



# BUILD FOR LIFE

From innovative planning and design, to conscious construction and operation, today's sports venues are redefining what it really means to be sustainable

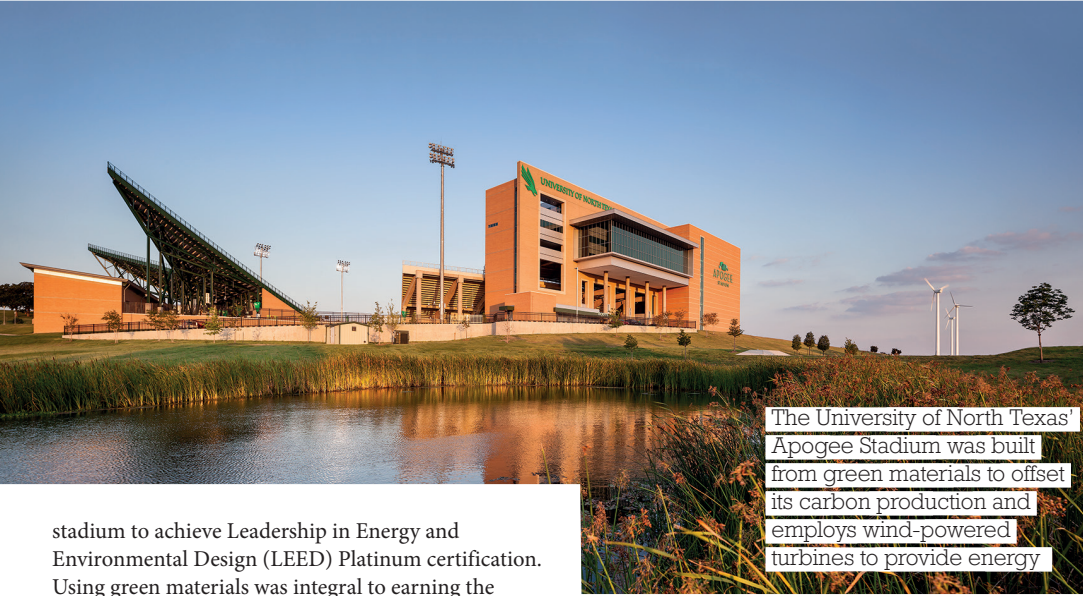
**W**hen sustainability expert Dirk Kestner began work as an engineer nearly two decades ago, few people in the field of sports stadium projects spoke about “embodied carbon” at the design phase. But attitudes have changed remarkably quickly. Kestner, the director of sustainable design at Walter P Moore engineers, says awareness of climate change has driven sustainability concepts such as embodied carbon – the calculated carbon footprint of building materials – right to the top of the agenda.

“The design community has recognized there’s an urgency to make reductions in greenhouse gases by 2030,” he explains. “Even if a new building will be operational for 50 years, we must consider the

importance of near-term impacts, so we apply the concept of life cycle assessment, which is essentially carbon footprinting for buildings. We have to consider the impact of extracting and manufacturing materials, and these are even before [the impact of] fans. It can be everything from how the concrete is made, to the size of a roof, or the choice of lighter-weight membrane roof materials. There’s also renewed interest in timber construction for its sequestration benefits.”

Kestner advises Walter P Moore engineering projects with a focus on sustainable design, which is a growing number of sports stadia today. One successful project he has worked on is the University of North Texas’ Apogee Stadium, which in 2011 became the first newly built collegiate football





The University of North Texas Apogee Stadium was built from green materials to offset its carbon production and employs wind-powered turbines to provide energy

stadium to achieve Leadership in Energy and Environmental Design (LEED) Platinum certification. Using green materials was integral to earning the rating, where engineers replaced 2.8 million kilograms (6.2 million lbs) of Portland cement with fly ash, which is the equivalent of offsetting the electrical carbon production for three years. Meanwhile, 20% of materials were recycled and 47% derived from regional materials. Wind turbines also provided, and continue to do so, a third of the energy to support Apogee Stadium's annual electricity consumption.

