How Long Duration Energy Storage (LDES) can solve the energy challenges of manufacturing companies

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The innovative LDES technologies offer a sustainable, affordable, and dependable transition to renewable energy. With global shifts emphasizing the paramount importance of energy security, our event dived into the opportunity to grasp the staggering $4 trillion global potential of LDES by 2040.

This article was co-authored with Paul Peeters (Agoria).

On February 28, 2023, we kicked off the "Powering the Future - Manufacturing meets Energy Transition challenges" series of events. Industry experts and visionaries from Sirris, Agoria, and Energyville presented the state-of-the-art of Long Duration Energy Storage (LDES) to an audience of 70 professionals in Genk.

The innovative technologies involving LDES offer a sustainable, affordable, and dependable transition to renewable energy. Let's start with a quick look at the four central LDES technologies:

- **Electrochemical energy storage** (the main topic of this event), where energy is stored in batteries through chemical-electrical conversions, offers benefits like durability and scalability but faces challenges such as material sustainability.
- **Thermal energy storage** (TES) involves storing thermal energy to balance supply and demand, enhancing efficiency and reducing emissions, though it requires advancements in conversion mechanisms and material safety.
- **Mechanical energy storage** converts electrical energy into mechanical energy using systems like pumped hydro-storage and flywheels, focusing on improving security and storage duration.
- **Chemical energy storage** uses hydrogen to store energy in high-density fuels derived from various energy sources, supporting grid resilience and offering opportunities for emission reductions, highlighting each technology's unique advantages and challenges in sustainability, efficiency, and environmental impact.

> **"If we want to move to more renewables, we will need technology that adds flexibility into the system"**
> **– Michel Verschuere, owner & managing director at Yuso**

A market ready to explode

With global shifts emphasizing the paramount importance of energy security, the event dived into the opportunity to grasp the staggering **$4 trillion global potential of LDES by 2040.**

Lately, the integration of energy storage into our grids has received a lot of attention. Battery Energy Storage Systems (BESS) will play a key role in solving **grid stability and flexibility** when moving towards (a mix of) renewable energy sources, propelling us faster toward a carbon-neutral future.

It's important to note that within this industry, **market potential** exists both before the meter (grid) and behind the meter (companies and microgrids). An excellent example is the set-up at Jan De Nul, one of the first commissioned cases in Belgium. Engie Laborelec used Invinity's two-story Vanadium Flow batteries to create up to 12 hours of storage capacity.

By 2040, a whopping 8 TW of long-duration energy storage is forecasted for deployment across global electricity grids.

The battle of technologies

Unfortunately, Moore's Law doesn't apply to Lithium-ion battery cells. Over the past 30 years, the energy density of Li-ion batteries has only quadrupled, and battery lifetimes have not taken a quantum leap forward. As per one of the speakers, "Lithium-based batteries should be seen as sportscars that can go very fast but with only minimal range. We will need other types of 'cars' to make the renewable energy transition happen."

That's where LDES technologies come into play. This event mainly focused on **electrochemical flow and zinc-ion batteries**, which have one significant advantage over lithium-ion: a longer discharge rate. Commercial products on the market today typically offer storage times of 4 to up to 12 hours.

Two types of alternative batteries with market potential have been presented by guest speakers Engie Laborelec and EOS Energy:

