Why is electrolysis so important for the energy transition?

Interview with Ulf Bäumer, CTO at ThyssenKrupp Industrial Solutions India

Bert Beyers: **Why is electrolysis so important for the energy transition?**

Ulf Bäumer, CTO at ThyssenKrupp Industrial Solutions India

Ulf Bäumer: The energy transition is about making renewable energies usable on a large scale, and they are local. Where does the wind blow most often and most strongly? Where does the sun shine most intensively? As we know, the wind doesn't always blow, but it's the same with solar energy. And hydrogen is probably the key to transporting and storing the energy produced.

To produce hydrogen, you need electrolysis.

In water electrolysis, electricity is used to turn water into hydrogen and, as a by-product, into oxygen. And that makes electrolysis ideal for the energy transition.

What are you working on at thyssenkrupp?

We are working on alkaline water electrolysis. In principle, electrolysis works like an inverted battery. You have a positive side and a negative side. There is a separator in the middle to keep the two gases separate from each other. And when you add electricity, hydrogen and oxygen are produced. Our main task, together with our partners, is to make alkaline water electrolysis usable and energy-efficient on a large scale and to develop the right components to do so.

Where do you stand in development?

We at thyssenkrupp are lucky that we have been present in electrolysis technology for over 50 years, we come from chlor-alkali electrolysis. This is a very similar process. Hydrogen is produced on the cathode side.

On the anode side, chlorine is produced instead of oxygen. The electrolysis cells of both processes are very similar. Against this background, our questions are: How do you develop such cells specifically for hydrogen production with the help of renewable energies? How can they be operated optimally? How do you develop the global value chains? Transferring our experience in chlor-alkali electrolysis to alkaline water electrolysis plays a key role here.

Where are the sticking points in the development of this technology?

At the moment, we are mainly working on scaling up. As I said, we have a lot of experience in the development and production of electrolysis cells. But what is being demanded at the moment in the context of the energy transition is completely beyond this scope. We are in the process of greatly increasing our production capacities. We are currently at 1 gigawatt per year, but we must and want to get to 2 and 5 gigawatts. This upscaling is of course accompanied by a reduction in costs. This means that we are very active in the field of automation, the use of robots and Industry 4.0. We are also working on improving the core components. These are the electrodes, the catalytic material and the separating diaphragm. An important point is to reduce the use of precious metals. Of course, this is also about costs.

We are talking about platinum and iridium, for example?

Yes, exactly. But there are other metals.

How far can we push technological development to reduce the use of precious metals?

You have to know that precious metals have excellent functions as catalysts. They allow us to run high current densities in alkaline water electrolysis, but also in PEM electrolysis (polymer electrolyte membrane). This means that efficiency is improved. This means that the amount of material used in the cell is much lower. The more current I can put into a cell, the less material it uses. This is a major advantage of precious metals. Of course, if I reduce their use, I have to make sure that the current density is maintained. And if I take the next step, namely to work completely without precious metals, then you might need more cells. The space-time yield changes.

Are there other economic sticking points in the expansion of production?

There are many components for water electrolysis that are currently still being built in the pilot phase, in low quantities. This is true for all competitors in the market. If you have a machine and you have to set it up first in the morning and then make a hundred pieces of something or other, then take the machine down again in the evening and make something completely different the next day - that's pretty uneconomical. We expect mass production to offer clear potential for cost savings. This applies to many components, including the materials we still want to develop and qualify.

So from manual to automatic production?

Yes, absolutely. Due to our long history, we already have advanced automation in cell production. But this also has to be taken further. In addition to automation, it is about the handling of raw materials, up to the fully assembled cell and that it is installed and connected at the customer's site. All this has to be integrated in order to produce as efficiently as possible.

In Germany, an electrolysis capacity of 5 gigawatts is planned by the end of 2030. Do you think that's realistic?