Streets ahead

Another important theme in modern stadium development, which is related to sustainability, is the tendency to build stadia in downtown areas. Kestner advised on the 2014 development of the Southwest University minor league baseball stadium, in El Paso, Texas, which helped to revive a decaying downtown area and reached LEED Gold certification. As is quite common for inner city developments, the El Paso Stadium presented logistical challenges to the engineers with a tight and irregular space to work in. Just 160ft (48m) from the home plate stood a large concrete retaining wall, separating the edge of the site's outfield from a railroad. "We had to make the ballpark taller than usual and it had to be cantilevered and hang over the adjacent railway. There were further engineering gymnastics to avoid loading the retaining wall. But we wedged it into the small space without new parking, which is uncommon in the US. As a result, it catalyzed some urban development in the city center," he says.

Elaine Aye, associate regional manager and sustainability consultant at specialty engineers RWDI, explains that the Golden 1 Center, home to the NBA's Sacramento Kings, is a good illustration of how a move downtown can have a positive environmental impact. The team's owners calculated that it reduced travel-related greenhouse gas emissions per fan by 36%, compared to games at their old stadium situated on the outskirts of the city. Meanwhile, more than 90%

of food from concessions is being sourced from local businesses and farms within 150 miles (240km). "Stadia such as the Golden 1 Center can transform downtown cores. The sustainability aspects come, especially, when the development is tied to local transportation management and there's a plan to get masses of people to the venue without single-occupancy vehicles. We're seeing stadia integrated with downtown commerce, the hotel market, science, technology and education. This helps make downtown areas sustainable in the broader sense," Aye claims.

Aye, who is also a board member of environmental organization, the Green Sports Alliance, echoes Kestner's belief that sustainability concerns are transforming approaches to design. In the recent past, the focus was mainly on energy efficiency, water consumption and waste reduction, but there is now a wider definition of sustainability. "When we speak to designers, architects and engineers now, we stress how climate change has made the concept of resiliency more important," she says.

WEATHERING THE STORM

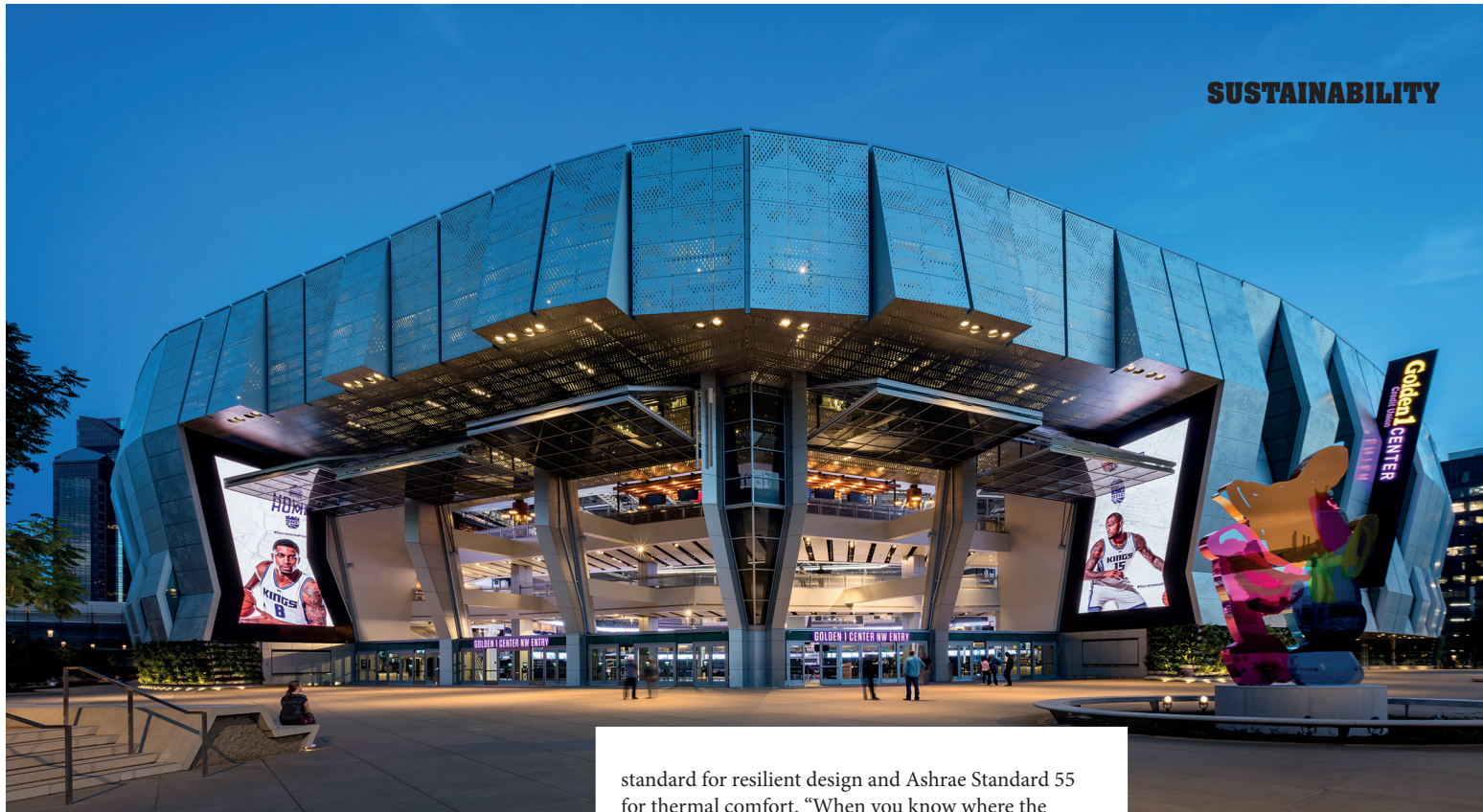
When Hurricane Sandy devastated densely populated areas across several US states in 2012, stadia acted as refuges, but too many were poorly prepared, becoming too hot for comfort and lacking food and water. "When designing, or upgrading, a stadium now, there's more emphasis on comfort. We ask designers to look at cooling, shading, glare control, and appropriate air flow to ensure the building will function as a safe and comfortable environment for people in the event of a disaster or if there's no power for period of time. This is a significant new direction [for stadium design], but we are in the early stages of these conversations," says RWDI's Elaine Aye.



