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[Game Changer] This Korean start-up aims to set the battery market on fire without any flames

Kim Bu-gi, Standard Energy CEO, speaks during an interview with the Korea JoongAng Daily at the company's office in Daejeon on April 10. [PARK SANG-MOON]

Vanadium, a hard, silvery metal element, has been on an upward demand curve with its price soaring 84 percent over the past 10 years — lifted partly by its potential as a battery candidate that is safer than lithium.

And this is where Standard Energy, a Korean start-up, is betting big.

The world's first vanadium-ion battery is set to finally take off in Korea, with no explosion involved, and it may forever change how electricity is stored with an energy storage system (ESS), says Kim Bu-gi, CEO and founder of Standard Energy.

Founded in 2013, the Daejeon-based start-up received a 10-billion-won ($7.7-million) investment from SoftBank Ventures in 2021. In January last year, Lotte Chemical announced a 65-billion-won equity investment in the battery developer to acquire 15 percent of the company.

Standard Energy plans to market its vanadium-ion battery this year, as the local regulators are readying a first-ever industry standard for vanadium-ion batteries in the world.

The review process is under way, and Standard Energy is expecting the result in the near future.

Standard Energy fact sheet

Founded	2013
CEO & Founder	Kim Bu-gi
No. of employees	140 *
Major business area	
ESS battery product (vanadium-ion battery)	
Production capacity	
10 megawatt hours per year	
Accumulated investment	
90 billion won*	
Major investors	
Lotte Chemical, SoftBank Ventures	

* approximate figure Source: Standard Energy

"This will mark the first case for Korea to set an industry standard for an original battery technology ahead of other countries," said Kim, as most of the battery technologies in the market were originated outside Korea, which the country later adopted for further scale-up.

"It will be a significant milestone in the battery industry," Kim added.

As the world moves away from the fossil fuels, an ESS plays a pivotal role in ensuring a stable supply of renewables. Large-scale stationary batteries for ESS deployment needs to be more durable and energy-efficient compared to smaller counterparts installed on electric vehicles (EVs) and other mobile devices, as it needs to store a large amount of electricity for a long time.

However, with lithium-ion battery fires at energy storage facilities hitting the headlines across the globe, inevitable safety risks remain one of the biggest drawbacks of predominant lithium-based nickel-cobalt-manganese (NCM) or lithium ferro-phosphate (LFP) batteries.

Standard Energy believes it has a solution to that issue.
Punctured, beaten, dropped and even directly exposed to fire through numerous safety tests by multiple institutions, the company's vanadium-ion battery did not show any sign of ignition, according to the company.

But that's not all there is to it.

"Batteries for energy storage systems need to meet the standards in five criteria: energy efficiency, longevity, power characteristics, safety, and reusability," said Kim.

"The important thing is that you need to satisfy all five criteria, not just some of them."

Kim earned his bachelor's, master's and a Ph.D. in engineering at KAIST. Standard Energy currently has 140 employees, or "teammates," as the company calls.

The Korea JoongAng Daily sat down with Kim for an interview to hear about the company's journey and ambitions at its headquarters in Daejeon.

The following are edited excerpts from the interview.

What brought you to a vanadium-ion battery business instead of the predominant lithium-ion battery?

A. When I first entered the battery business, the market hadn't yet been separated into a mobile battery segment and a stationary battery segment for ESSs. What we found back then was that a battery technology's value would increase significantly if a battery could be used for not just powering mobile devices but for storing a large amount of electricity, since electric power is extremely hard to store.

But lithium-ion batteries were never meant for a large-scale energy storage, as the compactness and light-weightness was what made them more suitable for mobile applications. Our goal was to market a battery specialized for a large-scale energy storage, which led to developing a vanadium-ion battery.

Do you believe vanadium-ion batteries will replace the predominant lithium-ion batteries in the ESS market in the future?

Yes. I am sure of it, and I believe it is a necessity.
Lithium-ion batteries and vanadium-ion batteries are not exactly in a competing relationship. These are mutually complementary technologies. The former is more suitable for powering mobile devices, while the latter specializes in large-scale ESS facilities. The requirements for each segment differ significantly.

The ESS batteries, in particular, need to last about 10 times longer than mobile batteries. And our vanadium-ion batteries have a much longer lifespan even compared to the most long-lasting lithium-ion batteries available — that would certainly work as a pull factor in the ESS market.

The lithium-ion batteries have been predominant in the market despite ignition risks because there was no alternative that could catch up with its high energy efficiency and production quantity.

Vanadium-ion batteries, on the other hand, have zero risk of ignition, and also have high efficiency. Its energy efficiency is at the highest level compared to any other types of batteries in the world.

What was the biggest challenge you faced during product development?

