Utilities of the future

Recycling wastewater

Wastewater plants of the future will be geared for minimum impact on both the environment and the public purse – as international wastewater expert **Art Umble** explains.

Wastewater treatment plants around the world face growing pressure to produce more with less. Communities want zero waste with environmentally sustainable outcomes, regulators require strict conditions to be met while plant owners operate within tightening budgets. Increasingly local authorities, as plant owners, are looking at how to re-use every drop of wastewater to create sustainable, economic, self-powered "Utilities of the Future".

The innovative design of New Plymouth's Wastewater Treatment Plant has significantly reduced power consumption by 25 percent in the first year of operation and has also increased the plant's capacity. At the heart of MWH's design was a highly efficient combination of high-speed centrifugal blowers, fine bubble diffusers and an advanced control system.

1. ENERGY RECOVERY

In New Zealand, achieving greater energy efficiency within wastewater treatment plants is one of the most pressing drivers for change. The amount of energy embedded in domestic wastewater far exceeds that required to power a conventional treatment plant. However the capital investment required to realise a self-powered plant can result in an extensive payback period.

While larger cities may find it easier to invest in this infrastructure, local authorities in New Zealand need to look at how technology and recent advances allow them to modularise their plants to scale to make the numbers work. Their decision to invest needs to also consider the plant's ability to create a revenue stream from the energy recovered, and other products that can be derived from the organics in wastewater

Traditionally, some treatment facilities have captured 'waste' energy by combusting biogas produced from anaerobic digestion to generate thermal and electrical energy. A number of recent developments in digestion technology intensification (sludge pre-treatment, co-digestion, multi-phase digestion) have advanced energy recovery efficiencies to a point where plants can operate as 'energy neutral'.

A wastewater treatment plant in Strass, Austria, generates 72 percent more power than that required to operate it, with all excess energy sold to the national grid. This means the plant gives back to the community, offsetting the rising cost of energy by creating a new, consistent revenue stream.

Other utilities around the world are harnessing the recovery of thermal energy from the heat present in the treated effluent to offset onsite thermal demands or in order to market this to local power utilities. The opportunity also exists to use this thermal energy as supplementary heating for commercial buildings in business districts.

The generation of electrical energy is also rapidly advancing with the use of microbial electrochemical cell technologies to support the neutrality objectives, although this may still be a decade away from commercial viability.

2. WATER RECOVERY

Water is a critical commodity. Based on current usage we know that if 'business-as-usual' consumptive patterns continue, global demand for accessible water – one percent of all water – will exceed supply by more than 40 percent in 2030. Being able to recover water from wastewater for reuse within and around the local community is crucial to managing their supply, while contributing to preserving the world's resources. A Utility of the Future is one that recovers water and in doing so contributes to solving issues facing its local and the global community.

In New Zealand, the vast amount of irrigation required for dairy farming is a constant source of debate in rural communities. Reclaiming water from wastewater becomes a highly effective way to offset the demand created by agricultural and urban irrigation. It also acts as a viable supplement to water supplies in areas where reserves are scarce.

3. NUTRIENT RECOVERY

Nutrients are another valuable recoverable resource with nitrogen and phosphorus both found in abundance in raw wastewater. While cost-competitive technologies currently preclude the recovery of nitrogen, phosphorus can be more easily extracted and used in agricultural fertilisers.

Phosphorous recovery can also reduce the amount of phosphate that is being mined globally. This is even more important when we consider that global reserves are expected to be depleted in 370 years (based on 2010 production levels) if we continue with current practices of global phosphorus utilisation.

The Metropolitan Wastewater Reclamation District of Denver, Colorado (USA) has taken its first major steps toward resource recovery at its RW Hite facility. These steps include innovative sidestream enhanced biological phosphorus removal and deammonification to reduce energy, chemical usage and balance carbon while improving water quality in its receiving waters. These initial steps have set the stage for Denver to move to full recovery systems in the near future.

Agricultural irrigation in New Zealand.

4. THE SOLUTION

Transitioning to a resource recovery paradigm for treating wastewater is a positive global trend. Further advancing this trend requires individual utilities at all scales to make the conscious choice to engage and start the conversation at top managerial levels. This means drafting a roadmap toward their specific recovery future, and implementing calculated, incremental steps.

With the global scarcity of water increasing, you could argue that its recovery should be at the pinnacle of the decision-making process, followed closely by energy and nutrient recovery. However it is often the social and financial factors that have the greatest influence.

Even taking these into consideration, it is still clear that a "Utility of the Future" is one where 100 percent of all wastewater is recovered and reused.

Our future is definable and if we make proactive, courageous choices today, then the reality of reusing every drop of wastewater may not be all that far away. **WNZ**

• Dr Art Umble PhD is the Wastewater Practice Lead for the Americas regions of MWH, now part of Stantec. He has over 25 years of experience in a wide array of professional posts including managing a public water and wastewater utility, university teaching, serving in government-appointed stakeholder forums and consulting in the water and wastewater industry. He recently visited New Zealand and Australia to meet with local authorities and explore the global trends and advances towards recovering valuable resources from wastewater.