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2020 Tokyo Olympic Baseball Stadium Final Project

I. Abstract

The 2020 Olympics are in need of a venue that they can show off to the world as a LEED v4 BD+C Platinum building. To accomplish this there will be a refurbishing of the current baseball venue, Tokyo Dome. Built in 1988, it has been the home of many various types of baseball games and other events. We have decided to renovate this facility because according to the 2020 Olympic website, right now there is no set venue to host any of the baseball games. This old venue will receive many new changes to it where it will gain sustainable and green technologies and renewable energy. Micro wind-turbines, solar panels and the collection of rainwater are just some of the features that will all be added to Tokyo Dome.

II. Narrative

When deciding on what type of building we wanted to design as a LEED-Platinum facility for the 2020 Olympics in Tokyo, the decision itself was easy. As big sports guys, we decided to choose an existing athletic facility from Tokyo and give it a modern, green renovation, not to mention with the Olympics being an athletic competition we believed athletic facilities to be a primary focal point for a successful Olympics. Additionally, we chose to renovate rather than build an entire new building because in renovation, the existing building (given that you plan to use it under the same precedence as its original intentions) will already meet the given building regulation and specs of the area. As well, the space has already been cleared and modified to support said structure and whatever activities go along with it. By choosing to renovate, we skip a lot of site scoping tasks (i.e. looking for possible sites) as well as skipping most legal regulations as described above, saving us a lot of time and extra money we don’t need to spend. In this renovation we really wanted to focus on making the Tokyo Dome greener. Having been built in 1988 and not having too many modifications done to it since, the

Tokyo Dome made an excellent candidate for a green makeover. Things we considered in these ideas for renovation included, other green stadiums worldwide that set the precedence to be referred to as a green stadium, the overall shape and organization of Tokyo, the weather in Tokyo and the LEED requirements to make the Platinum level certification. This plan outlines the renovations we would make to the Dome.

III. Renovations

To cover our need to produce renewable resources we installed solar panels over the parking lot areas and along walkways outside the stadium to reduce our heat island production as well as to create energy to be used in the stadium by harnessing the natural heat and solar radiation normally associated with parking lots. Wind Turbines were also installed along the lining the outside of the dome as another source of renewable energy to be put towards powering the stadium. This design is closely related how Lincoln Financial Stadium in Philadelphia is designed with solar panels providing shade in the parking lot and wind turbines along to top of the stadium. This allows for natural lighting and heating, as well as allow for feeling of being outside at a game we decided to make the dome retractable. This also makes for a more pleasant venue while inside. A rain water catching and filtration system was added to the gutters lined around the outside of the roof and glass shell to catch rainwater. It transports it down pipes connected underneath the stadium where the water is treated and moved to various uses around the stadium (i.e. plumbing, watering the field, cleaning, etc.). There is also water reuse from the neighboring amusement park in Tokyo Dome City which takes excess water from rides. It is run through pipes underneath with a filtration system, then run through water turbine to help power stadium and then sends treated water through cooler and back to water park. With a retractable roof and a rainwater filtration setup, we turned the turf to a grass field. Though turf is

sustainable, grass is greener and more environmentally friendly. Upkeep costs increase, but it creates a nicer aesthetic for the venue as well as a greener overall environment around and in the stadium, not everything is artificial.

Architectural glass replaced the exterior shell of Stadium which now takes away from the excessive lighting and beams that limit natural light exposure. Motion detectors for lights now turn off when stadium sections are not in use such as bathrooms, employee facilities or locker rooms. LED lights now are used on the exterior of dome. This replacement of lights on exterior glass shell of stadium with energy efficient LED lights saves on cost, light pollution and energy usage. No flush and energy saver toilets are installed into the bathrooms to help eliminate waste water used from the mass amount of flushing done in each event. Leftover food that was not used is now repurposed for people in need rather than being thrown out. Unfinished food is ran through a pulper which turns it into a compost. This compost is sold off as fertilizer to farmers. This system is closely related to what Elizabethtown College does already to help local Lancaster farmers.

The location of the Tokyo Dome is located along the routes of three major subway/train lines, providing quick, easy, public transportation for stadium goers as well as limiting the carbon footprint of every fan driving their own cars to the game. Also, with the many attractions around the stadium as well as the airport and park, this is the location of many bus stops and loops to also help in public transportation. A new “Drunk Bus” is now running routes which helps in public transportation as well as provides a safe option for intoxicated fans to limit dangerous drunk driving home from an event game. The “Drunk Bus” runs routes from bus and train stations, the Tokyo Dome Hotel and other various locations in a simple, safe manner. Bike parking and pickup stations have been implemented which were inspired from the public bike

rental initiative in Washington, D.C. People rent out a bike ride to where they need to go, return it to a station close to the destination and continue on their way, leaving the bike to be rented by another pedestrian. To promote and reward pollution/carbon footprint reduction from others, the closest parking spots to the stadium are restricted to charging and refueling stations for green cars, carpool (3 or more passengers), and bus parking (as long as capacity of bus is not in question). Other bays will be reserved for Uber and other quick pick up methods.