That is ambitious, but definitely possible. At the moment we have many projects worldwide in the gigawatt range. And when you look at the huge tasks that the energy transition entails, you simply need such ambitious goals.

Where do we currently stand in terms of production in Germany? Not only at thyssenkrupp, but also at the other producers?

As of today, we are already a lighthouse in terms of production capacities. Of course, there are many companies that are currently building production facilities that will go into operation at the end of this year or the beginning of next year. So I would say that if you now ask about the next year or the next one and a half to two years: How high is the production capacity for water electrolysers in Germany or in Europe? Then we will have a strongly rising curve. As far as I know, we are currently the only ones producing on this scale.

In Germany?

Yes exactly.

You keep hearing about big projects worldwide, for example in India or Australia. How do you assess that?

As a plant manufacturer with a 100-year history, we are active all over the world and of course we are very involved and also very interested. For example, we have a big sister company in India. But we also have water projects worldwide in the Middle East, in Australia, in North America, in South America. Exporting technology is a core part of our business model.

In order to reduce costs, you can improve the technology on the one hand, but also the production on the other. Where does thyssenkrupp stand in comparison with competitors from China?

We definitely assume that Chinese technology suppliers will be far ahead in terms of costs. But you also have to see that if you have a high degree of automation, the costs will be in a similar range around the world. We want to be the leader in technology, in performance and in reliability. That is our USP (unique selling proposition), with which we want to win our customers in the hydrogen market. Sooner or later, many technologies in the low-price sector will come onto the market. And we want to position ourselves clearly against this with our technological know-how. We will never become the low-wage country in Germany, but will always remain the high-tech country. That is what we are proud of, what we are building on.

And the demand is there?

The demand is there, and it is huge. And it's not only coming from Germany, it's coming from Europe, it's coming from all over the world. That is really gratifying to see. It's almost a kind of gold-rush atmosphere when it comes to hydrogen and water electrolysis.

What else is needed to be able to meet this high demand?

In order to manage the upscaling and to be able to handle the amount of orders and projects, we need above all well-qualified, experienced employees who can help to further develop the technologies. In Germany, it is a matter of offering appropriate courses of study, and possibly also adapting university curricula precisely for these professions that are so important for the energy transition. Because a lot will happen there, and a lot of manpower is needed.

We have talked about scaling up production in Germany. Let's switch to the global level. The International Energy Agency is talking about around 3,600 gigawatts by 2050. Do you think that's realistic?

Well, I don't know the figure now. But the order of magnitude will be right. That is a huge task. Our industry is largely based on fossil fuels. If you think about how much oil, coal and gas is produced every day. And you have to replace that with hydrogen, with renewable energies. You very quickly reach the gigantic range of capacities that need to be installed. So these big numbers that we constantly come across: in studies or in the strategy papers of the countries, that is all very credible to me. And I also believe it is necessary.

Could electrolysis become a bottleneck for the production of green hydrogen on a global scale?

It depends on the rates of increase in installed capacity worldwide. At the moment, there are many technology companies that have plans similar to ours to scale up production. It takes a certain amount of time until the output is there. And it also depends on how quickly the capacities are demanded by the projects. And how quickly companies and countries are able to conclude and implement contracts.

Do you have plans at thyssenkrupp for global production around the year 2050?

It is difficult for me to talk about the global market because so many companies are currently investing worldwide. If we now take our medium-term target of 5 gigawatts of installed capacity per year and continue that until 2050, we will certainly arrive at a realistic order of magnitude. If the market continues to pick up and more capacities are desired, this can also be adjusted.

In your view, are there alternatives to electrolysis for the production of green hydrogen?

Of course, there are several electrolysis processes that can be used. Apart from electrolysis, there are one or two ideas that are still in the qualification phase. It may well be that other processes will be added in the next decade. For example, hydrogen could be produced from natural gas or crude oil without generating CO_2. But as far as I know, we are still in the basic research phase. To the Video.