# PURIFICATION PIONEERS

TANQIA, in the Emirate of Fujairah, is the first privately-held wastewater collection and treatment utility in the UAE and the Middle East. TANQIA – which means 'purify' in Arabic – encapsulates in one word the mission of the company. Mr Ibrahim Elwan, Chairman of the Board, speaks to Sarah Pursey about how TANQIA was created as a ground-breaking state-of-the-art wastewater utility to provide services for the City of Fujairah and its environs, with ambitious plans to extend its innovative model throughout the Emirate and overseas. Written by Gemma Carter.

**TANQIA was established** as a response to the need for an efficient and sustainable wastewater treatment system for the concession area of 120 km2 covering the City of Fujairah, the Emirate's capital, as well as the towns of Qurayya and Mirbah, and all the population hamlets between them.

The Government of Fujairah had tried unsuccessfully since 1973 to solicit contractor financing for a wastewater collection and treatment system (the 'System') for the capital. In 2001, Elwan Group (formerly Infrastructure Capital Group) responded to the government's request by submitting a proposal based on Public-Private-Partnership (PPP), with financing provided under a BOOT (build, own, operate, and transfer) model.

Framework for the development of the System relied on the sharing of risks by the government and TANQIA, with the government assuming all sovereign risks, and TANQIA assuming all commercial risks.

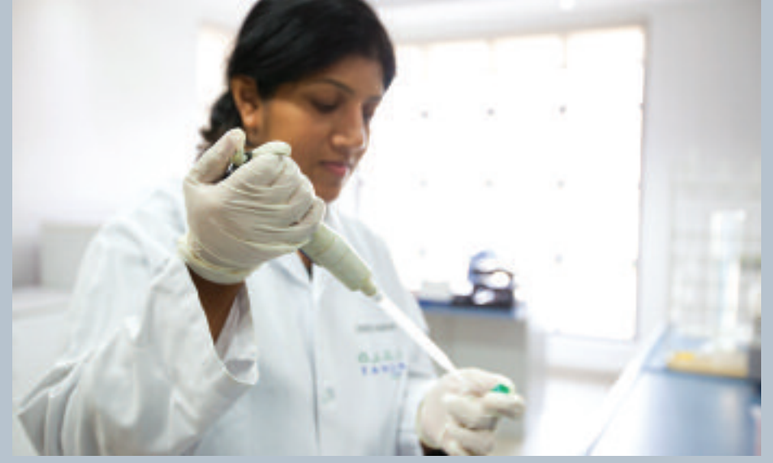
In 2003 TANQIA was incorporated to own the wastewater system, and in 2004 the government granted TANQIA a 33-year concession for the exclusive rights to design, finance, construct, own, operate and maintain, and expand the System for a Concession Area, encompassing the city of Fujairah, the towns of Qurayya and Mirbah, and the hamlets between them.

Mr Elwan outlines the agreement: "TANQIA has undertaken to generate effluent and sludge that meet the standards set for each; to meet at all times during the concession period the demand for wastewater services at the lowest commercially viable cost; and to comply with Fujairah's promulgated Law on Wastewater and UAE Environmental Law. The company's development and operations reflect Elwan Group's expertise in the private sector development of major environmentally sustainable infrastructure projects – that is, power generation, water and wastewater treatment. TANQIA is the first privately-owned wastewater utility to be developed in the UAE, and one of the very few in the entire MENA region."



## Recycling valuable resources

TANQIA is in essence an environmental company, whose mission is the collection and treatment of wastewater to extract complying effluent that would provide a substitute for higher value underground and desalinated water in non-potable applications, and sludge for soil enhancement. The company's shareholders are Elwan Group, with 51 per cent; Mubadala Development Company, with 30 per cent; and Overseas Trading Company, with 19 per cent. "Elwan Group developed the wastewater treatment system, and supervised – in collaboration with the company's staff and owner's engineer – the construction and commissioning of the System under the broad guidelines of its board of directors," describes Mr Elwan. "Elwan Group manages TANQIA, and operates and maintains the wastewater system under a 30-year O&M contract with SIYANA, a wholly-owned subsidiary of Elwan Group."



