

2010

FIFA World Cup



Green Point Stadium

Environmental performance enhanced

By March 2008, construction of Green Point Stadium's angled pylons was advancing quickly. Less noticeable, though, were the behind-the-scenes interventions to ensure a green design, especially from a water- and energy-efficiency point of view.



By mid-2007, preparations in South Africa's FIFA World Cup 2010 host cities were rapidly advancing. Construction of new stadia and refurbishment of existing structures were, by then, well under way. The various project teams naturally went out of their way to design appropriate facilities; boasting cutting-edge and environmentally-appropriate features. But was the roll-out programme meeting best environmental performance standards? Were the stadia designed in line with green building principles?

To answer these questions, the South African Department of Environmental Affairs & Tourism, through the Urban Environmental Programme (UEMP) - which is funded by the Royal Danish Embassy - commissioned a review of the greening status of the FIFA World Cup stadia (the official match stadia and training venues). Not only would this establish how green the stadium designs were, it would also give the design teams the opportunity to enhance some green aspects of their designs. At the same time, such a review would summarise the lessons learned for the benefit of other stadium designers and operators.

Five of South Africa's FIFA World Cup match and training venues participated in the review:

1. Green Point Stadium (Cape Town)
2. Moses Mabhida Stadium (Durban)
3. Athlone Stadium (Cape Town)
4. Royal Bafokeng Stadium (Rustenburg)
5. Peter Mokaba Stadium (Polokwane)

***This booklet tells the story
of Green Point Stadium***



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Green Point Stadium

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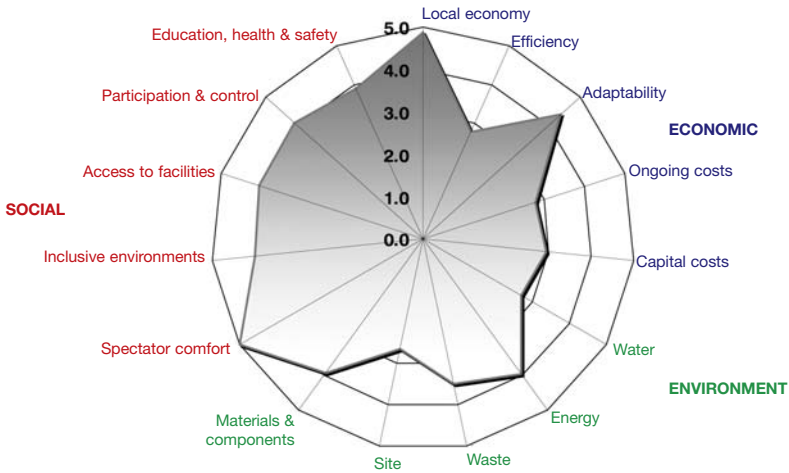


7 key interventions **but why?**

Following an extensive review of the environmental performance of Green Point Stadium, the review team identified seven “low-hanging fruits”; termed “must have” interventions as they would achieve significant results. The “must haves” entailed water sub-metering, energy sub-metering, optimising the building-management system, off-set programmes, education and awareness campaigns, operational guidelines and targets, as well as a national waste-management programme.

In addition, it was recommend that Green Point Stadium invest in solar water heaters, a heat pump and intelligent or drip irrigation, while waterless urinals and photovoltaics for lighting were classified as “nice to haves” but not necessarily viable in terms of cost.

The green review team utilised the Sustainable Building Assessment Tool (SBAT) and a “shades of green” analysis process to determine whether or not Green Point Stadium meets sustainability performance benchmarks. These tools were, in turn, used to identify the key interventions required for Green Point Stadium to become truly green.



Triple-bottom-line approach

In terms of the Sustainable Building Assessment Tool, the performance of Green Point Stadium was measured in relation to social, economic and environmental criteria. The overall sustainability performance of the stadium was found to be good and well balanced across the three measured areas.

Stadium performance assessed

To reach their conclusions, the review team members assessed the Green Point Stadium in accordance with the CSIR's Sustainable Building Assessment Tool (SBAT). As sustainability deals not only with environmental performance but also social and economic issues, the SBAT tool embraces the triple-bottom-line approach. This is significantly different from the approach followed in 2006. Then Germany's Green Goal initiative for the 2006 FIFA World Cup exclusively focused on environmental issues.

Positive performance

With regard to SBAT, Green Point Stadium performed well in terms of environmental, social and economic criteria.

1 Environment protected

In reviewing the design proposals for Green Point Stadium, it was found to perform well in terms of energy and waste, as well as materials and components. As designs for the pitch and external landscaping were not yet complete, it was clear there was opportunity to achieve significant water savings.

Energy efficiency ensured

- close proximity to public transport infrastructure (train and bus) reduces reliance on private cars and cuts down on harmful emissions
- efficient heating and cooling within the stadium bowl
- energy-saving light fittings

Waste recycled

- 95% of demolished components from old stadium salvaged, recycled or reused

Sensitive materials and components specified

- fill material comprises concrete with 50% recycled content
- hazardous materials avoided

Water efficiency top of mind

Water consumption in a stadium can be significant with irrigation for external landscaping (58%) and the pitch (16%) the largest consumer of water. By opting for alternative water sources, such as stormwater harvesting or capturing mountain-spring water nearby, the consumption of potable water at the stadium could be reduced by as much as 88%. However, at the time of the SBAT evaluation, water sourcing decisions had not been made.



