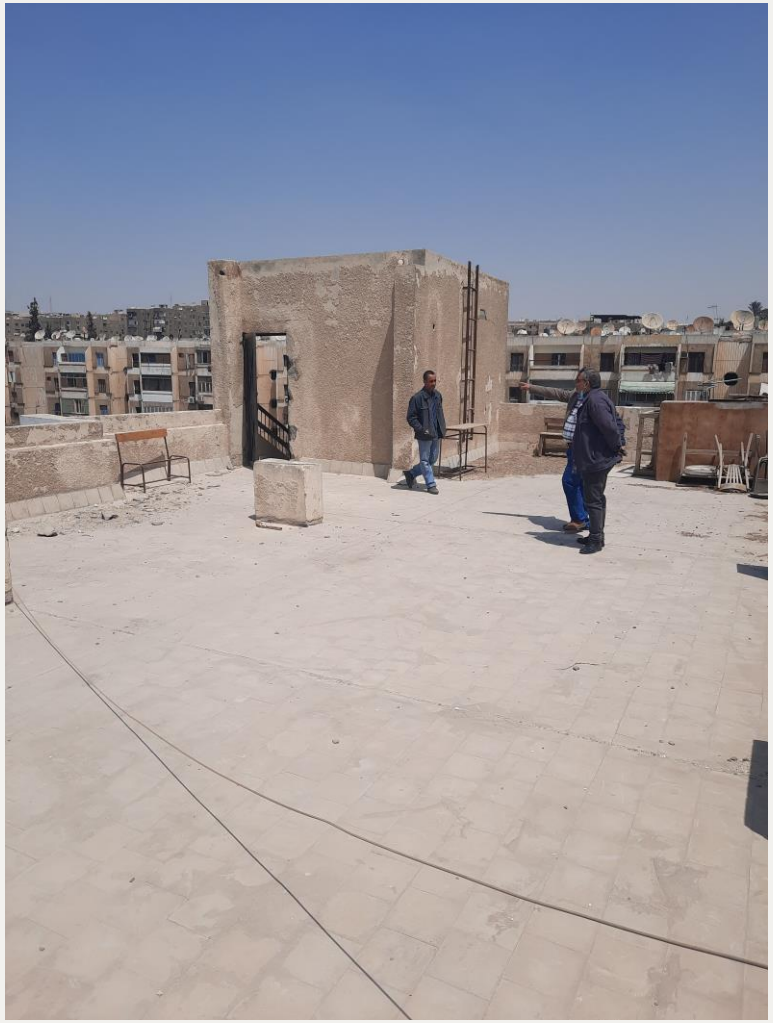
Two main criteria determines the choice of the school. Architecturally and structurally sound building and a proactive school administration. The first criteria is determined through examining the architectural and structural drawings databases of the Educational Building Department. After finding candidate schools a structural committee is formed with Shagara to assess the buildings based on field visit. The visit also includes area managers from the education department. The other important criteria, a proactive school administration, is concluded based on Shagara's purposefully designed interview with the school's administration, assessing of the school's amenities and staff relevant to others in the areas, in addition to feedback from the education area management. Finally, it is preferable that the schools also have an active agricultural and art class teachers to leverage the extra-curricular activities potential enables by the Green Roof Classroom.



The Targeted Rooftop

Al Shaymaa School for girls has 3 accessible rooftops, and a playground. The playground is often used during the PE class in football matches between girls and other physical activities.

The rooftop chosen for intervention has an approximate area of 120 sqm. It was chosen as a result of its of its accessibility and the low budget it required relative to the other rooftops. Its parapet was already 1.1 meters high meant that it saved on the steel structure parapet cost. This type of rooftop was the only one found in the area which motivated the its choice.



Green Roof Classroom Design

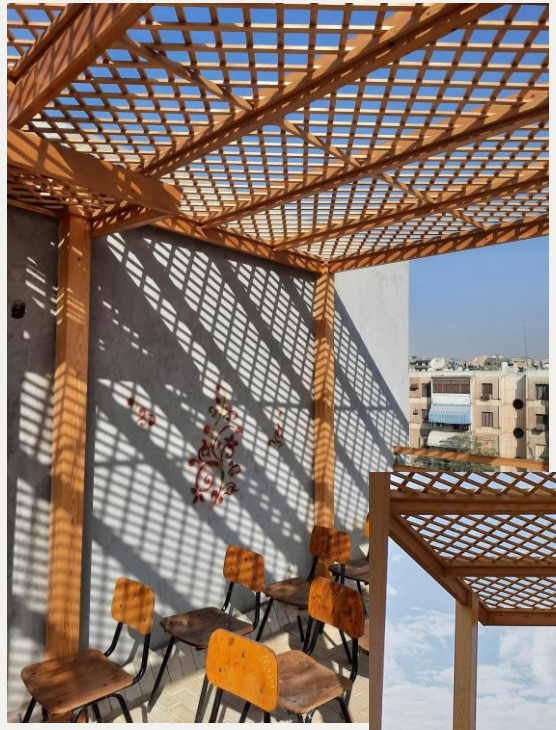
Shagara's philosophy towards design follows two main goals: Value maximization for the users and maximization of environmental value. The first goal is critical for the project's long-term maintenance. Simply if the Green Roof classroom intervention does not provide value for school, it will not exert the effort required for its maintenance, even though it is designed with minimal maintenance in mind.

