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Lusail Stadium: The New Generation of Stadiums

Anyone going to a sporting event can attest to the fact that sunscreen and wide-brimmed hats are necessary, especially during the hot summer months. However, in one of the hottest places on our planet those extra pieces of clothing will not be necessary during very important soccer matches. Huge sports venues, which can accommodate millions of people, are now an aspect of our society that can be instrumental in modeling environmentally friendly energy and promoting a green planet.

Introduction

Imagine a country that is only 11,463 square kilometers in size and has a population of 1.75 million [1]. Now, imagine that this same country is building a soccer stadium with 86,250 seats along with its very own city [2]. The country is Qatar and the stadium is Lusail Iconic Stadium located north of the capital city, Doha (see Fig. 1). By Summer 2022, when Qatar is set to hold the world's largest single-event competition, the FIFA World Cup of Soccer with an estimated 500,000 visitors [3], this main stadium and eleven other smaller stadiums will decorate the country. The interior and exterior of the Lusail are set to have some of the most innovative engineering ever imagined, making it not only beautiful and interesting enough to entertain spectators, but also exceeding anyone's expectations for environmental sustainability, spectator comfort, and engineering innovations.



Chris/Worldcupblog.com /world-
football/qatars-proposed-lusail-iconic-
stadium.html

Figure (1): Lusail Stadium model

Background

The FIFA World Cup of Soccer is held every four years and began in 1930 [3]. In the years between World Cup competitions, over two hundred international teams vie for

thirty-one spaces by playing a total of 853 matches [3]. The thirty-second spot is always reserved for the host country's national team. The 31 national teams who qualify as well as the host country's team play it out until, at the end of the one-month tournament, one final winner emerges [3].

In the last World Cup (2006) about 50,000 fans watched from within the stadium for the final match in 2010 in South Africa [3]. During that same World Cup tournament, more than 700 million people watched via television worldwide [3].

In order to be a host country for the World Cup tournament, countries must have their national FIFA committee make an official bid to the FIFA Executive Committee, which consists of 22 members [4]. The four countries in addition to Qatar that made it to the final step of the bidding process for the 2022 World Cup were the United States, Australia, Japan, and South Korea [4]. Each country's bid committee goes all out when making the final bid presentation. For example, Bill Clinton was one of the presenters for the U.S. bid, and in years past, bidders for other countries have included famous actors, singers, athletes, and models, as well as current presidents, vice-presidents, and foreign ministers [4].

The bidding takes place by silent ballot and repeats until one country has received a clear majority [4]. In the case of the 2022 World Cup, there were four rounds of voting, during which Qatar always maintained the lead. In the final round of voting between the top two bidders, the U. S. and Qatar, the latter won by a vote of 14-8 [5]. Although each of the five countries' bid committees had a central point outlining its argument, only Qatar's bid included innovative engineering and technology [4], and that is the reason it is believed to have clinched the votes.

History of Past Major Stadiums for the World Cup

In order to understand how important Qatar's bid proposal was, it is important to understand how past major stadiums were formed and what was found lacking and unfavorable as well as positive in them. In 1950, the emphasis was on sheer size, and a giant stadium represented national pride [6]. In 1954, the World Cup was held in Switzerland and it was the first televised one, so then appearance became important as well [6]. From 1954 to 1980, the push was for capacity. In the late 1980's, FIFA made a decision to require stadiums to be built in a way that would ensure spectator safety [6]. Up until then, there had been a concern about fires and vandalism by angry crowds. As a result, stadiums were required to be seating room only [6]. As stadiums were made larger and larger, they became commercial stadiums and had vendors selling food, beverages, and souvenirs. However, these new stadiums did not take into account environmental sustainability. In 2004, FIFA published a 250-page manual with new requirements for stadiums that were to be met in the bids for the World Cups in 2014, 2018, and 2022 [6]. There were eleven main conditions that needed to be fulfilled. For example, size and comfort, protection against the sun rays, security procedures, sufficient parking capacity, natural or synthetic grass, spacious and accessible dressing rooms, unobstructed view for spectators as well as weather protection, hospitality areas, give access to media and the

installment of alternative energy. In addition, for the FIFA World Cup Stadiums to be built in Brazil for the 2014 games, Russia for the 2018 games, and Qatar for the 2022 games, there was a requirement stating that stadiums would have to fulfill this sustainability push.

Other factors that were considered before selecting a country to host the tournament were location among the stadiums. In other words, there needed to be easy access to the stadiums from where the spectators were staying, and the landscape around the stadium needed to be appealing and inviting [6].

