

voltstorage

Sector brochure energy companies

# That's base load

Long Duration Energy Storage based on redox flow technology

# Net zero, zero problem?

## Challenges for energy companies

The energy industry is experiencing constant change, and its challenges are as numerous as they are diverse. One of the biggest challenges facing energy companies is grid decarbonization and the transformation to a net-zero energy system.

The Paris Climate Agreement set the framework to limit global warming to well below 2 degrees Celsius compared with pre-industrial levels and to step up efforts to reduce greenhouse gas emissions. Global gross power generation plays a crucial role in achieving these goals. The Paris Climate Agreement underscores the need to transition to a decarbonized economy with increased use of renewable energy sources such as wind, solar and hydropower. According to the International Energy Agency's Global Energy Review 2021 report, the share of renewable energy in gross global electricity generation increased by 7% in 2020. It is assumed that the share of renewable energies will continue to increase and reach over 30% by 2025.<sup>1</sup>

In order to achieve the climate targets, accelerated use of renewable energies is imperative. The energy industry is thus faced with the enormous challenge of expanding renewable energies and enabling the transition to a low-carbon economy.



## Stable energy supply, stable outlook

This transition to a net-zero energy system is thus anything but simple. One of the biggest challenges here is to ensure a constant power supply from renewable energies.

Since renewable energy is inherently volatile, it is difficult to maintain a continuous flow of electricity, especially during fluctuating weather conditions. Another problem

associated with renewables is curtailment. Excess power can damage the grid infrastructure and cause instability. In addition, places with high penetration of renewable energy often experience a period of low sales prices combined with high production. This is because the market is flooded with the amount of power generated, causing prices to drop. This can be a significant problem for energy companies that rely on stable revenues. Considering all these challenges, it is clear that energy companies need to leverage their innovation capabilities to meet the demands of a rapidly changing landscape and fulfill their role in providing a sustainable and stable energy supply to society.

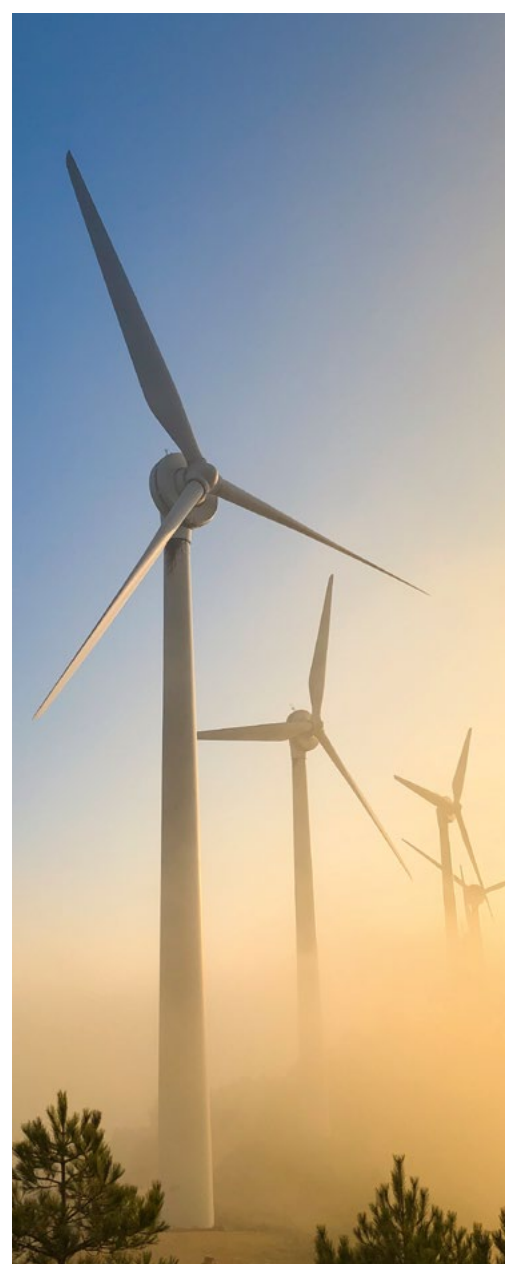
## "How do I create future-proof energy supply?"

<sup>1</sup> <https://www.iea.org/reports/renewables-2021>



# Renewable energies rethought

## Transforming challenges into chances



Energy companies are in transition and pursuing various strategies that pay attention to the increasing demand for renewable energy and the need to reduce environmental impact as well as geopolitical and market dependencies.

