A Primary Master Plan of Gardens' City- A New City in Egyptian Western Desert (EGCWD)

Somaya T. Abouelfadl, Khaled A. Ouda, Assmaa A. Atia, and Nada Al-Amir

***Abstract*—This paper discusses the primary master plan of the gardens' city, which is planned to depend on renewable energy. Gardens' city lies in the Egyptian's western desert in newly discovered to be developed areas, namely in the new Farafra oases. The general master plan of the city is designed for 117,000 inhabitants, with a final target of settling of 1 Million inhabitants in the oasis. The city has agricultural and industrial based economy, depend on renewable energy (solar and wind energy), and has the first Egyptian college of renewable energy.**

***Index Terms*—New Farafra oases, gardens' city, renewable energy, solar- wind energy, palm, olive, wheat.**

I. Introduction

Renewable energy is going to be more and more important every day. This paper discusses the primary master plan of a new city "the gardens' city", which is planned to depend on renewable energy. Gardens' city lies in the Egyptian's western desert. Solar and wind energy are available with enough amounts in the site to generate clean energy. National strategic crops like wheat, olive, palm etc, are economical base for it, which allows in turn establishing agricultural industry beside other resources.

II. New Areas to Be Developed in Egypt

In 28 June 2011 a combined Egyptian team work of geologists, stratigraphers, geophysicists and hydrogeologists selected from both the Geology Department of Assiut University, Assiut, and the Institute of Desert Researches, Cairo, which was led by Prof. Khaled Ouda, started an expedition in the previously unexplored regions of the Great Egyptian Sand Sea in the Western part of the Western Desert. The expedition found that, the Great Sand Sea is not consisting of Pleistocene-Recent sand dunes as previously described and mapped in the geologic map of Egypt. It is essentially made up of a series of parallel longitudinal sandstone ridges extending North Northwest- South Southeast and belonging to the well known Nubian Sandstone rock unit. A beg area of about 3.5 million Feddan is able to be developed [1], [2].

The site of our project "The Gardens City" lies in the new Farafrah oasis, which is one of the newly discovered oases. It lies on northern latitude 27 and eastern longitude 27, near the existing El Farafra oasis, which belongs to the new valley governorate. The road Cairo El Farafra passes near the oasis which lies on a distance of 570 km from Cairo. The nearest airport to it lies in Dakhla city [2]-[4]. Fig. 1 shows the new Farafra Oasis location in Egypt. Fig. 2 shows its' location in relation to the new discovered areas.

The New Farafra Depression- extends northeast along the boundary between the Esna Shale in the south and the Farafra Limestone in the north, between altitudes 27° 03' N and 26° 58'E to altitudes 27° 22'30 N and 27° 24' E., with a maximum NE length of 52 km and a maximum width of 20 km, attaining a total area of 932 km^2. It is bounded by a northern and western escarpments rising abruptly to 200- 230 m above sea level while to the east and south its floor rises gradually to 250-350 m above sea level. The floor of the depression is situated at a ground elevation varying from 60 m to 115 m and averaging 94 m above sea level, thus being similar to the average ground elevation of the classic Farafra and Dakhla depressions [5], [6].

Fig. 1. The site of new Farafra oasis in Egypt

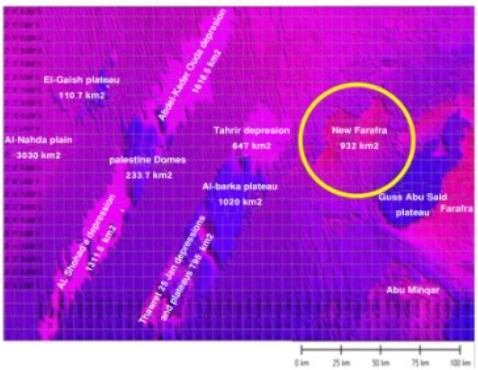

Fig. 2. The new discovered areas and the site of new Farafra oasis [6].

III. Why This Site?

We have chosen this site for different reasons as follows:

Manuscript received November 25, 2012; revised January 12, 2013.