When we first founded the company, our business was based on a preexisting technology named vanadium redox-flow battery, which was introduced more than 30 years ago. Many companies before us tried to monetize the technologies, like we did, but later we could see why the technology couldn't get the market traction.

It has its perks, but wasn't enough to meet our expectations regarding longevity, efficiency and so on. It was safe, yes, but that wasn't enough to win the market.

Batteries don't only consist of vanadium. We had to develop all four components of batteries — active material, separator, electrode and current collector — by ourselves from scratch. We currently run four manufacturing plants, where all the components as well as the end products are produced.

Companies are rarely able to establish a portfolio like us, which encompasses all stages of production from raw materials to end products and system engineering, even on a global scale.

How far have you come in commercial operation?

We already began manufacturing the vanadium-ion batteries. The products will be available for sales starting this year.
Batteries cannot be sold in the market right away even after a company succeeds in mass-production. Industry standards and regulatory framework should be established. Technologies for a vanadium-ion battery did not exist before, so we need to set up a new standard and regulations, and that process is almost completed.

So, things will begin to really take off this year.

Compared to predominant lithium-ion batteries, do vanadium-ion batteries have cost-competitiveness?

This is a very important point.

In order to compare the cost-competitiveness of an ESS battery, you need to consider the overall expenses including not only the initial price of the battery products, but also the operational costs

spent in maintenance. That is because the ESS batteries are basically used for purchasing and selling electricity, and therefore the buyers of ESS batteries need to provide a power supply service using the products.

Since the production capacity of vanadium-ion batteries isn't as big as that of lithium-ion batteries yet, the price of each battery cell is more expensive than lithium-ion batteries.

But when we consider the maintenance costs, vanadium-ion batteries have a competitive edge because of three reasons: they last longer; electricity losses are minimized thanks to improved efficiency; and most importantly, they're safe.

Lithium-ion batteries are exposed to risks of ignition, and therefore need additional casing and fire extinguishing gadgets and so on. But if the battery is safe from ignition, you won't need those.

Vanadium-ion battery cells are still about twice as expensive as lithium-ion batteries at this point, and we are currently striving to ramp up production from the current megafactory to a gigafactory in a bid to cut the price.

According to our calculations, if we achieve the economy of scale equivalent to that of lithium-ion batteries, the production costs of vanadium-ion batteries will be cheaper than lithium-ion batteries with about one-quarter the costs needed for production plant construction.

Do you have plans for overseas expansion?

Yes, we do.

Korea's domestic ESS market is close to non-existent at the current point mostly due to the previous lithium-ion battery fires, while the global market is growing very fast. So we are receiving a number of offers from companies in the United States and the European region, especially from power suppliers and EV charging service providers. Vanadium mining companies are also interested, as they recognized that vanadium can be used in not only steel-making but also battery manufacturing.

So discussions are actively ongoing, and we are definitely considering building an overseas production plant if the need arises.

As we require relatively low costs and a short period of time for production plant construction, the plan is to play to our strengths in cutting initial costs in establishing a production base overseas.

Raw materials procurement is one of the key issues in securing a stable battery supply chain. From where do you procure vanadium?

Vanadium is a common material worldwide, and it's even found in Korea. So securing a vanadium supply is not that difficult.

Demand for lithium-ion batteries is soaring, especially with the strong EV demand, and the preexisting battery technologies inevitably come with supply chain risks since they use rare earth materials.

We decided not to use rare earth materials from the early stage of development and set a goal to achieve strong performance and long lifespan without them, because we believed that's the only way to expand the market and establish a complementary relationship with the preexisting products.

All-solid-state batteries are often referred to as 'dream batteries' due to their expected stability. Would a vanadium-ion battery have a competitive strength over an all-solid-state battery, especially when deployed in an ESS?

All-solid-state batteries certainly have a huge potential, and many companies are trying to bring that to reality. But the market won't budge if safety is its only strength. Every other criterion should be satisfied as well. Vanadium redox-flow battery, for example, was already known for being safe from ignition, but that wasn't enough. What we need is a safe and also high-performing battery.

What is interesting is that over the past some 160-year history of secondary batteries, only three technologies succeeded in being widely adopted in the market. To market a battery on a commercial basis, you need to overcome so many challenges.

One of the major obstacles is enhancing the lifespan. Batteries need to last for a long time while maintaining their initial capacity, and that's where many new technologies fall short.

The vanadium-ion batteries experience minimum capacity decay even after being recharged tens of thousands of times as we minimized irreversible side reactions with our self-developed component technologies.

An energy storage system powered by vanadium-ion batteries installed at Lotte Himart in Apgujeong, southern Seoul [STANDARD ENERGY]

Lotte Chemical made a 65-billion-won investment in Standard Energy last year. How did that happen?

It took two years for us to receive the investment from Lotte Chemical. We approached Lotte Chemical first because we thought that as the company already has experience in battery business, it will be able to recognize the potential value of our technology.

