Creating organic fertilizer with cutting-edge plasma technology

Highlights:

- Radom has found a unique way to create nitric acid by utilizing a microwave plasma process using only electricity, water, and air
- Radom needed an industrial controller (PLC), capable of interfacing multiple industrial protocols simultaneously in real time for its 100-kilowatt microwave plasma system
- Radom selected PLCnext Technology, which offers programming in high-level languages and could communicate with all the required industrial protocols

"What's unique is that our plasma enables us to create the nitric acid from just electricity, water, and air."

– Aaron Arbiture, vice president of program management at Radom.

Customer profile:

Radom Corporation is a global leader in advanced plasma technologies. Radom's plasma products and instruments are designed to enhance safety, improve operational efficiency, and reduce environmental pollution (Figure 1).

"Plasma is the fourth state of matter, and we've found a way to create it more efficiently," said Aaron Arbiture, vice president of program management at Radom. "It's a scalable technology that we can apply on both the low-power and high-

Figure 1: Radom's first-of-its-kind nitrification system fixates nitrogen from air using plasma to enrich organic fertilizer with nitrogen.

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power sides to solve all kinds of problems. We started with chemistry, and we've moved onto larger industrial processes."

Radom has deployed its advanced technology to enrich the nitrogen content of organic fertilizer by using only electricity, water, and air. Traditionally, creating synthetic fertilizer emits large quantities of carbon dioxide and other greenhouse gases into the earth's atmosphere. By using high-powered plasma, Radom can create organic fertilizer with twice the nitrogen content, near zero ammonia pollution, and much lower greenhouse emissions (Figure 2).

Radom uses its patented Cerawave technology for plasma-driven nitrogen fixation. As Aaron explained,

"Typically, a plant with ammonia refining needs a lot of infrastructure. Frankly, this is a dangerous process that requires a lot of capitally intensive planning, as opposed to something portable that doesn't have to be in the same spot forever." Radom believes Nitrogen Fixation with plasma is the future of farming, and all systems will use industrial controllers (PLCs) for precise process control accuracy."

Figure 2: By using high-powered plasma, Radom can create organic fertilizer with twice the nitrogen content, yet near zero ammonia pollution and near zero CO_2 and greenhouse emissions.

Challenge:

"Creating plasma has many challenges," Ashok Menon, co-founder and COO of Radom Corporation, said. "When it's created at atmospheric pressure, it's a very, very high temperature. We're talking 6,000-degrees-Celsius hot. At that temperature, nothing, nothing can withstand it; everything melts and disappears. So how do you keep a plasma running in a device that's manmade at 6,000 degrees Celsius? And that's what we've solved with Cerawave technology" (Figure 3).

Aaron said, "Radom's technology is scalable. We can apply that to any application that could use high heat. We've currently focused that on analytical chemistry.

Figure 3: Creating plasma at atmospheric pressure involves temperatures up to 6,000 degrees Celsius.

We can also effectively generate chemicals onsite for places in the world where it would be tough to get resources."

"That's just given the nature of having a lightweight footprint of our overall system. If you don't have to go through the process of cooling things down because you're not generating extra heat by way of loss when transferring energy, you get to scale everything down accordingly," he continued.

For the nitrogen fixation process, Radom needed a controller that could interface with a 100-kilowatt microwave plasma system. The controller needed to communicate with multiple communications protocols, including Modbus, EtherNet/IP, RS-232, RS-485, 4-20mA, 0-5V, 0-10V, simultaneously. Phoenix Contact's PLCnext Technology provides that capability.

Solution:

Ashok said, "As we were developing some of these products, we realized that we needed a partner to help us automate and scale our ability to turn that technology into a product. That's where we got involved with Phoenix Contact."

After evaluating several leading automation suppliers, Radom selected PLCnext Control and other Phoenix Contact products. PLCnext Technology offered programming in high-level languages and could communicate with all the required industrial protocols (Figure 4).

The previous control system required manual readings. However, with Phoenix Contact's assistance, Radom created an entirely new, ground-up design that monitors several key parameters and automatically gives operators the data they need. Phoenix Contact provided a more cost-effective solution compared to other suppliers, and the products' small footprint minimized the control panel size (Figure 5).

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Figure 4: PLCnext Technology offered programming in high-level languages and could communicate with all the required industrial protocols

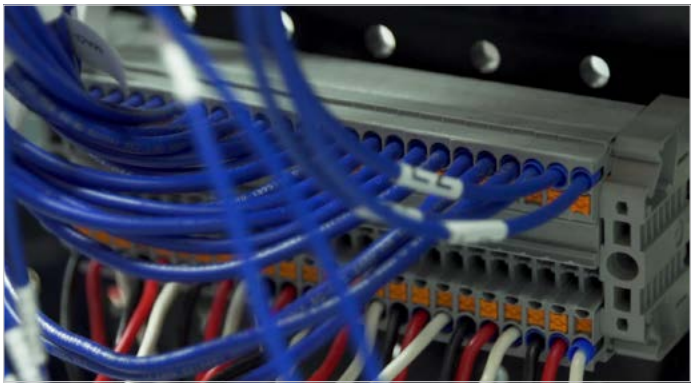

Figure 5: Phoenix Contact met Radom's needs from both cost and lead time perspectives.

Results:

Aaron stated, "The relationship has been great. We've got a really good local contact, who has been an excellent interface with our technical team. We can relay what is probably not a final design and have that translated into a real solution for what the end result needs to be from our perspective."

"We don't see ourselves becoming very successful without great partners," concluded Ashok. "We see ourselves identifying these key verticals and solving problems for customers. Bringing along partners, like Phoenix Contact, helps us deliver and scale these industrial processes."

Watch a video to learn more about Radom and its cutting-edge plasma technology.