WWF

REPORT

ZA

2015

DANISH-
SOUTH AFRICAN
PARTNERSHIPS
FOR WATER

INNOVATIONS
in the SA water sector
Danish investment into water management in South Africa

DANISH PARTNER

SOUTH AFRICAN PARTNER

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The World Wide Fund for Nature (WWF) is one of the world's largest and most experienced independent conservation and environmental organisations, with over six million supporters and a global network active in over 100 countries.

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WATER FOR SOUTH AFRICA

Eight percent of South Africa's landscapes provide more than half of its fresh water. Apart from their priceless water value, these water source areas are key biodiversity areas, rich in plant and animal species. Despite this, many of the water catchments within these landscapes are not protected and are often infested with alien invasive vegetation which absorbs vast quantities of water.

"To boost water quality and water security along the catchments we are engaging with landowners, local government, communities and agri-industry," says Christine Colvin, Freshwater Programme Manager for WWF South Africa. "We are also working with partners to address the sanitation challenge we face in many towns. Dysfunctional sewage systems threaten water quality in many of our critical catchments. A positive trend is that an increasing number of commercial farmers, industries, communities and municipalities are willing to get together to discuss the co-management of water resources."

INTRODUCTION TO THE PARTNERSHIPS

We rely on the natural environment to meet our needs – it is the foundation of human well-being. On a daily basis, living landscapes provide us with food and water. WWF's vision is to build a future where all people live in harmony with nature.

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Trine Rask Thygesen, Ambassador of Denmark to South Africa

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Christine Colvin, Freshwater Programme Manager for WWF South Africa

WWF South Africa has a particular focus on freshwater, and aims to help build water security in South Africa, with healthy catchments sustaining people and nature, and supporting economic development in a time of climate change.

All countries face threats to their water security from pollution, growing demands, drought, changing land uses and climate change. In the future we will all need to do more with less, to feed a growing population in a warming world. Our water sector will need to be strengthened to enhance the quality and quantity of supply. Innovations in technology, land and water management systems, together with skills development, are needed to cope with our current challenges and ensure sustainable water for all.

South Africa and Denmark have a history of collaboration. From 1963 to 1994, the Danish government provided significant support to the victims of apartheid during the struggle for democracy. This included supporting educational initiatives for the disadvantaged, environmental management projects, good governance and democracy-building processes, as well as general human rights empowerment.

Since 1994, the first year of our democracy, the Danish government's support has continued including significant investment in the implementation of integrated water resource management, in support of the South African National Water Act (1998) and the development of South Africa's water sector.

This phase of bilateral support has come to an end, and, in recognition of South Africa's leading role on the African continent and in the BRICS developing countries association, a new relationship of trade and technical cooperation is beginning.

In 2013, the Royal Danish Embassy in Pretoria, South Africa, and WWF-SA began a partnership to enable Danish-South African collaboration in the water sector.

The project began with an exchange visit to Denmark by more than 20 representatives from South African water institutions and local government, including the Department of Water and Sanitation, and the South African Local Government Association. The South African delegation was hosted by State of Green, the official green brand for Denmark, and visited Danish companies and organisations implementing cutting–edge solutions to universal water issues. South African-Danish partners were then invited to submit proposals to collaborate on the development of innovative pilot projects to be tested in the South African context.

The projects that are summarised in this report were selected by WWF-SA and the Royal Danish Embassy to demonstrate innovation and skills development in the South African water sector. The projects have been implemented during 2014 and 2015 across the country, from the Western Cape to the far reaches of the Inkomati catchment in Mpumalanga province and a rural town in Limpopo province.

The water-energy nexus in these projects is addressed at the local government level, with improved energy efficiency in water management and wastewater treatment at Drakenstein Municipality by VCS, as well as in energy production with an assessment of new technology from Haldor Topsoe that can reduce Eskom's water consumption in coal-fired power plants. Productive use of cleared alien plants has been made possible for farmers in the Western Cape with the use of a wood chipper from Linddana and improvements in water efficiency were tested in agriculture by FynBloem in partnership with Grundfos. Water losses in the rural north can be mitigated with new leakage detection monitoring introduced by Kamstrup in partnership with the local municipality. DHI South Africa have established online flood prediction and monitoring in the Inkomati catchment, and have developed a new web tool to support farmers in water stewardship in the Breede catchment. The DHI projects have been carried out in partnership with new catchment management agencies which will be critical for South Africa's sustainable water resource management in the future.

These pilots have demonstrated exciting new innovations in technology, skills and management systems that can support a stronger water sector and more efficient, productive water use. Water connects us all, and these projects have connected a range of committed partners from the north and south in building a more water-secure future.

Thank you to the people of Denmark and the Royal Danish Embassy for enabling this investment in our water sector. We look forward to experiencing the results of these incredibly important projects with you.

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Most wetland plants control erosion by reducing stream energy and stabilising soil, which helps river environments recover better after flood damage. One such plant is palmiet (pictured above), which is found in Cape river systems such as the Riviersonderend River.

PURE WATER FOR PROTEAS

"Three years ago we had to start addressing a serious, escalating water problem with our cultivated proteas," explains Beyers Beyers, CEO of FynBloem.

© FYNBLOEM

Beyers Beyers, CEO of FynBloem, together with Noah Chinyanga, the general manager, plantation

Situated between the villages of Greyton and Riviersonderend in the Western Cape, FynBloem farm has 83 hectares of established fynbos – including 27 different cultivars of proteas and 10 Leucadendron species – all grown for export, mainly to Europe where it supplies Marks & Spencer, Tesco and Sainsbury's.

FynBloem was founded in 2009 as a partnership between Beyers and FynBloem's Denmark-based director, Laurits Møller Larsen. Beyers and Larsen have known each other since 2000, when Beyers initially exported dried fynbos to Larsen.

The Big Issue
Optimising the number of 'jobs per drop' is a priority for water scarce South Africa. This often requires careful management to ensure we are getting the most productive use out of limited water resources. Careful management and monitoring of water quality is a critical part of farm-water management, and the technology used on this protea farm helps the blooms use less water and last for longer on their journey to Europe.