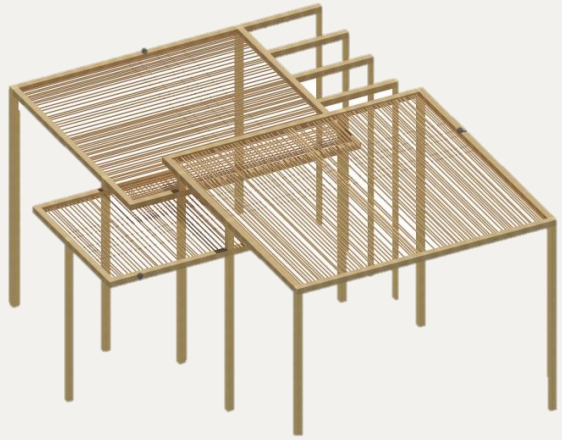
To achieve a design that maximizes the value for students and teachers a design centered approach is used. Where different techniques are used to assess the needs of the school. This approach also build the sense of ownership towards the project another critical aspect. The function that this rooftop is designed to provide is to act as an outdoor classroom for conventional subjects like mathematics, science, Arabic ...etc., while also enabling extracurricular activities.

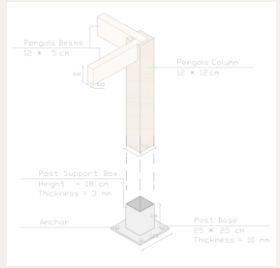
Design Choices: Pergola

The pergola is an important design element in the Green Roof Classroom. It allows the space to be used as an outdoor classroom. For this reasons it has to be designed to create thermal comfort for its users. In the wintertime, where school is mostly operational, it should allow some sun to access for warmth, specifically that the school time starts at 8am and ends at 12. It also should provide enough shading when the temperature starts to increase. To achieve this Shagara uses simulated solar analysis to adjust the angles of the pergola accordingly. Additionally, it uses plants and reed-based shutters to control the access of sun light. The plant initially used is Quisqualis. It sheds its leaves during the wintertime, thus allows for maximum sun rays and increases its vegetation when the climate is warmer. Feedback from the school, however, advised against the use of this plant. It is, therefore has been replaced by conventional jasmine.

The pergola structure is made from wood. Compared to steel is has a much lower carbon footprint, achieves better thermal comfort and adds more biophilic element to the space. However, it has less strength. For that reason, a specific design of the columns has been developed to increase the structural integrity of the pergola, reduce materials and the overall weight. The pergola is designed to accommodate 35-55 students. Finally, the pergola structure can be completely disassembled and reused at the end of the project's life cycle to avoid the creation of waste





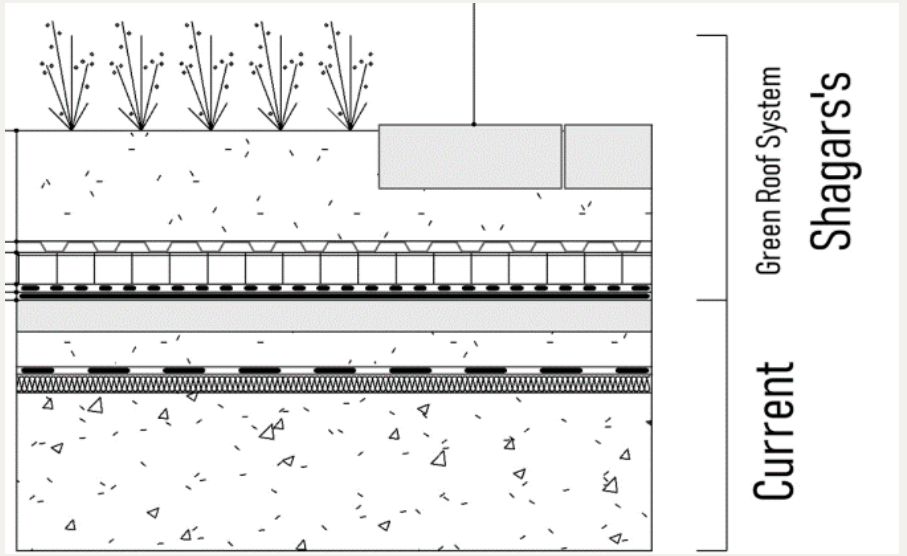


Design Choices: Shagara’s Green Roof

The green roof is not only present for environmental benefits. It is essential to complete the green roof classroom experience. Vegetation regulates the microclimate of the rooftop, improving the thermal comfort of space. It also adds extra biophilic elements that further enhances the experience for the classroom users. Moreover, it is used in the gardening and agriculture classes that are available as an optional class in the Egyptian public school system.