Brooke Patrick Publications

The entire economy of the City of Cape Town benefits from the construction of Green Point Stadium.

2. Local economy enhanced

In line with the City of Cape Town's procurement policy, participation by small businesses and historically-disadvantaged individuals is promoted.

Local resources optimised

- 95% reliance on local labour
- 95% use of local materials
- 75% use of local components
- 75% use of local furniture
- 90% intended use of local, small businesses for maintenance
- 30% of capital value of project undertaken by small and medium enterprises

Labour intensity achieved

- 2,4 person years of labour for each R1-million of capital cost

3. Spectators and community considered

The design of Green Point Stadium is cognisant of spectators' comfort.

Comfortable spectators

- 93% shading of seating area at midday
- design encourages air movement within stadium bowl
- design in line with FIFA's optimal and maximum viewing angles and distances

Disabilities considered

- design meets standards for people with disabilities (transport facilities within 400 m, elevators to all levels, toilets no more than 50 m from seating)
- access to accommodation (27 129 beds) within 5 km radius

Community enhanced

- multi-functional urban park encircles the stadium
- visitor centre informs public on progress of construction
- 80% of site workers have received HIV/Aids training

SBAT criteria

The key performance areas measured against the SBAT tool comprised:

Economy:	Environment:	Social:
<p>local economy Local labour, components, fittings and furniture, as well as maintenance.</p> <p>efficiency Capacity, occupancy, space per occupant, shared parking and multiple use.</p> <p>adaptability Alternative uses, external space, services, as well as media and suite flexibility.</p> <p>ongoing costs Water and energy consumption, cost centres, maintenance and cleaning, and facilities management.</p> <p>capital costs Training, labour intensity, support of small, medium and macro enterprises, sustainable technology and private-sector funding.</p>	<p>water Rainwater, water efficiency, run-off, grey water and planting.</p> <p>energy Location, passive environmental control, energy efficiency, control and building-management system, and renewable energy.</p> <p>waste Waste-management facilities, waste minimisation, demolition and construction waste.</p> <p>site Brownfield site, neighbouring buildings, vegetation, construction process and landscape inputs.</p> <p>materials and components Roof, concrete, roof efficiency, superstructure efficiency and hazardous materials.</p>	<p>occupant comfort Shading, ventilation, large screen and crowding, proximity.</p> <p>inclusive environments Transport, 'way finding', space, toilets and distribution.</p> <p>access to facilities Accommodation, banking, pedestrian and cycle routes, and food and drink.</p> <p>participation and control Environmental control, role players, social spaces, sharing access and local community.</p> <p>education, health and safety Education, website, health, safety and security.</p>

Water consumption minimised



gmp

Interventions implemented

Positive water-saving features incorporated into Green Point Stadium's initial design included:

- Toilets fitted with dual-flush mechanisms, taps with self-closing metering valves and aerators, and low-flow showerheads.
- Water-wise, indigenous landscaping.
- Rainwater and stormwater harvested off the stadium roof, pitch, podium surface and park, directed to a detention pond for reuse as an irrigation source.
- Site greywater (washwater off truck wheels and batch-plant water) is reused for dust control.
- Although not yet fully resolved in the early design stage, the need to source irrigation water from a source other than potable water was identified.
- A natural soccer pitch with artificial matting was specified to help reduce the need for irrigation.



Cape Town is a water-stressed city so it is extremely important for Green Point Stadium to consume as little potable water as possible.

Additional interventions proposed

Additional water-saving interventions proposed by the green review team included:

- Waterless urinals.
- Drip irrigation, as the most water-efficient form of irrigation, for all planted areas and an intelligent irrigation system with moisture sensors, rain shut-offs, and a time controller for the pitch and areas of lawn.
- To ensure accurate measuring and monitoring of water consumption, sub-meters for pitch and landscape irrigation, toilets and urinals, as well as hand basins, wash-down systems, rainwater-storage tanks and the residual storage tank on the pitch.
- A hybrid pitch would further reduce the need for irrigation.



*Bruce Sutherland,
City of Cape Town*

Once operational, Green Point Stadium will seat 55 000 spectators. Annual water consumption for a stadium of this size is benchmarked at 64 299 m³/year. However, in the case of Green Point this will be reduced to 25 067 m³/year.

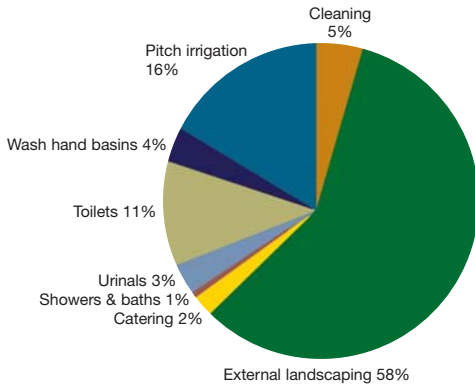
Water model assumptions

The baseline scenario for a stadium with capacity to host 55 000 spectators predicts annual water consumption of 64 299 m³/year.