The Beauty of Qatar's Bid

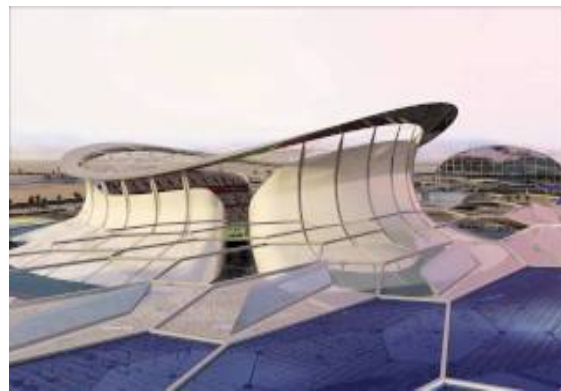
Of all the stadiums ever proposed, Qatar's proposed stadiums not only fulfilled all the requirements that FIFA had set, but it even surpassed them. Qatar's main soccer stadium to be built for the FIFA World Cup 2022 is called Lusail Stadium and it, along with the other eleven stadiums needed for the tournament, was designed with beauty, environmental sustainability, economic benefits, and access in mind.

The FIFA Manual specifies, "It is important to find ways to incorporate local traditions and culture within the stadium design and use" [8]. The stadium itself is oval shaped, and resembles a traditional dhow, which is basically an old traditional Qatari fishing boat (see Fig. 2 and 3 below). The entire area around the stadium will be a marina filled with boats to resemble Qatar's traditional boating history. In addition, there will be a waterfall around the stadium and six bridges, which will be the walkways into the stadium [8].



Peter C Barclay/ greydragon.org/ trips/Iraq/Qatar166.jpg

Figure (2): Traditional Qatari boat



Qatar22Bid/ <http://i2.ytimg.com/vi/mvESidOdQCs/mqdefault.jpg>

Figure (3): Lusail Stadium model

The roof of the stadium is designed in the shape of a sail, making it appear as if it is floating above the concrete seating oval [8]. There will be a ring of arching columns, which will be camouflaged to appear as part of the design, but it will more than adequately support the roof structure [8]. The roof, which can be completely retracted at its center [8], makes the Lusail the world's first fully retractable soccer stadium. The roof will be opened or closed depending on whether the stadium will want to achieve an

outdoor feel or not [9].

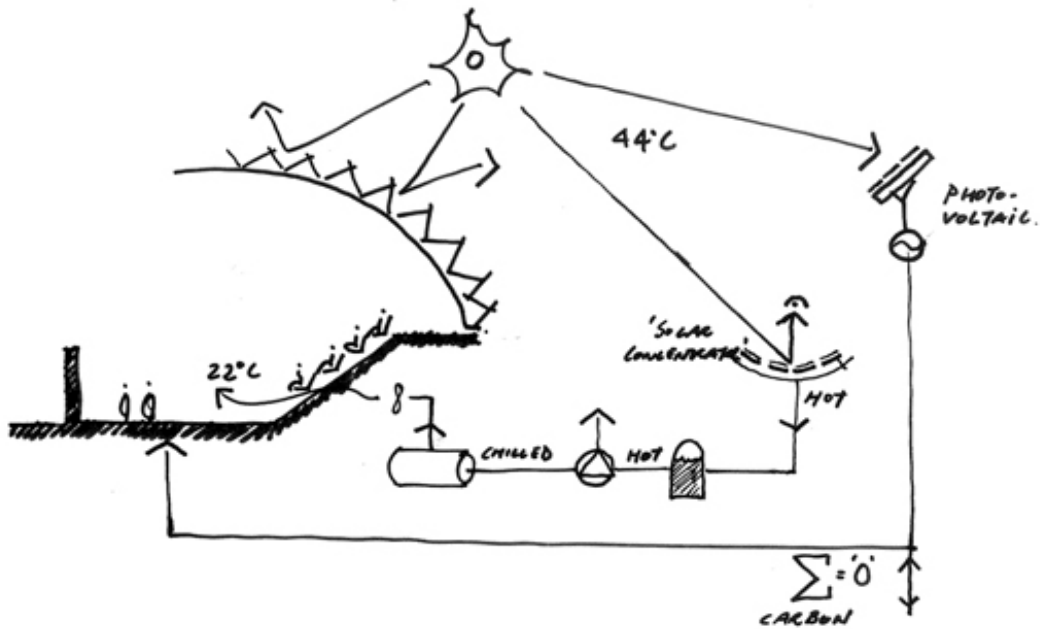
In addition, the Lusail is being built as part of Lusail City, which is being constructed as part of the stadium project. The city will include a hospital, spas, gardens, and accommodations for about 250,000 people [8]. There will be commercial districts and beautiful parks [10]. Finally, access to the city and the stadium will not only be very convenient, but it will also avoid being an eyesore since there will be an underground subway system and all parking for the stadium will be under the stadium structure itself [10]. Therefore, if one were to look at the stadium on the day of the opening ceremonies or the final game, there would not be a giant structure surrounded by cars. Rather, there would be a beautifully designed building with all cars and transport vehicles out of sight.

