Improving the sustainability of water treatment
With global climate, energy, and sustainability issues set to intensify, Calix has identified some key challenges that have emerged in the last decade and are increasingly putting our planet at risk.

This series will dive deeper into each of these challenges in a dedicated special feature.
With rapid urbanisation and development, and increasing environmental pressure on industrial emissions, there is an emerging trend for safe, sustainable solutions to prevent odour, protect existing and new infrastructure, and improve wastewater treatment performance. Communities consume large amounts of water, leading to higher water demands but also increased wastewater production. This creates an urgent need to be more strategic and thoughtful about water use, and rethink the way we treat wastewater.

*80 percent of wastewater generated by society flows back into the ecosystem without being treated or reused, and 1.8 billion people drink water contaminated with faeces, putting them at risk of contracting cholera, dysentery, typhoid and polio.

Water and wastewater treatment plants must become more efficient and innovative, improve processes and maximise output by recovering energy and nutrients, recuperating organic matter and producing clean, reusable water – instead of simply regarding it as waste. These plants are also becoming multifunctional, providing an integrated treatment approach that not only cleans wastewater but also recovers its resources.

Why it’s essential to make water treatment more sustainable

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Water is an increasingly fragile resource that needs to be protected at all costs. There is a global imperative for every nation, regardless of its available water, to contribute to smarter, more effective water treatment. This means operators in industries that rely heavily on water, such as agriculture and food production, need to be proactive in their approach to water management.
Water pressures create opportunities for innovation. And this is slowly reshaping regulation, policy, and procurement.

The challenge for innovative water treatment systems is the need to restructure the water industry to effectively deploy and implement innovations.

Public utilities that operate water and wastewater treatment systems need to become more cost-effective in meeting changes in demand and upgrading water quality while increasing the robustness of the system as a whole.

These changes create opportunities for innovative solutions that can improve public health and safety and protect natural ecosystems, while improving economic efficiency and overall system performance.
A DOUBLE-EDGED SWORD
Phosphate mining has made phosphate both plentiful and cheap in the past, which meant that thousands of tonnes were dropped on farmland every year. This resulted in massive amounts of phosphate in wastewater and runoff from farms, which washes downriver and results in algal blooms. This can be disastrous as the algae die off and decompose, dropping oxygen levels to a point where fish and other aquatic life die in massive numbers.

The intensity of harmful algal blooms has increased over the past three decades, creating a worrying situation for many waterways. It can even potentially threaten drinking water, as was feared during the New South Wales bushfire emergency in late 2019* (*source: https://www.waterquality.gov.au/issues/bushfires).

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RECOVERING PHOSPHATE THROUGH WASTEWATER MANAGEMENT
Although it isn’t possible to create or synthesise phosphorus, it is possible to recover useable phosphorus from waste streams, including urban and industrial wastewater. Sewage treatment plants can remove biological phosphorous to create a sludge that is high in phosphorous. Adding magnesium to the waste can help make and extract struvite, which is a phosphorous-rich material.

By capturing phosphorous in a biologically-available form within wastewater sludge, it can be composted and recycled as fertiliser, preserving nutrients in the land to ensure farming remains efficient for many more generations. This approach recycles phosphate back into the environment safely. Importantly, it guarantees the ongoing availability of this essential fertiliser.

While many organisations have tried and failed to create a cost-effective technology to recover phosphate from wastewater, Calix has succeeded. Calix ACTI-Mag makes it possible to rapidly capture phosphate within the solid waste stream while removing the need for other harsh chemicals and the associated additional pH adjustment required.

Fertiliser that contains nitrogen (N), phosphorous (P) and potassium (K) is known as NPK fertiliser and it’s one of the most valuable resources in the world when it comes to agricultural production. The world’s farmers have relied on phosphorous to grow food for centuries but phosphate reserves are dwindling and experts believe that peak phosphate, which is the catastrophic decline in output of phosphate, could have a bigger impact on food supplies than even climate change.

