



# ENERGY STORAGE: EUROPE'S ROUTE TO GREENER ECONOMY

## WHAT IS ENERGY STORAGE?

As we shift towards cleaner energy sources like wind or solar power, energy storage becomes a key player in this transition. At its core, energy storage is like a high-tech energy piggy bank. It collects excess renewable energy generated, for example, during windy days or sunlit hours, saving it for times when we need it most. This reserve of energy acts as a reliable safety net, ensuring a steady power supply no matter the weather or time of day. Energy storage not only keeps our lights on but also reduces our reliance on less eco-friendly energy sources, making it a cornerstone for a sustainable energy future.

## ENERGY STORAGE TECHNOLOGIES

The basic principle of energy storage technology involves 3 main steps: i) capturing energy, ii) converting and storing energy, and iii) releasing energy. Depending on the form of converted energy, we can divide the energy storage technologies into main categories:

### CHEMICAL TECHNOLOGIES

Energy is stored in the form of chemical fuels, for example hydrogen or methane.

### THERMAL TECHNOLOGIES

Energy is stored by heating or cooling a substance such as water or salt. Key trends include sensible, latent, and thermochemical technologies.

### MECHANICAL TECHNOLOGIES

Energy is stored as mechanical work through the movement of mass or compression of gases. The most used is pumped storage hydropower, which involves pumping water uphill to the reservoir and releasing it downhill through a turbine to generate electricity when needed.

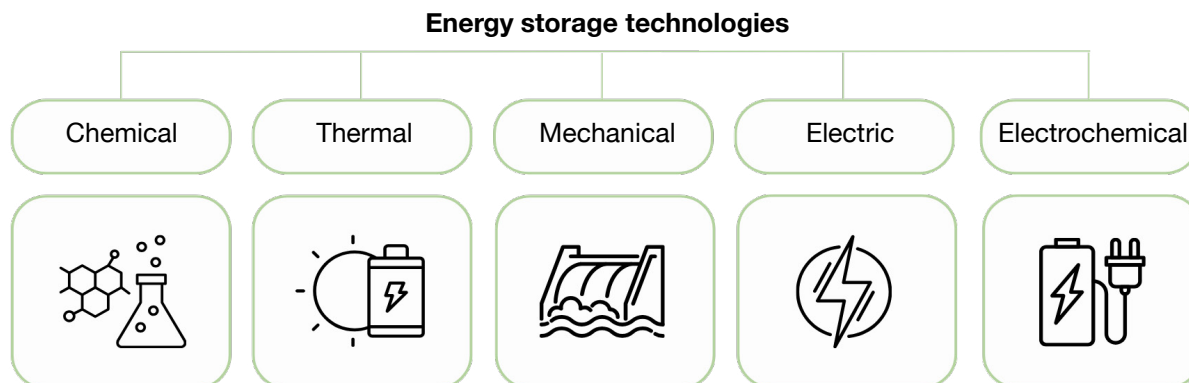
## ELECTRIC TECHNOLOGIES

Energy is stored based on differences in electric charges between materials, for example in supercapacitors.

## ELECTROCHEMICAL TECHNOLOGIES

Energy is stored by changing electricity into chemical power. Examples are batteries and hybrid supercapacitors.

Electrochemical technologies stand out from other energy storage technologies with recent advancements and versatile use. They can be categorised into i) rechargeable batteries (such as lead-acid and lithium-ion batteries), ii) electrochemical capacitors, and iii) fuel cells. Rechargeable batteries made huge progress in recent years, with ongoing research promising even greater performance and longevity.



## LEAD BATTERIES IN ENERGY STORAGE

**Battery energy storage systems (BESS)** are the rising stars of Europe's clean energy mission. They are key elements in our quest to meet ambitious decarbonisation and climate change targets, especially due to their versatility. BESS excel at capturing energy from renewable sources efficiently and affordably, helping us tackle the challenge of intermittent power supply. Their resilience bolsters our energy independence and security. Moreover, BESS serve as a lifeline for our grids, performing essential functions such as voltage control and frequency regulation.