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- It lies in the Egyptian western desert which represents a big ratio of Egyptian land that has not been good used yet.
- Oasis has almost flat land surface, which assures easy urbanization and development.
- It is away from sea flooding on Egypt due to global warming [7] which makes it a safe site for the coming climate migration from Nile Delta and coastal areas in Egypt.
- It lies in Upper Egypt, our lovely home, besides; it is our duty to think for it specifically and for Egypt overall.
- Water resource is available there. There are natural springheads in the oasis like Dalah springhead. The Nubian sand stone forms a great part of land there, which in turn forms a big storage of water (Fig. 3 and 4). Water comes without lifting over the surface and washes it sometimes.
- The oasis area is 932 km2 (222 thousand Feddan) which assures huge areas of agriculture land.
- Solar and wind energy are available with great amounts in the site, which is enough to generate clean energy.
- Shale/clay soil is available there which allows agriculture development over great areas with national strategic crops like wheat, olive, palm etc, as an economical base for the new urban areas. This allows in turn establishing agricultural industry.
- Shale/clay soil and lime stone is available there, which affords constructional material locally in the oasis.
- The white desert, in the western desert, lies near this oasis, which allows geological tourism.
- White sand found itself near the oasis, which allows initiation of glass and solar cells industries.

Fig. 3. The Nubian sand stone in Egypt western desert [5]

IV. Sustainability Aspects: Site, Water, Energy, Materials, Infrastructure

There are a lot of factors, which ashore sustainability. Oasis land surface is mostly flat, which allows easy building and developing. "White desert" forms a beautiful touristic site near the oasis. Water is available near ground surface. The Nubian sandstone covers the area near the surface [8]. Lime stone in the oasis with Shale/clay soil – local building materials. Solar energy is very intensive in the site of the city (6.7-6.8 kwh/m^2/day) [10]. Wind velocity is high (6-7 m/s) [11], which is equal to wind speed in Hurghada city in Egypt, where a wind power plant is found (Fig. 5 and 6).

As new areas have been added to be developed from the great sand sea as shown in Fig. 7, a road has been suggested to connect these new discovered areas with Cairo – the new valley existing road and to Bahria Siwa oases existing road as shown in Fig. 8.

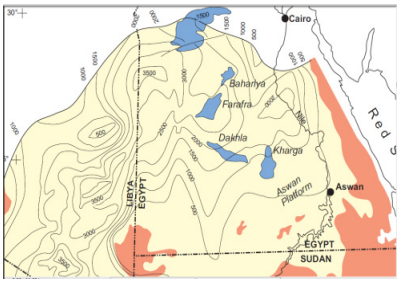


Fig. 4. The thickness of Nubian sand stone in Egypt and eastern Libya. The biggest thickness lies under the great sand sea in Egypt [2]

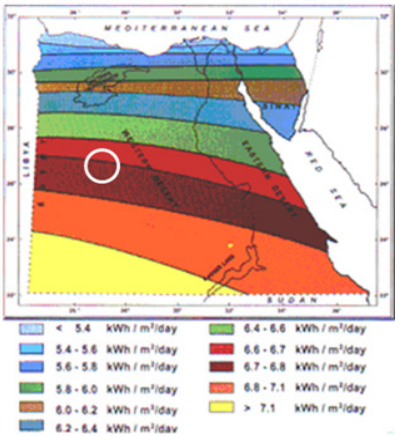


Fig. 5. Solar radiation in the new Farafrah oasis [9].

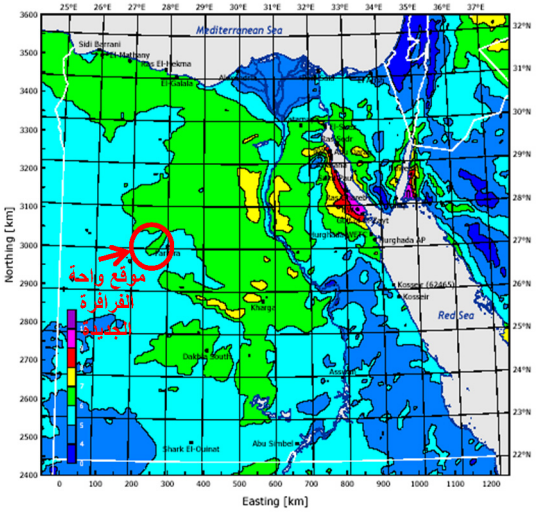


Fig. 6. Wind velocity in the new Farafrah oasis [10]