Water consumption by:

Pitch irrigation	10530 m ³ /year	16,38%
Wash hand basins	2277 m ³ /year	3,54%
Toilets	7087 m ³ /year	11,02%
Urinals	2220 m ³ /year	3,45%
Showers & baths	345 m ³ /year	0,54%
Catering	1500 m ³ /year	2,33%
External landscaping	37440 m ³ /year	58,23%
Cleaning	2900 m ³ /year	4,51%
Total water consumption:	64299 m³/year	100,00%

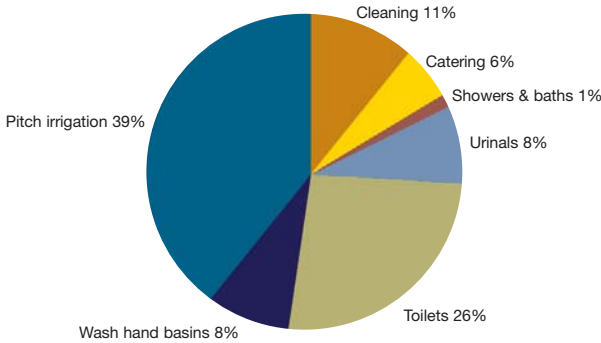
Water consumption baseline



Significant water consumers

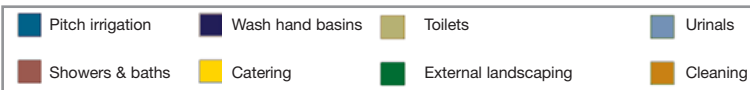
In the case of Green Point Stadium, if it was designed in accordance with the baseline (opposite page), the surrounding landscaped park would consume 58% of total water use, the pitch 16% and sanitary fittings (toilets and urinals) 14%.

Water consumption baseline (excluding landscaping)



Landscaping excluded

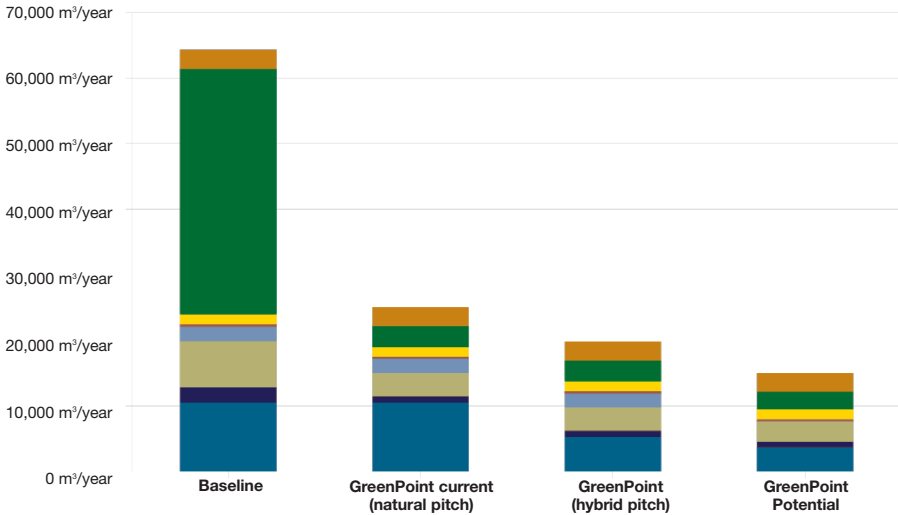
If water consumption for the irrigation of the surrounding park is excluded, the most significant water consumers are pitch irrigation and toilets.



Comparison of the scenarios

	Baseline	Green Point current (natural pitch)	Green Point (hybrid pitch)	Green Point Potential
Pitch irrigation	10 530 m ³ /year	10 530 m ³ /year	5 265 m ³ /year	3 686 m ³ /year
Wash hand basins	2 277 m ³ /year	911 m ³ /year	911 m ³ /year	820 m ³ /year
Toilets	7 087 m ³ /year	3 544 m ³ /year	3 544 m ³ /year	3 189 m ³ /year
Urinals	2 220 m ³ /year	2 220 m ³ /year	2 220 m ³ /year	0 m ³ /year
Showers & baths	345 m ³ /year	288 m ³ /year	288 m ³ /year	259 m ³ /year
Catering	1 500 m ³ /year	1 500 m ³ /year	1 500 m ³ /year	1 500 m ³ /year
External landscaping	37 440 m ³ /year	3 176 m ³ /year	3 176 m ³ /year	2 699 m ³ /year
Cleaning	2 900 m ³ /year	2 900 m ³ /year	2 900 m ³ /year	2 900 m ³ /year
Total	64 299 m³/year	25 067 m³/year	19 802 m³/year	15 052 m³/year

Water consumption





Filled to capacity, water consumption at Green Point will be significant. However much more water, on an ongoing basis, will be consumed by irrigation of the pitch and surrounding urban park. It is, therefore, essential to irrigate with non-potable water.

Possible water savings at Green Point

Taking into account the water-saving measures specified by the designers of Green Point Stadium, a 61% saving on annual water consumption would be achieved. Annual consumption would be 25 067 m³/year compared to 64 299 m³ per annum of the baseline. Should a hybrid pitch be added, annual savings would increase to 69% and, should the additional water-saving measures proposed by the sustainability review team be implemented, savings would increase to a staggering 71%.

