

MTN boasts SA's



first hybrid cooling tower

*By: Ilana Koegelenberg – assistant editor; with input from
Adèle van der Walt of Ingenium Engineers*

*MTN's new ground-breaking Doornfontein
co-generation installation will save
approximately 36% in water usage and
300kW in energy annually*

Doornfontein co-gen is part of the MTN vision to not only have alternative power sources, but also to make power more affordable. The Doornfontein project was inspired by MTN's first Tri-generation project at their 14th Avenue office.

The first priority of the project was to start the gas fuelled generation engines to ensure that Doornfontein, one of the key MTN switches, can run through load shedding without consequences of any sort. Secondary to that, the cooling aspect ensures that the finances make sense.

The project started in June 2014 and was completed at the end of August 2015.

Client brief

The client brief was simple: Find a new look for the trusted recipe when utilising the waste heat from the electricity producing gas fuelled generators to create cooling.

The cellular switch/data centre environment lends itself to tri/co-generation applications. The power consumption density in these facilities is at the high-end of the spectrum and runs 24/7/365. In addition, the equipment that uses the power must be cooled 24/7/365. The electrical and cooling load profiles are thus very flat throughout the day, suiting the application of absorption chillers very well.

In addition to the cooling requirements, MTN is always looking for ways to get things done quicker, smarter, more sustainably and more cost effectively. Sometimes this includes spending more initially.

Going hybrid

The hybrid cooling tower installed for the Doornfontein project is the first of its type installed in South Africa. Evapco assisted with the water and power savings comparison between conventional open-circuit cooling towers and the new Hybrid cooling towers. The long-term annual forecast, based on 100% load and Johannesburg weather data, predicts that the installation will save 36% water per year. Compared with traditional non-hybrid closed-circuit cooling towers, the new hybrid technology will save 14% water and 19% electricity based on the selected configuration.

To make sure the plant uses the least amount of energy and water, the cooling tower also cools down the engine and intercooler water from the gas fuelled

1. Hot water from gas fuelled generator to and from absorption chiller.
2. Chilled water piping – labelled.



Continued on page 43

Continued from page 41

generators. The efficiency of the hybrid cooler is much higher than normal radiators and will only be used when the cooling load in the facility is too low or when the chiller is not active. The capital cost avoided is not much, but every bit counts.

In other industries and on the coast, HDPE has been used for a long time. For chilled water systems, plastic pipes are not ideal because of the linear expansion due to temperature fluctuations, but HDPE piping has a lower linear expansion coefficient than other plastic piping systems and has the added advantage of speed of installation. The installation time and quality is superior to the average steel welded job. The skill of the operator does not influence the quality of the weld. The challenges of working with HDPE (as with most other plastic piping) include the shorter span between supports and fitting sensors into the HDPE piping which are plumb and straight.

The condenser water system is more complicated due to the additional cooling that will be required by the gas fuelled generators when the absorption chiller is not in use.

All the piping in the plant room is protected against ambient conditions and to improve visual appearance of the installation, coloured vinyl cladding in lieu of normal metal cladding was used. This also enables the intricate piping (hot water, chilled water and condenser water) to be easily traced.