A large number of energy companies in particular face a dilemma when it comes to energy supply. On the one hand, there is a need to drive forward the expansion of renewable energies in order to combat climate change and reduce dependence on fossil fuels. On the other hand, it is important to ensure the reliability of the energy supply. This is because energy suppliers depend on keeping the frequency of the alternating current at the standard frequency of 50 Hz to provide a stable power supply and thus avoid deviations from the standard frequency, which could cause damage to electrical devices.<sup>2</sup>

At present, however, it is difficult to guarantee a reliable power supply entirely from renewable energy sources. Since these energy sources are weather-dependent, they cannot always guarantee a constant power supply. Another important factor is the price factor. On the one hand, it is necessary to offer stable and competitive prices in order to attract and retain customers in the medium to long term. Price stability in particular is a special trust-building aspect here. Price fluctuations can lead to a decline in customer satisfaction and even to contract termination. On the other hand, energy suppliers must achieve a sufficient margin in order to be competitive. From the perspective of energy companies, the stability of prices is the basis for strategic business decisions such as long-term investment decisions.

<sup>2</sup> <https://www.interconnector.de/wissen/netzfrequenz/>

## "Stable and marketable prices are key."

Meeting these challenges will require clear and consistent regulation from government and regulators to reduce uncertainty and encourage investment in energy infrastructure. But it also requires innovative strategies and approaches that enable energy companies to take advantage of technologies such as energy storage and smart grids to counter the volatility of renewable energy.

## Dedicated storage systems for dedicated requirements

To balance the fluctuations of renewable energy sources and enable the decarbonization of the energy sector, energy companies need smart and economical solutions to reliably integrate renewables into the power grid and drive the widespread deployment of renewables.

To balance the high negative correlation of generated wind and solar energy over the course of the month and to ensure the provision of the base load on a daily to minute basis and to be able to meet the challenges posed by the energy transition, we need storage systems with a long charging and discharging duration – also called "Long Duration Energy Storage". These batteries are capable of closing natural supply gaps and thus enabling the switch to 100% renewable energies.



# Green energy becomes base-load capable

## Long-term storage of power from renewable energies

The term Long Duration Energy Storage generally refers to energy storage systems and storage technologies that charge or discharge over a period of more than eight hours. This contrasts, for example, with batteries as used in electric vehicles. The focus of the latter is on providing high power in a very short period of time, often less than an hour. Fast charging of electric cars, for example, takes just a few minutes. In certain applications, particularly in the storage of renewable energy generated from solar and wind farms, the focus is less on shortening the charging cycles and more on longer discharge times with significantly more storage capacity to close the supply gap and cover the base load during periods of low wind and low sun. In

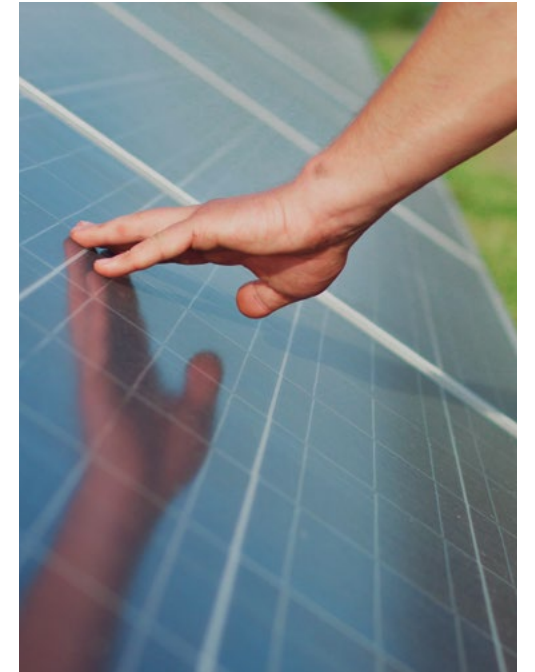
addition, low costs and a long service life of the storage solution are decisive parameters in the field of renewable energies.

Long Duration Energy Storage is a key technology to enable the decarbonization of the energy sector. Fluctuations in renewable energy sources can be balanced out and renewable energies, such as solar and wind energy, can be integrated more reliably into the power grid and expanded more quickly. In this way, the base load can be provided and secured from renewable energy sources. A lack of base load has long been an obstacle to integrating renewables into the power grid. This problem is now a thing of the past thanks to Long Duration Energy Storage.