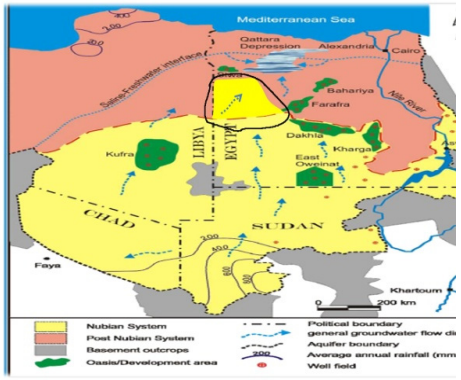


Fig. 7. New area added from great sand sea as area to be developed [6].

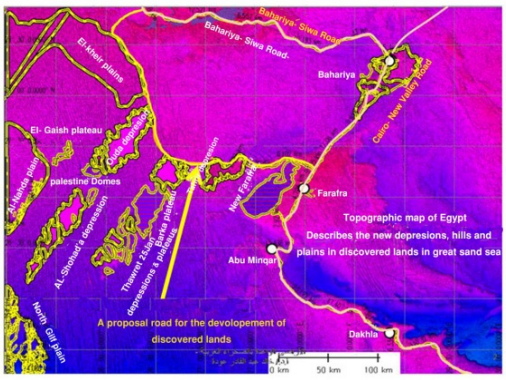


Fig. 8. A road to join the new discovered areas [2].

Water is near ground surface. The cross section in Fig. 9 explains the new Farafra depression. In Fig. 10 are two suggested roads leading to the oasis to connect it to Cairo-new valley existing road. The distance between the new Farafra oasis and the Nile valley to Cairo or to Assuit is about 500 km, therefore there are other three suggested roads to connect the new discovered areas to the Nile valley region near Assuit governorate, which are less than 200 km long.

There are natural building materials like limestone Shale/clay soil – local building materials, see Fig. 11 and Fig. 12. The working team takes in consideration to make use of these natural materials, Fig. 13 shows some members of the project working team during discussion.

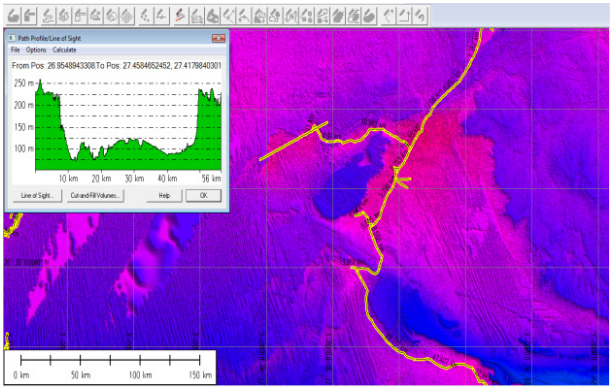


Fig. 9. Farfra depression section [2].

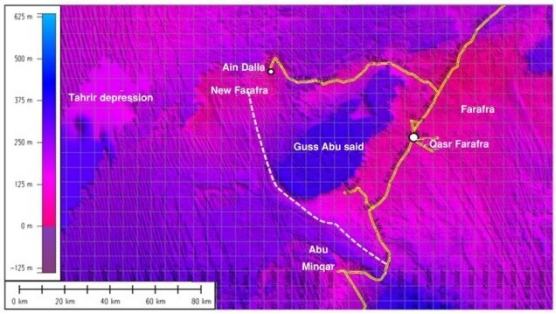


Fig. 10. Two suggested roads to new Farfra oasis, [2].

Fig. 11. Soil surface of Farafra oasis.

Fig. 12. Lime stone in the oasis with Shale/clay soil – local building materials

There are also some natural springs in the oasis; Fig. 14 shows one of them. White sand lies near the oasis, which is quite suitable to manufacture glass and solar cells, while the picture in Fig. 15 shows the white desert, which is a marvelous geographical touristic site.

Fig. 13. A picture of some of the project working team.

Fig. 14. Dala natural spring in new Farfra oasis.