With a restructured front area of the stadium transformed from concrete to open grass filled areas, it creates an open green space to give more environmentally friendly appeal. The grass brings out a large green aspect and statement, as well as a more aesthetically appealing area rather than concrete. The interior of the stadium was also given a more modernized look that is aesthetically pleasing, with other aspects of the park improved such as the seating, scoreboard, and furnishings.

IV. LEED Assessment

A major concern of ours in designing the renovations for this Japanese baseball stadium was to meet the LEED standards for a Platinum building (not just because it was required). We wanted to design environmentally friendly and minimally invasive stadium revisions to the existing stadium to make it a more pleasant experience for spectators as well as to decrease the overall footprint left by the stadium on its surrounding area.

Though neither of us are LEED certified in any way, we did our best to self-assess the LEED grade that we hope to achieve with our revisions. To start, by renovating an existing building rather than building an entirely new one on possibly undisturbed land; that provides us with a lot of points in the location category. The renovation will account for sensitive land

protection and having a high priority site as well as a LEED Neighborhood Development Location. Included in this category for location is the matter of transportation, which we have also accounted for in our design. We have provided quality transit by choosing a stadium located near three major metro stops as well as numerous bus stops and other public transit opportunities all around the stadium. Additionally, we have included bicycle facilities and promoted the use of green vehicles with special parking closest to the stadium for those with green vehicles. Such reward systems also exist for carpools, buses, and other shared community transportation, in the hopes of reducing an overall parking footprint. This gives us an estimated 16/16 points from the location and transportation category of the LEED review.

Next comes the Sustainable Sites section of the LEED review. To cover the requirements of this section, we focused on pollution from the stadium as well as maximizing the environmental potential of the area surrounding the stadium to help reduce negative pollution impacts. Aside from the required aspects which we have had to account for (construction pollution prevention) we then looked at what we could do to reduce other pollution. This included restoring some of the habitat surrounding the stadium, creating some open areas and adding back trees and other foliage to try to help bring the area back to a natural look rather than just the concrete everywhere look it currently holds. Additionally, we wanted to look at the rainwater management, heat island, and light pollution the stadium produced. For the rainwater management we decided to harness the rainwater the stadium experiences and reuse it for field maintenance, restroom facilities, and any other purposes needed around the stadium. In terms of heat island reduction, we plan to install solar panels above the parking spots in the parking lots to harness the solar radiation already drawn to the area (due to the black concrete/asphalt) therefore decreasing the heat island created by parking areas. Finally, we plan to reduce light pollution by

installing LED lights throughout the interior and exterior of the stadium as well as decreasing the number of lights lining the outer shell of the stadium, therefore reducing the light pollution out into the world as well as decreasing the amount of energy required to power the stadium. All in all, we hope that these changes will again give us all the points in this category, giving us a 10/10 points for this area.

Our rainwater management in the previous section then carries over into the next section which covers water efficiency. By reusing the excess rainwater that falls on the stadium we will decrease the outdoor and indoor water use as we will be using water naturally given to us rather than from a city well. Additionally, we plan to use some of the excess water from the water park next door to cover the rest of our hydro needs that the rainwater may not completely cover. These two combined, along with the addition of a water meter and constant checks will increase our water efficiency and hopefully provide us with 9/11 points from the water efficiency section.

Next came the largest section with the most possible points towards a LEED rating. The main focus of this section (Energy and Atmosphere) being the focus on optimizing energy performance. In order to achieve all of these points as well as make our stadium the best possible version of itself, we took multiple steps for renovation to maximize this rating. First we added the solar panels, discussed before, on the parking lots to create solar energy. We then added wind turbines around the exterior rim of the dome to create another source of renewable energy. With these two new sources of renewable energy, we plan to rewire and renovate all circuits, appliances, and other equipment/necessities in the facility to its highest potential. Meaning that instead of a normal flush toilet, we would install new, no flush, energy saver toilets for example. All such equipment and appliances would be required to be energy saver, or if not possible, the most energy efficient model for whatever equipment it is. Not to mention the LED lights and

motion sensors that will be installed to minimize light energy usage. In this manner, we are able to maximize the use of the energy that the stadium itself produces while minimizing if not eliminating the need to draw energy from the grid. By doing all of this we also cover a lot of other points in this section including renewable energy production, enhanced refrigerant management (Energy Saver Appliances), Green Power and Carbon offsets, demand response (creating all the energy that will be required to run the stadium), and advanced energy metering (required to run the renewable energy system we are planning on building). All this taken into account, we anticipate receiving around 27/33 of the available points in this section. Putting us already at the level of Gold LEED rating with 62 points.