## Wide range of possibilities

There are several technologies and approaches that focus on the Long Duration Energy Storage application. These include thermal, electrochemical, mechanical and chemical solutions. Long Duration Energy Storage batteries based on electrochemical technology such as redox flow technologies impress with high safety, flexible scalability, high efficiency, a large temperature resistance, low self-discharge, a long service life and low cost per kWh.

VoltStorage has developed a redox flow storage system based on iron and salt that, as a Long Duration Energy Storage, makes renewable energy base-load capable – reliable, environmentally friendly, flexible and extremely cost-effective.



VoltStorage is a member of the international Long Duration Energy Storage Council (LDES Council). The mission of the LDES Council is to meet baseload demand from renewable energy sources using carbon-free, long-term storage to eliminate the use of fossil fuels. To this end, the LDES Council provides guidance and advice on the implementation of long-term energy storage for government and electricity grid operators, while also acting as a point of contact for industry representatives in the energy sector.







# Clean Energy Day & Night

with batteries  
from VoltStorage



The energy transition is a great opportunity to make the world a cleaner and fairer place. With VoltStorage we make our contribution to this.

Jakob Bitner  
CEO & Co-Founder of VoltStorage

# That's energy transition

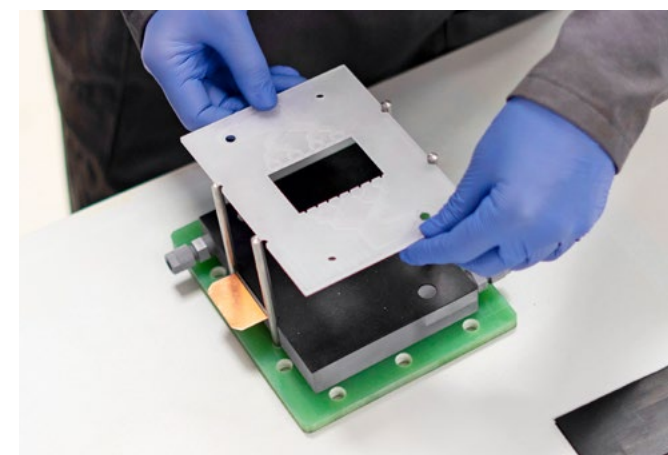
Climate change presents the world with enormous challenges and requires new thinking and action. As well as passion and courage to revolutionize the status quo.

The VoltStorage success story began in 2016 as a Munich-based startup with the vision of making clean and affordable energy accessible around the clock. Since then, we have been working continuously to give our customers the opportunity to take their energy supply into their own hands and drive the energy transition forward.

Our storage solutions are as environmentally friendly as the energy they store. We focus on a sustainable alternative in contrast to conventional storage technologies and develop and produce stationary storage systems based on redox flow technology. The result is revolutionary: green, durable and safe batteries for a wide range of applications.

Today, our storage systems make us the technological innovation leader for stationary batteries based on redox flow technology. VoltStorage, headquartered in Munich, Germany, employs more than 70 people, around 60% of whom work in research and product development. We offer commercial and industrial batteries for agriculture, manufacturing, logistics, hotels & restaurants as well as large-scale storage systems for energy companies.

With VoltStorage, power supply from renewable energies is available at 100% around the clock. Energy transition starts now.



# Base load from renewables? Works!

## Long Duration Energy Storage based on redox flow technology

12 **10.65 TWh**

of storage capacity is needed to power 100% of the USA by batteries for 24 hours.

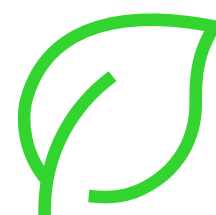
**2,665 %**

of the annual lithium production volume would be needed to provide this amount of electricity from lithium batteries alone.

For the energy transition to succeed, we need environmentally friendly, cost-effective and scalable energy storage systems for a wide range of applications. The forecast demand for batteries is gigantic, and the available technologies are limited in their possibilities. Currently, solutions based on rare resources that are mined under questionable conditions dominate the market. In addition, the specifications of these technologies make them unsuitable for ensuring the provision of base load on a daily and weekly basis.

VoltStorage's batteries are based on redox flow technology, which is fundamentally different from conventional storage technologies and relies on materials and raw materials that are available worldwide in almost unlimited quantities and at low cost. The characteristic feature of redox flow technology is the storage of electrical energy in a liquid electrolyte solution. With our international team of experts, we have now continuously developed the resource-saving storage technology in recent years and scaled and optimized it for various applications. The result is a redox flow technology based on iron and salt, that offers several advantages, particularly with regard to charging and discharging times of more than eight hours and for applications as Long Duration Energy Storage.

