Take 5: An interview with Art Shirley, EVOLOH

By Stephen B. Harrison on Nov 24, 2023 FEATURE | INTERVIEWS

Take 5 with Art Shirley, Chief Commercial Officer at EVOLOH, focused on AEM Electrolyser technologies and green hydrogen production.

Shirley discusses the benefits behind AEM technology, business models behind realising hydrogen's potential, the future and much more besides...

Thanks for joining H2 View today, Art. Tell us please, why focus on AEM? What can it offer as an electrolyser technology?

EVōLOH has been focused on AEM from the beginning because we did not see a path to hundreds of millions of tonnes of green hydrogen production annually using existing PEM or alkaline technologies. Our conviction was that, if we developed AEM using earth-abundant materials, and having high-power density, this would offer the best path to low-cost, mass-manufactured electrolyser stacks.

I have conversations almost daily with project developers who could build GW-scale green hydrogen-and-derivatives plants in the next few years, but they have no way to secure the electrolyser stacks for those projects. This is the problem that we are looking to solve.

What has your team is achieved in the world of AEM electrolysis?

One of the biggest accomplishments the EVōLOH team has made has been in cell durability. Most AEM electrolysers suffer from rapid voltage degradation that shortens lifetimes and requires expensive maintenance to rectify. In a short time, we have achieved stack operation with near-zero performance decay over industrially relevant timescales.

This means that our first commercial stacks will have lifetime warranties as good as or better than those of other electrolyser manufacturers.

What are some of the unique aspects of the technology or manufacturing approach you are following?

EVōLOH has already obtained patents for our stack design and manufacturing and has multiple patents pending on other key elements of our technology. These innovations allow the high-speed, highly automated, roll-to-roll manufacturing processes that allows a single manufacturing line to produce 3.75 GW per year of stacks. Our Manufacturing Centre in Lowell, Massachusetts will be able to manufacture three times the electrolysis power in one-fifth of the space that our competitors require, and at a fraction of the cost.

We've worked with a leading engineering firm to design the equipment layout and automation of our Lowell factory, and we are now working with equipment suppliers to provide the machines to fulfil that design.

What will your business model be?

EVŌLOH's goal has always been to make and sell more electrolyzer stacks than any other manufacturer on the planet. We decided early on that, to hit targets of hundreds of millions of tonnes of green hydrogen annually, the electrolysis plants that were needed would have to be of hundreds of MW to several GW each. These plants would be engineered, not packaged design, and so any company trying to play in this space should focus on the most critical part of the process. And that is the stack.

But our business model must be broader because our factories are products in themselves. We intend to partner in manufacturing with green hydrogen producers that have their own demand for stacks, thereby enabling those deploying GW-scale projects to self-supply their stacks.

What is the potential for AEM? Can it displace PEM?

If AEM is done the right way, that is, with low manufacturing costs combined with performance characteristics of PEM, it can absolutely displace PEM. First, because PEM has inherent materials requirements that limit the GW of electrolysers that can be manufactured, and second, because the raw materials costs will always leave PEM at a disadvantage.

Of course, there are many other costs besides the stack that go into the levellised production cost of green hydrogen, but it seems evident that PEM may never be more than a niche technology.

What are some 'best-fit' use cases for AEM?

Most potential customers I speak with are looking to take 'stranded renewables' (that is, renewable energy that could be generated in places remote from the electrical grid) and convert these green electrons into a hydrogen derivative, such as ammonia or methanol, for export. The MENA countries, southern Africa, the Canadian Maritimes, South America, and Australia, for example, have huge renewables potential but no economic way to get this power to market.

Several of these projects require multiple GWs of stack capacity, tied directly to solar or wind, with downstream conversion to the exportable product. EVŌLOH has been approached by several of the largest project developers for supply of over 600 GW of stack capacity before 2030.

How might AEM develop in the future?

The anion exchange mechanism requires the anodes to operate in an alkaline environment, but this does not mean that one must use concentrated caustics like lye. EVŌLOH operates its stacks using a mildly buffered water that is compatible with stainless steel and organic polymers but without the need for high concentration potassium hydroxide. This preserves the process design of pure-water operation while ensuring that stack degradation is minimised.

Because of the scale of manufacturing for which we aim, we have focused our development activities on 1MW and 5MW stacks of high-power density. Each of these weighs less than 1,000kg, such that we can build modules up to 50MW that meet the weight and size restrictions of a standard ISO container. That greatly reduces transport and installation costs, since a 1GW electrolysis plant would only require 20 of our largest modules.

Each of these features contributes to lower capital cost for plant builds, and lower costs in operation. As EVŌLOH continues to scale, we expect these unit costs to continue to decline.