To maximize the environmental benefits Shagara’s proprietary green roof system is designed with circularity in mind. It employs recycled plastics in 3 of its 4 layers and its engineered soil utilizes composted agricultural waste. Further, it is designed to be disassembled and utilized else where at the end of its lifecycle to avoid adding more waste to the landfill. This allows the green roof to achieve minimum carbon footprint.

Further, Shagara chooses vegetation that has low water footprint and has the ability to boost pollinators. This contributes significantly to improving the urban biodiversity.



Design choices, steel parapet, flooring, paint

For the flooring Shagara opted for a concrete based interlocking tiles that can be installed without cement. Despite its relatively high carbon footprint, the material was chosen because of its long-term reliability. It can withstand outdoor conditions easily and the stress from friction resulting from the classroom traffic. It can also be reclaimed at the end of its life cycle and repurposed, unlike tiles that requires cement for installation. Shagara is exploring tiles made from recycled plastics and sand as a replacement for these high carbon cement tiles. However, Shagara fears from the risk of microplastics leach over the long-term. Currently this risk is being evaluated.

To improve the safety of the Green Roof Classroom in Al Shaymaa School, the parapet height is increased by 30cm. A mix of steal and wood was used to achieve a balance between the strength of steal besides low carbon footprint and aesthetics of wood. Two wooden bars were mounted on a steel column.

Finally, an outdoor paint with grey color was employed in the rooftop. The grey color was used so it can withstand the outdoor conditions longer.

Implementation

After the design working drawings is approved by the Education's Building Authority the implementation phase starts. Shagara involves the students and teachers in implementation tasks that don't require technical expertise like green roof planting.

A workshop with the agricultural class teacher took place where 137 girls participated to plant the 65 square meters, the total vegetation area, with 1555 seedlings and mix 2.2 cubic meters of compost with sand to prepare its engineered soil.

In addition, the agricultural workshop the art class was involved on some decorations in the rooftop as well.

03 Project Impact

3.1 Environmental Impact

Climate Change Mitigation and Adaptation

As mentioned earlier, one of the main objectives of the project is to maximize environmental value. One aspect of this is the project's contribution to climate change mitigation and adaptation. Climate change mitigation is concerned with reducing the causes of climate change, the later recognizes the inevitability of the climate change consequences and provide approaches that increases adaptation to those consequences. Shagara at School Green Roof Classrooms project attempts to mitigate and adapt to rising temperatures through carbon sequestration, reducing Heat Island Effect, employing materials with low carbon footprint and adopting a circular design philosophy.

Carbon Sequestration

The exact amount of carbon absorbed by vegetation varies according to the species, the plant growing medium, climate and even the air quality. Therefore, to determine the carbon sequestration rate of AL Shaymaa school vegetation area a dedicated 2-year study with specialized equipment's should be established. However, for the sake of this report, Shagara uses data generated by other studies to attempt to generate several scenarios that guesstimates carbon sequestration. Shagara assumes two scenarios for the carbon sequestration potential of the 65 square meters of vegetation of the green roof. This area does not include the vine plants on the pergola and only the succulent's species in the main vegetation area. The scenarios also assumes a project's life cycle of 20 years. The first scenario assumed by Shagara regarding carbon sequestration employs data from a study made on 12 green roofs in Michigan and Marylin across 2 years estimates annual carbon sequestration rate of 187.5 gm/year/m2. The green roofs in this study, employs sedums as a vegetation of choice and grow in colder climates compared to Cairo. However, it's a widely referenced study when it comes to measuring the green roofs potential to mitigate climate change. The other scenario uses data generated by a study done on Portulacaria afra (Spekboom), a fast-growing succulent that have some resemblance to the succulent species employed on Al Shaymaa school. It is also done in arid and semi-arid climates similar to Cairo. The study estimates a sequestration rate of 15.4 metric tons per hectare per year when considering the entirety of the plant which includes its biomass above and under the ground including its debris. However, it is estimated that it can store 2.9 to 8.6 tons of CO2 per hectare per year in its aboveground biomass. Shagara employs the most conservative estimate, 2.9 tons, to take in consideration the different green roof and species condition and to avoid potential false exaggeration.

