

Gabel El-Zeit wind farm

The wind farm "Gabal El-Zeit" shown in **Figure 1** which was assembled by the Spanish company "Gamesa" before being merged with the German company "Siemens", its construction started in 30th September 2015 and ended in November 2018, costing about 12 billion pounds, is located in Kilo 118 in Gabal El Zeit area south of Ras Gharib city, covering 100 square kilometers, where it is one of the world's largest electricity-generating plants in terms of area, capacities generated and the number of turbines, as the plant's total capacity is 580 MW and about 3 TWh in three years' production, and the number of wind turbines it contains reaches 300 (one of them is shown in **Figure 2**), it is expected to produce more than 47.048 TWh in its life time.



Figure 1: A picture of Gabel El-Zeit wind farm

The station includes 3 projects, the first of which included 120 turbines with the capacity of 240 MW, the second project included 110 turbines with a capacity of 220 MW, and the third project included 60 turbines with the capacity of 120 MW, it also contains three administrative buildings, including a building for the monitor and control room for all turbines at the same time.



Figure 2: A close-up picture of a wind turbine in Gabel El-Zeit wind farm

Mechanism

- shut down on demand mechanism

The station contains a system of monitoring migratory birds, through the radar to stop the turbines when the birds fly then reoperate them, a system used for the first time in the world, the result was a mortality rate of 0.003% of all birds that had crossed Gabel El-Zeit wind farm of spring season 2016; in the meanwhile, the production loss was 0.15% during the same monitoring period.

- Harnessing the location

The station has the most optimum conditions for wind farms such as wind speed, as it reaches 15.5 m/s as shown in **Figure 3**, wind stability and ground terrain which prompts to 51.7% annual average capacity factor, that achievement is viewed as a world record because the majority of wind farms worldwide can accomplish just from 30% to 40% annual average capacity.

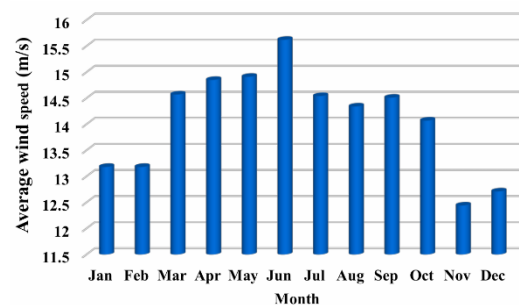


Figure 3: The average monthly wind speed data at 60 m height

Points of strength

- Reduction in Greenhouse Gas Emissions

Reducing the fossil fuel consumption as it is expected to save more than 1.3 million Ton, Reducing the amount of Greenhouse gases emission especially CO₂, where Egypt accounted for about 218 Mt of CO₂ or 0.6% Share of global emissions, as it is expected to save more than 25.8 million Ton equivalent of CO₂, minimizing any negative impact of project implementation on the surrounding environment and protecting the ecosystem.

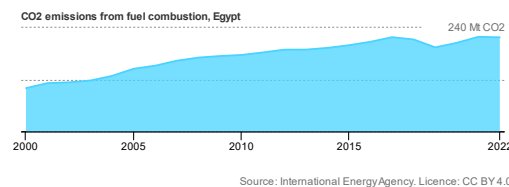


Figure 4: CO₂ emissions from fuel combustion, Egypt

- Sustainability

One of the main goals of establishing Gabel El-Zeit wind farm is to increase the amount of clean energy utilized in the Egyptian national electricity grid, **Figure 5** is representing the energy portfolio from 2000 to 2023, where the total amount of wind and solar energy represented 2.1% of the total national grid, but The Egyptian Energy strategy aims to increase clean energy representation to 42% by the year 2035.