"When drawing water from the Riviersonderend River for irrigation, we started picking up excessive levels of sodium and magnesium in the water at certain times of year. This can burn the roots of the plants, affect their water uptake and reduce their yield," Beyers adds. "In response, we have had to use one and a half times the amount of water that these plants normally need in order to flush out the sodium and magnesium. This was simply not sustainable and we needed to address the problem more efficiently."

With its water supply originating from the Theewaterskloof Dam, approximately 100 kilometres away, FynBloem is down river from a number of wheat farms where the lands are fertilised and the run-off heads down the catchment.

Beyers believes that as upstream farming expands and becomes more intensive in soil preparation and fertiliser application, so the sodium and magnesium content downstream intensifies.

"In addition to better water conservation and management, we are in the process of installing solar technology for our pack house, with input from the Danish International Development Agency. The Danes are experts on renewable energy and they are also highly supportive of agriculture."

To address this growing problem he approached Charles Cherry, his local irrigation specialist and a civil engineer, who operates from the nearby town of Grabouw. He also consulted with Janeke Hoffmann, business development director for Danish pump manufacturer Grundfos.

"As Grundfos produce the best pumps, it was essential to match the best irrigation design with the best pump for optimal outcome," says Beyers.

Cherry explained how this irrigation solution would provide an alternative water source to help dilute the overly salinated water as and when necessary: "In a low pressure pipeline over four kilometres, FynBloem is gravity-feeding water that comes from a mountain stream to the point of the river where water is currently pumped for irrigation."

© FYNBLOEM

In 2013, South Africa supplied 90 percent of the world's 10 million stem protea market – and this demand is estimated to be 12 million stems in 2015. In 2013, FynBloem had a 30 percent share in this market which was expected to increase to over 35 percent by 2015.

"When the sodium and magnesium levels are high, we can now mix in the mountain water we need, and when levels are low we increase the amount of water coming from the river."

"The existing pump has also been replaced with a vertical multi-stage Grundfos pump, making the whole system automatic. I can manage and monitor it from my office on the farm, or wherever I am in the world," adds Beyers.

"None of this would have been possible without the investment from the WWF-Danish partnership, which is contributing one-third of the costs of this system, while we are inputting the rest."

FynBloem is a local leader in social, environmental and financial sustainability standards. With a permanent staff of 162 people and 30 contract staff during peak season, FynBloem is also working on offering selected employees a stake in the company by way of the workers ownership trust, which will provide them with a more financially stable future.

"Success for me is measured by your people," says Beyers. "At FynBloem we believe in rewarding our team for their commitment."

Initial results

"The less water we use per hectare as a result of the new system, the more sustainable we become, both in terms of water and energy usage," says Beyers. "With better quality water we should be able to pick more stems per plant, perhaps 15 percent more. We'll be able to share the results from the first harvest. We are also planting an additional 13 hectares. These plants will give us a good indication of the kind of results we can achieve because they will be receiving the better quality water from day one."

Guidelines for best practice learned in this project

Reliable, clean water means that FynBloem will be able to introduce carefully controlled amounts of fertiliser into the drip irrigation system, which they could not do before because when you add fertiliser to water with a high sodium and magnesium intensity, you substantially increase the overall salt intensity. "We are producing stems at a high rate so we need to use fertiliser but with lower sodium and magnesium levels we will be able to irrigate less and flush less and therefore also use less fertiliser," Beyers explains.

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WWF-DANISH INVESTMENT INTO THE COST OF THIS IRRIGATION SYSTEM

© FYNBLOEM

To reduce its carbon footprint and as an inflation buffer, FynBloem's target from July 2015 is to send 30 percent of its flowers by sea freight.

WHEN THE FLOODS COME

From the Gauteng boardroom of DHI South Africa, an online system is able to forecast flooding in real-time in the Inkomati catchment in South Africa's Mpumalanga province.

© DHI SOUTH AFRICA

From left: Hydrologist Jason Hallowes, the managing director of DHI South Africa and his colleagues Mehari Frezghi, an agricultural engineer, and Moroka Letshela, an environmental scientist

"The Crocodile East River extends hundreds of kilometres eastwards through the Nelspruit industrial area, the Lowveld agricultural area and the Kruger National Park where it joins the Komati River on its way into Mozambique. It has a catchment area of 10 446 square kilometres and a mean annual run-off of 1 236 million cubic metres per year," explains hydrologist Jason Hallowes, the managing director of DHI South Africa, a global company that specialises in water environments, with headquarters in Denmark.

The Big Issue

The power and force of water in full flow becomes a frightening reality when mighty rivers are in flood, causing damage, destruction and death. It emphasises the necessity of flood forecasting through accurate year-round water monitoring and management. This project aimed to provide a better system to monitor and manage catchment flow, dam levels and weather patterns.

The flood forecasting system significantly assists the local catchment management agency – the Inkomati-Usuthu Catchment Management Agency (IUCMA) – in the advance management of flooding throughout this catchment, where water levels can rise several metres in less than a day.

This flood forecasting project is a partnership between DHI, the IUCMA and the Department of Water and Sanitation. It builds on the Decision Support System (DSS), a real-time, online water management system that DHI implemented for the IUCMA in 2010. This system gathers information on the current status of flows and dam levels in the catchment, and combines this with a rainfall forecast from the South African Weather Service, thus assisting the IUCMA to monitor and manage the release of water from the upstream dam.

"We've now integrated the flood modelling system into the DSS, and we can thus extend the flood warning lead time to between 10 and 14 days," says Hallowes. Discussing the system alongside him are his DHI South Africa colleagues Mehari Frezghi, an agricultural engineer, and Moroka Letshela, an environmental scientist.

"The flood warning forecast is ultimately aimed at getting people, livestock and infrastructure out of the danger zones, including large irrigation systems, ploughs and pumps," Frezghi explains. "At the same time it is aimed at putting mitigation measures in place, such as protection dykes and sandbagged areas to save homesteads and common agricultural crops such as sugarcane and citrus."