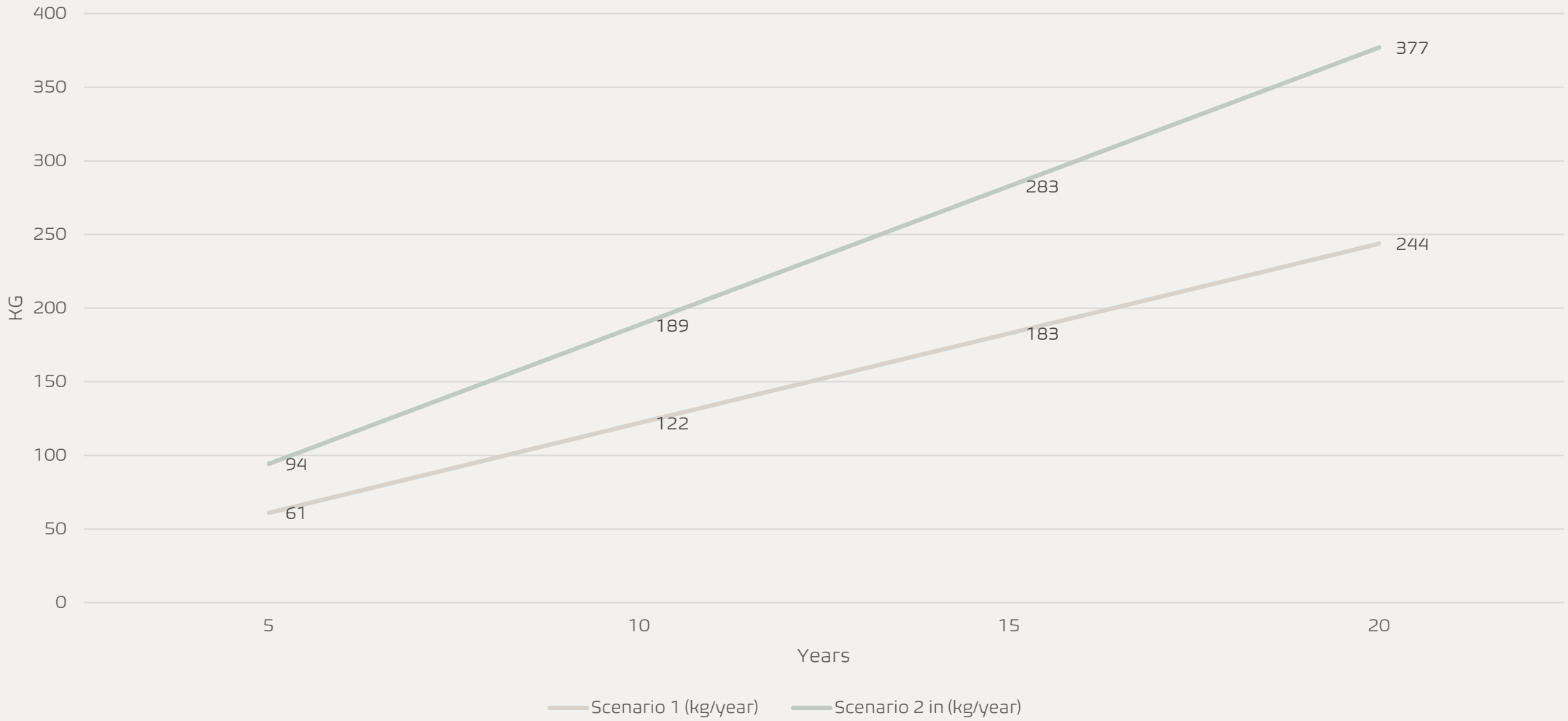
Main Vegetation Area 65m2

Life Cycle of the project: 20 years

Carbon Sequestration Scenarios

- 187,5 gm of CO2/Year/m2
- 290gm of CO2/Year/m2

Accumulated Carbon Sequestration Potential in KG



Heat Island Effect Reduction

Metropolitan areas are constructed with modern materials that absorb heat during the day and emit it after sun set. This is one of the of the causes that makes urban areas to be significantly warmer than its surrounding natural habitat. Green Roofs can significantly alleviate this phenomenon, specifically when implemented on a larger scale. Several studies has demonstrated that a green roof can reduce the temperature of a building by up to 50%. This can drastically save green house emissions resulting from air conditioning. This makes Shagara's Green Roof classroom an important asset specifically when considering climate change adaptation. In fact, green roofs are an important design consideration towards to adoption of "Sponge Cities" philosophies for climate change adaptation.

This microclimate improvements abilities of green roofs are not only limited to summers. However, its benefits extend to winters too where it can create a warmer environment on the rooftop.

These effects are instantly felt in Al Shaymaa School Green Roof Classroom.