VoltStorage's environmentally friendly, cost-effective and durable batteries based on this technology are a forward-looking solution for making renewable energies base-load capable. And exactly what we need for the success of the energy transition.



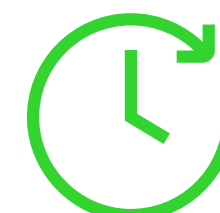
### Eco-friendly

No rare or conflict raw materials are used in the manufacture of storage systems based on redox flow technology. The storage technology is based on raw materials that are available worldwide in almost unlimited quantities and thus at low cost.



### Safe

Operational safety plays a major role in energy storage. Since the storage medium consists to a very large extent of pure water, it is neither flammable nor combustible.



### Durable

Storage systems based on redox flow technology can be loaded and unloaded a large number of times without losing storage capacity. This makes redox flow storage systems among the longest-lasting storage solutions on the market.



# The flow principle

A redox flow battery consists of two tanks, a pumping system and battery cells, also called battery stack. The two tanks contain a liquid ferric chloride-based electrolyte solution that serves as the storage medium. The electrolyte is pumped through the battery cells for charging and discharging the battery, which binds electrons. The amount of electrolyte determines the capacity, and the number and size of the battery cells in turn determines the power. In this way, the power and capacity of a redox flow battery can be scaled independently.

## Electrolyte

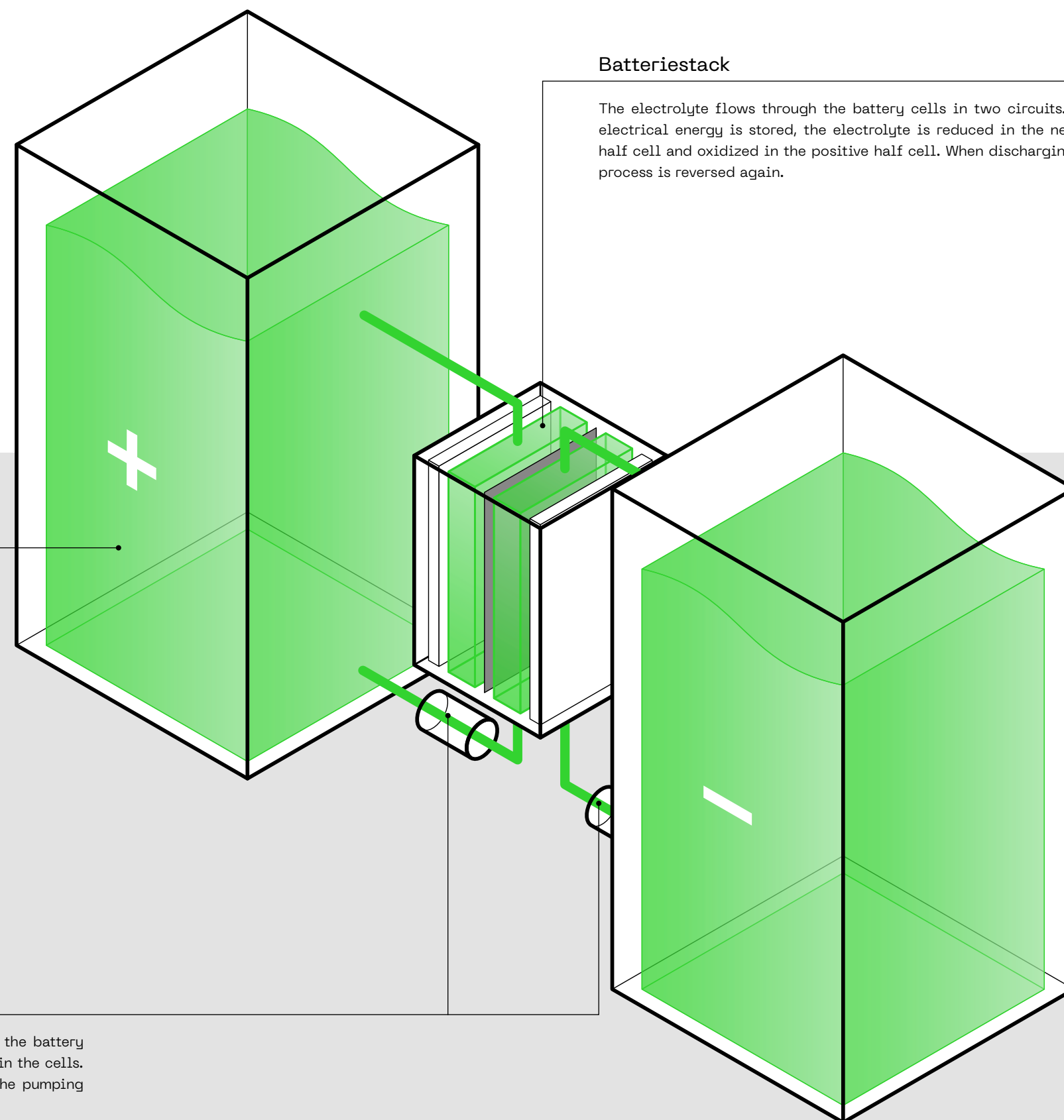
The storage medium is a liquid electrolyte. This is located in two separate tanks and can assume different oxidation states through a redox process, whereby energy is stored.