Fig. 15. Photos for the white desert near the new Farafrah oasis [4], [11]

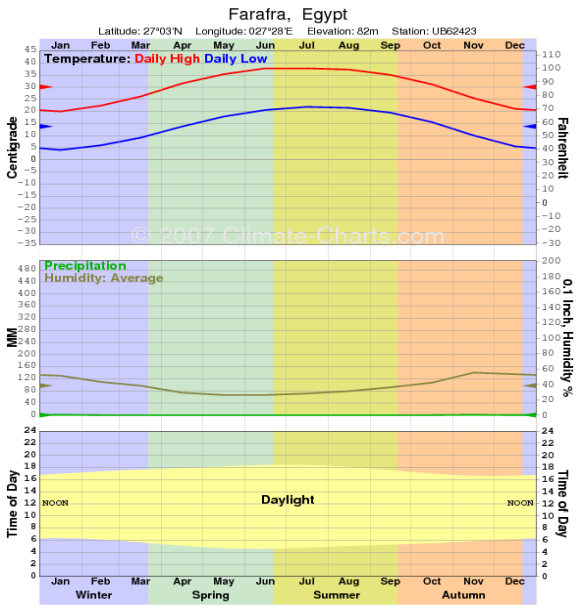
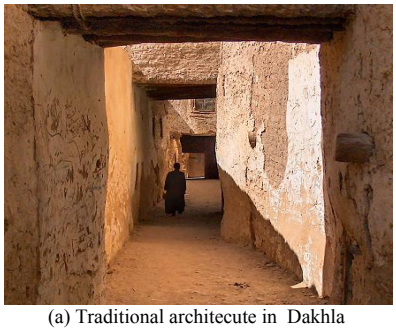


Fig. 16. Climate of existing Farafra oasis [11]

Climatic data for the new Farafra oasis is not yet available. Climatic data for it will be temporarily considered as for the existing Farafra oasis nearby. Average max-temperature reaches 38 in Jun, while the average min reaches 4 in January.



(a) Traditional architecute in Dakhla

(b) Traditional architecute in Siwa oasis

Fig. 17. Traditional architecute near new Farafra oasis [12], [13].

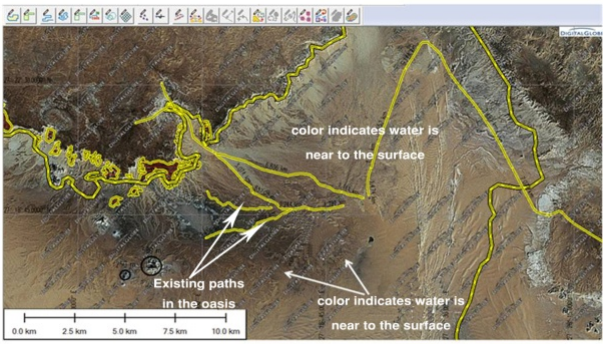


Fig. 18. Rough roads in the chosen place for gardens' city [6]

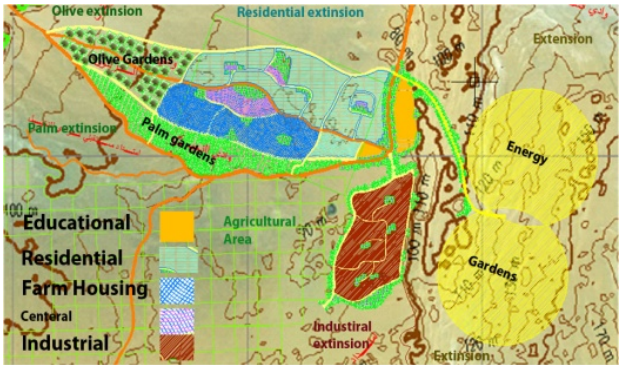


Fig. 19. General layout of the city.

V. Gardens' City Master Plan

The site of Gardens' city has been chosen to be put in eastern northern part of the new Farafra oasis. There are some rough roads in the chosen site. The plan makes use of these rough roads as shown in Fig. 18, one of these roads has been chosen to be a major axe of the city, another one works as a high way.

Deseret area around new Farafra oasis is famous for its good palm and olive [14]. Palm and Olive are being used as main economical base for the oasis. A big Palm garden has been planned southern from the city with an area enough for 65 thousands Palm trees, another garden for Olive to the west of the city with an area enough for 56 thousands Olive trees. Agricultural area of about 15 thousand Feddans is to the southern direction to the city, they will be planted with wheat rotated with other crops. The city site has elevations mostly between 70- 90 m above sea level. Housing areas lay mostly between 70-80 m above sea level. Industrial areas lay to the southern east of the city. Energy production area lies on 100 m above sea level eastern to the city with an extendable area to 9000 Feddans. This area supposed to produce solar and wind energy to supply not only gardens city but also for the all new discovered areas. Fig. 19 explain different zones in gardens' city, its primary master plan and future extension areas for different zone, while Fig. 20 Shows a detailed layout for gardens' city different zones.