Next came the section on Materials and Resources. Here, LEED focuses on the materials and resources used to build and maintain the building. With plans to recycle all material used in the construction and maintenance as well as smaller scale actions such as composting trash and providing leftover food to those who need it rather than just discarding it we greatly reduce the impact the stadium currently has on the area and additionally, the impact it will have on the area in the future. Not to mention this will be a building renovation rather than a complete new construction, minimizing the impact on the area and ultimately improving the area from its current state with the proposed renovations. All this considered, we anticipate anywhere from 7-13 of the total 13 points from this section as we satisfy the building life-cycle impact reduction, the building product disclosure and optimization subcategories and the construction and waste management. But depending on the LEED grader, we predicted a minimum of 7 points from this section with a definite possibility to achieve all 13/13 points.

The final major section lies in the Indoor Environmental Quality. To account for good air quality throughout the stadium we proposed to renovate the roof to one that retracts and opens up

for spectators and players alike. That way on good days the stadium officials could open up the dome and allow fresh air to come in and fill air filtration and pumping systems rather than pumping artificial air or having to draw it in from outside through the use of machines. By opening up to a direct flow of air into the building, we allow for the most natural and comfortable air to be brought into the stadium for the best viewing atmosphere. By doing this we also limit the amount of emitting materials to heat and cool the stadium, have satisfactory indoor air quality because of filters and systems running while the dome is open as well as closed, and allows for control of the indoor air and overall thermal comfort to the people who run the dome rather than always be at the mercy of an indoor system or an outdoor facility. We give the managers the choice of both worlds. As discussed in previous sections we also account for interior lighting, daylight, quality views, and acoustic performance through the various renovations discussed in the prior sections. Totaled up, we anticipate 16/16 points from this category. This puts us at worst case, 91 points and a Platinum rating with the innovation and Regional Priority Sections still left.

In terms of Innovation, we anticipate all 6 points from this category as all the renovations we intend to make on the stadium are top of the line in terms of innovation. Each renovation carries a specific purpose as well as being the most advance innovative technology for each purpose they serve. Finally, with Regional priority we leave that up to the distinction of the Tokyo LEED accreditors as we they are specified as Regional Priority: Specific Credits, to which we do not know what they are.

All this totals up to a predicated grand score of 97 points, providing us with the necessary score to achieve a LEED certified Platinum building and achieve the mark we set up to meet at the beginning of this project.

V. Conclusion

To hit the point again, by renovating the building rather than building a new one or knocking an old one down to build an entire new one, we are limiting our overall impact on the environment. Reusing the building is a huge factor on the green impacts and standing/rating overall. With the renovations listed and our organized reconstructed design, we believe this is the step in the right direction for the Tokyo 2020 Olympics. It is our understanding that with all the changes we implemented, we were able to successfully achieve a designed platinum level LEED certified building/stadium for the Tokyo games.

VI. Annotated Bibliography

(1) Than, More. "Solar Power Installation at Lincoln Financial Field." *Solar Power Installation at Lincoln Financial Field* (n.d.): n. pag. *Nrg*. Web. 19 Oct. 2016.

This PDF file of the work done on the Philadelphia Eagles stadium, Lincoln Financial Field, provides great insight on what green energy solutions were implemented on an already built facility. This file explains how the solar panels and turbines needed new structural enhancements to accommodate for vibrations of the stadium due to fans.

(2) "Tokyo Dome | Tokyo Dome City." *Tokyo Dome | Tokyo Dome City*. N.p., n.d. Web. 19 Oct. 2016.

This is the website of the facility itself. Within this website it provides an abundance of information. Events that have been posted as well as a map overview are included within the site. With the unique architectural dome, some information of how it works and the purpose of it are included.

(3) "World Weather & Climate Information." *Weather and Climate: Tokyo, Japan, Average Monthly, Rainfall (millimeter), Sunshine, Temperatures (Celsius), Sunshine, Humidity, Wind Speed*. N.p., n.d. Web. 20 Oct. 2016.

This website is of great use because it gives details on the climate conditions of Tokyo. There are many factors that need to be known to make sure the right decisions are being made. This site shows the most efficient times of year sunlight and sunshine are.

(4) "Earthquake Building Codes in Japan." *Japan Property Central*. N.p., 01 Aug. 2016. Web. 19 Oct. 2016.

This website discusses the unstable shifts in the earth's core in Tokyo's region. This site shows the different codes that the government has implemented within the last century. Due to the advancements in modern technologies in buildings, there has been a new code implemented in the last 30 years. Information from this website will be vital in making sure that our buildings are up to code.

(5) Integrating, By. "BD+C | U.S. Green Building Council." *BD+C | U.S. Green Building Council*. N.p., n.d. Web. 16 Oct. 2016.

The best information about LEED accreditation is from the direct site. This site was able to provide all the information we needed on making sure that we were able to meet all requirements on the check sheet to earn Platinum status.

(6) "Streetcar, Cable Car: What's the Difference? | Market Street Railway." *Market Street Railway*. N.p., n.d. Web. 19 Oct. 2016.

This article discusses the different types of cable cars that can be used in a metropolitan area. This is knowledge that can be used in determine what would work best for tourist to use. This site worked best because it gives the user's perspective on these carts.

Appendix