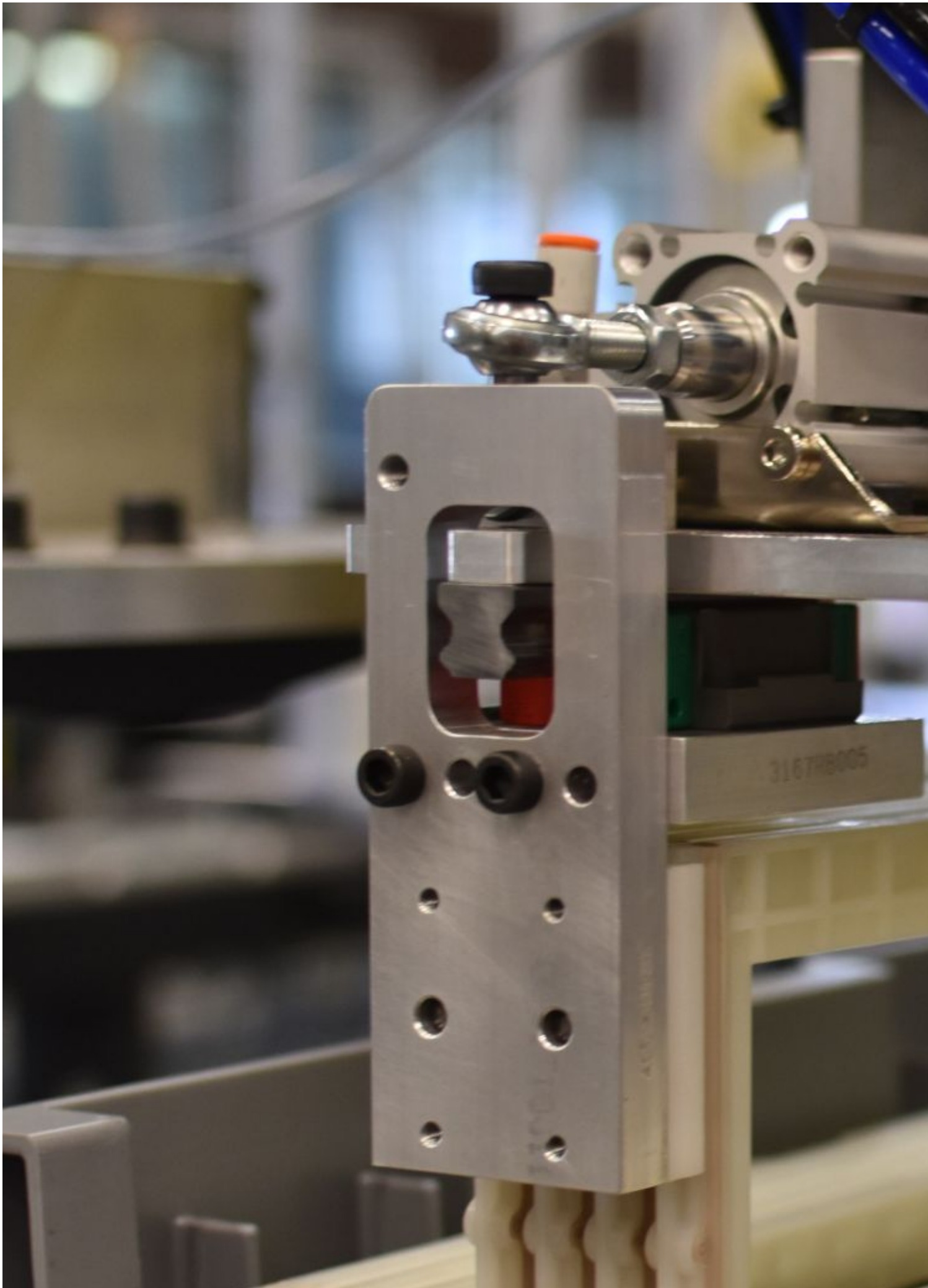
1. **Vanadium-based redox flow batteries (VRB)** have existed for many years. However, Vanadium is quite expensive, its power density is relatively low, and maintenance costs tend to be high.
2. **Zinc-bromine batteries (ZNBR)** use zinc and bromine as active materials. They offer advantages such as fast charging and discharging times, long cycle life, much lower fire risk than lithium-based systems, low noise, and the ability to store significant energy.

Manufacturing capabilities

To be able to position new LDES technologies as a strong alternative versus Lithium-based batteries, significant **breakthroughs will be needed** concerning **product innovation** (increasing power density and round-trip efficiency), ramping up (semi-automated and automated) **production capacities** and significantly **reducing the cost** of LDES batteries.

In this respect, **the US clearly takes the lead**. EOS Energy Enterprises, a Pittsburgh-based Nasdaq-listed company, has focused on Zinc-Bromine electrolyte-based chemistry for the past 15 years. This LDES technology is non-flammable (which means modules can be stacked together easily), uses abundantly available materials, operates in a wide temperature range, has a 20+ year lifespan, and only needs very low auxiliary power requirements. It currently offers a storage capacity of 4 up to 12 hours. It's also favourable that cooling doesn't create a lot of noise, which is a considerable asset for acquiring environmental permits.

Today, an investment plan to produce four fully automated manufacturing lines – expected to produce a staggering 8 GWh of energy storage annually – is being carried out. **The US Department of Energy has granted EOS a staggering $399M conditional loan guarantee commitment.** To put this amount into perspective, the total budget of the leading European BATT4EU-innovation project is only €925M.



36 hours of storage?

According to the participating manufacturing companies, there is a distinct need for **battery storage capacities of 36 hours** or more in the market. The good news is that as technology matures, we can expect commercial LDES solutions with capacities exceeding those 36 hours to become more prevalent in the coming years. Innovations in materials, system design, and cost reduction will play a crucial role in whether or not we achieve this goal.

Moreover, there is an urgent need for additional **LDES-focused training (programs)**. Transferring the proper knowledge to the right people and the safety aspects of battery management & handling should be a focus.

As the renewable energy landscape evolves, LDES will play a vital role in achieving a sustainable and resilient grid. Continued research, investment, and collaboration will accelerate the commercialization of longer-duration energy storage.

Powering the future – more upcoming events

This LDES event was part of our "Powering the Future - Manufacturing meets Energy Transition challenges" series. We are looking forward to seeing you at the following upcoming events:

- March 27, 2024: Thematic workshop Circularity & sustainable Energy solutions
- April 24, 2024: Green alternatives for gas-powered manufacturing processes

Authors

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