Water consumption: final findings

- The most significant saving will be achieved by eliminating potable water as a source of irrigation.
- The specified interventions in the stadium's design will achieve the highest water savings for the lowest cost.
- If a hybrid pitch is specified, significant additional water savings could be achieved.
- Further proposed interventions would have a minimal effect on water saving with an exponential growth in cost.



Shades of green

Water-saving initiatives at Green Point can be categorised as best practice (initiatives implemented elsewhere and now a desired standard) and good practice (methods used widely for many years).

Best-practice interventions

- **Dual-flush toilets**

Implementation of this simple technology results in a 5,5% reduction in potable water consumption; equating to a saving of R53 160 per annum in water costs while the upfront capital cost for installation is R140 000.

- **Low-flow shower heads**

The fitting of all showers with low-flow heads results in a 1% reduction of potable water consumption. This equates to a saving of R6 000 per annum in water costs.



Bruce Sutherland, City of Cape Town

During construction, dust on site is being controlled through the spraying of harvested stormwater, wheel-washing water and batch-plant water so as to reduce the use of potable water.

Good-practice interventions

- **Metering valves and tap aerators**

These technologies result in a 3% reduction in potable water consumption; equating to an annual saving of R20 500 in water costs. The upfront capital cost of the installation is R170 000.

- **Waterwise and indigenous landscaping**

By planting drought-resistant, indigenous plants, as much as 20% less water is required for irrigation. This results in a saving of R187 725 per annum off water costs.

- **Dust control by 'recycled' water**

In keeping with a City of Cape Town by-law, water for dust control on the construction site is sourced from harvested stormwater, wheel-washing water, and batch-plant water.

Energy efficiency achieved

Interventions implemented

Positive energy-saving features incorporated into Green Point Stadium's initial design:

- The building is raked outwards to shade itself while the mesh fabric cladding allows only 30% light through and the white colour reduces thermal radiation.
- The fabric cladding allows for natural ventilation.
- Translucent roof facilitates natural lighting.
- Open concourse at podium level facilitates natural ventilation.
- 5 m gap between inner and outer skins of façade provides for passive ventilation through stack effect.
- Insulated panels behind fabric façade reduce need for cooling.
- Water-cooled variable refrigerant-volume cooling system makes it possible to have individual cooling units for different spaces.
- Heat transfer between spaces is possible if one room needs cooling and another heating.
- Compact fluorescent lamps used where possible.
- Where halogens are used, they are 45% more efficient than the standard.
- Building-management system allows for control and monitoring of air-conditioning and lights in different areas.
- CO monitors in parking garage control fans.
- Offices fitted with presence detectors to automatically switch lights on/off.
- Option to purchase "green" power from Darling Wind Farm.
- Generators are biodiesel-compatible.



As the stadium will not be in constant use, it is important to be able to switch off energy-hungry systems during non-event days.

Additional interventions proposed

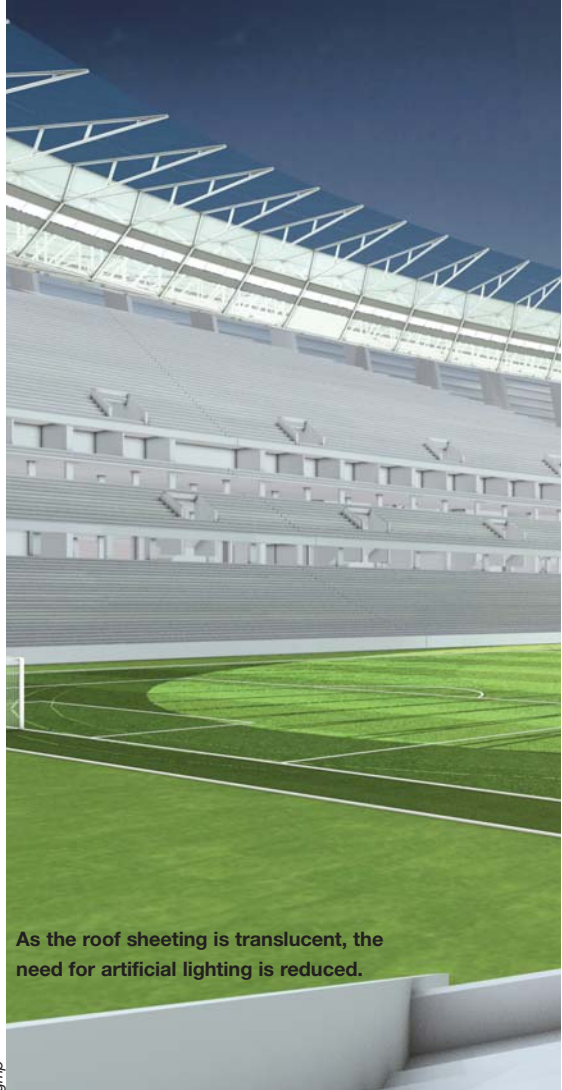
Additional energy-saving interventions proposed by the green review team included:

- Solar water heaters near ground level in service areas close to hot-water demand.
- Heat rejected off the air-conditioning system reused for heating water.
- Variable speed drives for parking-garage fans.
- Sub-metering of individual spaces linked to building-management system.
- Guidelines for operation to be issued to stadium operator.
- Climate offset programmes.