Lotte Group's retail infrastructure also stood out to us. That is how we installed our first ESS station for EV charging at a Lotte Himart in Apgujeong, southern Seoul.

Production-wise, Lotte Chemical is building a production plant for vanadium liquid electrode in Yeosu, South Jeolla, and will begin operations soon.

Lotte Chemical is making major investments as of late while shifting its focus from the traditional petrochemicals to battery businesses. And while big-name companies have already taken the lead in the lithium-ion battery business, this is still the right time to enter the ESS battery market.

What kind of measures or government support do you think is necessary to revitalize the sluggish domestic ESS market?

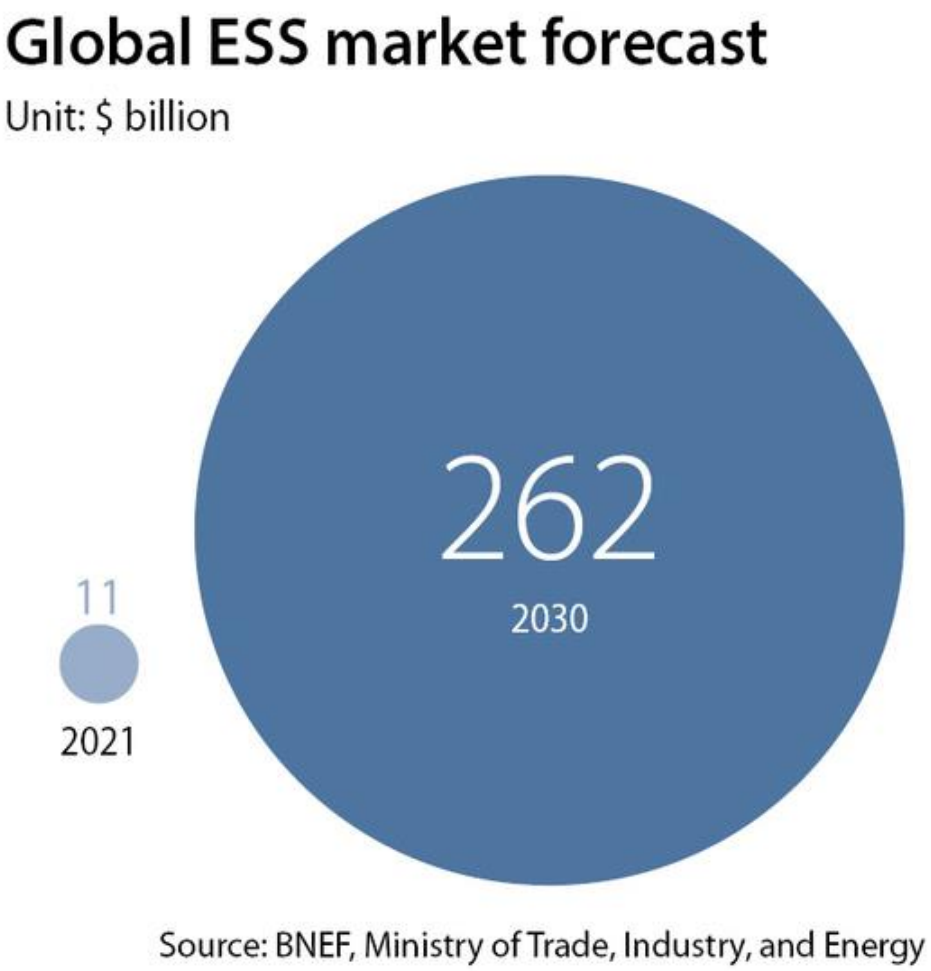
I don't think it is the government's fault that the domestic ESS market came to be in the current situation. Over 30 cases of lithium-ion battery fires at ESS facilities were reported despite implementing preventive measures. How would the government continue to provide incentives for that?

I can see that the government is willing to provide policy support for ESS businesses. What they really need is the proof that such fire incidents won't happen again. That is why we have tried really hard to install an ESS at the center of downtown Seoul; we were confident that it is going to be safe.

Korea is often called one of the strong battery players, but it is only half truth, because the domestic industry relies too heavily only on lithium-ion batteries.

But other countries are trying to diversify battery types in the market, since the limited quantity of resources makes it risky to depend too heavily on a single battery technology.

Furthermore, in order to achieve the RE100 initiative, we need a lot of batteries for ESSs. Korea needs to establish an industrial portfolio that can cover both lithium-ion batteries and ESS batteries.



What is your ultimate goal?

We have an ambitious goal of providing our batteries and services to wherever electricity flows. If that vision comes to reality, electricity will be much cleaner and abundant than it is now. Everyone will have an equal accessibility to energy.

We began as a battery developer, but ultimately, we hope to become an energy distributor.

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