Desert challenge

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In the GCC, treated wastewater is mainly used for landscaping or for fountain displays.

In a region in which water seems scarcer than oil, state-owned utilities have a job at hand to keep the taps running. With precious little drinkable groundwater available, the region is currently producing an average of 30 million cubic metres of desalinated water every day. And due to unabated population and industrial growth, there is little indication that demand will go anywhere but up.

Water reuse is primarily used for landscaping and agriculture irrigation, district cooling, and industrial and municipal uses. It is only natural that more thought is now given to increase this usage. “The GCC market for water reuse is on the verge of major expansion,” says Walid Fayad, partner at Booz & Co. “Capital expenditure on advanced water reuse is expected to increase the capacity by more than 13 percent per year in the coming five years.”

Saudi Arabia alone is expected to become the third largest water reuse market in the world after the United States and China, estimates the Sustainable Water Alliance. Currently, the Kingdom reuses only about 22 percent of its wastewater, if the reuse of low quality treated sewage effluent is excluded.

Booz & Co. estimate that between 2010 and 2016, GCC countries will spend around US$60 billion on expanding wastewater collection and treatment capacity. While reuse capacity will expand by 13 percent per year, contracted desalination capacity will grow by only four percent.

“Reused water is expected to play a growing role in curbing supply levels from non-renewable groundwater,” says Nadim Batri, principal at Booz & Co.

This makes sense, as treated sewage effluent (TSE), the product of wastewater treatment, is much cheaper than desalination. At present, around 2 million cubic meters of treated water is used in the GCC every day, according to Booz & Co, a fraction of the amount of water that is desalinated on a daily basis. While costs vary according to quality and transportation expenditure, Booz & Co estimate that a cubic metre of treated effluent costs $0.66 in Kuwait, while a cubic meter of desalinated water costs an estimated $2.27.

“Swapping the energy intensive desalination of sea water via reverse osmosis (RO), and replacing it with upgraded TSE would have a more positive, profound and lasting impact on resource conservation,” says Mohamed Hijaz, general manager at Eagle Electromechanical & Al Hijaz Mechanical Equipment.

The financial case for investing in wastewater treatment plants is a strong one, as is the case for immediate action. While the economics are favourable, procrastination will erode the financial health of the water sector, says Fayad: “The supply-demand gap will widen driven by a fast growing water demand and depleting renewable water resources while increasing capital investment requirements will further deteriorate the financial viability of the sector.”

Gaining acceptance

One of the biggest obstacles to the reuse of wastewater is public acceptance. Currently, the use of TSE is limited primarily for landscaping, or for water displays such as the Burj Khalifa fountain display in Dubai. Even farmers are unwilling to make use of TSE, at a great cost to utilities: The agricultural sector accounts for 80 percent of water consumption in the GCC, as governments insist on a degree of food autarky in spite of the region’s limited suitability for farming.

Changing public perceptions is thus important, as the wastewater reuse must find acceptance amongst the farming community and the general public. In addition, a strong emphasis should be placed on those technologies that produce water fit for irrigation purposes at the best possible price.

“The region should embrace technologies that produce suitable reuse water for irrigation purposes rather than polished water for discharge purposes,” says Jonas Sipaila, head of research, development and innovation at EPIC Green Solutions. “Agriculture and landscaping needs is the largest volume consumer of water and if reclaimed water can become a suitable substitute reducing freshwater demands, and on the flip side tertiary treatment of wastewater becomes unnecessary for the nitrogen and phosphorus removal process.”

Fortunately, those technologies already enjoy a high degree of popularity in the region, says Hijaz: “Extended aeration (EA), sequencing batch reactors (SBRs) and membrane bioreactor (MBR) plants are popular in the Middle East. All of the afore-mentioned technologies are applicable to yield water that can be reused for irrigation.”

Those methods are referred to as secondary treatment, which follow the process of segregating the water from solids. Membrane-based technologies, such as membrane bioreactor and reverse osmosis processes are becoming more common in the GCC as tertiary treatment forms, says Hijaz. Tertiary treatment results in the highest possible water quality, and can produce potable water from wastewater.

New treatment plants in the region will increasingly rely on tertiary treatment and use a combination of established technologies such as chlorination, UV, advanced tertiary filters and biological treatment, believes Fayad.

The choice of technologies used in tertiary treatment plants should take into account the particularities of the region in terms of climate and the end use of treated effluent, he says: “For example, conventional activated sludge and stabilization ponds which are commonly used in the West have proven to be environmentally and economically suboptimal in arid GCC regions leading to high energy consumption, high sludge production and odor pollution problems. Alternatively, anaerobic digestion is suitable in arid climates and leads to similar effluent quality at lower costs.”

Bog standard

It is, however, not only technology that has to be compatible with local conditions. Standards also need to adapt. “Reuse standards in the Middle East are adopted from international standards without adjustment to epidemiological, socio-cultural and environmental local conditions, which end up being either too stringent, limiting reuse, or lenient, compromising public health,” says Hijaz. “Regulations need to be tailored to the conditions mentioned previously through local studies and need to be monitored effectively to ensure enforcement.”

Developing a suitable regulatory landscape is needed to ensure the growth of the wastewater sector, says Batri. “Going forward, water laws in the GCC should establish a legal framework for the adoption of regulations on all matters regarding water treatment, discharge and reuse.

Much of this type of framework is in existence but is not adequately administered or has not been adequately developed into workable regulatory form.”

While governments are clearly driving sector growth, and state-owned utilities are the predominant owners of wastewater plants, the number owned by private developers is increasing, says Batri.

This is due in part to the proliferation of mega-projects, such as Masdar City in Abu Dhabi, or the King Abdullah Economic City in Saudi Arabia. While those projects are state-owned and funded, they rely on partnerships between developers and international utility operators to build and operate the cities’ infrastructure.

In addition, GCC governments are starting to encourage private sector participation in the wastewater sector. Examples include plans by the Saudi National Water Company to invite

private companies to construct and operate wastewater treatment plants and networks for the reclaimed water.

“With improved treatment technologies waste water can become feasible for private developments such as the subsequent reuse of treated water on site. A combined approach from both entities reduces costs and volume for both entities,” concludes Sipaila.

Size matters

Another emerging trend is for smaller scale plants, which serve isolated communities or developments. “Going forward, higher decentralization is required to provide wastewater treatment and reuse services for smaller communities,” says Fayad.

While large treatment plants process water at a lower cost than smaller installations, this has to be offset by the costs incurred by transportation. Apart from the outlay for piping infrastructure or water trucks, the water lost over longer distances is significant, with estimates reaching up to 50 percent. Fayad believes that the technological progress has made small scale plants economically and environmentally feasible: “With the available technology, building local wastewater treatment plants is feasible with limited environmental risks.”

Should the need arise, smaller plants can be scaled up or upgraded much easier than their larger counterparts, thinks Sipaila: “Smaller more efficient treatment technologies are by design modular in nature and as such more easily expandable at a lesser cost. Smaller lower cost technologies are more adaptable to improvements and changes.”