TABLE I: Statistics of Different Sector of Gardens City

Land use	Area/ person m2	Area Feddan	Number	% of city area
Residential	43.3	1140		37.5
Residential + farm	800 avg.		1700	
Residential+ walk/ fold/barn	240	570	1300	18.8
Industrial		800		26.3
Educational	6	172	23 school	5.7
Services		356		11.7
Total- City		3038		100
Palm Gardens	64	770	65000 Palm tree	
Olive Gardens	50	660	56000 Olive tree	
Energy Gardens		Up to 9000		

A part of the city strategy is to give pieces of land with low price for youth people to be planted with daily consumed crops like tomatoes, cucumber, potatoes etc.. This will be done specially in the beginning of the project to attract inhabitants to the city and to let them produce their need of vegetables and fruits with flexible managerial system to let both owners and city make their benefits from these products. That will give owners a chance to feel owners of the city, which enhances their creativity and drives their efforts forward. Different crops will be planted and industry will be initiated on crops and others. There will be a lot of work opportunities for different people (educated, craftsmen, expertise, workers, etc.). People will share societies and help in serving their society. All of this will allow a stabilized, well balanced society, and will also assure dignity and social justice. Housing design will depend on passive design to afford suitable indoor climate following Egyptian legislation- there are not working environmental legislation in Egypt [14]. These will be activated. Fig. 24 shows a primary figure for houses which integrates solar in house design. Table I drives some statistics for the city.

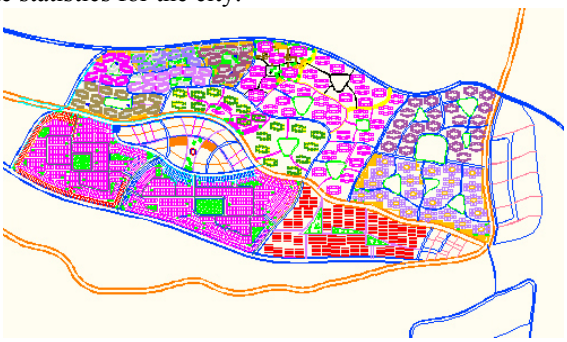


Fig. 20. Layout of the Gardens' City.

The new valley governorate has celebrated an opening ceremony for developing the new Farafra Oasis in 29th Aug. 2012. Fig. 22 defines places defined for experimental water wells to be digged into the new Farafra Oasis. The working team extended itself to integrate experts from different fields (Agriculture, solar and wind energy, soil and materials, etc).

Fig. 21. A Primary design of houses with solar cells to afford energy

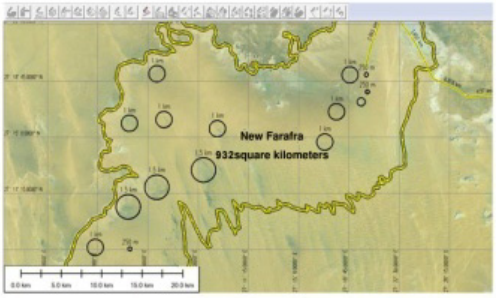


Fig. 22. Places defined for experimental water wells to be digged into the new Farafra Oasis [2]

VI. Conclusion

In Egypt, there are newly explored areas (3.5 million Feddans) - to be developed - have been discovered by a scientific expedition. This paper explains the primary master plan of the gardens' city, which lies in one oasis in the discovered areas. The general master plan of the city is designed for 117,000 inhabitants, with a final target of settling of 1 Million inhabitants in the oasis. Economic agricultural base of the city and oasis are palm, Olive and wheat. A garden with 65 thousands of palm trees, and another garden with 56 thousands Olive trees will be planted. Industrial economy based on this agricultural economic base beside other local resources. The first Egyptian college of renewable energy will be located there. A field of renewable energy is planned to afford energy requirements for gardens' city and all new discovered areas in the region.

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