Systems selectively switched off

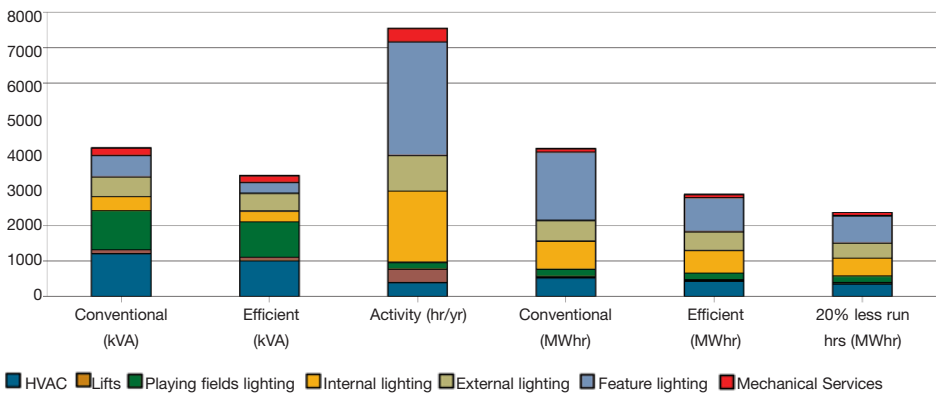
While floodlights are energy hungry, they are only used for limited periods of time. Feature lighting, although it has a much lower installed capacity, could, therefore, account for more energy consumption due to lights running for many more hours.

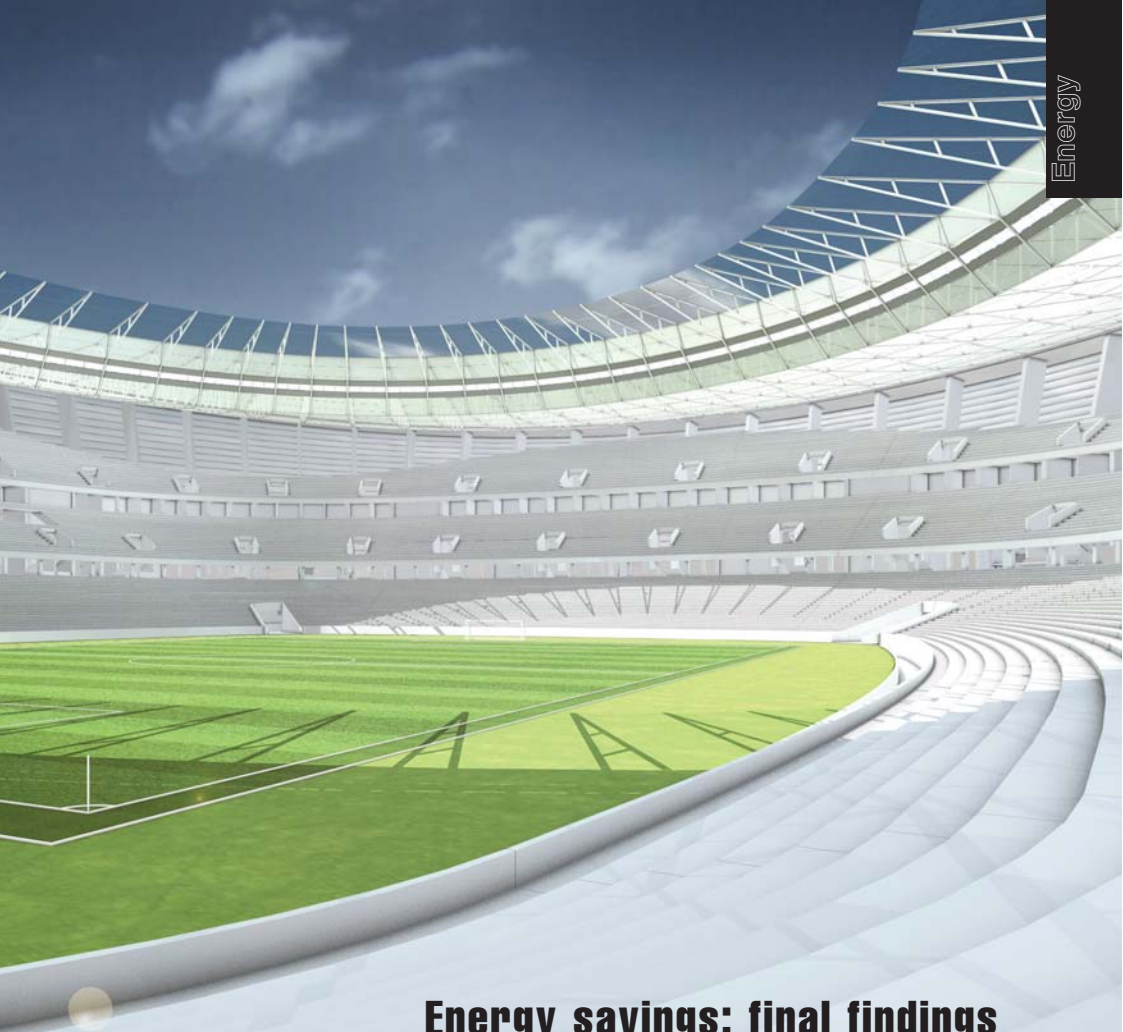
When the installed capacity of a conventional stadium (first bar) and an efficient stadium (second bar) is compared in terms of running hours of the various services (third bar), it is clear floodlights consume less overall energy than lighting (fourth and fifth bars). If the running hours of non-match systems, such as heating, ventilation and air-conditioning, as well as external lighting are reduced by 20%, significant overall energy savings can be achieved (sixth bar). The ability to turn systems off when they are not needed is, therefore, of utmost importance.