"The social, economic and environmental benefits are far greater than the cost of the warning system, particularly since the number of natural disasters such as flooding is predicted to increase with climate change," Hallowes adds.

DHI has been designing flood forecasting and water management systems for 30 years and the new customised systems, including the latest flood toolbox designed in 2013, are increasingly accurate.

"The system has to be reliable because if it is inaccurate people won't trust it the next time around," adds Letshela. The data is also shared via a public website that includes a water resources information dashboard where flood forecasting will be highlighted.

The forecast is based on flow modelling of measured information from a range of sources, including weir gauges along the course of the catchment that determine the height of the water, rainfall, timing of flow peaks and flow waves, and satellite information. The information is received by the IUCMA's operations centre in Mbombela, from where it is distributed to the municipal, regional and national disaster coordination committees. To understand the extent and reach of this project, the DHI team gives an overview of the catchment's complex water management system.

"Competing water demands in the highly over-allocated Crocodile River catchment – including massive water demands from agriculture for irrigation in IUCMA catchment areas in South Africa – complicates the management of the catchment with its many unregulated tributaries and competing local, international and ecological demands," Hallowes explains. "There are frequently periods when water restrictions need to be implemented."

Only one dam at the top end of the catchment, Kwena Dam, regulates the flow to some degree for water users on the main stem of the Crocodile River. The IUCMA and the Crocodile River Irrigation Board (CRIB) cooperate closely over the management of the water, but up until 2010 there was no system in place to inform them, in real time, about the flow in the different tributaries or the total water supply and demand. This made it almost impossible to manage the system in an optimal, sustainable manner. Too little or too much water would be released from the dam, impacting water security throughout the catchment.

The newly integrated system not only resolves many of the above issues, it also helps to ensure that all water users are complying with their water use allocation, and this has helped to reduce tension between competing water users. A public website displays all the relevant information on river and reservoir levels, weather data, modelling results, international obligations and environmental requirements to facilitate maximum transparency and buy-in.

10 446 KM²
THE SIZE OF THE INKOMATI CATCHMENT AREA WITH HEADWATERS IN SOUTH AFRICA AND ENDING IN THE INDIAN OCEAN

Initial results

While the Inkomati catchment is still one of the most over-allocated catchments in South Africa, the difference is that the stakeholders know that a world-class management and flood forecasting support system is in place to help ensure their water is managed optimally to reduce the devastation from flooding.

Guidelines for best practice learned in this project

Getting all stakeholders on board to see the value of effective modelling systems is essential to the success of this kind of project. Meetings, discussions and presentations at every level – which include the CMA, CRIB, municipalities, regional and national disaster management authorities – have been well received and improvements are ongoing.

Useful Links Decision Support System: *www.inkomaticma.co.za* & River Operations application

© DHI SOUTH AFRICA

Fish ladder in the Inkomati catchment, to facilitate fish migration through the river system. "With the addition of our new flood forecasting system we now have a catchment-wide system where we're basing our decisions on information available, in real-time, at our fingertips, and we have far better knowledge of what's going on in the catchment, and how to respond," says Brian Jackson, IUCMA's executive manager for water resources planning.

WOOD CHIPS FOR WATER

It is a shocking sight to see a river choked with alien invasive trees and biomass, the remains of woody invasive trees chopped down but never removed.

© KOBUS TOLLIG

Dr Saskia Fourie, Water Balance Programme Manager for WWF South Africa, inspects a river choked with dense alien biomass

This river is in the Western Cape's Riviersonderend catchment, which is in one of South Africa's key water source areas and part of the critical eight percent of our land area that provides half the country's fresh water. It is also one of the last remaining palmiet wetland systems in South Africa. Palmiet is an indigenous, semi-aquatic wetland plant that is essential for year-round water storage, sediment stabilisation and slowing down of flood waters.

"When it floods, the force of the water pushes these felled trees down the river, scouring both the riverbed and river banks. This is devastatingly changing the shape of the river structure and creates fast-flowing erosion channels instead of a diffused slow flow across the well-adapted palmiet wetlands," says Dr Saskia Fourie, Water Balance Project Manager for WWF South Africa.

Water-thirsty alien invasive plants are also sucking up the water and destroying palmiet wetland systems, which should be anything from 50 metres to 200 metres wide.

The Big Issue

Alien plants such as wattle, pine and eucalyptus are a threat to water resources in South Africa because they invade catchments and use much more water than indigenous plants.

It is estimated that approximately 1.4 billion cubic metres of water are lost annually in catchments invaded by alien plants.

There are several clearing programmes, both government and private, that are attempting to eradicate alien plants. But once the wood is cut down it is often left behind, creating another risk for intense fires and damage to river systems in flood.

This project introduced a world-class wood chipper and demonstrates how value can be created out of 'waste' wood generated from clearing alien plants – while also saving more water.

Water saved through removal of invasive alien vegetation

Research conducted by South Africa's Council for Scientific and Industrial Research (CSIR) shows that the national average for South Africa is 2 076 kilolitres of water gained per hectare cleared, and it is estimated that the clearing of invasive alien species in the entire Riviersonderend catchment can increase water yield by 13 million cubic metres annually.

"This long-term project aim is to attract an increasing number of landowners along the catchment to participate and to become biodiversity and water stewards."

"Fortunately the river system can still be saved with timeous intervention and restoration," says Fourie who is overseeing this project alongside on-the-ground project manager, Eben Olderwagen, from NCC Environmental Services who is contracted by WWF-SA.

From October 2014 to October 2015, over 180 hectares of alien invasive trees – predominantly black wattle but also long-leafed wattle, golden wattle,

© KOBUS TOLLIG

The wood chipper is mobile and will be transported from one river-fronting farm to the next to deal with the biomass. The initial focus area for the project is a 12-kilometre stretch between Greyton and the Theewaterskloof Dam. In time, it will make sense to bring in additional wood chippers, but at R400 000 per machine, including transport from Denmark, it is a costly investment.

blackwood, beefwood, eucalyptus and pine – have already been cleared from the Riviersonderend catchment, extending from farms above the Theewaterskloof Dam near the town of Villiersdorp to Meulrivier Farm near the village of Greyton.