Can Reduce temperature of the building by up to 50%

Regulates the Microclimate

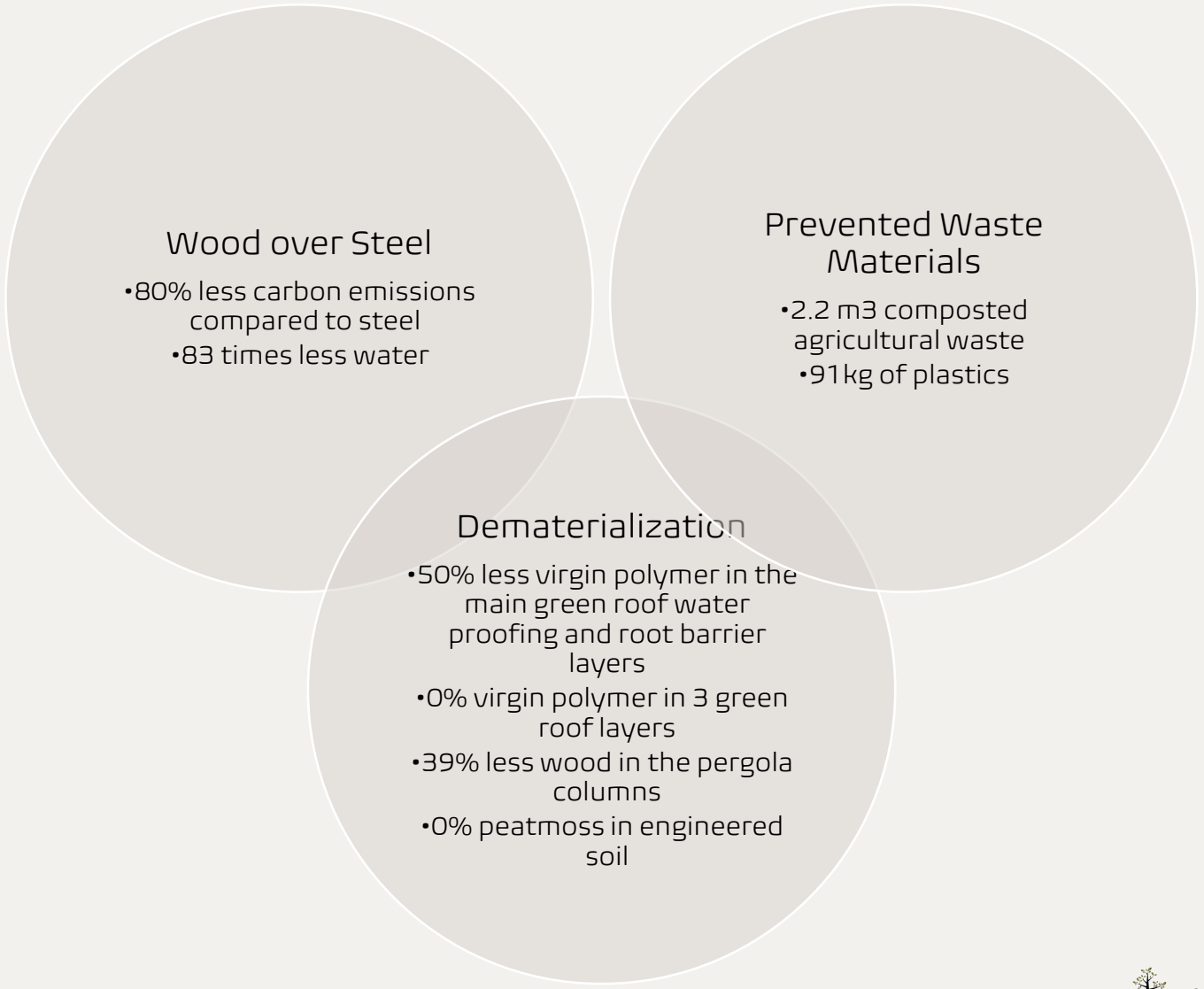
Save AC energy related emissions

Increase climate change adaptation

Green Materials and Circular Design

The material choice and circular nature of the project further enhances its positive environmental attributes. The choice of wooden structure over steel generally saves about an 80% of carbon emissions, even when taking into perspective the treatment of wood to enhance its resistance to rotting and the outdoor conditions. Additionally, wood usually consumes 83 times less water compared to steel. To push for more environmental gains, Shagara engineered the pergola columns to use 39% less wood while achieving more structural strength.

Additionally, Shagara's proprietary green roof system in Al Shaymaa school employed 2.2 cubic meters of composted agricultural waste significantly reducing its methane emissions and avoiding peatmoss. It has also prevented 91 KG of plastics from ending up in a landfill through employing 100% recycled polymers in 3 of its green roof layers

