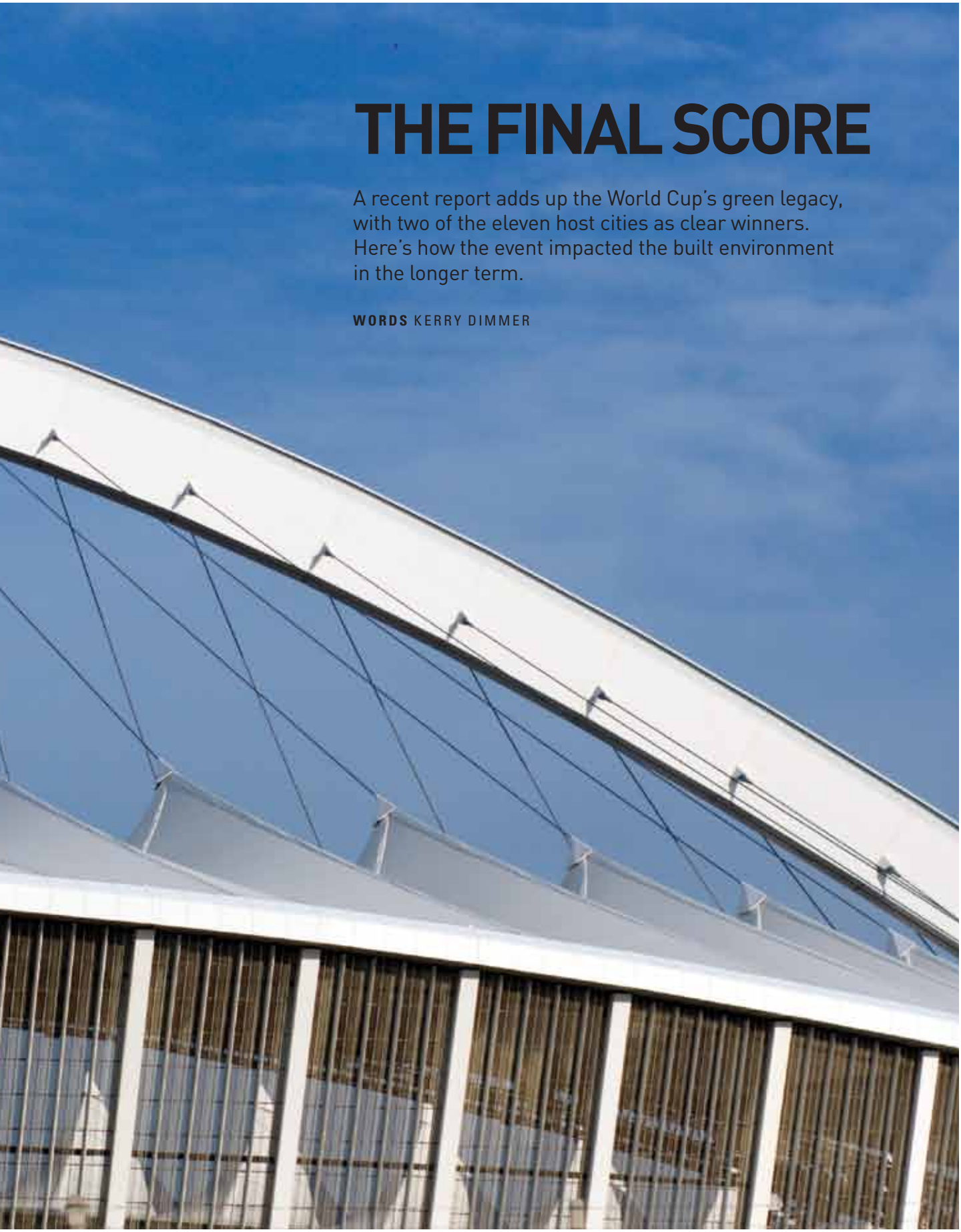
The President's Award for excellence in design was presented to the eThekwini Municipality for its erection of the Moses Mabhida Stadium. The stadium was also awarded a Platinum Impumelelo Sustainability Award and the *Mail & Guardian* Green Award.



THE FINAL SCORE

A recent report adds up the World Cup's green legacy, with two of the eleven host cities as clear winners. Here's how the event impacted the built environment in the longer term.

