

## CTO OUTLOOK

# Triggering the waste-to-value revolution

German water and wastewater operator Remondis Aqua is positioning itself at the forefront of resource recovery from wastewater and sludge. Phosphorus offers the most immediate opportunity, according to CTO Martin Lebek.



## MARTIN LEBEK

CTO, Remondis Aqua Group

Martin Lebek heads up Remondis Aqua Industrial but is also responsible for technical issues and R&D in the Remondis Aqua group of companies, which provides municipalities and industries with technology and operating solutions for water management. Martin has been at Remondis since 2003 and holds four patents in the field of phosphorus recycling from wastewater. He obtained a PhD in civil engineering from the University of Hannover, with a focus on biological wastewater treatment.

### What market drivers have been most important in shaping the direction of your technology strategy?

The needs of municipalities and industry for economic and ecological solutions are our core business, with cost pressures and environmental regulations as the prevailing market drivers. For industrial clients the increasing complexity of their markets as well as technology force them to gain support from specialised companies for technical installations that do not belong to their core business. In this regard we preferably offer contracts which we call “company partnership”, which are usually O&M or BOT contracts. This partnership with Remondis releases the customer of his water-related problems.

Our technology strategy is for this reason as diverse as the needs of our clients. However, in recent years we have been focusing on technologies for the recycle of wastewater and residuals within it. Examples are not only energy recovery from highly polluted industrial wastewater and closing the energy circle of municipal wastewater treatment plants, but also greater recycling of materials contained in wastewater.

### What are the key technology areas you are looking at in your R&D activity and why?

As a service company we need to work with a very open-minded approach for every single project and client. For cost saving reasons in recent years we have invested a lot in optimising anaerobic treatment of industrial wastewater. Integrated technology and processes such as the RE<sup>2</sup>Energy system are service products resulting from these efforts.

Besides wastewater treatment, we also handle sludges and residues from the treatment process. This mass flow is one of the most interesting “Urban mines” in terms of its contents of nutrients, organics and even noble metals.

The most interesting constituent which accumulates in sewage sludge is phosphorus. Europe is completely dependent on phosphorus import from a very few countries, while its production from ore has a massive negative ecological footprint with heavy metals and uranium imported with

the raw material to our environment.

Sewage sludge has a significant concentration of this element and therefore the recovery of phosphorus was one of our main R&D activities over the last three years. These activities resulted in the Remondis TetraPhos process, a technology which is able to recover over 80% of the phosphorus out of the ash of sewage sludge.

### What's the key benefit of recovering phosphorus out of sludge ash?

While extracting phosphorus as struvite in wet sludge has benefits, it is not an economic process and you cannot recover more than 50% of the phosphorus. Given today's technology, we need to greater concentrate the phosphorus, which is achieved by incineration. Moreover, this process is economically efficient because the ash is completely turned into useful products. After incineration of the sludge, phosphoric acid, gypsum and precipitants such as iron and aluminium are also produced. The precipitants can be reused to remove phosphorus from wastewater.

The market for land application of treated sludge is getting smaller, and the amounts of sludge being produced are growing while space to dispose of it is reducing. For that reason, we think that incineration looks strong for the future.

### What gaps do you see in Remondis' water technology portfolio that could be strengthened?

The examples of materials mentioned above that we already recycle from wastewater is still not complete. New approaches such as bio-plastics, cellulose, fats, rare earths, noble metals or even silicon are hidden treasures in municipal and industrial wastewater that we have in our focus. We might recover, for example, fats with special bacteria to generate biodiesel afterwards. This is not science fiction – this is happening today, and more will happen tomorrow.

As “Urban mining” is the word for solid waste recycling, at Remondis Aqua we are now speaking about “Aquatic mining”.

### If considering acquisitions, would you be looking at start-ups or well established ►

## ASHES TO ASHES

Remondis Aqua has been piloting its phosphorus recovery from sludge ash technology in Hamburg for over two years. A commercial project is expected to come online in 2019.



### firms and why? What technology areas would these cover?

Both types of companies are interesting for us and the most important thing is the value that the acquisition can bring. Start-ups normally have treasured minds, ideas and innovation. As we have to work hard and close together it's the chemistry between people that counts as well as the technology.

Because we are a family company, responsibility for human resources is backboned in every Remondis manager's mind. This means that acquisitions – especially of start-ups – must be of long term potential and long term cooperation.

The mentioned principles are valid for well-established firms too. It is not only the economic and technical benefit that we are looking for, it is the partnership that drives decisions.

### What are important factors for successfully developing the waste-to-value sector in the wastewater and biosolids areas?

For us it is the technical and economical feasibility. We learned from the past that environmental regulations are helpful for the development of the market. On the other hand, regulations should not be the only driver because they can change. What need is there for development of a waste-to-value process if it is not economical and regulations or subsidies change?

The other thing which has been a success driver for Remondis in the past is our role as a service company, where the needs of the client are the basis for the business.

We say that before the client feels they need a solution, we have to have developed it. Easy to say, but motivation for every day.

### Is there room for new technologies in extracting value from waste(water), or is it a case of existing technology acceptance and education?

Today the development of new technologies is always, for us, about connecting existing technical capabilities to the bigger picture. Existing technology in most cases is sufficient, but you need the idea and the knowledge to connect them.

Education is an interesting issue in that context. Particularly in Germany, knowledge and environmental responsibility is common to the broad public. Environmental education should not only train economical behaviour but explain that there is a very interesting industry and economy behind it. It is worth becoming a chemical, sanitary or environmental engineer. This is something we all should bring to the public's mind.

### How are you looking at greater involvement in the digital water space?

We are operating huge networks of sewers and drinking water pipes with all the required technical equipment. Tools for the digitalisation of sewer systems (e.g. geo information), maintenance work, optimising routes for our service offerings, and apps for our clients are only a few solutions that have been developed and will be developed further. We will be announcing when we have solutions ready for market.

### Where are you looking for new ideas for innovation outside of Remondis (i.e. partnerships with universities, in other industrial sectors etc.)?

We have a long history of cooperation with universities and research institutes. Universities like Rostock, Bremerhaven or Cottbus and Dresden are partners with which we either support professorships, have cooperation agreements or work together on specific projects.

One very interesting example is our cooperation with the Clausthal Institute of Environmental Technologies, with which we work together in a research programme of the BmBF in Germany. The goal is to develop a bio-electrochemical fuel cell which is able to produce electric energy while degrading organic pollutants. We are trying a new approach to fuel cells by trying to optimise the cells through the construction of the membrane grid within the system. We are not very close to commercialising this process, and it will make more sense in the future when used as a combination with other technologies for energy recovery from wastewater.

### What do you think will be the game changing technologies in the water sector in the next ten years? What is ripe for disruption?

'Aquatic mining' will enable the development of new techniques and advances in the recovery of water goes along with that. Particularly in the dry regions of the world the recycling of process and drinking water will be driving technologies. This is not really disruptive, but the different approach to wastewater is disruptive.

The new step is not to treat wastewater as something unpleasant to keep environmental impact as small as possible, but to handle it as a resource. The treatment plant then turns into a resource (energy and material) recycle plant.

### How can we incentivise technology adoption further with utilities or industries? As an operator, what role can Remondis play?

As an operator, Remondis is not selling the technology and building a plant in the centre of Germany, saying we have the technology, bring us the custom. We want to be integrated with a municipal or industrial client to work together on a technology, making it easier to talk about chances and risks. But if we say we will take all the risk, then we want to take all the chance.

Bringing public perception, science and companies closer together is also an important point to increase technology acceptance and adoption. ■