Beating the Heat in Qatar's Bid

One of the biggest concerns in Qatar, as in the entire Gulf region, is the extreme heat during the summer months, when the World Cup is held. Temperatures can easily get to 40 degrees Celsius or 104 degrees Fahrenheit [11] and above, making it impossible for a person to stay outside for more than a few minutes, let alone play intensive soccer for more than a few seconds. However, engineers have found a way to cool the entire stadium on renewable and sustainable energy.

The Lusail will use photovoltaic panels to gather energy from the sun [12]. Photovoltaics are a technology that involves drawing the sun to the glass and then using that energy it has harnessed and converting it directly into electricity [13]. In addition to the photovoltaic panels, reflectors will be used to generate electricity. These reflectors will direct the solar energy onto a water tube, where the water tube will be heated to around 200 degrees Celsius, providing the needed energy to generate electricity [14]. This electricity would then generate the cooling systems by providing air conditioning to the entire stadium [12]. When the stadium has no matches, the solar panels will transfer power onto a power grid, which will then be stored and used for neighboring buildings and areas in Lusail City [15]. Since the electricity generated is being done in a carbon-neutral way, there are no byproducts to pollute the air [16]. Prior to matches, the roof will be closed and the cooling system will work at maximum efficiency to get the climate ready for the match [16].

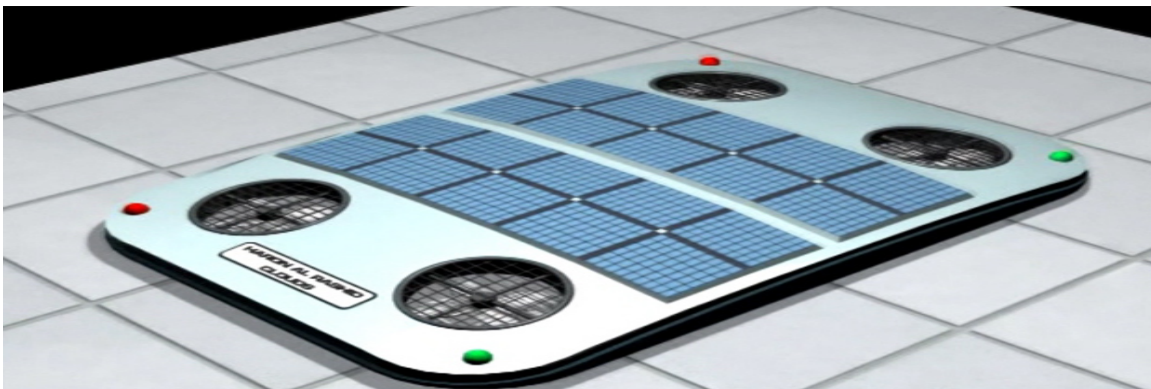
The result will be that during the evenings, the stadium roof can be opened and the cooling efficiency will provide the spectators with the outdoor feel of a cool summer evening while watching the game, not to mention the sheer effect of watching in an outdoor stadium. There will also be air-handling units under the spectator seats, which will cool the entire seating area and then the cool air will filter down to the players on the field [17]. The cooling mechanism is illustrated in Fig. 4.



ARUP Associates/ <http://www.arupassociates.com/media/cache/fa/ce/face83e36685acba278df453a2dad33b.jpg>

Figure (4): Cooling mechanism of the stadium seats.

In addition to the cooling system, engineers are planning to develop robot clouds. These robot clouds will have the size of a jumbo jet, will use solar panels to power their engines, and they will be made from carbon fiber. They would hover in the air like real clouds and would block the sun from beating down on the stadium, and the clouds will be using advanced monitoring technologies to track the sun and shield its rays. Furthermore, this technology can also be useful in security and broadcasting, and the possibility of installing camera transmitters could provide an unobstructed view for security personnel [18]. Fig. 5 below shows the initial design of the robot cloud.



News Elite/ http://newseliteimags.s3.amazonaws.com/110328_robocloud2.jpg

Figure (5): Robot clouds design

Conclusion:

All in all, Lusail Iconic Stadium truly fits its name—iconic. It is something that not only stretches the imagination in regard to engineering marvels, but it also maintains a responsibility to maintaining environmental considerations. More importantly, it has included traditional attributes of the country hosting the games, both by design and the momentum that the Qatari government has to maintain a green country. It is truly a marvel for engineers, sports enthusiasts, and future generations of environmentally conscious youth.

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