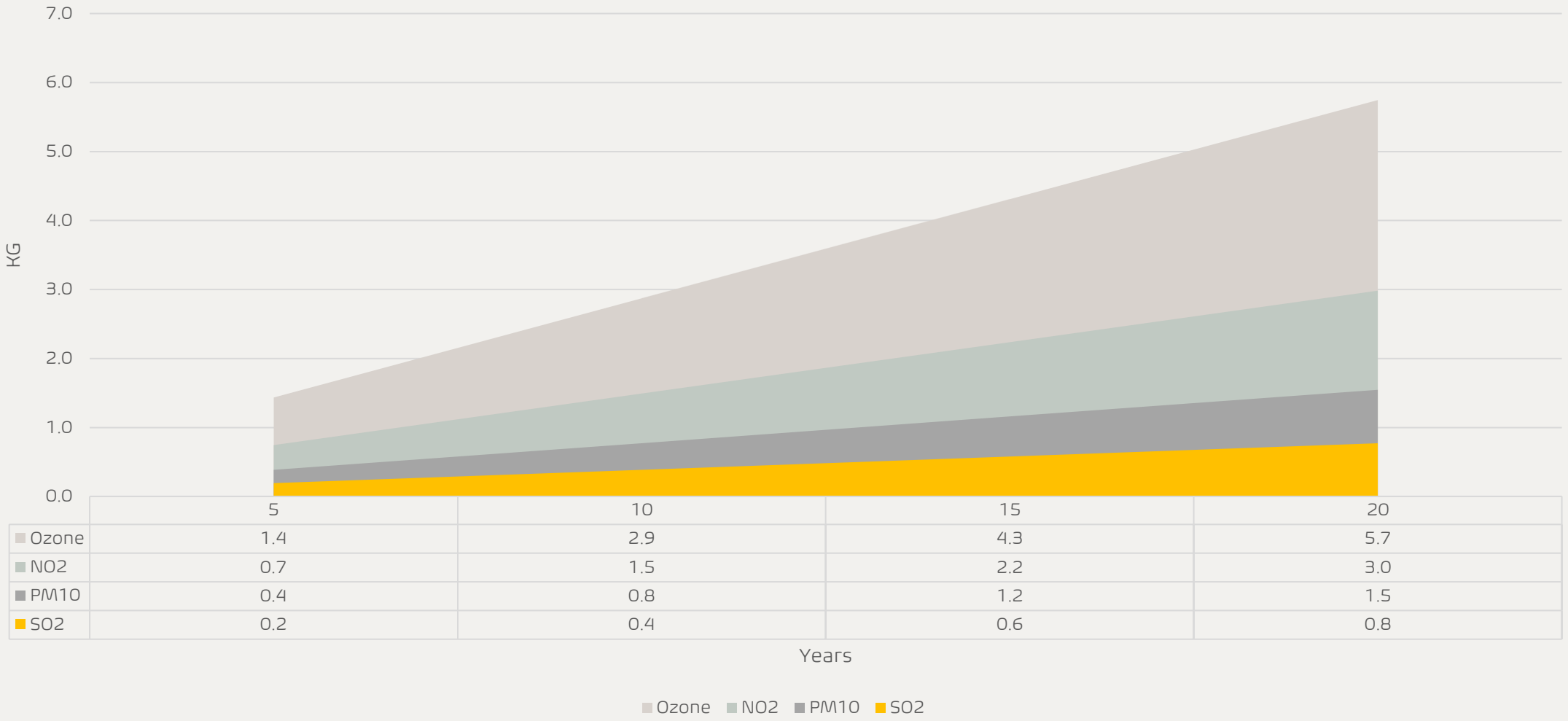


Air Pollution Reduction

According to the WHO 99% of the world population live in places where air pollution exceeds the organization's guideline levels. Moreover, 4.51 million annual death are attributed to the exposure to outdoor air pollution. Green roofs can play a role in reducing pollution in urban areas. Similar to the methodology used for Al Shaymaa School green roof carbon sequestration, data from previous studies done on green roof potential in clearing pollution will be employed, since data from dedicated study is absent. If similar rates of pollution removal according to this widely cited research are applied to Al-Shaymaa School Green Roof Classroom vegetation area the potential of annual pollution clearance is 550gm. This includes 290gm of Ozone, 150gm of NO2, 80gm of PM10 (Particulate Matter less than 10 micrometers in size) and 40gm of SO2.

Estimated total annual pollution removal potential by green roof vegetation (65m2) in kg	0.55
Ozone	0.29
NO2	0.15
PM10	0.08
SO2	0.04