While phosphate occurs naturally in numerous sources, including manure, farmers have relied on phosphate rock for fertiliser since the mid-1900s. Phosphate mine deposits are expected to be depleted within a few centuries, creating a predicament for the agriculture industry, requiring it to manage the amount of phosphate that makes it into fresh water while preserving phosphate supplies for use as fertiliser.

“"In the mid-1800s, food shortages due to farmland nutrient depletion became a major problem. But, thanks to native Peruvians, NPK fertiliser came to the rescue and became one of the most valuable resources in the world.” Calix business development manager, Michael Wheatland.

Peak phosphate and its impact on food supply

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How Calix ACTI-Mag is helping make wastewater treatment more sustainable

REMOVING HARSH CHEMICALS FROM OUR WATERWAYS

ACTI-Mag is one of Calix’s flagship solutions to key water-based environmental challenges. When used in wastewater treatment, ACTI-Mag significantly boosts the conversion of organic waste into biogas, which can then be used to offset carbon-intensive energy production methods. It helps reduce odour and improve the quality of water while having a real and meaningful impact on climate change.

ACTI-Mag is created in Calix’s proprietary and unique flash calcination and hydration technology, which produces a very high surface area magnesium hydroxide. Calix technology is a reinvention of the kiln process, which can produce high purity, high surface area products that have high levels of reactivity.

New materials produced by Calix technology are proving to have similar reactive properties to Nano Particles, without the safety concerns or high cost of production.

Calix technology also allows for the direct separation of CO₂, allowing it to be used for CO₂ reduction in traditionally CO₂ intensive industries.

Made with high surface area MgO (200m²/gm), Calix ACTI-Mag provides excellent neutralisation speed and produces less sludge, making it a much more stable product, which stays as a suspension longer compared to other Magnesium Hydroxide slurries.

Calix is also able to offer better service, reliability and performance to its customers because it controls the entire production process from mining of raw materials, processing and production. Calix owns and operates a mine in South Australia as well as production, testing facilities and manufacturing plants. The ability to hydrate our high surface area MgO in our patented, close-to customer facilities creates multiple benefits for our customers and local communities.

As a concentrated, stabilised suspension of magnesium hydroxide, ACTI-Mag has a higher neutralising value per dry kilogram when compared with caustic and lime, and is significantly safer than other traditional alkalis. It’s also a very cost-competitive option for hydrogen sulphide gas control in sewers and industrial waste treatment, which means it can help reduce unpleasant odours. It can also efficiently remove phosphorus and nitrogen from wastewater. This makes it the ideal solution for sustainable wastewater treatment.

MANAGING SALINITY TO IMPROVE THE QUALITY OF OUR SOILS

Sodium degrades the quality of soil, making it harder to grow healthy plants. It interferes with water’s ability to infiltrate the soil and seedlings’ ability to break through the surface. Farmers using water to irrigate their fields may inadvertently be adding excess sodium through the water source.

Many food manufacturing facilities use sodium hydroxide (“caustic soda” or “caustic”) to “clean in place” or flush their systems between food processing runs. This results in large amounts of waste water with very high sodium levels requiring treatment before discharge.

As efficient waste water treatment systems require alkalinity to keep bacteria healthy, addition of more caustic to boost alkalinity only adds more sodium. Given the impact of sodium on downstream water uses and treatment processes, legislated maximum sodium levels are trending downwards, creating significant pressure on food processing companies on finding alternative solutions to their waste water treatment.

Replacing caustic with ACTI-Mag, a natural mineral product, in waste water treatment systems can significantly lower the overall sodium levels discharged to the environment.

“Magnesium hydroxide has been known as one of the preferred methods for pH and alkalinity control within municipal waste water treatment processes for decades. Its benefits include improving digestion output from anaerobic digestors.” Calix business development manager, Michael Wheatland.
Audrey Barucchi, Calix marketing manager said: “Calix ACTI-Mag helps make an anaerobic biogas plant work much more efficiently, which reduces groundwater pollution, generates potentially re-usable industrial water, and also delivers a financial return on investment through sustainable power production.”