WORDS KERRY DIMMER

Now that the 2010 FIFA World Cup in South Africa is history, we are beginning to look back at its legacy. People often comment how they miss the intense energy of an excited but united nation during that heady period last year. Such sentiments mean that there is still a window of opportunity to harness that kind of energy and thus meet one of the greatest challenges of hosting the tournament: how to maximise its long-term benefits for the country and its people.

It was acknowledged from the start that, for the World Cup to have a positive legacy, important economic, environmental and social issues would also have to be addressed. To what extent was this realised?

Following the lead taken by Germany's hosting of the tournament in 2006, the first time that sustainability issues had been incorporated into a FIFA World Cup, the South African government took up this challenge.

It was clear that an event of this magnitude would have an enormous impact and require many diverse organisations to come together: the Local Organising Committee (LOC), international donor agencies and governments, national, provincial and local government, the private sector, volunteers, non-governmental organisations (NGOs) and the public at large.

"Taking into account that this was a voluntary exercise, there were no definitive allocated budgets other than what was already set aside to fund (various local) initiatives," says Dr Jenitha Badul, director in the Department of Environmental Affairs (DEA) and responsible for the greening of the event.

The DEA's role was essentially to support the LOC Environmental Forum in guiding the wide range of localised greening initiatives. These aimed to coordinate support from national government departments, donors and other greening partners, to mobilise resources and funding, to support and implement provincial and local plans, and to drive the carbon offset programme at a national level. The areas that were addressed across the 9 host cities were: carbon emissions, energy, water, waste, transport, biodiversity, sustainable tourism, and communication/marketing.

NATIONAL GREENING INITIATIVE

While some cities opted to adopt individual green branding for their programme, like eThekwini's "Greening Durban 2010" and Cape Town's adoption of FIFA's "Green Goal 2010", the DEA launched "National Greening". The latter brand's aims are now reaching beyond the World Cup to stimulate the momentum of partnerships working towards greening events and related construction projects.

> The benefits of investing in such technologies are now recognised as the future for South African building standards

Badul believes that with COP17 taking place in Durban later this year, the many sustainability and greening projects continuing from 2010 will serve to prove South Africa's commitment to environmental responsibility.

The DEA recently released a National Legacy Report for the greening of the 2010 FIFA World Cup (which was prepared on its behalf by WSP), and will be joined by the departments of Tourism and Water Affairs as well as Eskom to spread the word around the country through road shows.

"Our target is primarily the hospitality sector," says Badul. She says much more is happening around the country than people may think, "especially when for so long, many have been under the illusion that greening is only related to biodiversity. It is much, much more, as the Legacy 2010 document proves."

CHALLENGES

The report acknowledges that a key element to improving environmental performance is the ability to monitor and track sustainability indicators. The DEA commissioned and distributed the CSIR's Sustainable Building Assessment Tool (SBAT) for Stadia to host cities, but it was not widely used. Several reasons were put forward, including the fact that some cities had put in place their own systems, while others did not have the basic infrastructure to provide the data to populate the monitoring tool. Take for example energy consumption, which required a stadium to have different meters to provide a breakdown of energy use in different areas or for different applications: such meters were rarely in place.

While Green Goal 2010 set some quantitative targets, "these proved to be overly ambitious", according to the report. The DEA also elected not to set quantitative targets for National Greening "in recognition of the differences in financial and human resources between Germany and South Africa" as host nations. Most municipalities, especially the smaller ones, simply did not have the manpower, budget or time to contribute to such a process.

In addition, the report argues, environmental

issues were not legally binding, so host cities tended to see them as "optional" and afforded them a lower priority than logistics and security.

The report concludes that South Africa's response to these challenges was "mixed". Yet, while there were many missed opportunities, it would be rash to dismiss the many positive examples.

CARBON EMISSIONS

Five new stadia were constructed. Of these, Durban (eThekwini Municipality) was the only host city to commit to achieving carbon-neutrality and offset the total embodied carbon emissions associated with the building of the Moses Mabhida stadium, which constituted 62% of the total emission footprint. The stadium's sustainable building design is largely to thank, as it is estimated to have reduced the operational energy footprint of the precinct by about 30%. The energy savings realised are expected to result in cost savings of R1 million per year.

"A centralised building management system (BMS) allows for optimal management of ambient temperature (air conditioning) and lighting for different zones. Even after the event, the stadium's performance is undergoing constant modification which is central to ensuring sustainable performance in years to come."