The project has decades of alien invasive trees to clear, in partnership with the Department of Environmental Affairs, the Breede-Gouritz Catchment Management Agency, Nedbank, and the region's landowners and farmers who are directly dependent on the river for their irrigation needs.

Without a viable method of dealing with the abundant biomass though, the river restoration project cannot make sufficient headway nor achieve the required landscape and water recovery.

Enter the TP 270 tractor-driven wood chipper, funded through the Danish Embassy and purchased from Danish company Linddana, renowned for its quality machines. The wood chipper started working on Meulrivier Farm where chunks of alien invasives are fed into it and wood chips effortlessly flow from it.

"The wood chips provide extremely good mulch for our apple orchards. It protects the soil and increases its carbon content and fertility, which in turn, leads to a decrease in the use of fertiliser and better fruit production," says farmer Carl van Lingen of Meulrivier Farm.

"We also do not need to irrigate as much when the soil is well protected because the water does not evaporate as quickly," he explains.

"As part of the project we have trained up a team of four people to operate the wood chipper," Olderwagen explains. "This creates jobs for people in the local communities, as does the South African government's Working for Water clearing work which includes seven teams of 13 local people per team, 60 percent of whom are women and 60 percent young people."

"We are fortunate to have developed strong relationships with most of the farmers in the project area because they need to commit to follow-up management," says Fourie.

"They need to ensure that the riverine areas cleared on their farms remain free of alien invasives and that the indigenous plant restoration project in the riparian zone is maintained."

Initial results

The TP 270 tractor-driven wood chipper can chip wood up to 270 millimetres in diameter and produces about 24 cubic metres of wood chips per day. One tonne of wood chips contains an average 1.4 cubic metre solid content wood, though this varies between different types of wood.

Guidelines for best practice learned in this project

Partnerships with government are often demanding to administer. It is essential to have a reliable, professional project manager like Olderwagen in the field to ensure the projects are running properly and that each team is well managed.

The teams need to be thoroughly trained in a variety of skills – from chainsaw operating to herbicide application, first aid to health and safety. They also need training in professionalism and meeting project targets, based on Working for Water's set of norms and standards.

2 076
KILOLITRES OF WATER GAINED PER HECTARE CLEARED

Useful Links Find out where your water comes from: *www.journeyofwater.co.za*

HIGH TECH LOW WATER

It is expected that continuing with current conventional technology, Eskom will need approximately 3.6 million cubic metres of water per year to run a power station such as Majuba in Mpumalanga province.

Dr Emma Mokoena is one of the chemical engineers who worked on this project

Danish technology innovation company Haldor Topsoe offers an alternative solution that does not use any water. Known as the SNOX™ process, it can be retrofitted to any coal-fired power plant.

The Big Issue

Approximately 77% of South Africa's energy needs are directly derived from coal, including 81% of our coal-fired electricity production. Although South Africa has a transition plan to a lower-carbon economy and has introduced renewable power into the energy mix since 2013, coal-fired power stations will still be with us for a while. Energy derived from coal not only results in carbon dioxide (CO_2) emissions but dust and ash as well as harmful nitrogen oxide (NOx) and sulphur oxide (SOx).

Conventional technology requires a lot of water and many of our coal-fired power stations are located in dry areas where water is already a scarce resource. Using a desktop study, this project examined the feasibility of using innovative technology to dramatically reduce the amount of water required to regulate the sulphur oxide emissions from coal-fired power stations.

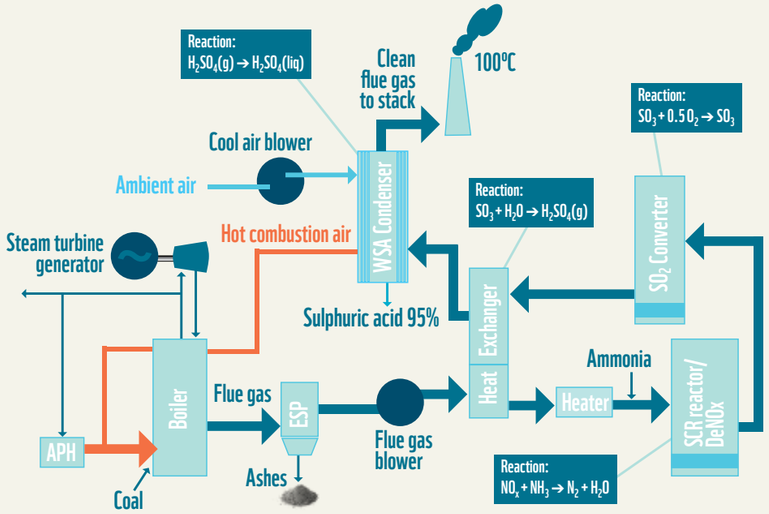
"The SNOX™ process is a clean coal technology option that can achieve emission levels similar to conventional technologies without the need for additional water. It can be used for any grade of coal and it produces three to four percent less greenhouse gases, plus the flue gas that comes out of the stack is well below legislated requirements," says Helge Rosenberg, local managing director for Haldor Topsoe.

Eskom is currently installing their first conventional water-based process plant to reduce the levels of sulphur oxide on one of their newly built power stations. However, it remains a water-based process that also requires limestone and produces a commercial grade gypsum byproduct. Sourcing and disposing of both limestone and gypsum adds additional cost and logistical requirements.

In contrast, the SNOX™ technology does not use limestone nor produce gypsum. The byproduct from this process is a commercial grade sulphuric acid – of which approximately 1,600 tonnes will be produced per day from a power station like Majuba. As part of the project, a research study has been conducted to assess the market viability for sulphuric acid, which is in high demand globally for fertiliser and also used by the mining industry. Sulphuric acid cannot be easily disposed of, and it is therefore essential to have a confirmed and reliable market for it.