As the roof sheeting is translucent, the need for artificial lighting is reduced.

Installed vs consumption





Energy savings: final findings

As the entire stadium is only used for large-scale sports events, the focus is on a flexible design where electrical systems to certain zones can be switched off when they are not in use. A building-management system (BMS) will make this possible while the water-cooled variable refrigerant volume cooling system – a first of its kind in South Africa – will be able to cool small zones efficiently or the entire stadium during large events.

Passive design principles such as 'day-lighting', natural ventilation, solar control and night-time cooling reduce the reliance on energy-hungry mechanical and electrical systems.

Where mechanical and electrical systems are used, energy-efficient equipment is specified and where a system can be omitted in its totality this is done (for instance omitting hot water taps in hand basins). A BMS and measuring equipment enables the facilities manager to optimise energy efficiency during operations.

Shades of green

As is the case with water-saving practices (see page 16), energy-saving initiatives at Green Point can be categorised as cutting-edge, best practice or good practice.

Cutting-edge interventions

- **Water-cooled variable refrigerant-volume cooling system**

This technology is used for the first time in a South African application and involves a central system with individual cooling units for spaces requiring cooling only at a given time.

- **CO monitors in parking garage**

Ventilation fans in the parking garages are only turned on by these monitoring devices once a certain level of CO is detected. The ventilation system in the parking garage consists of two systems, one supplying fresh air and the other exhausting stale air. Under times of very low usage, the operator could switch off the supply system.

The parking garage in the podium is only fitted with an air supply system in the deep areas away from the perimeter. The remainder of the parking in this area is naturally ventilated, saving considerable power in that there are no fans.

Best-practice interventions

- **Mesh fabric façade**

The entire stadium will be clad in a light, silver mesh fabric façade. It allows only 30% of natural light and thus significantly reduces thermal radiation and glare while providing natural ventilation and cooling for spectators in the stadium bowl. The capital cost of the cladding amounts to R206-million. The cladding has another important environmental function; that of reducing visual clutter by creating an even outer façade that respects the surrounding historic urban fabric.

- **Translucent roof**

The roof allows natural lighting through and reduces reliance on artificial lights.

- **Insulation panels behind fabric façade**

These panels further reduce the need for artificial cooling. The capital cost for installation is R2,7-million.

- **Centralised circulating water system**

Through this technology, heat transfer between rooms is possible, thereby reducing the amount of energy required for heating and heat rejection.

Good-practice interventions

- **Electric geysers controlled by BMS**

Where small, remote hot-water requirements are met by electric geysers, these geysers are controlled by the building-management system (BMS).

- **Feature lighting controlled**

As feature lighting can be switched on in phases, the running time for this lighting is reduced.

- **Green energy purchased from Darling Wind Farm**

The City of Cape Town is considering the purchase of wind energy from the Darling Wind Farm for the stadium during the 2010 FIFA World Cup.

- **Air conditioning console units**

The offices on the 3rd and 4th floors of the north and south stands are air conditioned by console units only. If only a few offices are occupied when no events are being held, the occupants can switch on their own air-conditioning units. The central cooling tower and pumps do not need to run, thus saving a lot of electricity.

- **Open concourse, gap between inner and outer façade**

The open concourse at podium level facilitates natural, wind-driven ventilation while a gap between the inner and outer liners of the façade leaves space for passive ventilation through the stack effect. This reduces reliance on fan-powered ventilation.

- **Fluorescent and compact fluorescent lighting**

Use of energy-efficient light bulbs reduces consumption of coal-fired electricity.

- **Building zones for individual control**

By allowing for individual control of spaces and systems, it is possible to reduce the running times of systems.

- **Centralised control for air-conditioning and lighting**

It is possible to completely shut down these systems when the stadium is not in use.

Waste minimised

Interventions implemented

Positive waste-saving features incorporated into Green Point Stadium's initial design included:

- Space for collection and separation of waste is accommodated.
- The stadium operator is required to have a waste-management plan in line with the City of Cape Town's Integrated Waste Management Plan.
- Topsoil rescued prior to construction will be reused in landscaping.
- Materials from the old stadium will be crushed and reused in haul-road construction.
- Building rubble from other sites will be sourced for fill on this site (waste diverted from landfill).
- Waste to landfill from the site is logged and monitored.

Additional interventions proposed

Additional waste-management interventions proposed by the green review team included:

- All the host cities should collectively with the Local Organising Committee and the Department of Environmental Affairs & Tourism formulate an integrated waste-management strategy for 2010.
- Clauses regarding waste-management performance need to be stipulated in the contract with the facilities manager.
- The packaging industry should be engaged.
- The publication of actual figures of waste diverted from landfill should be encouraged.

Shades of green

As is the case with water- and energy-saving practices (see pages 16 and 22), waste-management initiatives at Green Point can be categorised as cutting-edge, best practice or good practice.

