The population continues to grow, demanding more output from fewer resources. This strain is felt acutely in the power industry. New plants are built to accommodate the growing population’s power needs, requiring more water than ever for power generation and cooling. As freshwater resources continue to dwindle, more plants are turning to reclaimed water.

To get a handle on how and why the power industry takes advantage of reclaimed water, we spoke with Veolia Water Technologies. The company shed light on the state of the water-energy nexus, the advantages of utilizing reclaimed water, and the unique treatment issues it poses.

What is the state of water risks faced by the power industry?
The interplay between water and energy is known as the “water-energy nexus.” This describes the relationship between water used for energy production and the energy that is required to extract, purify, treat, and dispose of that water. This nexus continues to be strained as population growth exerts more demand on both water and energy and as drought conditions emerge in unexpected places around the world. Feeding this growing population will further strain the freshwater supply, as irrigation is the number one consumer of water.

The risk of freshwater shortage is real, and the effect upon profitability and company stock prices is real as well. Bloomberg reported last year that when the science minister of India reported less than normal rainfall, there was a drop in the nation’s equities of $23 billion in a two-day period. Last year, the World Economic Forum listed water crises as the number one risk facing the world.

Because power generation uses water more than any other industry, that is a primary area where water conservation needs to take place.

What are some ways the power industry can reduce water usage?
An easy one is to use water more efficiently. You can increase the cycles in the cooling tower; we have some clients who do so up to 20 times per day. You can find a non-freshwater source for cooling, which accounts for most of the water usage in power plants. You can use treated sewage or industrial wastewater. You can recycle and reuse your own wastewater. You can improve the efficiency of the power unit so you’re producing more megawatts per gallon of water used, which also adds to both sustainability and profitability.

Treated municipal wastewater, or reclaimed water, is one of the most available sources for power plants and can be an effective tool for reducing freshwater usage.

What are the advantages of using reclaimed water for cooling?
For one, the use of sewage effluent for
cooling is proven and safe. In the U.S. it began in the 1970s. It's estimated that today, more than 70 of the country's power sites are using treated, reclaimed water — and not just in dry areas.

Sewage is a virtually risk-free source. It has consistent quality and temperature compared to surface waters. Because secondary effluent is relatively consistent in quality, the treatment process, design, and operation become easier. Also, the cooling tower blowdown may be able to be returned to the municipality, eliminating one of the waste streams needing treatment at the power plant.

**What regulatory considerations affect power plant cooling?**

There are several sets of regulatory requirements that govern the use of reclaimed water for cooling.

Federally, the Clean Water Act (CWA) requires that all discharges of pollutants to surface waters be authorized by a permit issued under the National Pollutant Discharge Elimination System (NPDES) program. The U.S. EPA implements the NPDES program and has the power to authorize states to issue permits and administer the program. NPDES permits contain discharge limits determined by the treatment technology that the EPA believes is available and affordable, as well as by the states' water quality standards and available dilution in the receiving water bodies.

State rules vary, usually taking into account the likely degree of public exposure to reclaimed water. Where the exposure is high, reclaimed water must be highly treated. States usually establish limits on fecal or total coliform bacteria and may require wastewater be filtered before it can be reused as reclaimed water. They also usually have turbidity standards.

**What are some challenges that the quality of reclaimed water poses for operational use?**

Facilities that utilize reclaimed water have to figure out how clean it must be to satisfy their individual operational requirements. Reclaimed water's chemical elements can cause problems like mineral scaling, corrosion and stress-cracking, and biofouling.

Interestingly, these problems are increased in closed-cycle cooling systems when water evaporates and leaves behind higher concentrations of constituents. To control the water quality, power plant operators can remove some of the concentrated, recirculating water. They can adjust the flow volumes and makeup. They can treat the incoming reclaimed water before it is added to the recirculating system.

**Can you share any case studies that relate to the water quality necessary for use in cooling towers?**

In 2012, Veolia advised a client that it would experience problems if it continued to send water at its existing quality to its towers. We found that the use of disc filters would be an effective method to treat their sewage plant effluent for cooling tower makeup, and Veolia was contracted to do so.

In another case, the West Deptford Energy Station in New Jersey was using treated effluent diverted from a local sewage treatment plant for its non-contact cooling tower makeup, boiler feedwater, and plant service water. Veolia was contracted to assist in the supply of water treatment technologies to support the station's environmentally friendly and sustainable energy operation. We furnished it with a biological aerated filter (BAF) and disc filter system, which allowed effluent from the plant to be reused in the cooling tower, with a treatment capacity of 7.35 MGD. The BAF greatly reduced the ammonia level in the sewage, thereby saving the power company a large amount of chemical addition. The owner added ultrafiltration ahead of the membrane-based demineralizer system, enabling the use of treated reclaimed water as a source of boiler feedwater.

**What do you think the future is for reclaimed water and power plant cooling?**

As freshwater supplies dwindle and demand grows, the power industry has come to realize that reclaimed water can be a very valuable resource. As the power industry continues to expand globally, it will call upon reclaimed water to meet its needs for cooling and potentially other process applications.