Rosenberg adds that while the SNOX™ technology is more expensive than the conventional water-based process, water security considerations could drive the uptake of the technology. The project team is currently carrying out a lifecycle analysis with Eskom to estimate the cost differentials between SNOX™ and conventional technologies. This will quantify both the water and financial savings, and thus help to justify SNOX™ technology as a viable option for South Africa.

SNOX™ Process



- Starting with an additional filter system, dust and ash is almost completely removed, typically from 20-50 milligrams per cubic metre of flue gas down to 1-2 milligrams per cubic metre.
- A small amount of ammonia is added to the remaining flue gas and, initiated by a catalytic process, the nitrogen oxide (NOx) is converted into harmless water (H2O) and nitrogen (N).
- Sulphur oxide is then passed through another catalytic process which converts SO2 to SO3, followed by a moderated cooling process under which SO3 reacts with a small amount of water vapour already present in the gas to form sulphuric acid (H2SO4) in vapour form.
- Using large air-cooled condensers, the vapour is then condensed – or liquefied – from which the commercial grade sulphuric acid is produced.
- The flue gas leaving the stack is now free from dust and with concentrations of nitrogen oxide and sulphur oxide well below the required limits.

Initial results

"We have been focusing on this study with Eskom since April 2015 and we are completely confident of the technology," says Rosenberg. "It has 20 years of operation behind it, and it is used in plants all over the world, including Denmark, Austria and Brazil. We look forward to the results of the study that will specify the savings for a power station like Majuba."

81%
OF ELECTRICITY COMES FROM COAL-FIRED POWER STATIONS

Guidelines for best practice learned in this project

South African partnerships are a key factor — there will be a huge element of local content into possible future SNOX™ projects in South Africa. It is also very important to invest in skills development. Two exceptional South African chemical engineers with whom we have worked are Dr Emma Mokoena and Xolelwa Ntlango.

"SNOX™ technology is used in plants all over the world, including this plant in Austria. It is all about the correct technology for the process and this is what Haldor Topsoe is proposing for one of Eskom's largest power stations, Majuba, in South Africa's Mpumalanga province," says Helge Rosenberg.

REDUCING WATER RISK HOTSPOTS

"Fruit farming in the Ceres area had been identified as a water risk hotspot in South Africa," explains Dr Klaudia Schachtschneider, Water Stewardship Programme Manager for WWF South Africa.

© WWF-SA

South Africa has approximately 3 445 export fruit growers and an additional 400 fruit growers who supply the local market

Supplies of peaches, nectarines, plums and apricots grown in the Breede catchment in South Africa's Western Cape were identified as being at risk following a supply-chain analysis on WWF's water risk filter web tool. The water quality from this catchment does not always meet international standards and the water quantity can be unpredictable.

The Big Issue

Farmers are the biggest direct users of water – 66% of all South African consumption – and the most widespread custodians of landscapes in our catchments. It is critical that they are supported in managing water and land resources to maximise the benefits for all water users. Water stewardship involves mimimising negative water impacts and joining forces with your catchment neighbours to tackle shared risks. This project developed the first online support tool to support farmers in this area implementing the international Alliance for Water Stewardship (AWS) standard. It grew out of an existing partnership between WWF-SA, the Breede-Gouritz Catchment Management Agency (BGCMA), GIZ and the retailers Marks & Spencers and Woolworths, together with their fruit suppliers in the Ceres area.

"In 2014 we started working with farmers in the Ceres fruit-production area who fall under the local catchment management agency to identify their key water risks and to pilot the first Alliance for Water Stewardship standard towards addressing these risks," Schachtschneider continues.

The three key water risks identified were:

- Pollution from rapidly expanding low-income settlements;
- Rapidly invading alien plant species, which decrease run-off;
- Continued poor practice because of lack of awareness and limited or fragmented access to information.

When it came to discussion about how to go about complying with the AWS standard, what quickly emerged is that farmers are suffering from 'compliance fatigue'. They have to comply with so many different standards that yet another one was daunting for them. The alliance's methodology is also better suited to larger companies that have a sustainability team to address the requirements.

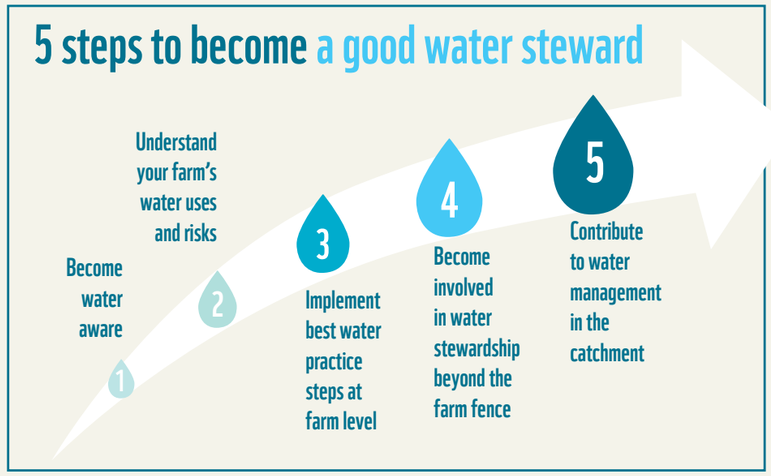
WWF-SA and the Danish Embassy recognised the need to simplify the process, and contracted DHI South Africa, a global company that specialise in water environments, to develop an easy-to-use, free, water stewardship web-based tool.

The aim of the online tool is to give farmers and businesses the opportunity to begin their water stewardship journey with guidance on the best local information available.

© KLAUDIA SCHACHTSCHNEIDER

On the Farm Romansrivier in Wolseley, these young fruit trees are irrigated with a microjet system, and mulch is used on top of the soil to improve the water retaining capacity of the soil, and therefore reduce irrigation frequency.

"The web tool includes the six-step structure of the AWS standard, but makes it locally relevant with pragmatic descriptions and tips to help people understand their water use and what actions they can take to manage their water better," explains the managing director of DHI South Africa, Jason Hallowes.