The treatment plant has an installed capacity of 16,000 cubic metres per day, or 5.8 million cubic metres per year, and is based on activated sludge technology involving two paths: a wastewater treatment path and a sludge treatment path. "The wastewater treatment path involves four stages," he explains, "commencing with the removal of solid matter by mechanical processes, including screening and sedimentation. The secondary treatment process targets the dissolved matter – i.e., phosphates, nitrates, ammonia – in a totally biological process, where micro-organisms convert pollutants to biomass. The biomass is removed from the system as surplus sludge and treated further in the sludge treatment process."

The secondary wastewater treatment stage copies nature, as this natural process takes place in rivers and other bodies of water. "Optimal process conditions for the biomass in terms of oxygen concentration, pH level and so on, allow for a compact footprint and high treatment process efficiency," states Mr Elwan.

"The tertiary treatment stage is designed as a polishing stage, where any remaining traces of solid matter are removed via filtration and chlorination. The fourth treat-↘



million), covering the initial system, annual extension of the wastewater collection network, and connection of new customers."

When TANQIA started commercial operations in 2008, its System comprised a treatment capacity of 5.8 m3 million per year, and covered a network of 350.2 kilometres, including 30 pumping stations, providing services to 5,231 properties. Yet TANQIA's system has expanded significantly since the initial system was completed in 2008. As of 30th September 2014, the collection network had reached 418 kilometres and 15,000 properties, providing wastewater services to 100,000 inhabitants, representing about 84 per cent of the total population in the concession area. "The remaining 16 per cent of the population discharge their Septage in soak-aways which are evacuated by tanker trucks and delivered to the plant for treatment," adds Mr Elwan. Customers that are not connected to the system are located in the old part of the City of Fujairah, which is to be demolished to construct a new commercial and business centre for the city."

## Specialised support

TANQIA's achievements are due largely to the quality of the team involved in the design, finance, and construction of its System, and the effectiveness of its staff in managing the large number of specialised contractors, consultants and lenders involved in the project. These include TKC Construction Consortium, which is a partnership between civil contractor Bilfinger and its environmental engineering affiliate Passavant-Roediger Anlagenbau, both of Germany, for the design and construction of the initial system and extension of the network after the completion of Phases I & II; Hills & Fort Construction LLC of Dubai, for the annual extension of the network and connection of new properties; and leading independent engineering consultancy Fichtner GmbH & Co., as owner's engineer. Specialised consultants include Hyder Consulting Co., Pöyry GmbH, and Emscher – one of the largest water and wastewater utilities in Germany.

"Our success and strength to keep on going, when at times it was hard to continue, is due to the support – both moral and financial – that TANQIA, as a regulated, privately-managed and operated and maintained company under a PPP struc- ↘

ment stage allows the treated effluent to be reused for irrigation, landscaping or industrial purposes.

"The sludge treatment path reduces the volume of excess sludge (biomass) generated by the wastewater treatment process to a minimum, and stabilises it by removing all biodegradable components. Stabilisation takes place by digestion, a process that also generates biogas. The biogas has a methane content of around 70 per cent, and can be combusted to recapture electrical energy and generate heat required for digestion. Finally, the sludge's water content is reduced to a minimum by thickening and dewatering, which makes the volume of sludge manageable for further re-use for soil improvement.

"We do not see ourselves as a environmental utility that recovers valuable resources in the process of treating wastewater," he tells us. "Rather, we see ourselves as a utility that recycles valuable resources for re-use as a substitute of higher-value products. TANQIA's effluent complies with stringent standards that stipulate ultraviolet and chlorination treatment to allow for agricultural and industrial applications. Higher quality effluent can be produced by further treating the effluent through ultra-filtration and reverse osmosis. These will result in effluent that is substantially lower in cost than desalination that is perfectly useable as a substitute for the higher-value groundwater and desalinated water."

