

How to Avoid Day Zero with Zero Liquid Discharge

There has been much discussion about how residents of Cape Town can reduce their intake to prevent Day Zero, but what about industries? New technology offers options for industrial facilities to make more clean water from wastewater by achieving the pinnacle of water treatment targets – [zero liquid discharge](#) (ZLD).

Nearly four million people living in and around Cape Town are grappling with its worst drought in 85 years that has been caused by alarmingly low rainfall over three consecutive years. While several areas around the world have been under stressed water conditions for extended periods, Cape Town is the first major city in the world to be affected this harshly by a water crisis in the recent past.



The Theewaterskloof Dam previously housed 41% of the water storage capacity available to Cape Town.

Response to Day Zero

The city has attempted to provide temporary relief to its residents by setting up water stations at various locations and is asking residents to consume less than 50 litres per day. Further extreme measures may be necessary, as the government tries to find a long-term solution. The response to the Day Zero crisis has resulted in a push far beyond Cape Town's municipal limits to make people aware of the amount of water they consume.

While much of water conservation efforts have been targeted at domestic activities, it is important that agriculture and industry also contribute to preserving our precious water resources. Treating water on industrial or agricultural sites not only lowers water consumption through re-use, but also protects rivers and lakes – the ultimate source of freshwater. Understanding that droughts stress these water bodies, protecting them from pollution becomes even more important, as pollutants concentrate to higher levels when less water is available.



The main pollutants in agricultural and industrial wastewater are either organics, salts or both. When the concentration of these pollutants is high in effluent streams, safe disposal of this wastewater becomes challenging. However, if these pollutants can be removed from effluent streams, freshwater can be recovered and reused, or returned to the environment.

Technology: New Options for Treating Tougher Water

The good news is that water treatment technology has made significant strides and can be economically implemented at agricultural or industrial facilities that produce wastewater. Some of these innovative technologies include:

- Compact and simple biological systems that use microorganisms to reduce organic matter
- Reverse osmosis (RO) which uses pressure to squeeze freshwater out of wastewater via semi-permeable membranes
- [Electrodialysis reversal](#) (EDR) – an electrochemical process that utilizes the latest in membrane technology to selectively separate ions and extract them from wastewater
- Evaporators and crystallizers that use heat to separate fresh water from contaminants

Each of these technologies are suited for different water chemistries and can be combined to produce a wastewater ‘treatment train’ that suits the treatment project.

ZLD: The Pinnacle of Fresh Water Recovery

Modern water treatment technology has engineered its way to the upper limits of freshwater recovery, known as zero liquid discharge (ZLD). This water treatment approach makes use of membrane systems to first concentrate salty waters to membrane limits, and then send the saltier brine to [highly efficient evaporator-crystallizers](#). They squeeze every drop of freshwater from the salty brine until solid salt waste is the only by-product.

While stand-alone thermal systems such as large-scale evaporators and crystallizers may prove to be a costly option, combining technologies in different configurations provides a more efficient and economic solution. For example, zero liquid discharge can also be achieved by combining different technologies: RO-evaporator-crystallizer or EDR-evaporator-crystallizer configurations. In addition, planning for zero liquid discharge from the onset can lower water sourcing costs through recycling, lower risk cost of meeting future regulatory requirements, integrating waste heat in facility design to treat water at a lower cost, enhancing stakeholder relations while protecting rivers and lakes, and enabling better relations for future expansion and

new facilities. Treating wastewater can also be turned into a profit centre, for example:

- Treating agricultural wastewater run off to selectively remove sodium, while beneficially recycling both the water and agricultural by-products
- Desalting oil produced water for enhanced oil recovery re-injection, whereby lower salinity injection improves oil recovery and makes money



Zero Liquid Discharge System Pilot

The technologies mentioned in this article are tried-and-tested and readily available for industries to adopt. Those who seek innovation and have the courage to pioneer installations will help lead the way. These innovators can bring long term de-risking benefits to their organizations in a world where the value of clean water only increases, and risks of environmental damage can result in extremely high liabilities. By adopting innovative wastewater treatment systems today, we can help prevent Day Zero tomorrow while also advancing economic development and industrial growth.