"The tool also helps you to gain a far a better understanding of the risks around water supply," Hallowes continues. "The value of water is not only reflected in its price; it is also in the risks associated with it. The lack of water supply or an erratic water supply can be catastrophic for farmers, just as too much water in mining can halt production with massive economic impact. Polluted water can also result in severe environmental consequences, and make crops unusable."

On the positive side, you can make significant economic savings if you manage your water efficiently, such as putting systems in place that reduce leakages and that recycle water where appropriate.

"The added benefit of pursuing water stewardship is that you can work on water stewardship within the internationally recognised format set out in the AWS standard. While the subscription to the alliance's standard is still voluntary, this provides a clear gauge as to how far along the water stewardship journey you are. Local and international retailers may start requiring AWS certification to protect the health of their customers and to meet their own sustainability goals in the future."

66%
OF ALL WATER CONSUMPTION IN SOUTH AFRICA IS BY FARMERS WHO ARE THE BIGGEST DIRECT USERS OF WATER

Your water is my water

The Alliance for Water Stewardship is an independent, global organisation that takes a 'whole cycle' approach to water stewardship — from sound management of wetlands, rivers and catchments, to the social and reputational issues of business management. It addresses the need for collective catchment management, where, whether we are upstream or downstream, we are dependent on each other for the quality and quantity of the water we receive.

Useful Links

WWF's water stewardship web tool: *www.wwf.org.za/what_we_do/freshwater*
WWF's water risk filter tool: *www.waterriskfilter.panda.org*
Alliance for Water Stewardship: *www.allianceforwaterstewardship.org*

Initial results

The web tool was officially launched in October 2015. Its approach and design has been well received by test groups. It links water users to relevant water and catchment information from many sources including the Department of Water and Sanitation, the Water Research Commission, and the Breede-Gouritz Catchment Management Agency. The tool is now ready to be expanded into other agricultural sectors such as sugar and sustainable wine.

Guidelines for best practice learned in this project

"The complexity of making something work simply is a difficult but necessary challenge," says Schachtschneider. "Solid water expertise is the first step, but it has required extensive work with our digital team and communications experts to make sure that our guidance on how to use the standard is accessible to farmers."

Agriculture in the Breede River Valley where the water quality from the Breede catchment does not always meet international standards, and the water quantity can be unpredictable.

SAVING WATER
LOSSES IN RURAL SOUTH AFRICA

The summer rains have not yet arrived in early October in the rural village of Lerupurupung in South Africa's Limpopo province. Situated a stone's throw from the Botswana border, the parched red earth is a billboard for the necessity to manage water.

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Electronics engineer, Thinus Botha, technical manager for Kamstrup in South Africa, demonstrating the water-monitoring meter

"We are still waiting for the rain," says Lerupurupung resident Paulina Malatji as she fills up her bucket from a communal tap in the street. Her home is right next to the tap, which eases the burden of fetching and carrying water. Half of the houses in the village have taps in their homes, the other half make use of these communal taps.

Lerupurupung's water is pumped from the nearby Lephalala River, which is running low ahead of the summer rains. From the river, the water is first led to a water treatment reservoir and then to a storage reservoir on a hill above the village, from where it is finally distributed to all the households.

The Big Issue

Preventing, monitoring and repairing water supply leakages in deep rural areas is a significant problem. Leakages are caused by anything from burst or blocked pipes to taps that are left running. As a water scarce country we urgently need to bring down the 37% of water losses that occur in most South African municipalities.

Thirty kilometres from the village in the town of Lephalale, the Lephalale Municipality manages the water for this remote area. It is provided free of charge to approximately 5 000 people, many of whom are unemployed, some work on farms in the district and others are subsistence livestock farmers.

When there are leakages or problems with the water supply, it can take days, even weeks, to locate the problem and have it resolved. Exacerbating the problem is that community members do not always know whom to contact to report leaks and broken taps.

"To demonstrate what can be done to reduce leakages and improve the management of water through accurate technological monitoring, the WWF-Danish partnership is funding a pilot project in Lerupurupung, using Kamstrup's water meters to monitor water use and track irregularities," says electronics engineer, Thinus Botha, technical manager for Kamstrup in South Africa. A Danish company, with an office in Pretoria, Kamstrup specialises in the design of water, electricity and heat energy meters. This project will install 40 of the blue, cricket-ball-size water meters on communal taps in Lerupurupung and 48 on taps in individual houses, plus a bulk meter at the reservoir on the hill above the village.

Simple in their sophistication, these meters are hardy and non-mechanical. Each meter has a lifespan of 16 years and they are designed in such a way that the parts are not useful to the general public, which minimises the risk of theft. They are also easy to install and the project will train approximately 12 local people to do this.

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Paulina Malatji filling up a bucket at the communal tap next to her home in the village of Lerupurupung. She says the water from this tap has been reliable. The Lephalale Municipality, situated 30 kilometres away in the town of Lephalale, manages the water for this remote area.

"The moment water flows out of the tap, the meter switches on and uses sound waves to measure the flow of the water. Every 16 seconds each meter sends information via a tiny, lithium battery-operated radio to a central 'concentrator', which has a miniature computer that can manage the information from a few thousand meters," Botha explains.

The concentrator will be installed at the top of the ultra-high lamp-pole of a large floodlight in the village. "From the flow readings the concentrator can detect if there are leakages or if the flow is insufficient, indicating a burst or damaged pipe. In addition, if the sum of the usage does not equal the sum of the water coming out of the reservoir it indicates leakage," Botha continues.

The concentrator has a simcard linked to the internet, and it logs the data for each meter every 16 seconds. Every six hours it then sends the information to the hosting server in Denmark, with an alert message if there is any problem, locating exactly where the problem is. An SMS or email detailing the nature and location of the problem is then immediately sent to the appropriate person in the Lephalale Municipality, as well to the town engineer.