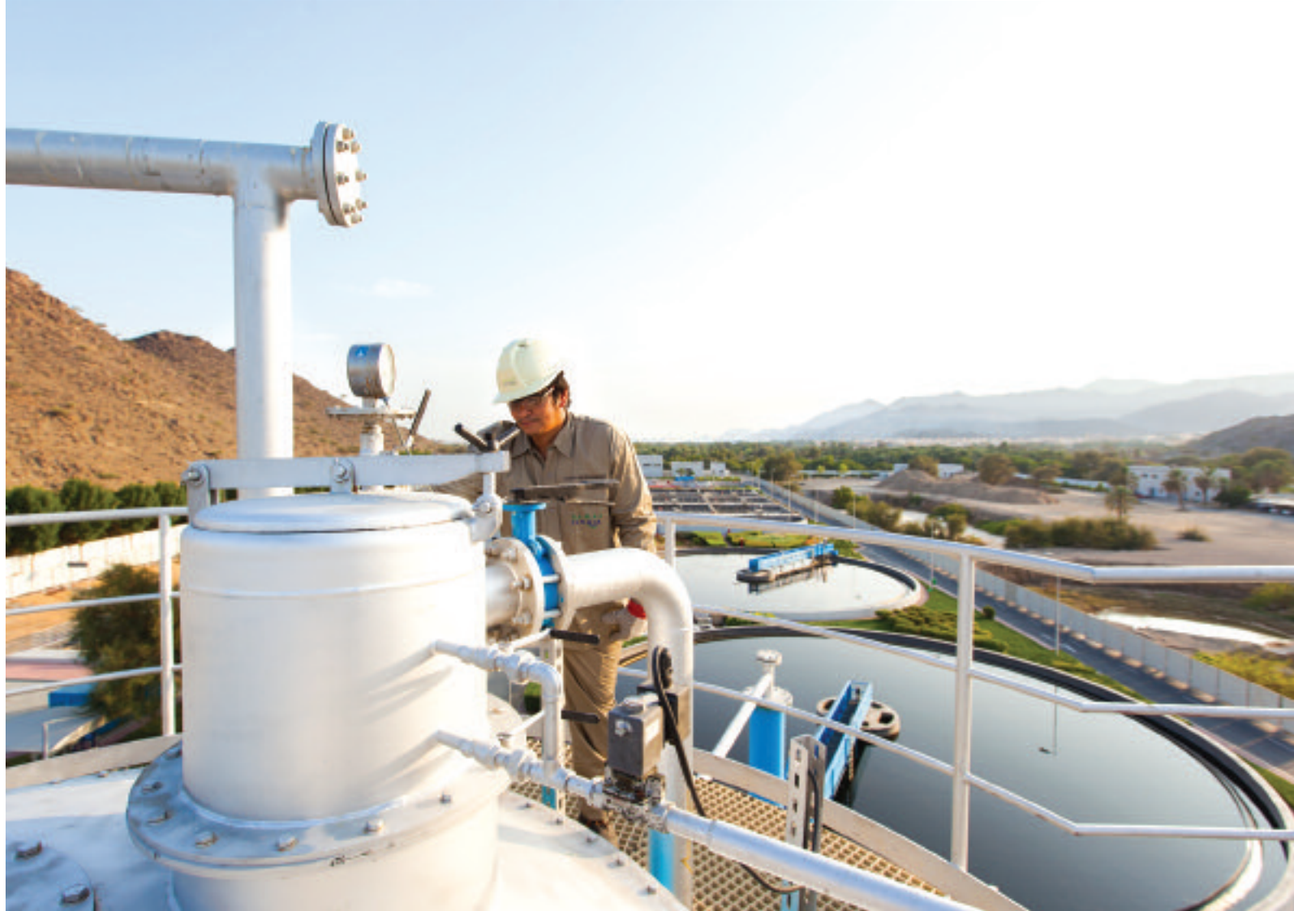
## Investment driven by growth

TANQIA has undertaken to design, finance and construction of the initial system, and to invest annually, using its internal sources and customer connection charges, to extend the network to connect new properties. Mr Elwan elaborates: "The forecast of wastewater generation agreed in 2004 anticipated an average annual rate of population growth for 2005–2015 of around five per cent, based on historical growth rates since 1985. However, Fujairah has experienced unprecedented growth in its population since 2005 due to accelerated economic development, which increased the net immigration and resulted in an average rate of population growth during the past 10 years of 7.5 per cent."

The forecast of population growth and wastewater generation in the concession area assumes population to continue its increase at the rate experienced over the past 10 years. This will require boosting treatment capacity by 32,000 m3/day (WWTP- Expansion I), increasing the treatment capacity from 16,000 m3/day to 46,000 m3/day.

Expansion I will take 30 months to complete. In the interim, and in order to avoid the production of non-complying effluent, a skid-mounted emergency treatment plant of 8,000 cubic metres per day (two units, each of 4,000 cubic metres per day) is planned to commence operations in March 2015. When expansion is completed, the emergency treatment plants will be moved to provide wastewater services in the largest two towns in northern Fujairah.

"TANQIA has had to increase its annual investments to extend the network connecting new properties, and bring forward investment in increasing the treatment capacity," he reports. As of 30th September 2014, the cumulative investment undertaken since 2004 amounted to AED 800 million (US$218




ture, has had from all concerned governments and their agencies in the UAE and abroad," Mr Elwan asserts. "We are also grateful to Hermes of Germany, guarantors of our buyer's credit; our lenders Royal Bank of Scotland (RBS) and Abu Dhabi Fund for Development (ADFD), as well as consultants, contractors, and above all, our customers, who never ceased to express their appreciation of the quality of our services.