(Main and bottom right) Southwest University's baseball stadium in El Paso, Texas helped revive a decaying downtown area and has a LEED Gold certification







“We are now asking the question of whether you can design [a stadium] to create a more comfortable environment for longer stretches of time in case of power outages and whether the building is ready if disaster occurs,” Aye says.

While some stadia are designed with the potential to support large populations when storms, or earthquakes strike, those older questions of whether the building can be designed for net zero energy, waste and water are still crucial.

Before working with designers, Aye carries out a climate change impact assessment. For a city such as San Francisco, climate change has already had a major impact. In a climate assessment by UC Berkley, it revealed the area's average annual maximum temperature has risen by 1.7°F (0.9°C) since 1950. Coastal fog is less frequent, sea levels have risen and there has been unprecedented coastal erosion from storms. Droughts and severe fires have also become more likely in California.

RWDI's climatologists feed this type of data to stadium designers, who need to take it into account. It's no longer enough to aim solely for LEED. Designers should also aim for other certificates, such as the RELi

standard for resilient design and Ashrae Standard 55 for thermal comfort. “When you know where the climate is going you have to design buildings accordingly,” says Aye.

### Cleaning up

The urgency to mitigate climate change makes it essential to upgrade older facilities too, in order to reduce their carbon footprint. For the past 10 years, Aye has been working as an advisor on the redevelopment of the multi-purpose Moda Center, home of professional basketball team, the Portland Trail Blazers. Acknowledging it could take years to achieve, Aye has set the most ambitious possible goal of the Moda Center becoming “the greenest stadium in the world”.

She has adopted a “top-down, bottom-up” approach, which involves working with both venue managers and stadium staff to establish and implement initiatives around sustainability, improved communication of its green goals to fans, and reductions in single-occupancy journeys.