A meeting was held in the local community hall to share with residents how the meters work and to answer any questions. In attendance were community members and delegates of the Lephalale Municipality, as well as representatives from the Johannesburg-based Spatial Planning Agency of Southern Africa (SPASA) who are partnering on the project. SPASA's senior data and GIS officer, Herman Motshegwa, did the on-the-ground and online layout for the project and they are also responsible for the overall quality of the water supply. SPASA assists local government in addressing issues of service delivery, governance, capacity building, integrated development planning and sustainable development.

"It's an important step towards managing water correctly for South Africa, with significant financial savings," said SPASA's financial manager, Ben Loggenberg. At the meeting the local ward councillor, Alpheus Thulare, reassured the community members that the meters did not have anything to do with billing them for water, which was a key concern they raised.

"These meters will help us to find and fix water problems much faster than before," he explained. "We won't be sitting without water for days."

"It will help us to manage our water better throughout the year because sometimes the boreholes inside the river dry up in the non-rainy season," added assistant technician for water from the Lephalale Municipality, Matlhodi Kgobiwa. This is the first time a project of this nature has been piloted in South Africa. "What is great about this model is that it can work equally well for small and large municipalities, and for urban and rural areas," Botha adds. "Once we demonstrate how much water it can save, the model will hopefully be extended to many other areas in South Africa."

Guidelines for best practice learned in this project

Community meetings and ongoing community engagements are key to the successful implementation of the project to ensure that community members understand exactly what water meter measuring is all about, how it can benefit them, and to encourage them to own the project. This way, they will take it upon themselves to ensure the meters are kept in good order. To get the project rolling the WWF-Danish partnership will cover the data hosting costs in Denmark for the first six months. Thereafter, SPASA has shown interest in assisting the Lephalale Municipality in hosting it in South Africa.

37%
WATER LOSS OCCURS IN MOST SOUTH AFRICAN MUNICIPALITIES

BLUE DROP, GREEN DROP

"This is blue drop world. This is green drop world," announce the banners in the civil engineering services head office of Drakenstein Municipality.


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From far left: Specialist water engineer and project manager Chris Swartz who is partnering with VCS and the Drakenstein Municipality on this project. Next to him, from the Paarl Wastewater Treatment Works are (from left) senior superintendent: wastewater, Mark-Anthony Watson, chief chemist: scientific services, Raymond Swarts and superintendent: wastewater treatment, Grant Rhoda

The message that the Drakenstein Municipality is conveying to its citizens is that every 'blue drop' of water (every freshwater source including rain, rivers, wetlands and dams) – and every 'green drop' (the wastewater treatment systems) – needs to be optimally managed because it is essential to human, economic and ecosystem health. In 2013, only 60 out of more than 300 wastewater treatment plants in South Africa achieved green drop status.

The Big Issue

Water leakages are a major problem with an average water loss of 37% for South African municipalities. The majority of South African wastewater treatment plants are also struggling to meet effluent guidelines and ensure safe water quality.
The Western Cape's Drakenstein Municipality has done exceptionally well by reducing water loss to 13%. This project looked to improve that level further within Drakenstein's water supply and wastewater treatment plants. Approximately 24 million litres or mega-litres (ML) flow through the Paarl wastewater plant per day, with a design capacity of 35 ML per day. Ensuring this system is operating optimally, with good quality discharge and minimal energy consumption, is also critical to the health of the natural environment especially the Berg River. This improves the health of the river, which in turn means that all downstream users of the water – including domestic, agricultural and industrial users – benefit from a better river quality.

"South Africa faces significant challenges in terms of water quality and quantity, now and in the future," says specialist water engineer and local project manager Chris Swartz who is partnering on this project with Danish water and wastewater company VCS and the Drakenstein Municipality.

"The aim of this partnership is to facilitate successful public-private partnerships by drawing on Danish technology and know-how to enhance South Africa's water and wastewater sector through a pilot project." Within the Drakenstein Municipality's six-town jurisdiction, Paarl and Wellington were selected for this pilot. From October 2014 workshops were held in Paarl, led by VCS's specialist water engineer Thomas Jørgensen and specialist wastewater engineer Per Henrik Nielsen and attended by a range of supervisors and scientists from the Drakenstein Municipality, as well as from the Stellenbosch and Breede Valley Municipalities. Based at the Paarl Wastewater Treatment Works the core team consists of Mark-Anthony Watson, senior superintendent: wastewater; Grant Rhoda superintendent: wastewater treatment; and Raymond Swarts, chief chemist: scientific services. They manage the operation and maintenance of six wastewater treatment plants and 12 wastewater reticulation pump stations to ensure the safe return of treated effluent back into the environment as per South African legislation.

"These are exciting times as the Drakenstein Municipality has achieved blue drop status for all drinking water plants, and green drop certification for one wastewater plant, acknowledging our high management standards. The input from Chris and the Danish specialists is now taking us to another level," says Watson.

“One example is the improvement of our biofilter efficiencies. These biofilters utilise bacteria that feed on solid organic material and require oxygen for the biological oxidation process. Through this collaboration we realised that we needed a more consistent inflow over the stone beds where the bacteria live. When the flow is inconsistent, the bacteria die off, which, in turn, leads to a reduction in efficiency when the flow increases.” Swarts and his team are constantly monitoring the type and quantity of bacteria (biomass) in the treatment system, as well as the ammonia and nutrient levels (nitrates and phosphates) in the wastewater effluent.

“Another issue in terms of operational shortcomings is that not all the operational staff thoroughly understand the biological and chemical processes in the plant,” adds Rhoda. “Training all staff in the basics of these processes would help to more accurately identify and rectify problems.”

The initial water and wastewater process that this project is addressing will:

- Provide guidelines to reduce water leakages in the system;
- Look at opportunities for water saving through water re-use and recycling, including further irrigation and other uses of secondary treated wastewater;
- Improve the quality of the wastewater plants’ final effluent which flows back into the Berg River;
- Provide specialist inputs into upgrading the Wellington wastewater plant.

The second phase will:

- Provide guidelines and best practices to improve the energy efficiency in the Drakenstein water supply and wastewater treatment systems;
- Generate power by installing micro-hydroturbines in the high-pressure elevated water supply pipelines from the Paarl mountain or other high-lying areas. This would reduce the electricity costs, as the Drakenstein Municipality would be able to use the energy it generates for its own on-site needs.