## Pumping system

A pumping system directs the electrolyte into and through the battery cells. This means that not all the electrolyte has to be kept in the cells. This enables capacity and performance to be decoupled. The pumping system is only activated when necessary.

## Batteriestack

The electrolyte flows through the battery cells in two circuits. When electrical energy is stored, the electrolyte is reduced in the negative half cell and oxidized in the positive half cell. When discharging, this process is reversed again.





# Iron and salt

The raw materials for tomorrow's storage technology

Iron salt technology is based on materials that are not only environmentally friendly, but also cost-effective and available worldwide.



## Iron

Iron (Fe) is a chemical element in the periodic table of elements and belongs to the metals. It is the most abundant element in the earth's mass and is mainly obtained by mining iron ore. In the electrolyte, it acts as an energy carrier, as it can accept or release electrons through redox reactions.

## Water

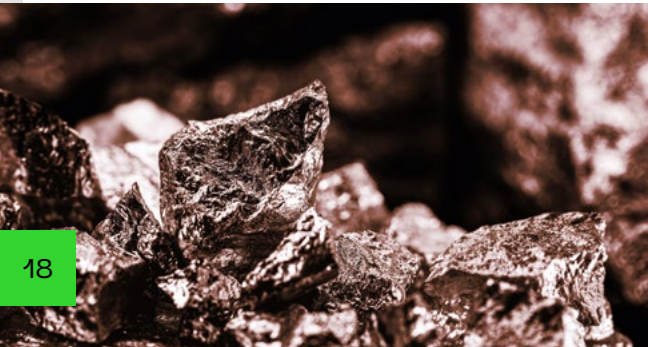
Water (H<sub>2</sub>O) is a chemical compound of the elements oxygen (O) and hydrogen (H). In the electrolyte, water acts as a solvent in which the remaining components are dissolved.

## Salt

The salt used for the electrolyte has the chemical name ammonium chloride and is a colorless, crystalline solid which is highly soluble in water. When dissolved, the salt increases the electrical conductivity of the electrolyte, which in turn improves efficiency. It is a classic industrial salt that is used in numerous applications, such as pharmaceuticals.



# Made for Long Duration Energy Storage



**VoltStorage Iron Salt Battery**

Designed for use as a Long Duration Energy Storage system, the Iron Salt Battery is suitable for stationary applications with a need for constant power throughout the year. The storage system has a modular design so that capacity and performance can be flexibly expanded as required. Compared to other technologies in the Long Duration Energy Storage segment, the storage solution is also more efficient, with an efficiency of over 70%. With over 10,000 charging cycles and a service life of more than 20 years, the Iron Salt Battery from VoltStorage also offers a high degree of durability and cost-effectiveness.



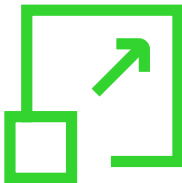
**Cost-effective**

In a Long Duration Energy Storage optimized configuration, the Iron Salt Battery results in a significant reduction in cost per kWh.



**Eco-friendly**

The Iron Salt Battery relies on an iron-based storage medium – and thus on one of the most abundant raw materials in the world.



**Versatile**

The system can be installed in a compact and decentralized manner, is particularly temperature-resistant and can therefore be used worldwide.