Best-practice interventions

- Integrated Waste Management Policy**
 The operator of the stadium will have to adhere to the City of Cape Town's official policy on waste minimisation.
- Demolition waste reused**
 By reusing demolition waste as aggregate for the construction of haul roads, waste to landfill is reduced considerably.
- Waste to landfill logged**
 By closely monitoring what is sent to landfill, the total volume of waste to landfill is also reduced.

Good-practice interventions

- Space provided for waste collection**
 This ensures the operator is able to minimise waste through a management strategy.
- Topsoil rescued**
 A valuable source of organic growth material is preserved for landscaping and rehabilitation purposes.
- Cut-and-fill material balanced**
 By balancing the cutting away of earth and filling up of areas in order to create flat podiums for construction purposes, the production of waste material is avoided.
- Rubble from other sites used for fill**
 Waste to landfill is further reduced by sourcing fill material from the construction waste produced at nearby building sites.
- Site waste separated**
 During construction WasteMan sorts and separates all waste on site.
- Environmental Management Plan followed**
 By following this plan, during the construction process, the overall environmental impact of the stadium is reduced.

Appropriate materials specified

Interventions implemented

Positive interventions regarding construction materials incorporated into Green Point Stadium's initial design:

- Specification of local materials reduced the need for transport and cut back on emissions.
- Materials with recycled content were specified where possible: for instance, concrete containing fly ash, crushed building rubble as aggregate and geotextiles made from recycled PET bottles. Of the 27 different types of concrete mixes used at Green Point Stadium, some contain as much as 50% fly-ash content.
- Rubble from the old stadium was reused for layer works in new roads.
- Low-emitting materials with low levels of volatile organic compounds have been specified in the cases of adhesives, sealants, paints, coatings and carpets.

Additional interventions proposed

Additional interventions regarding the use of materials proposed by the green review team:

- Seats made of recycled plastic.
- Seats of the old stadium will be reused in training and other venues.
- PVC minimisation – as it releases chloride gases, PVC should be replaced by HDPE for waste pipes, polyethylene and steel for conduits, and polyethylene for cabling.



When the old Green Point Stadium was demolished, some materials were reused in the layering works of haul roads. At the same time, most new materials brought onto site are sourced locally.

Shades of green

As is the case with water, energy and waste-management practices (pages 16, 22 and 25), material specifications at Green Point can be categorised as cutting-edge, best practice or good practice.

Cutting-edge

- **Low-emitting finishes**
Materials containing minimal volatile organic compounds ensure improved indoor environmental quality.
- **Timber from sustainable sources**
Relying on sustainable forests ensures demand for timber from irresponsible forestry is reduced.

Best-practice interventions

- **Fly ash in concrete**
Material that would otherwise have gone to landfill is recycled.
- **Geotextiles made from recycled PET bottles**
Again, material that would have gone to landfill is diverted for reuse.
- **Materials from old stadium recycled**
Waste to landfill is reduced further.

Good-practice interventions

- **Local materials specified**
By using local materials, transport and, therefore, emissions are reduced while the local economy is stimulated.
- **Composite materials avoided**
To improve recyclability at the end of the stadium's life, the use of composite materials in the initial construction is avoided.

Additional interventions

Following the extensive design review of Green Point Stadium, making use of SBAT, shades of green and modelling studies, the green review team identified various "must have", "should have" and "nice to have" initiatives that would further enhance sustainability of the stadium.

7 'low-hanging fruits' – the 'must haves'

Seven low-hanging fruit initiatives should be pursued. The green review team argued these would be easy to achieve and have a significant additional impact in terms of the stadium's environmental performance – specifically so in terms of water and energy consumption.

These comprise (with the four most significant interventions detailed):

1. Water sub-metering
2. Energy sub-metering
3. Optimisation of BMS
4. Offset programmes
5. Education and awareness (water consumption)
6. Operational guidelines and targets
7. National waste-management programme

1. Water sub-metering

The installation of sub-meters to measure water consumption for different systems, areas and applications, would be invaluable assistance for the facilities manager by making it possible to measure the effectiveness of any water-saving initiatives. It would also play a role in detecting leaks early on.

2. Energy sub-metering

Meters that measure electricity consumption in specific areas would enable the facilities manager to monitor the effectiveness of energy-efficiency initiatives. Although these meters cost about R12 000 each, the benefit would become evident only once the operation patterns of the stadium are measured. It would then be possible to plan realistic energy-saving initiatives.

3. Optimisation of BMS

Although Green Point Stadium boasts an advanced BMS, it can be further optimised. For this, additional investment would be required with the aim of creating smaller zones that could be more closely controlled. Also on the agenda would be the installation of occupant sensors to turn lights and air-conditioning on only when a section is occupied. Additional investment in the BMS would have the most significant impact of all the energy-saving options available to the stadium.

4. Offset programmes

Through offset programmes, renewable-energy projects could be located where they would have the most socio-economic benefit.

recommended

Many 'should haves'

Many additional options exist to achieve energy and water savings at Green Point Stadium. The green review team recommended eight interventions as "should haves" for the stadium.