South Africa’s Water Research Commission has pioneered generating of electricity from our water pipes by placing micro-hydroturbines in municipal infrastructure. This has already worked well in Bloemfontein and VCS are assessing the Drakenstein infrastructure to see where this new technology could be implemented. Micro-hydroturbines help to further reduce leakages by reducing pressure in the pipes and then constructively convert the energy to electricity for use by the municipality.

Initial results

Drakenstein Municipality is already seeing significant improvements in the whole system. They have also increased the number of days when the final, treated effluent flowing into the river is fully compliant with all the specifications set out by the Department of Water and Sanitation. On days when it is not, such as when a pump has broken down or another incident occurs, the problem is far more quickly identified and mitigated.

13%
DRAKENSTEIN MUNICIPALITY’S REDUCTION IN WATER LOSS FROM 37% NATIONAL AVERAGE

Guidelines for best practice learned in this project

It’s extremely important that the laboratory staff and operations staff work hand-in-hand to empower the team and achieve optimum results with input from world specialists like the Danish.

Useful Links

More information can on microhydro-power and South African water management can be found at *www.wrc.org.za*

The Paarl Wastewater Treatment Works where good management standards are evident. This project is helping to improve biofilter efficiencies here. The biofilters utilise bacteria that feed on solid organic material and require oxygen for the biological oxidation process. “Through the WWF-Danish collaboration we realised that we needed a more consistent inflow over the stone beds (pictured here) where the bacteria live. When the flow is inconsistent, the bacteria die off, which, in turn, leads to a reduction in efficiency when the flow increases,” says Mark-Anthony Watson, senior superintendent: wastewater.

CONCLUSION

If we are to meet the enormous challenge of supplying enough water to meet our growing needs, it can no longer be 'business as usual'.

Water management is undertaken by a myriad of institutions, directly in the water sector and indirectly by those who impact water resources. The projects we have supported during this partnership, have engaged a diverse array of organisations to build and strengthen relationships that support new ways of 'doing business' with water.

New technologies, such as the high-tech Kamstrup water meters attached to communal and individual taps, can dramatically improve our understanding and management of our water systems. However, they are not sustainable without the broader support and understanding of the communities they serve. These projects have focussed on building that understanding, not only between the Danish and South African implementers, but also between the government and the broader community of workers, farmers and beneficiaries. Skills development has been a critical component to ensure the innovations are embedded in environments that can make full use of them.

It is important for South Africa to build a thriving water sector with local products and innovations, as well as including appropriate technologies from countries such Denmark. These partnerships have recognised this. Haldor Topsoe, in addition to demonstrating the significant water savings that can be realised by including the water-saving SNOX™ technology in coal-fired power stations, have started discussions with Eskom about how to bring local content – local systems and people – into the application of SNOX™ in South Africa. VCS, as well as recommending design and management improvements to the wastewater plant operation in Drakenstein Municipality, saving on water and energy usage, also advised on how best to implement South African micro-hydroturbine innovations to generate electricity.

Farmers are a critical part of our water sector in South Africa and manage much of the productive land that makes up our catchments. Helping them to manage their land and water better results in huge water savings and benefits. WWF's work in Riviersonderend supports farmers to clear damaging, thirsty, invasive alien vegetation and the Linddana wood chipper helps them to make good use of the wood from the plants. By spreading the wood chips over cultivated areas they then create a protective mulch that reduces their irrigation requirements. At the same time these catchment landscapes can start to heal as aliens are removed, the invasion is halted in its tracks, and less water is needed to maintain agricultural production. Similarly, FynBloem were able to reduce their water needs by using better quality water controlled via the Grundfos pump.

"We realised that it wasn't enough to only train the process controllers at the wastewater treatment plant, we also needed to train their supervisors, managers and others up the 'chain of command' so that optimisation and improvement decisions were understood and supported." Chris Swartz, water engineer from CSWUE, partnering with VCS and Drakenstein Municipality.

South Africa's water sector is going through a period of transformation. We are shifting from an engineered supply focus to a new era with a focus on demand management in a 'low-water' economy. The technologies we have tested will be important stepping stones to new management systems with radically reduced carbon and water footprints. They also support our fledgling water institutions, such as catchment management agencies, who will be the critical defenders of our water resources and negotiate an important part of the interface between water and the broader economy.

DHI's work with the Inkomati-Usuthu Catchment Management Agency helps us to manage the periodically ferocious power of floodwaters and predict floods better.

"In order to achieve (our) strategic priorities we have realised that there is a need for increased impetus and pace. This calls for a revolution, a water and sanitation revolution to reclaim and better manage our water in order to tackle the triple challenges of inequality, poverty and unemployment." ***Nomvula Mokonyane, Minister for Water and Sanitation****, 2015 Budget Speech to parliament.*

A new water stewardship web tool, developed with DHI for South African farmers and water-users in the Breede-Gouritz Catchment Management Agency, helps everyone become a better water manager. Water stewardship is gaining momentum in the private sector around the world, and through this partnership, South Africa has the first online tool to connect farmers to a wealth of local information that exists to support them in managing their own farm water, and in collaborating with their catchment neighbours to address the collective water issues that they cannot tackle alone.

These projects have meaningfully contributed to addressing some of our big water issues. Many small steps, taken in partnership together, move us closer to a water secure future.

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Process controllers, such as Marcel Cornelissen at Drakenstein Wastewater Treatment Works, are at the front line of protecting the health of our people and environment.

DANISH INVESTMENT INTO SOUTH AFRICA'S WATER MANAGEMENT

100% RECYCLED

66%

of all water consumption in South Africa is by farmers who are the biggest direct users of water

8%

of South Africa's land area produces half of our fresh water

2 076

kilolitres of water gained per hectare cleared of invasive alien vegetation

37%

water loss occurs in most South African municipalities

WWF

Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

www.wwf.org.za