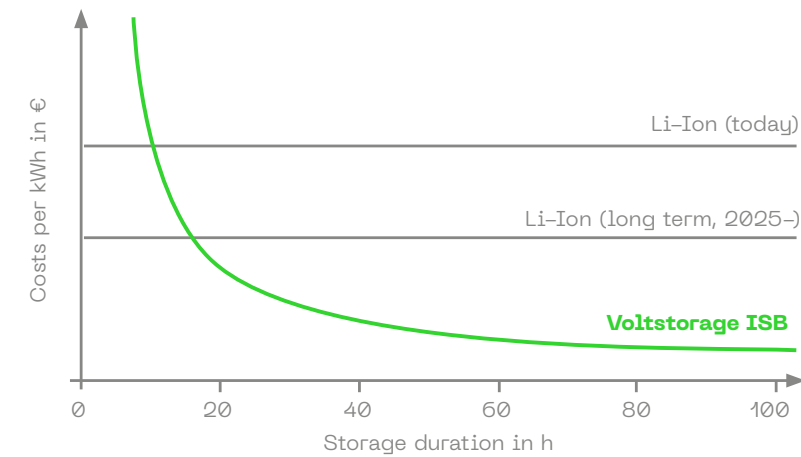
# Unrivaled

## 3 good reasons for the Iron Salt Battery from VoltStorage

Die Iron Salt Battery von VoltStorage ist eine besonders kostengünstige, nachhaltige und universell einsetzbare Anwendung für Energieunternehmen, um Versorgungslücken in wind- und sonnenarmen Zeiten zu überbrücken und damit die Bereitstellung der Grundlast zu sichern.

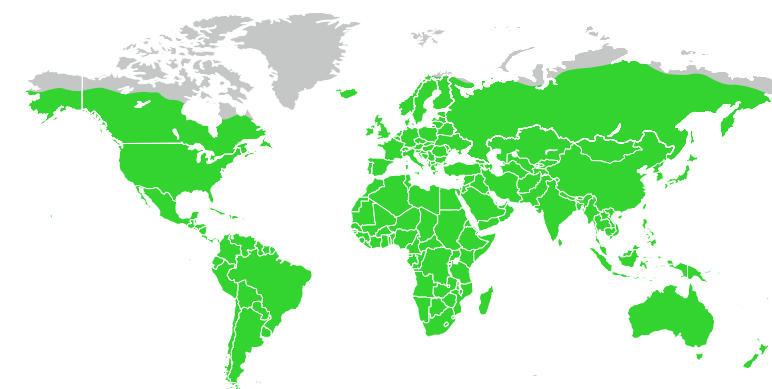


In storage systems based on redox flow technology, performance can be decoupled from capacity and scaled independently according to demand. In a configuration optimized for Long Duration Energy Storage, this leads to a significant reduction in costs per kWh compared to other storage systems. The cost advantages of this ecological storage technology increase significantly in correlation with the storage duration, which makes this storage technology particularly interesting from an economic point of view for use as Long Duration Energy Storage.



With iron salt battery technology, we are relying on an iron-based storage medium – and thus on one of the most abundant raw materials in the world. The use of ecological materials allows the storage technology to be scaled according to the given needs, resulting in economies of scale. In addition, thanks to the CO<sub>2</sub>-saving technology, power from renewable energies can be stored in a sustainable manner, thus making a double contribution to combating climate change.

Compared to, for example, storage systems based on hydrogen or pumped-storage power plants, the use of VoltStorage's Iron Salt Battery does not require massive expenditure in the provision of a suitable infrastructure – the system can be connected to existing infrastructures in a space-saving and decentralized manner. Since the iron salt technology is a particularly temperature-resistant storage technology, the system can also be used in climatically challenging regions.



Therefore so  
low cost

Therefore so  
eco-friendly

Therefore so  
versatile





How wind and solar farms in combination with the Iron Salt Battery from VoltStorage can secure the provision of the base load, we show you with a concrete example in our white paper. Learn more about the economic viability as well as the relevance of Long Duration Energy Storage as a key technology for reducing greenhouse gas emissions and paving the way for a net-zero energy system.







## Contact

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Do you have any questions, would you like more information or an individual consultation? We are here for you.

### Phone

You can reach us Monday to Friday from 9:00 to 16:00 on: +49 89 215 294 900

### E-mail

[hello@voltstorage.com](mailto:hello@voltstorage.com)

More information:  
[www.voltstorage.com](http://www.voltstorage.com)

voltstorage