Durban expects to offset its entire tournament footprint within three years through just three of its ongoing sustainable projects, namely the Western Aqueduct Hydropower Scheme, the Durban Solid Waste Marianhill landfill biogas-to-energy project and the roll-out of 100 000 solar water heaters to high-end users by 2015.

The national effort to reduce the transport sector's emissions relating to the World Cup and beyond has not been quantified. However, considering the number of Park and Ride/Park and Walk facilities introduced at all host cities, plus the development of the Gautrain, Rea Vaya bus rapid transport (BRT) system, pedestrian walkways and cycle routes, a contribution towards a sustainable urban transport system will be felt in years to come.

Carbon emission control was also realised by a myriad of projects funded by participating World Cup teams and other NGOs, where the focus was on greenhouse gas savings. A total of 361 000 indigenous trees were planted as part of World Cup related projects and with each of those sequestering 20.3 tons of CO_2 during an average lifespan of 40 years, not only is the offset beneficial for the environment, but the trees also beautify our surroundings.

Although the goal was to completely offset the carbon emissions generated by the World Cup, South Africa did not have the financial resources to purchase carbon credits. Still, 2 491 271 million tons were avoided and the event can be considered "carbon fair",

ENERGY-RELATED LEGACY PROJECTS

Host City	PROJECT
Cape Town	• Energy-efficient technologies in stadia and training venues; fan-parks; public viewing areas and training venues. • Smart design and energy installations at the stadium • Installation of a hydroelectric turbine at the Green Point Park (Planned)
Durban	• Undertook a post-hoc review of all aspects of energy procurement for stadium and its precinct to determine if other sources of green energy can be purchased or supplied • Review of stadium and precinct design and installations to maximise energy efficiency at Moses Mabhida and training venues. • Developed Energy Efficiency Guidelines for all municipal infrastructure and installations for 2010, and advocacy thereof
Johannesburg	• Implemented alternative interventions for cooking/heating purposes in two targeted areas in the city, and in stadia • Installation of energy-saving lamps in stadia • Retrofitting of the LOC – now South African Football Association – headquarters
Mbombela	• Maximised energy efficiency at the venue • Promotion of energy efficiency in the private sector • Retrofitting of traffic and street lights • Installation of solar powered precinct lights at the stadium
Port Elizabeth	• Installation of 50 000 energy-efficient street lights • Replacement of geysers with solar water heaters, target is 100 000 over five years • Supply of luminary replacements in some 750 000 households of previously disadvantaged communities • Motion sensors and CFLs in stadium offices and corridors
Polokwane	• Energy efficient design and installations at the stadium and venues • Retrofitting of street lights, traffic lights and billboards
Rustenburg	• Maximised energy efficiency at 2010 venues, intelligent sensor light • Retrofitting of street/traffic lights and billboards
Tshwane	• Retrofitting of municipal buildings with energy efficient lights • Retrofitting of street/traffic lights and billboards

The International Olympic Committee (IOC) Sport and Environment Award was presented to Cape Town in recognition of its 2010 Green Goal Programme. The Cape Town Stadium also received a Silver Impumelelo Sustainability Award.

if not carbon neutral. "The major lesson learnt... is that binding agreements for fiscal support should be sought upfront for a carbon emissions reduction programme," according to the report.

ENERGY

Modern football stadia are particularly energy intensive to construct, operate and maintain – and the entire African continent struggles to ensure adequate electricity supply for its economies.

Before the World Cup, baseline studies of five existing stadia concluded that none of them had energy management plans in place, monitored or had records of energy use (aside from municipal accounts), had on-site renewable energy sources, or had comprehensive sub-metering of different facilities. While most were using energy saving lamps (CFLs) for general public lighting, they generally did not manage lighting and HVAC (heating, ventilation and air-conditioning). It was hoped that implementing best practices would reduce usage at official World Cup venues by 15%.

Of the new stadia, Durban's Moses Mabhida Stadium leads the pack in terms of energy-efficient design. It is projected to use more than 30% less electricity than Cape Town Stadium per match despite having a bigger seating capacity.

