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Edison Explains

Waste-water treatment

With 1.8bn people regularly drinking water contaminated with faeces, how is the waste-water treatment market reacting?

Why is waste-water treatment important?

Improvements to sanitation continue to fall short of UN development goals, with only 68% of the global population retaining access to sanitation facilities in 2015, 9% off the UN's stated objective.

Unicef reported that in 2015, 1.8bn people regularly drink water contaminated with faeces, while a Lancet study estimates that 2.5bn people have no access to basic toilet facilities.

The industrial and urban growth of China and India has not ameliorated the situation, as water pollution remains an ever-present issue.

The Chinese government's Environmental Statistical Yearbook that waste-water outflow grew from 48.2bn tons in 2004, to 71bn tons in 2016, while in India, around 38.2m litres per day (mld) of wastewater was produced by cities with more than 50,000 citizens. India's municipal waste-water treatment capacity is around 11.7mld, according to IDFC.

Mature economies are not blameless either, falling short on environmental performance, especially when it comes to anaerobic digestion and composting that transforms sludge into a valuable resource instead of landfilling it.

How large is the waste-water treatment market?

Global Water Intelligence estimates that Western and Northern Europe spent around $25.2bn on waste-water utilities in 2017, followed by the US ($16.9bn) and Japan ($16.1bn).

In the developing world, China's waste-water infrastructure has been expanding steadily. The 11th Five-Year Plan (2006–2011) mandated a 10% reduction in chemical oxygen demand (COD). More recently, ¥559bn (or $80bn) was allocated to waste-water treatment in the 13th Five-Year Plan.

Elsewhere, little has been done in India to scale up anti-pollution efforts and the Modi government's industrial corridor programme has yet to generate significant waste-water spending.

The promised clean-up of the Ganga River, whose biochemical oxygen demand (BOD) in the city of Varanasi can reach more than triple the EU's recommended maximum, has yet to materialise either.

In Brazil, planned investment into water-ways over the next five years have stalled due to low oil prices and political turmoil in South America's largest waste-water market.

Edison's insight

"The treatment of waste water/sludge is universally recognised as one of the greatest environmental challenges globally. While in low-income countries the biggest issue is the lack of infrastructure, in high-income countries tightening environmental regulations and potential economic benefits suggest the need to upgrade the existing treatment plants." Dario Carradori, industrials analyst

What is BOD and COD?

COD and BOD are commonly quoted measures of water contamination.

COD measures how much oxygen it would require to oxidise all organic material in a volume of water. BOD is an indicative measure of how much oxygen aerobic organisms in the water are consuming to break down organic material.

For example, one study puts the average COD of pharmaceutical waste water at around 5,000–15,000mg/L, with a BOD figure 30% below its COD. This indicates that pharmaceutical waste water is highly contaminated with organic materials.

The World Health Organisation designates water with BOD values of 2mg/L and COD of 20–200mg/L as unpolluted.

It also means that organic substances in the water are not biodegradable, as aerobic organisms do not demand much oxygen for decomposition compared to the proportion of organic material, making it particularly damaging to the environment over the long term.

In addition to COD and BOD, the proportion of suspended solids, hydrocarbon, nitrogen, phenol and chloride in waste water are common measures of contamination.

How is waste water processed?

When waste water is collected, it is pre-treated, removing the grit and debris. Then comes the primary settlement stage, where solids sink to the bottom of huge tanks and fats rise to the surface.

Following the settlement stage, one of two techniques provide the basis of secondary treatment.

The suspended growth process uses bacteria, filter feeders and oxygen that process organic material in the water to remove contaminants.

The attached growth process uses materials to which microorganisms adhere in order to absorb organic contaminants from the water. A third treatment stage, following settlement, is required to bring the treated water up to drinkable standards.

Waste-water treatment still leaves the filtered organic material, 'sludge', in need of further treatment. The sludge is first thickened with the aim of separating liquids from solids. Dewatering then reduces the amount of water remaining in the solid portion.

Thickening and dewatering reduce the volume of transported sludge, the size of the facilities and ultimately the operating costs for the utilities. Following treatment, sludge is transported for disposal in landfills and incinerators, or for composting.

Which companies are involved in waste-water treatment?

The waste-water treatment industry can be divided broadly between technology and equipment providers on the one hand and utility companies operating waste-water plants (and in most cases providing potable water as well) on the other.

The waste-water treatment business is a fragmented industry and most utility companies are either national or regional players, although French operators Suez and Veolia have built significant international operations. Suez also recently extended its involvement into the technology side of the industry in late-2017, with the acquisition of General Electric's Water & Process Technologies division for €3.2bn.

On a national stage, UK quoted waste-water treatment companies include Pennon, Severn Trent and United Utilities. In the US, the market remains very fragmented, with 50,000 active water utilities, but American Water Works is the largest quoted water company.

The Chinese market has been growing rapidly in recent years with significant players including Beijing Enterprise Water, Beijing Capital Co, SIIC Environmental Holdings, China Water Affairs, Tianjin Capital and Sound Environmental Resources. Other notable companies include Sabesp (Brazil) and FCC Aqualia, a Spain-based international supplier.

As for technology providers, Fluence, a global supplier of water and waste-water solutions, was recently formed after the merger of RWL Water and Emecfy, while Kurita Water, BASF, 3M, Evoqua, Aquatech, Xylem and Dow Water are all major players.

On the more innovative side of the spectrum, Calgon Carbon uses activated carbon, a substance which absorbs contaminants in the water, to treat waste, while Cambi is a leader in the advanced anaerobic digestion of sludge into biogas. In addition, French company Orège has developed a patented compact technology for sludge treatment called SLG (solid, liquid, gas).