A series of charters around greenhouse gas emissions, energy and waste reduction and transportation management have also been set up. “The top-down, bottom-up approach is about addressing sustainability goals holistically. We

The Golden 1 Center's downtown location has helped reduce greenhouse gases as fans are now able to travel to the venue using mass transportation

**We're seeing stadia integrated with downtown commerce, the hotel market, science, technology and education. This helps make downtown areas sustainable in the broader sense”**

**Elaine Aye**, associate regional manager and sustainability consultant, RWDI







## PACK LEADERS

In the push for sustainability, sports stadia and the automotive industry sounds like an unlikely pairing, however the initiative to re-use old battery packs from electric vehicles is giving venues a new energy solution. The Johan Cruijff Arena revolutionized this approach when it installed 148 old Nissan electric vehicles and repurposed them as Europe's largest energy storage system.

Harvesting energy from its solar panel system and off-site wind-powered turbine, it uses Eaton power conversion units to create the arena's own energy supply that it can use during gamedays to alleviate pressure from the national grid, remove itself from the reliance on fossil fuels, as well as ensure power is available in the event of a blackout.

gradually work with the facilities teams to make upgrades to lighting, plumbing, and mechanics. Gradually chipping away at the iceberg works best for most older venues," Aye explains.

In working with facilities teams, Aye considers issues such as the best location for a central energy plant, the optimal placing of kitchen exhausts and the installation of displacement ventilation under seats. Small decisions, such as the selection of hand dryers, can have unexpectedly large benefits. Excel hand dryers, for example, have been installed at the 65,000-seat Gillette Stadium, home to the NFL's New England Patriots in Massachusetts, which was using 6 million paper towels a year. According to a peer-reviewed life-cycle assessment from Excel, the mechanical hand dryers reduce carbon footprints by 75% compared with paper towels. The surprisingly high carbon cost of paper towels comes from cutting down trees, transportation and the manufacturing process.

### Natural world

Biodiversity is a less well-publicized aspect of the sustainability agenda. Mostly, stadia have a minimal impact on ecology, but there are exceptions. The International Olympic Committee is particularly careful when planning for Games that require multiple new stadia built across large areas of land. The IOC's report on Sport and Biodiversity highlights how a colony of green and golden bell frogs was discovered within the proposed site of the Sydney 2000 Olympics tennis venue. The IOC spent US\$700,00 to protect the threatened species, including building a suitable habitat. Similarly, the development of the London Olympic Park in 2012 was designed to support the



regeneration of a run-down part of east London, as well as improving the ecology of the Lea Valley. Innovative solutions included creating habitats for bird and bat species on bridges within the park.

The glare of publicity surrounding the London Olympics undoubtedly served to improve awareness of biodiversity and salient sustainability issues. The attention sports stadia receive, particularly the grand and iconic ones, are ideal for conveying important ecological messages to the wider public. The Atlanta Falcon's Mercedes-Benz Stadium, which showcases an incredible array of innovation and technology for reducing emissions and conserving energy is such a venue. As the first professional sports stadium to earn LEED Platinum certification, the MBS has more than 4,000 solar panels and an enormous cistern at street level capable of collecting up to 680,000 gallons of stormwater to be repurposed within the venue.

In Europe, the Johan Cruijff Arena, home to soccer club Ajax FC and the Dutch national team, adopts similar strategies and plays a similar role as it aims to be the world's most sustainable stadium by 2020. The arena is carbon neutral with 4,200 solar panels, wind turbines, rain-water harvesting used to irrigate the grass pitch, energy-generating escalators, and a 3-megawatt storage battery made from recycled car batteries. "Sport is such a powerful an influence on the public, especially amazing venues such as the Mercedes-Benz Stadium and Johan Cruijff Arena. When integrated into city centres, they can become hubs of sustainability," adds Aye. ■

## GANG GREEN

Since the Green Sports Alliance's inception in 2010, the number of teams, leagues, and sports organizations invested in its mission and vision have grown exponentially towards advancing the sports greening movement.

"Our partners see the intrinsic value the sports industry holds and are excited to lead positive change alongside the Green Sports Alliance towards healthier and more sustainable communities," says Roger McClendon, executive director of the Green Sports Alliance.

"Recognition and visibility drive many of our members to pursue certification of venues and buildings, both new and existing. But we have seen a significant shift in fans calling upon businesses and sports organizations to have a stronger commitment to their social responsibility efforts. Patrons see value in not just efficient event operations but also in having a more open equity and diversity footprint."