Did we invent a new water industry on Monday?

The world of water, through the eyes of GWI publisher Christopher Gasson

It felt like it. We ran a symposium entitled 'The new future of water'. The objective was to think through some of the ways that Neom – the urban sustainability initiative on Saudi Arabia's Red Sea coast – could change the way that we do water. Without legacy infrastructure or any preconceived notion about how water should be addressed, Gavin van Tonder and his team are reimagining how we might manage water if the objective is to have a zero environmental footprint. That means zero carbon and zero waste. It is a particular challenge, because the region of Saudi Arabia where Neom will be built has close to no natural water resources: everything has to come from the sea. That means finding uses for an awful lot of brine.

My expectation before the event was that Neom's optimism about the possibilities of brine would be steadily overwhelmed by the practical and technological challenges spelled out by the experts we had corralled to be part of the discussion. The volume of sodium chloride the project would produce would exceed global demand; it is not possible to separate out the different ionic compounds in seawater to the required purity at an economic price; the area of land you would need to undertake such a project and power it by solar and wind is entirely impractical; the bittern that you are left with once the obviously valuable salts have been removed is nothing but a hazardous waste. All these concerns were raised, but ultimately the message from the event was a hugely positive one. We are inventing a new water industry: brine refining.

It is a subtly different concept to brine mining, which is probably the paradigm most of us had when we went into the discussion. Brine mining suggests a world in which the sea is full of minerals which are already valuable, and the only challenge is to find the technologies which release that value. The refining paradigm takes a more realistic view about the minerals in the sea.

The parallel is with the oil refining business. In the early days of crude refining, there was just one valuable product: kerosene. Everything else – even the petroleum – was waste. Over time, however, markets were developed for all of the different fractions, giving way to the enormously diverse and important petrochemical industry. The same is true of the brine refining industry. At the moment it produces one product (water) and a lot of waste. Building the industry is going to require work on both the supply side and the demand side. For example, we will develop new applications for sodium chloride in the construction materials industry, and as that market matures, it will open up the economics of separating out other salts which currently have little commercial application. One by one, we will uncover new refining technologies and new ways of using those refined products until there is more value in the brine than in the water it was produced from.

In that sense, when I say that we invented a new water industry on Monday, I don't mean that we have found a way for water technology companies to take market share from the mining industry in certain product lines. What I mean is that we have established the paradigm for a wholly new industry: one for which neither the products nor the market is fully developed, but one which by a process of industrial logic seems bound to develop. Neom will play a key role in accelerating that process.

The logic is as follows. We are transitioning from a linear economy to a circular economy. This new economy will have different material needs. We don't know what those needs are going to be, but we do know the following:

1. Inorganic chemistry will grow in importance as our material economy is no longer shaped by the availability of low-cost hydrocarbons. The sea is the largest and most accessible repository of inorganic chemistry.

Source: Global Water Intelligence (September 30th, 2021),

2. Electrochemistry is likely to become an area of sustained focus for innovation, as protons and electrons squeeze combustion out of the energy mix. This could give rise both to new applications of ionic compounds, and new means of separating them out.
3. The main reason why we do not use the sea as a renewable resource is because the energy numbers don't add up in a carbon-limited world. Once low-cost renewable energy removes that constraint, refining seawater becomes a more attractive proposition in comparison to the conventional mining industry.
4. Brine management holds the key to water management in many parts of the world. Although the Neom project is about seawater, more generally as natural freshwater resources are exploited faster than they can be recharged, the world is having to depend on more saline raw water resources. Unless we can find better ways of managing brines, it will be difficult to meet all of the world's water needs.

There may be other countries around the world which have benevolent reasons to explore sustainable technologies, but only Saudi Arabia has the motive and the money to look beyond oil to reimagine the natural resources industry. Furthermore, its young and growing population, its suitability for ultra low-cost solar power generation, and its proximity to major trade routes ensures that it is well placed to seize the opportunities that might lie ahead. The investment in Neom positions it to understand the needs of a post-carbon economy and develop the technologies and supply chains to meet those needs before the rest of the world knows how to respond.
When the Polish chemist Ignacy Łukasiewicz built the world's first industrial oil refinery in Ulaszowice in 1856, he could not have foreseen what his invention might mean for the materials industry or the transport industry. What he did know was that he could use kerosene for street lighting, and that the refining of oil had potential beyond that. It was "a new branch of industry which will bear plentiful fruit", he said. 165 years later, brine refining could hold similar promise.

Source: **Global Water Intelligence (September 30th, 2021),**