Accumulated Pollution Removal Potential in KG

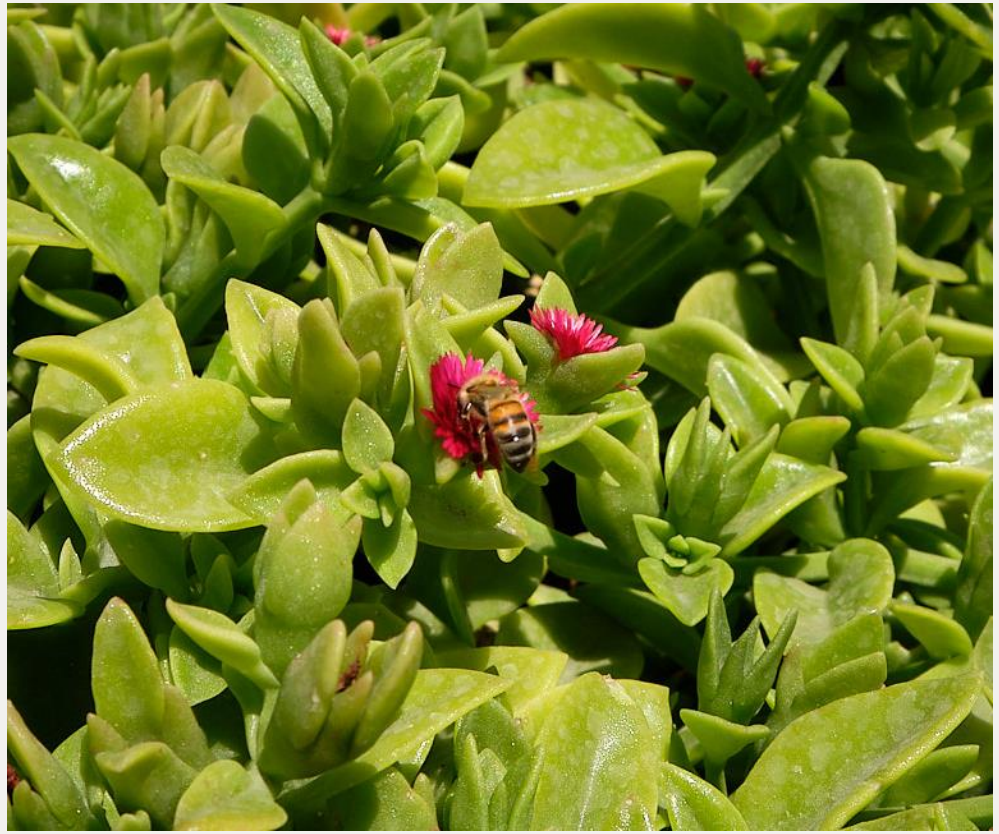


	5	10	15	20
Ozone	1.4	2.9	4.3	5.7
NO2	0.7	1.5	2.2	3.0
PM10	0.4	0.8	1.2	1.5
SO2	0.2	0.4	0.6	0.8

Environmentally Conscious Vegetation

The Green Roof Classroom employs 1555 seedlings. The 65m2 vegetation area are totally comprised of succulents. They have a little water footprint and were deliberately chosen so that flowers are available all year round to support pollinators.

Item	Number	Flowering Season
Aptenia cordifolia	650	Summer/Spring/Autumn
Lampranthus spectabilis	300	Summer/Spring/Autumn
Euphorbia Milii	300	All year
Combretum indicum	5	Summer
Carpobrotus edulis	300	2 Month in the summer



3.2 Social Impact

Impact on School Users

Direct Jobs Created by the project

Main Beneficiaries

The direct beneficiaries of the project includes the school's teachers, students and labors. They benefit from improved school water proofing and general upgraded infrastructure, better psychological and physical health, improved learning experience, attention and the ability to participate in extracurricular activities. The table on the right shows the current direct users of the project. As mentioned earlier the green roof classrooms enables two types of use: a regular outdoor classroom and gardening activities use. The school may also utilize it for other kind of activities as their needs require. For example, other Green Roof Classrooms are also being utilized for sports activities and other are used for art-based activities like theatre shows.

