

FLOW BATTERIES AS A CONTRIBUTOR TO THE SECURITY OF SUPPLY

**10-12 HOURS GREEN ENERGY SUPPLY TO
AVOID GAS IMPORTS**



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1. SECURITY OF SUPPLY AND RENEWABLES

With the onset of the war in the Ukraine, it has become clearer than ever that the European Union must work towards its energy independence and self-sufficiency. However, the EU must also avoid jeopardising its climate commitments by turning back towards fossil fuels. Instead, the EU must stand firm in its commitment to achieve carbon neutrality by 2050, which includes the transition to a renewable-based energy system. Flow batteries, as an important long-duration storage technology, can play a significant role in supporting this transition.

Since renewable energy is inherently variable, solutions are needed to ensure power availability and grid stability. Curtailment is not only highly inefficient, but is also costing a lot to the EU Member States. For example, in 2020, Germany curtailed 5900 GWh of wind energy, or about 5% of its total production, costing EUR 730 million in total.¹ It is possible to substantially increase the proportion of generation from renewable energy, provided that the energy system is set up to be more flexible and allow to add capacity, shift energy, and improve power quality through energy storage solutions. Energy storage technologies therefore have a fundamental role to play in the clean energy transition, ensuring that more renewable energy can be introduced and used efficiently within our power system.

The recent surge of interest and deployment of large-scale batteries has focused on applications of under 4-hours discharge duration to provide frequency control and fossil fuel peaking plant replacements. However, studies show that there is a substantial need for long-duration energy storage technologies. The study “Storage in the Loop”, undertaken by the Fraunhofer Institute and the Institute of Information Systems and Marketing, investigated the possibility of implementing 100% renewable energy in the German land of Baden-Württemberg. The study identified “renewable gaps”, where, in a one-hour period, the total renewables production is less than 50% of the total load. The results show large energy gaps at not only 1- to 2-hours, but also at 8- and 10-hours. This confirms that more long-term storage technologies are needed to support the transition to renewables.

II. FLOW BATTERIES CAN SUPPORT THE CLEAN ENERGY TRANSITION

Flow batteries, as a key long-duration storage technology, are a fitting solution to fill these long storage gaps. Flow batteries encompass different types of chemistries, which can provide 10-12 hours of storage, with the possibility of reaching even 100+ hours in the future.² Flow batteries have several sustainability and safety advantages. Firstly, they can be mainly produced with low-cost materials and without using

1 [Key findings and summary Monitoring report 2021 Eurostat - Data Explorer \(europa.eu\)](#)

2 [HBr Flow Batteries: long term storage for grids, compatible with hydrogen - Energy Post](#)

any ‘conflict’ materials, such as cobalt. Flow batteries also have a very long operational life, which can exceed 20 000 cycles and 20 years. During this period, they can cycle and recharge with almost no loss in power.

In addition, vanadium, one of the most commonly used electrolytes in flow batteries, is widely available. As well as mining, it can also be recovered from different waste products, such as mining slag, oil field sludge, and fly ash.³ Once a vanadium flow battery is decommissioned, the vanadium electrolyte can be recovered and reused by up to 97%, leading to both lower environmental impacts and a lower cost of ownership. Flow batteries are also modular, and their parts can therefore be replaced or reused, if necessary.

A further flow battery technology option is based on organic electrolytes, which avoids the use of metals completely. Sodium chloride, as one of the main raw materials in these technologies, is highly available in the European market, which is the second largest producer globally. Even at 50GW of output, only a single-digit percentage of the annual salt mining in Germany is required. This results in a substantial independence from global supply chains and scalability for applications in Europe.

Furthermore, flow batteries are an inherently safe technology. One of the key advantages of an aqueous flow battery is that “thermal runaways” are not possible, as the key component of the non-flammable electrolyte is water.

In addition, the embodied energy in a flow battery is less than the embodied energy in other battery types, meaning that less energy is needed to construct and maintain a flow battery across its entire lifecycle.⁴ Developing a local flow battery chain would also further lower its environmental impact by reducing the emissions related to the transport of raw materials. As flow batteries have a longer operational time, the embodied energy amortised over the lifetime is therefore even lower.

III. INVESTMENT IN FLOW BATTERIES

For flow batteries to reach the market at a large scale, we need a more favourable legal framework and more funding opportunities. The funding should come in the form of Research & Development support, support for more demonstration projects, and endorsement of flow batteries as an important green investment opportunity. This is particularly important, because other parts of the world, including the United States and China, are already ahead of the EU in investing in these technologies. For example, the US Department for Energy dedicated USD 17.9 million in funding for four R&D projects on flow battery and long-duration storage systems,⁵ and China is building a flow battery gigafactory.⁶ In addition, the United Kingdom government launched a call for long-duration storage in 2021, offering GBP 68 million capital funding.⁷

3 [Imergy Uses Recycled Vanadium to Cut Materials Costs for Flow Batteries | Greentech Media](#)

4 [Flow battery production: Materials selection and environmental impact - ScienceDirect](#)

5 [Department of Energy Invests \\$17.9 Million in Long-Duration Energy Storage Technologies | Department of Energy](#)

6 [VRB Energy breaks ground on 100MW / 500MWh flow battery and gigafactory in China - Energy Storage News \(energy-storage.news\)](#)

7 [Government boost for new renewable energy storage technologies - GOV.UK \(www.gov.uk\)](#)

We urge the EU to offer similar investments to EU producers and manufacturers, to ensure both the competitiveness of the EU's long-duration energy storage technology value chain and the achievement of energy independence of the EU. To anticipate and match an increasing demand for energy coming from renewable sources, larger investments in flow batteries will be needed as well.

Currently, a Tesla gigafactory produces 35GWh per year and costs USD 5 billion, most of which goes into electric vehicles (EVs). If scaled, 1GWh would cost around USD 140 million. Meanwhile, a flow battery factory would cost less than half of a lithium-ion factory.

According to IHS Markit, the global energy storage market will add up to over 30GW a year by 2030. If, say, we need 30GW of stationary storage a year, and only 5% of that is flow batteries, that would still mean 1.5GW coming from flow batteries. A 1.5GW flow battery factory would cost around USD 100 million. We therefore think that Europe should invest approximately EUR 100 million per year in flow battery manufacturing, to keep up with other technologies.

IV. SUMMARY

Introducing more renewables in the energy system is crucial to ensure the security of supply in the EU. This also means more investment in energy storage to avoid curtailment and backup power generation through fossil fuels. As the EU already counts many industrial flow battery players with numerous different chemistries, it presents a strategic opportunity to further accelerate the achievement of decarbonisation and security of supply. Flow batteries are an important long-duration storage technology, and more investment is necessary to ensure their scale-up and uptake as well as an effective transition to a clean energy system and the EU's energy independence.

As Flow Batteries Europe, we remain open to answer any questions and to discuss our statement further.

FOR FURTHER INFORMATION:

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ABOUT FLOW BATTERIES EUROPE (FBE)

Flow Batteries Europe (FBE) represents flow battery stakeholders with a united voice to shape a long-term strategy for the flow battery sector. We aim to provide help to shape the legal framework for flow batteries at the EU level, contribute to the EU decision-making process as well as help to define R&D priorities. Flow Batteries Europe is working to create and reinforce networks between key stakeholders in the flow battery industry.

www.flowbatterieseurope.eu