System description

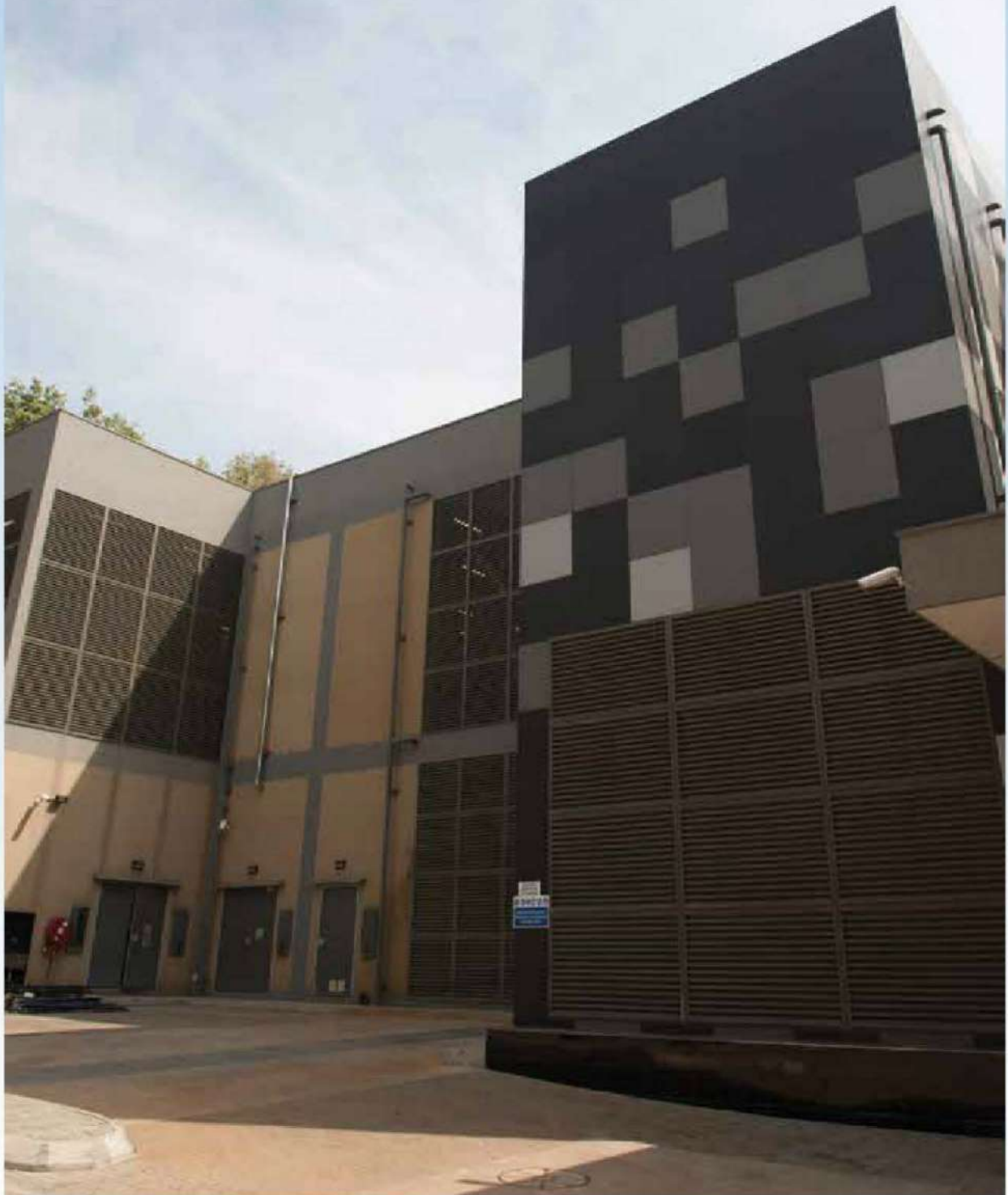
The HVAC system in the Doornfontein switch was an existing installation consisting of a dual-redundant system, boasting two independent chilled water systems to ensure reliability. The co-generation plant co-exists in parallel and will be used to provide chilled water via plate-to-plate heat exchangers to both the A and B systems. The co-gen plant consists of a 716kW absorption chiller that utilises the waste heat/hot water from the 1 MW MTU engine to generate chilled water at 6°C.

1. *Make up water and chilled water storage tanks and very clever Sage control panel for the cooling tower.*
2. *Chiller – right; pumps centre; heat exchangers left.*
3. *Broad absorption chiller.*



Continued on page 45

“ Doornfontein co-gen is part of the MTN vision to not only have alternative power sources, but also to make power more affordable. ”



Continued from page 43

This water is then pumped through two plate-to-plate heat exchangers to the dual redundant chilled water reticulation systems. This allows the electrically driven chillers to be off almost all the time, thus saving electricity. To ensure that the system does not hunt, a buffer tank of 6 000ℓ was installed. All in all, a very simple system. Three-way valves regulate which heat exchanger will be used and although the pumps are fitted with variable speed drives, they will run mostly at the same speed when the full complement of cooling is required.

The condenser water system is more complicated due to the additional cooling that will be required by the gas fuelled generators when the absorption chiller is not in use. Plate-to-plate heat exchangers separate the HVAC condenser water from the engine water of the generators and three way valves control the water flows. The cooling tower is a new generation hybrid cooling tower from Evapco. This tower is the second generation of hybrid cooling towers and was designed by Evapco from scratch with energy and water savings in mind.

