The Future of Water and Wastewater

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Water shortages, sickness from contaminated drinking water, pollution from poor waste treatment, and emerging contaminants are all quite common events in the current world. These issues will likely be magnified in the near future with urbanization, increasing populations and climate change. Looking 10 to 20 years into the future, what will the next generation implement as solutions to our current problems? 'NEWS' (see figure) may offer a few of the solutions that need to be considered, developed and accepted.

WATER

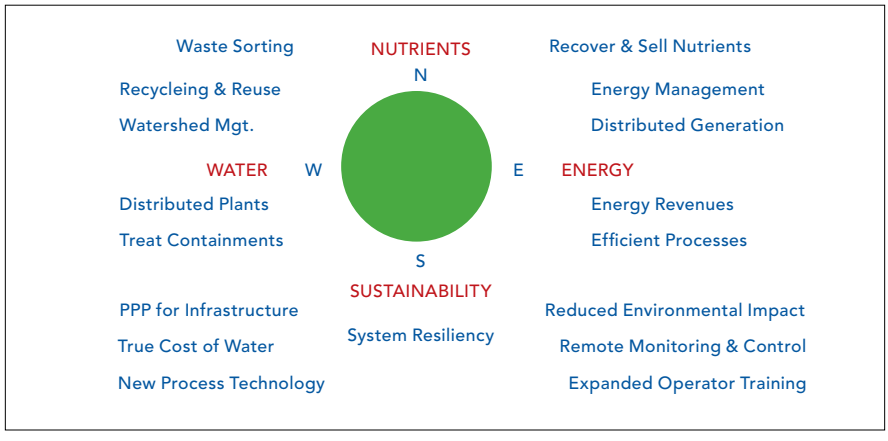
Starting with WATER, there may be at least four advanced solutions in this area. Recycling and reuse, with technologies such as composting of organics may reduce the load on sewage systems. Metals, minerals and even sand can be recovered from wastewater, and used as a resource. Watershed management with control of runoff waters may be essential to have sufficient high quality raw water for future generations. The cost of treating water is expensive, and maintaining higher quality raw water could lower the overall water treatment operation and maintenance costs of a system.

Distributed or decentralized plants for water treatment for the replacement of facilities may be an alternative solution when large centralized treatment plants are either outdated or overloaded. Rather than add new piping, pumping and expanded megaplants to address new development areas within a community, compact distributed or decentralized plants can take over some of the load. The need to treat a long list of emerging contaminants (ECs) is moving to the front line of water management. Pesticides, pharmaceuticals, personal care products and endocrine disrupting compounds are among the prime examples of emerging contaminants. Did you know that up to 90% of oral drugs pass through the human body and end up in the receiving waters?

NUTRIENTS

NUTRIENTS may be another key advancement in the future of water. The recovery of nutrients such as phosphorous and nitrogen can generate a high value fertiliser product from an existing resource, using processes that are both environmentally and economically viable.

Regulations can stimulate the recovery of products from waste streams to support the principles of a circular economy. The load on sewage treatment facilities is also reduced when organics are prevented from entering the wastewater system.



ENERGY

ENERGY is a current and future opportunity, with energy management to reduce our dependence on the fossil fuels becoming mainstream over the past several years. Energy management is the process of monitoring, controlling, using and conserving energy in a process with the help of advanced control systems and metering.

Distributed generation is a new technological development facilitating cost-effective distributed power generation. Environmentally friendly fuel cells and other devices can be operated from bio-gases generated from waste at independent locations. Other breakthrough technologies are nearing commercial production, and may radically change the electrical distribution industry. Associated with generation are energy revenues that can offset paying for electrical power to operate systems. The plant of the future will be net energy positive, and there will be new technologies that allow for enhanced income from various sources such as nutrients and bio-gas.

Efficient processes manifested as energy intelligence isn't a common term, but it soon will be. Energy consumption is one of the largest factors affecting profitability and competitiveness. Reducing energy costs by improving efficiency in production processes adds to the bottom line. Super insulation and efficient heat capture are two technologies waiting to be developed.

SUSTAINABILITY

SUSTAINABILITY is a well-established concept that will continue to be pursued into the future, with potential applications

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through Public/Private Partnerships (PPP) for infrastructure. Many water and wastewater utilities are financially in the red with revenue from customers not equalling total life cycle costs. Solutions may be provided by the private sector to produce better results. Design-Build and various P3 alternatives may be utilized on a larger percentage of projects because the traditional Design-Bid-Build process often incurs higher cost overruns and extended time frames. The true cost of water will emerge, and water will no longer be taken for granted as a free resource. More treatment plant owners will need to enlighten the public about the reality of both operating costs and future capital costs for water facilities.

New process technologies and sharing of knowledge through the Internet of Things (IOT) will help to reduce operating costs by allowing for more efficient operation. New compact treatment technologies will have a smaller footprint, be more efficient and reduce costs of treatment. However, advanced sensors are required as part of the solution. LED-based ultraviolet disinfection and chlorination innovations may lead the way in this regard. The environmental impact of waste residuals and by-products, especially waste discharged from some industrial processes, needs to be reduced. New technologies such as biofiltration can help improve the quality effluent going to waterways and the environment.

Remote monitoring and control has entered the picture as a significant tool. It is now possible to pull out your smart phone, and dial up a facility for real time process information and alarms. This will make it even easier for one operator to monitor several small treatment plants, and make changes to operations remotely, and then carry on to deal with any emergencies.

It has been recognized that operators are the ultimate key to efficient operations, however, they are only as good as their training and experience. With young operators taking over from retiring baby boomers, there is often a gap in knowledge. Expanded training programs and operator networking will help to fill this gap.

"System resiliency" is a reasonably new term in regard to water facilities. Design for resilience is the strategic design of buildings, infrastructure and other systems to sustain required operations during and after the impact of severe disturbances, in addition to accommodating adaptation to longer-term influences. The goal is to maintain or quickly return to near normal functionality in the event of severe disturbances.

Considerable resources are currently being invested in innovation of water and sanitation systems. More innovation will 'flow' from these research and development activities. Innovation may not only evolve from new technologies, but also new applications of existing and 'old' technologies. Ideally, we can utilize 'technology leapfrogging' like the cell phone industry has accomplished in sparsely populated northern Canada.