Michael Wheatland, Calix business development manager said: “With growing concern about the impact of industry and agriculture on Australia’s greenhouse gas emissions and the environment in general, biogas is swiftly emerging as the most attractive, affordable, and logical waste management solution available.”

WASTEWATER CAN BE USED AS A SOURCE OF GREEN ENERGY

Traditional wastewater treatment plants aren’t necessarily optimised for the production of biogas from wastewater sludge. Biogas is created through anaerobic digestion, which requires the material to have the right pH levels so bacteria can break down the micro-organisms in the wastewater stream. During this process, methane and carbon dioxide are created.

If the pH gets too low, significant amounts of hydrogen sulphide or “rotten egg gas” is released to the air, creating unbearable and toxic levels of contamination evidenced by a strong odour. When too much hydrogen sulphide is created, it can reduce the lifespan of the plant’s equipment because it becomes corrosive when it’s converted into sulphuric acid.

Adding an alkali reduces production of hydrogen sulphide and maintains optimum bacterial growth conditions for anaerobic digestion.

Anaerobic treatment with biogas production is also a realistic solution for industrial sites and farms with concentrated wastewater management issues aiming to work sustainability philosophies into their wastewater management strategies. Treating wastewater with anaerobic processes to produce biogas energy can significantly reduce pollution, and help industries recycle water and cut costs that would otherwise go towards electricity and energy demands. Increasingly, industrial sites are investing in on-site anaerobic cogeneration plants to treat wastewater.

For example, a rendering plant that processes four million kilograms of animal waste per week was consuming more than $130,000 worth of electricity per month, burning the equivalent of 24,000 tonnes of black coal per year. Before working with Calix, the plant sourced half of its energy from a coal-powered generator and the other half from biogas.

Using ACTI-Mag to improve its biogas production helped the plant save more than $1.5 million in energy costs.

Calix has also worked with a South-West Victorian piggery to reduce hydrogen sulphide from pig waste biogas and to improve biogas production. Working with Calix, this piggery increased biogas volume by 20 per cent and power generation by 23.5 per cent. It decreased the average daily effluent soluble phosphate levels by almost 40 per cent and hydrogen sulphide by 70 per cent, significantly reducing the unpleasant odour. Importantly, the piggery was able to achieve an increase in earnings of $68,000 per year from increased power generation due to the improved treatment of its wastewater.

Biogas is a viable alternative to traditional waste management approaches. It’s a clean, renewable energy that’s created from materials that would otherwise simply be wasted. It can reduce the greenhouse gas emissions of energy by over 20 times and prevents methane from escaping directly into the atmosphere. Creating energy through biogas is considered carbon neutral, so it’s a genuine solution to excess emissions.
Calix has become a corporate member of WaterAid, an international not-for-profit organisation, determined to make clean water, decent toilets and good hygiene normal for everyone, everywhere within a generation.

This partnership with WaterAid aligns perfectly with our purpose, the reason why we exist: “We Solve Global Challenges” and with our core value of “positive impact”. 

Calix is a proud corporate partner of WaterAid
Our passion is to find innovative ways to apply our technology to solve pressing global challenges. This innovation drive is at the heart of that we do as we continue to seek new ways to apply our technology and know-how in new markets, on a global scale.

Calix is a leading global innovator of award-winning environmental solutions for industry. Through developing unique processes and materials, we work with businesses and governments to help them minimise their impact on the environment whilst still achieving performance levels that they require.

**Innovating for the Earth.**

With global climate, energy, and sustainability challenges set to intensify, Calix has identified some key challenges that have emerged in the last decade and are increasingly putting our planet at risk. These Global Challenges are at the heart of everything we do.

[www.calix.global](http://www.calix.global)

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