All the piping in the plant room is protected against ambient conditions and to improve visual appearance of the installation, coloured vinyl cladding in lieu of normal metal cladding was used.

Challenges

It is always challenging to work for MTN, explained Adèle van der Walt of Ingenium Engineers, who designed this system. "Willem Weber of MTN thinks up new ways of doing things in his sleep! The recipe for the plant exists. The new HDPE piping was probably the biggest challenge," said Van der Walt. "It was unknown and even now, I would like to see with my own eyes that the expansion will not be excessive although it was taken into consideration at design and implementation time."

At the end of the project, the team also realised that it is imperative to ensure that that the condenser water does not flow/trickle through the absorption chiller when the chiller is not active as this can cause the chiller to freeze up.

1. Condenser/chilled water pumps and chiller.
2. One of these pumps up close.





Sage controller interface

The other difficult aspect was to discard the 'old way' of installing monitoring systems and renew it to match the look of the vinyl-cladded pipes. "MTN insists on hiding away all wires which is sometimes extremely difficult in a plant room setup", said Van der Walt. "IES (the contractor) and all the subcontractors worked together as a team to get the final product looking this way. Chris and Duane Braund were both pivotal in getting everything in place in time and within the budget."

Product choices

The advantage of working for MTN is that they are open to new ways of doing things, said Van der Walt. The absorption chiller was part of this project from day one. Having seen the high volume of water used at the 14th Avenue installation, the hybrid cooling tower from Evapco was an obvious choice. The client (Willem Weber) insisted on using HDPE piping to see if future roll-outs cannot be done in a shorter time.

Savings

If one takes a conservative coefficient of performance (COP) of a chilled water system at 2, then the plant will avoid approximately 300kW of energy. This includes the pumps' parasitic loads. The numbers are still estimates; the proof is in the pudding and will be measured as soon as it has been running for a full year.

As mentioned earlier, this system also uses 36% less water than normal open cooling towers.



EVAPCO SOUTH AFRICA (PTY) LTD.
Reg. No. 1998/018098/07

SPECIALISTS IN HEAT TRANSFER PRODUCTS AND SERVICES



Mr. GoodTower




PRESERVING THE ENVIRONMENT

eco-Hybrid Coolers

The NEW Family of Closed Circuit Coolers

New!



New!

Providing maximum water savings & higher dry switch over temperatures offering combination wet and full dry mode operation

NEW!

ARID fin Pak
Ellipti-Fin spiral fin wet coil design and ARID Fin Pak Dry cooling coil technology

Evapco S.A. (Pty) Ltd
18 Quality road
Isando, Kempton Park
PO Box 262
Edenvale, 1610
Tel: 011-392-6630
Fax: 011-392-6615
evapco@evapco.co.za

eco-ATWB-H

Environmentally Conscious Operation Hybrid

www.evapco.com



Sage
CONTROL SYSTEM

About the Eco-Hybrid unit

Evapco has developed a unit which is BOTH environmentally conscious and environmentally responsible. The new eco Hybrid, features full wet and dry modes of operation, seeking to provide the best of both worlds. This unit offers the perfect balance and compromise between water savings and energy savings, while still designing around the benefits of a water-cooled system with the lower installed power and the high COPs. This unit is a win-win for both the client, and the environment. **RACA**



Hybrid Evapco cooling tower. Note the grid – there is a 1m deep access floor where all pipes are hidden.

List of professionals			
		Name of company	Contact person
Owner		MTN	Willem Weber
Developer		MTN	Willem Weber
Architect / Designer		Project Works	Justine Pieterse
Project manager		ISF	Ian Funeka
Consulting engineer	Electrical	CAI	Louis de Kock
	Mechanical	Ingenium Engineers	Adele van der Walt
	Structural Engineers	DSM Engineers	Mike Silberman
Contractors	Main building	ISF Services	Ahmed Katrada
	HVAC & R	IES	Chris Braund
	Electrical	Master Power	Braam Pretorius
Product suppliers	Hybrid Cooling Towers		Evapco
	Absorption Chillers		Voltas/Broad
	HDPE Piping		Natal Plastics
	Electronic services		Ushaka
	Piping Insulation		Fedder & Moffat