Industrial Solutions

Flexible Energy Storage

thyssenkrupp
Think big, store flexibly.

Big and flexible together: thyssenkrupp provides large-scale energy storage solutions with its utility-scale redox flow batteries and economy-of-scale, long-term hydrogen energy storage. Our state-of-the-art electrochemical technology makes thyssenkrupp redox flow batteries a safe and simple modular solution for the world’s large-scale energy storage needs — in the gigawatt hour range.

Optimize your revenue streams: Otherwise curtailed renewable electricity is stored and can be reused for short-term or longer-term supply/demand imbalances, such as the weekend. Our outstanding experience in electrochemical plant safety, international support in over 70 countries, and decades of experience, bring peace of mind to utility-scale energy storage implementation.

Our flow batteries make energy storage as easy as plug-and-play static batteries – just more flexible, capturing more revenue streams, with less risk and more cost-effectiveness for large-scale projects. Ideal for grid operators, renewable energy generators, micro-grids, behind and in front of the meter, and many more applications.

- Expected lifespan of several decades at stable capacity
- Extremely reasonable levelized costs and easy operation
- Environment friendly (e.g. almost completely recyclable electrolyte) and safe
- Flexible, independent adaptation of power input/output and storage hours
- Robust due to high overload capacity
- Grid-dynamic response times
- Large electrochemical cells for large economic benefits
- Full rated power input/output possible for long periods of time
- The only company offering both long-term, cost-effective hydrogen storage and redox flow batteries, customizable according to your specific revenue stream needs.

Through decades of practical electrochemical experience, thyssenkrupp has developed the technology to maximize the revenue streams of your electricity generation and transmission assets. Our extra-large electrolytic cells come in state-of-the-art modules and are integrated into a scalable, flexible, and cost-effective solution. Power is simply adjusted by adding more modules, and hours of energy storage are independently adjusted through tailored amounts of our vanadium electrolyte and, if needed, hydrogen energy storage. Our flow batteries respond in a grid dynamic manner, serving to address rate of change of frequency (providing virtual inertia), load following, daily scheduling, and taking care of longer term, weekend, temporary campaign and seasonal supply/demand imbalances.

thyssenkrupp’s technology expands the capabilities of industrial energy storage in a safe and practical way. Referring to the figure below, our patented extra-large electrochemical cells used in our redox flow battery extend the MW power range while increasing the MWh/GWh of storage at the same time. From one source, we provide accompanying hydrogen energy storage, together expanding the landscape of energy storage.

Technology that expands the energy storage landscape

Pushing the boundaries of utility-scale energy storage into the gigawatt hour range

[Chart and diagram showing power and capacity ranges for different storage solutions, including typical redox flow batteries (RFB) and hydrogen (H2) storage solutions, compared to a new RFB solution from thyssenkrupp, showing significant increases in power and capacity over time.]
With safety experience from hundreds of chlorine and hydrogen producing plants we designed our flow batteries for maximum safety and easy operation. The batteries cannot short-circuit themselves, as can occur with lithium ion batteries. The system uses no flammable liquids, is not significantly pressurized and operates at mild temperatures between 15°C and 40°C. This reduces expense for safety certification and audits. Using redox flow batteries means reducing the hazards often associated with lithium ion batteries to a minimum.

Safe operation

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Large capacities, true economy of scale advantage

thyssenkrupp offers advanced flow battery technology based on our decades of experience in world-scale electrochemical plant design and construction. Our large electrochemical cell area of 2.5 m² is the foundation of our economy-of-scale advantage. Our large flow batteries can easily handle massive power and energy requirements, starting from 1 MW to hundreds MW of power and gigawatt-hours of storage time, if needed. We provide cost-effective solutions e.g. for smoothing and peak shifting of large-scale renewable energy production; alternatives for a grid interconnector; ≥ 4 hours long-duration bulk energy storage to utilize over-generation; and ease of steep ramp-up and ramp-down management.

Low environmental impact

For our vanadium electrolyte, membranes and power output we expect virtually no fade or deterioration. This translates into several decades of expected lifespan, rapid and frequent ramp-up and ramp-down, low levelized costs, and overall low service requirements. We designed our batteries for high efficiency and used a meticulous choice of low environmental impact materials. The cradle-to-cradle product life cycle – from mining to reuse – is engineered to be earth-friendly. In contrast to lithium ion batteries, the majority of our components can be easily recycled or reused, particularly thyssenkrupp’s specialty vanadium electrolyte, which is almost completely reusable.

Flexible, simple and cost effective

We designed our batteries to fit ≥ 1 MW in a standard container, so transport and setup are easy and efficient. For smaller footprints the batteries can be stacked. Power and energy capacity increases are easy by simply adding containers or increasing tank storage volume as projects evolve. We reduced the number of components needed in our system to an absolute minimum, making the system more robust, more reliable, lower in cost and easier to maintain.

Unified control system optimizes capacity usage and arbitrage

Our redox flow battery solutions use only one unified control system for the complete plant. This makes the helelot system easy to operate. By pooling all data in one system, you can make the most out of your plant. This capacity is used optimally: You can charge during low-price periods and discharge when the price is high; you can ramp-up and ramp-down in the same time frame, with extremely high flexibility. And when combined with thyssenkrupp’s electrolytic hydrogen production, you can make profitable use of supply during days of decreased demand. These and other features such as modularity, unique large electrochemical cells, maximization of the electricity generation’s asset value and a company you can rely on, make the thyssenkrupp flow battery the smart solution.
We have planned, built and commissioned hundreds of electrolysis plants and installations all over the world – experience you can rely on.

Performance at your fingertips: service by thyssenkrupp

We bring all our experience into our service portfolio, which aims at maintaining maximum plant efficiency and making operation of the plant as easy as possible. With digitized solutions for remote condition monitoring, safeguarding and performance evaluation, you can make the most out of your assets.

With our know-how we assist you throughout the plant’s life cycle – from start-up to on-site support by thyssenkrupp engineers, specialists and trainers for your personnel. We are your single point of responsibility for all maintenance issues, be it inspections, spare parts, or even capacity increases.

Decades of success in electrochemical plants

As a globally renowned EPC specialist for electrochemical plants, we are the leading supplier of equipment for electrolytic H₂ production. You benefit from our proven competence in realizing complete plants which operate smoothly and safely over decades. Through continuous improvements and dedicated research and development, we deliver cutting-edge technologies for high efficiency and maximum revenue.

Our know-how about the complete setup of electrolysis plants enables us to tailor the energy storage solutions to your needs. We are well accustomed with the details of high-voltage installations, with optimizing energy input/output, and connecting these plants to the power grid. Our technologies have proven their robustness and durability worldwide, even in regions with high fluctuation of power supply and frequent outages. And thanks to our modular approach, we can offer solutions which are cost-effective and scalable at the same time.

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