"Here in the UAE, TANQIA's strength and success has been the result of several factors, first and foremost being the foresight of the Ruler of Fujairah, HH Sheikh Hamad Bin Mohammed Al Sharqi, who supported a PPP initiative by a regulated privately-owned company – a model that, at the time, had never before been tried in the region. Indeed, we have benefited from the continued support of the Government of Fujairah throughout the execution and operation of the plant, despite all constraints."

In addition to this is the unwavering and generous support that we have received from the Government of Abu Dhabi, through ADFD, without which TANQIA would not have been able to cope with the unprecedented increase in the demand for services," he comments.

"Moreover, we receive support and understanding from the Government of the UAE and its agencies – in particular, the guidance of HE Sohail Al Mazroui, UAE Minister of Energy; Mr Mohamed Saleh, Managing Director and senior management of the Federal Electricity & Water Authority (FEWA), whose advice and guidance has been exceptional."

## Training to retain talent

Both TANQIA and SIYANA consider manpower as their most valuable asset, a belief that is underscored by their recruitment and employment policies, whose main objective is to recruit and maintain highly-trained professional staff at the lowest technically-feasible size, with market-based competitive compensation, and extensive training design to attract and retain them.

"We believe in training as a tool to keep our professionals at the cutting edge," Mr Elwan affirms, "and we invest in training courses led by internationally reputable, specialised firms. These include courses in accounting, contract drafting and negotiations, and process design. The on-the-job training courses are in addition to external short-term courses and specialised graduate courses in reputable institutions."

TANQIA employs 30 members of staff who administer the agreements and day-to-day activities of the company, as well as planning, implementation and supervision of the continuous investment programme, which is referred to as the Lease Cost Plan (LCP) under the CA. The LCP includes both the extension of the wastewater collection network and increasing the installed capacity of the wastewater treatment plant.