1. Solar water heaters
2. Heat pumps
3. Intelligent and drip-irrigation systems
4. PVC minimisation
5. Recycled plastic seating
6. Low-emitting materials

The three most significant 'should have' interventions are:

1. Solar water heaters

If a combination of 70% solar and 30% electric heating was implemented at ground level, in close proximity to where the water is needed or in the gym, it would result in an energy saving of 70% compared to direct electric heating.

2. Heat pumps

Typical heat pumps consume as little as 35% of the energy of a direct heating system. A heat pump could utilise heat rejected from the air-conditioning system to heat water. It could also utilise cold rejected from the air-conditioning system by injecting it into a higher temperature loop – for instance, the cooling water loop of the air-conditioning system. In the former case, 20% less energy would be consumed than in the case of direct electric heating.

3. Intelligent and drip-irrigation systems

An intelligent and a drip-irrigation system would save 30% in water consumption when compared to a conventional system. This saving on irrigation water would equal a 4% saving on total water consumption at Green Point Stadium. If non-potable water could be used for irrigation purposes, the need for investment in an intelligent irrigation system could be negated, though.

Some 'nice to haves'

Even more opportunities exist to reduce water and energy consumption. However the green review team categorised these as “nice to haves”. While their incorporation would make a difference, the impact would be far less than is the case with “must haves”.

1. Waterless urinals
2. Photovoltaics

1. Waterless urinals

Green Point Stadium would achieve a 5% reduction in water consumption if waterless urinals are installed. However the capital cost for 360 urinals would total R1,42-million while the annual water saving would be R33 300. The long payback period makes this option less feasible unless it is subsidised.

2. Photovoltaics

The installation of photovoltaics on the roof of the stadium was seriously considered, but could not be implemented due to technical and cost constraints. Photovoltaic technology could be employed to power street and walkway lights. However the cost of electricity generated from photovoltaics, measured over a period of 20 years in Cape Town, is calculated as R2/kWh. It is, therefore, not feasible, from an economic perspective. In addition, the batteries associated with this technology could have a negative impact on the environment. The green review team is of the opinion it would be more beneficial to invest in carbon offset programmes elsewhere. This way much-needed renewable energy could be brought to clinics and schools.

Sustainability in practice

Following the completion of the green review team's report, design and building work on Green Point Stadium has continued at a rapid pace. In practice, recommendations are often altered to best suit the reality on the ground.

Installation depends on budget and technical considerations

Although many technologies have been recommended by the green review team as "must haves" or "low-hanging fruit," the final decision as to whether or not to install these depends on budget and technical considerations. Some of the recommendations will only be considered in the legacy scenario after the 2010 FIFA World Cup due to budget, time and technical constraints.

Public place-making pursued

Sustainability is not only about achieving technical goals but supporting the softer and highly-significant principle of public place-making. If spaces are well designed, they will serve much more than only receiving and channelling people to the stadium. Urban design has been actively employed at the Green Point Stadium to support flexible use of space and to optimise public use of the spaces around the stadium. The spaces are varied in terms of form and character, and allow for a multitude of uses.

Spring water for irrigation

The City of Cape Town commissioned a study to determine the feasibility of directing water from the Oranjezicht springs to Green Point Common for irrigation purposes. The study has shown that this is technically and financially feasible using a combination of existing and new piping between the source of the springs and the Green Point Common with storage of water in ponds on the common. Further detailed design studies will follow.

If implemented, this solution will reduce the significant financial and environmental costs of using potable water for irrigation purposes. Cape Town receives winter rainfall. In winter, it is not necessary to irrigate but it is impossible to store the large volumes of water for use during the dry summer months. In summer, it does not rain at all, making it impossible to harvest water when it is most needed. With the mountain-water solution, the demands on the city's already overworked water purification works will be significantly reduced.

The professional design team

Client:

City of Cape Town

Architecture:

Von Gerkan, Marg & Partners (lead design architects) in joint venture with Stadium Architects Joint Venture (led by Louis Karol Architects, working with Comrie Wilkinson, Jakupa, Munnik Visser and Paragon)

Urban Design:

Comrie Wilkinson, Jakupa and OVP Associates

Lead Electrical Engineer:

BKS Engineering and Management

Lead Mechanical, Plumbing and Drainage Engineer:

WSP Consulting Engineers

Project Managers:

Mitchell du Plessis Associates

BKS – Engineering and Management

Ariya Project Managers

Ngonyama Okpanum Associates

The sustainability review team

GREEN by DESIGN WSP

PJ Carew Consulting

CSIR

Funding

Royal Danish Embassy

Publication of this booklet by

Brooke Patrick Publications, publisher of *Urban Green File*, *Architechnology* and *JFM Sports Facilities* magazines and e-mail bulletins, among others.

This booklet is the first in a series of six covering five participating 2010 FIFA World Cup stadia and training venues, including an executive summary.

A booklet on lessons learned relating to the greening of the stadia, as well as the Sustainable Building Assessment Tool is also available.

For a copy of this booklet:

Visit the UEMP website: www.uemp.org.za

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A lot has been achieved since May 2007. Cape Town is looking forward to hosting the world in a super-efficient stadium by 2010.



Behind the scenes, extensive work has been undertaken to ensure Green Point Stadium will be green not only in name but also in its environmental performance. Learn how this greening was undertaken and how the City of Cape Town will ensure Green Point is efficient when it comes to water and electricity consumption.

Bruce Sutherland, City of Cape Town