Moses Mabhida Stadium (Durban)

- Punched corrugated metal sheeting behind the façade facilitates natural ventilation.
- Natural lighting and a light-coloured roof reduce energy demand, while the shade provided by the roof ensures spectator comfort.
- Fitted with energy-efficient LED lighting technology and T5 fluorescent lighting. Control gear such as electronic ballasts and timing controls for feature lighting were installed to help streamline energy usage.
- Water is heated by heat pumps – a system that consumes as little as 35% of the energy of a direct heating system.
- The pumps, plants, heating and air conditioning are all controlled by a centralised building management system (BMS), minimising energy wastage.

Cape Town Stadium

- The translucent roof allows natural lighting.
- The mesh fabric cladding allows 30% light through, and the white colour reduces thermal radiation.
- External lighting is designed to use high efficiency light sources: metal halide (see Box out on lighting),

COOLING

The central system has 170 individual water-cooled VRV® air conditioners for spaces requiring cooling only at a given time.
Contact Daikin Air Conditioning South Africa
www.daikin-ce.com

LIGHTING

Metal halide is five times more efficient than standard tungsten halogen lamp technology.

Cape Town Stadium features 360 separate 2 kW floodlights (each producing approximately 215 000 lumens of light output – or about the same light as 430 desktop lamps combined.

Several different settings have been programmed into the floodlighting control system, so that lower levels of field illumination can be selected for non-televised events, practice/training sessions or for maintenance works.
Contact Gibb engineering and science consultants
021 469 9100 www.gibb.co.za

fluorescent and LED lamp technologies. LED lighting on the façade provides high efficiency, long life, low maintenance illumination.
- Currently undergoing sub-zoning to allow for separate zoning of emergency lighting.
- A water-cooled, variable refrigerant volume cooling system – the first of its kind in South Africa – to cool small zones or systems efficiently. (see box out on Cooling)
- Ventilation fans in the parking garage of the stadium are activated when a certain level of carbon monoxide is detected. In times of low use, the air supply system can be switched off altogether, leaving only the exhaust (outlet) system.

SOLAR

- Renewable energy was considered a priority for the World Cup and Eskom, along with the South African Power Pool, donated 2 418 GWh of green power from hydro and wind sources.
- Cape Town used part of the World Cup funding to contribute to the installation of 300 solar water heating systems at the Darling community in the Western Cape.
- Nelson Mandela Bay, through funding received from the Division of Revenues Act, has committed to retrofitting 100 000 solar water geysers over the next five years.
- Tshwane, through funding received through the CEF and Eskom, launched the National Solar Water Heating Programme with the replacement of 270 units in the township of Winterveld, with a further 2 730 units to be installed in Phase 2.
- Ten billboards, five major traffic intersections and 65 street lights across the cities were retrofitted to run on solar power.

"The energy efficiency interventions and cutting edge energy optimisation techniques employed within the stadia – given the time and budgetary constraints – is notable," the report states, adding: "The benefits of investing in such technologies are now recognised as the future for South African building standards."

WATER

Water consumption during the World Cup, in a country that already considers this resource under threat, provided stadium designers with an opportunity to showcase their ability to contribute to the national goal of saving at least 10% in potable water. Using this scarce resource for other purposes is wasteful and the Green Goal target expected host cities to reduce water use within the stadia by 25%.

A baseline study once again showed that none of the stadia included were actively managing their water usage, although Ellis Park did have a rainwater harvesting system. A number of venues were provided or retrofitted venues with water efficient fittings, harvesting of rainwater, and sustainable landscaping and irrigation practices along with the rehabilitation of natural resources in the surrounding precincts (wetlands, rivers, streams etc).

Moses Mabhida Stadium (Durban)

This stadium achieved a 74% reduction on estimated annual water consumption of 59 112 m^3, thanks to an intelligent pitch-irrigation (see box out on irrigation) system, tap aerators and low flow showers, water-efficient toilets and urinals, and rain and pitch-water harvesting for use for irrigation. The irrigation system was designed so that the soil moisture was set at a specific threshold and that the moisture never goes above or below the threshold. Retail and restaurant basins are metered separately for accurate charging.

Cape Town Stadium

Not all of the planned measures were implemented in time for the World Cup, due to scheduling and costs, but Cape Town Stadium is using 61% less water than the estimated annual consumption of 64 299 m^3. Space for rain water tanks have been built into the design and these will be installed when funds are available. Water savings will increase by another 10% if and when a hybrid pitch is installed.