"Of those 30 employees, 17 are involved in administering the contracts, managing accounts and finance, and personnel for both companies," he informs us. "The remaining 13 members of staff are involved in planning, implementation and supervision of ongoing investment activities that will expand TANQIA's system, and in turn its customer base. SIYANA, on the other hand, has 60 employees, 29 professionals and technicians, and 31 skilled and semi skilled workers. " Certainly, in its Chairman the company has considerable leadership experience and expertise at its helm: Mr Elwan was a senior manager with The World Bank for 20 years, responsible for infrastructure. Towards the end of this lengthy stint, he was responsible for spearheading the Bank's private sector initiative.

## A quest for energy efficiency

Research and development is part of Tanqia's long-term vision, and the company has joined forces with the Netherlands-based Water4All to manufacture containerised water purification systems with low power consumption in the UAE, for export to the MENA and Africa regions. Reliance on locally manufactured components where possible will be maximised to provide potable treated water at affordable tariffs.

TANQIA is also involved in assessing the effect on biological treatment of high-temperature wastewater, through a joint project entitled 'Technology transfer-oriented research and development in the wastewater field – validation using industrial-scale plants', which is sponsored by The German Federal Ministry of Education & Research (BMBF).

Mr Elwan reveals more about the project: "Aeration systems of the biological water treatment process are the largest power consuming components. The R&D project is assessing the feasibility of reducing the power consumption of the aeration tanks to minimise power consumption in hot climates. One of the major objectives of this project is to arrive at a computer algorithm that would be more exact than the currently applicable design rules for calculating the necessary oxygen input related to water temperature."

Energy efficiency is also a key concern of TANQIA, and the energy consumption by each component of the influent and sludge treatment paths is recorded throughout the year, with a view to optimisation. "Substantial energy efficiency is maintained in the sludge treatment path by capturing the methane generated by the process," he outlines, "and using the methane in burners to maintain a temperature of 52 degrees Celsius. This enables us to generate treated sludge that is free of pathogens and odours, and can be used as a soil enhancer."

Investment in drying and sanitising the sludge and packaging it for sale using drying by solar energy is currently being prepared for execution, reveals Mr Elwan. In addition, the concept of installing a solar power farm is also being prepared with a view to reducing the demand for power based on oil and gas. "Indeed, we believe in the use of renewable energy, such as solar energy, as a viable means of reducing energy consumption, and TANQIA liaises with Masdar in Abu Dhabi for this purpose, which, as an authority in the use of renewable energy, provides us with guidance and support."

## Ready to address demand

There is an absence of unified treatment standards across the Middle East, which can be a challenge, but TANQIA has chosen to adopt the best treatment standards based on German norms. "The pricing of wastewater treatment services is also a challenge," notes Mr Elwan, "especially as all inputs are obtained or bought at market prices, which is why it is important to raise awareness of the public about the actual treatment costs associated with potable water and the importance of re-using wastewater. TANQIA has initiated a number of awareness campaigns to that end, which will continue for the foreseeable future.

"Looking ahead, our wastewater treatment capacity must be tripled over the coming three years, in tandem with the growth of the city," he states. "In addition, the effluent distribution system will be developed to distribute treated wastewater to identified demand centres."

TANQIA has accumulated extensive know-how in all aspects of design, finance, construction, planning and O&M of wastewater treatment systems under PPP and BOOT arrangements. Indeed, during the past decade the company has achieved a great deal, including the enlargement of the concession area to reach cities and towns in the northern part of the Emirate of Fujairah; and the extension of the wastewater treatment system to include the new Sheikh Mohamed Bin Zayed Al Nahyan City in the capital area, which requires increasing the treatment capacity of the plant for municipal wastewater, and a new plant for treating industrial wastewater. These will be developed and constructed alongside a substantial extension of the collection network – both to be developed, constructed and operated. "We are also exploring opportunities for O&M contracts in a number of countries in the MENA region, including Jordan and Egypt, both of which are currently under consideration," concludes Mr Elwan. □