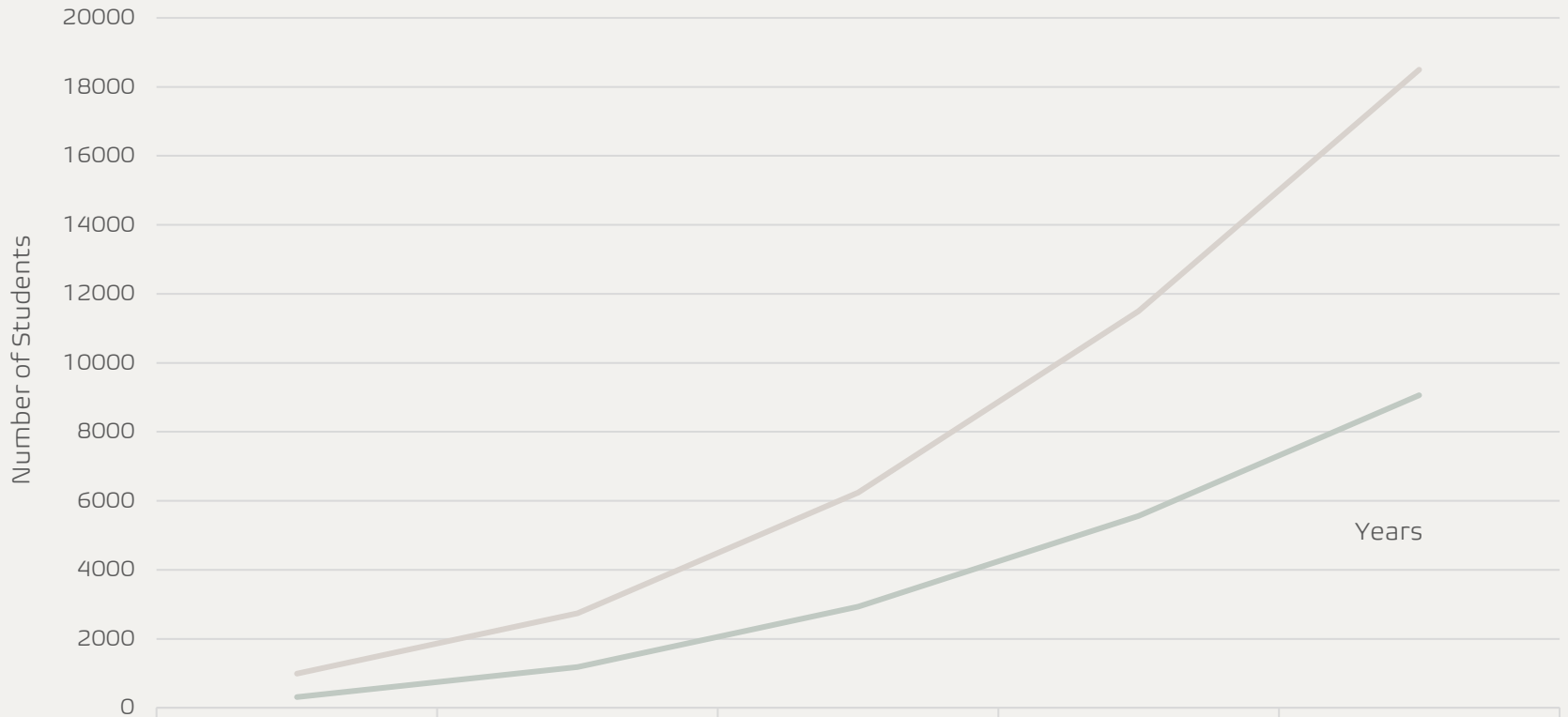
According to interviews held with the school's administration it takes around 17-20 days for the same class to use the Green Roof Classroom space. As for the 312 agricultural activity students its once a week per class. The space is utilized the most by the agriculture class teacher, Arabic teacher and the Philosophy teacher. Al-Shaymaa school administration is developing a schedule for next year to manage space utilization by the different teachers.

Current number of students	994
Approximate New Students joining the school each year	350
Student in registered for the agricultural activity	312
Number of teachers	54
Total Number of school labors	4
School guard and his family	5

Estimated Accumulated Students Beneficiaries over the Project Lifetime

Assumptions:

- 350 total new students/year
- 175 new agriculture activity registered class/year
- Project lifetime of 20 years



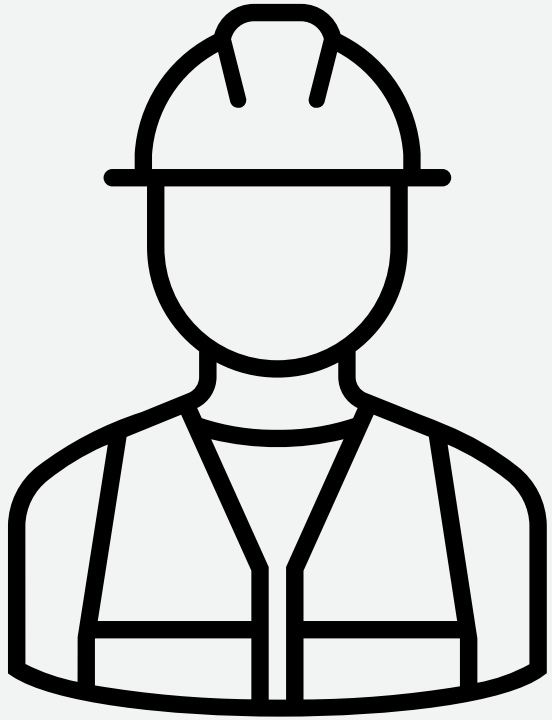
	1	5	10	15	20
Accumulated total number of students	994	2744	6244	11494	18494
Accumulated number of students registered for agriculture class	312	1187	2937	5562	9062

School Guard and His Family

In addition to the teacher and student, the school guard and his family who have their accommodation inside the school are among the direct beneficiaries. Specifically in the summer they use the space as a private garden.

Direct Jobs Created

Al Shaymaa School has involved 19 direct suppliers and contractors during the project implementation



19

Direct Suppliers and Contractors

3.3 Economic Impact

Publicity Value

Inauguration event was covered by 34+1 media outlets and provided an Ad Value of EGP 719,930 and a PR Value of EGP 3,002,619 according to AstraZeneca's report

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Teacher testimonial

Art class teacher during the art workshop she held at the time of project implementation