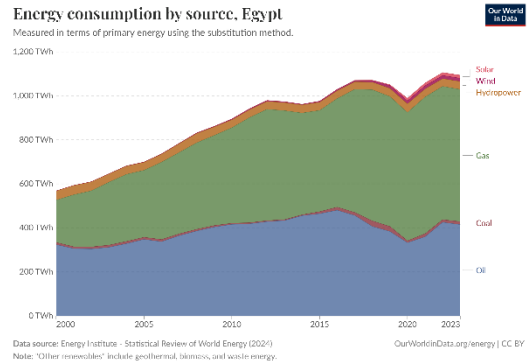


Figure 5: Energy consumption by source, Egypt

- High capacity factor

The Gabel El-Zeit wind farm added 580 MW of installed capacity to the Egyptian national grid in November 2018 and boosted the renewable energy installed capacity to about 1125 MW, and it has produced 3.132 million Megawatt hour, and it is expected to produce 47.48 million Megawatt hour in its lifetime, where Gabel El-Zeit wind farm hourly production is equivalent to 916 thousand average homes electricity consumption, and also equivalent to lighting 145 thousand kilometers on highway roads, which is bigger than the total national roads length.

Points of weakness

- Bird Migration

Egypt includes a great part of the Great Rift Valley/Red Sea flyway, the world's second most important flyway for migratory soaring birds, as it is a major passage between Eurasia and Africa, where a total of 143,906 soaring birds belonging to 32 species

were counted, the most common bird species was the white stork (63.1%), the northern steppe buzzard/common buzzard (13.21%), the great white pelican (7.42%), the European honey buzzard (6%), the Levant sparrowhawk (2.38%), and the black kite, (2.17%), other than globally threatened and endangered migratory soaring bird species recorded surpassed 1% of the flyway population, these species include the Egyptian vulture (1.2%) and the steppe eagle (3.02%). Two other nearly threatened bird species are the pallid harrier (6 individuals), and the red-footed falcon (two individuals), which were also observed, these results spotlight on the importance of protecting this area as a bird migration flyway.

- High initial cost

The construction of Gabel El-zeit wind farm required a significant high initial investeent, as the total cost of the project was approximately 12 billion pounds or about \$514 million, where it consists of about 300 wind turbine with advanced technology, but costing a substantial amount of the total invested money, that is other than the costs of research and development (such as researches conducted to ensure optimal performance and minimal environmental impact), infrastructure development (such as connecting the wind turbines to the national electricity grid), environmental safety measures (such as the "shutdown on demand" approach, which is used to protect migratory birds), and maintenance and operation (such as maintainance of the turbines, and the operation of monitoring systems), all these factors adds up to the total cost of the project.

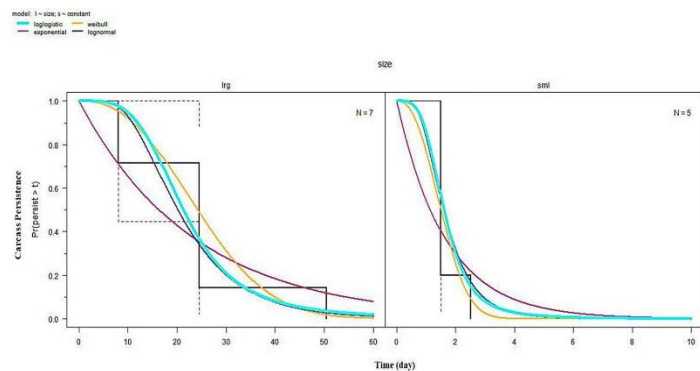


Figure 6: Carcass persistence for Migratory Soaring Birds (MSB) and non-MSB during time period of 60 days.

References

[Gabel El Zeit Wind farm complex \(Ensuring access to affordable, reliable and modern energy for all\) | Department of Economic and Social Affairs](#)

[Largest Power Plant in Gabal El Zeit](#)

[Greenpeace welcome Gebel el-Zeit wind farm as landmark energy plant - Greenpeace Middle East and North Africa - Greenpeace Middle East and North Africa](#)

[A STUDY OF SOME ENVIRONMENTAL IMPACTS OF AN OPERATIONAL WIND FARM ON MIGRATORY SOARING BIRDS AT GABEL AL-ZEIT//RED SEA, EGYPT | Ain Shams Scholar](#)

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