Soccer City (Johannesburg)

Having initially aimed to use 25% recycled water for irrigation, harvested rain water is now collected in a moat and supplies 80% of pitch irrigation needs.

Nelson Mandela Bay Stadium (Port Elizabeth)

Rain water collection was considered too late to be

IRRIGATION

There are three different Acclima irrigation systems at the Moses Mabhida Stadium:
- Pitch - the system runs at set times to meet set precipitation rates or at the turf manager's discretion.
- Stadium surrounds - the independent system with soil moisture sensing has its own pump station complete with 700 m^3 storage tank for rainwater collected off the roof and residual water off the pitch.
- People's Park - another soil moisture based system that caters for two practice pitches and a 7 ha precinct.

Contact: Controlled Irrigation CC
031 569 1984 www.conirr.co.za

SUMMARY OF STADIUM WATER GREENING INITIATIVES

Action	Purpose/description	Match venue
Water management plan	Building management systems	Cape Town, Moses Mabhida, Soccer City, Mbombela
Water audits	To indentify water uses, consumption levels and areas for improvement	Cape Town, Moses Mabhida, Peter Mokaba, Royal Bafokeng
Design or retrofit venues to maximise water efficiency	Installation of water efficiency equipment	Moses Mabhida, Soccer City, Cape Town, Nelson Mandela Bay, Royal Bafokeng, Peter Mokaba
	Harvesting of rainwater	Soccer City, Moses Mabhida, Peter Mokaba, Mbombela
	Ecological sanitation systems on site	Mbombela
	Installation of drip irrigation for landscaping and/or moisture sensor irrigation system	Cape Town, Moses Mabhida
	Selection of indigenous or drought tolerant pants for gardens and landscaping	Cape Town, Moses Mabhida, Royal Bafokeng, Peter Mokaba, Mbombela
	Use of non-potable water for irrigation	Cape Town, Nelson Mandela Bay
	Intelligent pitch irrigation system to minimize water consumption	Moses Mabhida, Peter Mokaba
	Monitor and maintain water systems to avoid losses through leakage, and install sub-meters to enhance identification	Cape Town, Soccer City, Mbombela Moses Mabhida
Promote conservation of wetlands or estuaries near event	Work with local conservation organisations	Princess Magogo, Mbombela
Use of porous or permeable paving	To allow stormwater infiltration, groundwater recharge and on-site storage of water	Royal Bafokeng, Peter Mokaba
Divert rainwater	Into ponds or rivers of build retention dams or ponds on site	Royal Bafokeng, Peter Mokaba

included in the design process. High salt levels also meant water from the adjacent North End Lake was unsuitable for irrigation. While a reverse osmosis process was initially considered too expensive, it has since become justifiable and phase 1 – a filtration and disinfection plant – has been completed.

REUSE OF MATERIALS AND WASTE MANAGEMENT

During construction, more than 70% of rubble from the old stadium was crushed and reused in the building of Soccer City. Bricks not reused were cleaned on site and made available to locals, while old seats were also used elsewhere. In Cape Town, 95% of demolition waste from the old stadium was reused.

The integrated waste management system featuring split bins and recycling collection points that was implemented in Cape Town during the event, continues to operate effectively.

TRANSPORT

"(The transport) sector presented some of the most challenging of the greening tasks because of the significant long-planned infrastructural developments that needed to be brought forward in time to cater for the high demands of the World Cup," the report states. There are significant greening advantages to be gained from mass transport evolution, like the Gautrain, bus rapid transport (BRT) system, and the construction and upgrades of public transport systems, including road development. Initiatives included the promotion of non-motorised transport such as bicycles, park-and-ride/park-and-walk, and shuttle buses.

The taxi industry had a major boost from government in the creation of the Taxi Recapitalisation Programme, whereby more than 27 800 old taxis were scrapped with more than R1.4 billion paid out to operators. This ongoing programme will spend a total of R7.7 billion in the years to come.

"Perhaps most importantly, the upgrades have created innovative ways of encouraging people to use public transport in a country in which private vehicle use is the default option for those who own vehicles."

Going forward, the challenge will be to continue the drive for improvement in public transport and to realise a behavioural change among commuters.

CONCLUSION

"The greening of the World Cup and resulting sustainable legacy outcomes should also be seen as part of a greater process – and, in fact, as part of the start of this greater process – to fundamentally embed the concepts of sustainability within South Africa's national economic development framework," the report concludes