**Lead batteries** have a long-standing legacy in Europe and their prominence continues to grow. Renowned for their reliability and cost-effectiveness, lead batteries are used in various applications, including backup power systems and uninterruptible power supplies (UPS). Lead batteries are also gaining popularity in renewable energy storage projects, such as those for remote off-grid installations.

As Europe intensifies its commitment to sustainable energy transition, ongoing **research and development** elevates lead battery technology to new heights. These advancements focus on improving overall battery performance and driving down costs. Through the incorporation of cutting-edge additives and designs, lead batteries are improving in performance and lifetime. These advances are accompanied by evolving battery management systems that fine-tune charging and discharging processes, optimising energy efficiency to the fullest.








One remarkable feature that distinguishes lead batteries is their **adaptability**. Their straightforward installation process, excellent safety profile and flexibility to be deployed at various grid levels make them a perfect fit for both on-grid and off-grid scenarios. Moreover, lead batteries are known for their robustness, capable of withstanding even the harshest of weather conditions.

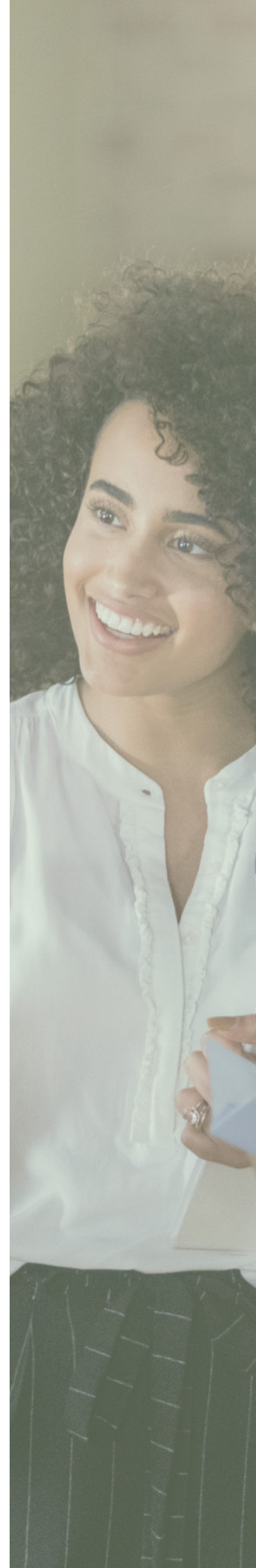
Yet, what truly sets lead batteries apart, beyond their technical prowess, is their **environmental responsibility**. Within the European Union, lead batteries boast a near-100% collection and recycling rate—a perfect example of closed loop circularity in action. This eco-friendly practice not only diminishes our environmental footprint but also reduces our dependence on external energy sources.

A clear distinction emerges when **comparing lead batteries** to other energy storage solutions. Lead batteries shine brightly as they offer a one-of-a-kind mix of performance, reliability, safety, sustainability, and affordability that sets them apart from the crowd. Their budget-friendly nature makes them a preferred choice for applications with hefty upfront costs. While some other battery energy storage options may offer high energy density and rapid charging capabilities, they often come with higher price tags. Plus, their lifespan may also fall short of that of lead batteries, and concerns about resource availability and recycling challenges linger.

In a nutshell, lead batteries are cost-effective, dependable, and environmentally conscious. Their adaptability and support for renewable energy sources match our green energy aspirations.

## LEAD BATTERY APPLICATIONS

	<p><b>renewable energy</b> (wind energy storage, solar energy storage, grid stabilisation)</p>
	<p><b>communication networks</b> (cell towers, emergency systems, communication infrastructure)</p>
	<p><b>UPS systems</b> (data centres, emergency elevators, retail stores)</p>
	<p><b>transport &amp; vehicles</b> (recreational vehicles, electric cars, electric golf carts)</p>
	<p><b>logistics &amp; warehouses</b> (electric forklifts, industrial equipment, tractors &amp; farm equipment)</p>
	<p><b>medical equipment</b> (diagnostic devices, life support equipment, hospital beds &amp; wheelchairs)</p>
	<p><b>marine industry</b> (navigation systems, electronic equipment, onboard lighting)</p>



## WHY IS ENERGY STORAGE NECESSARY?

Energy storage plays a crucial role in Europe's ongoing battle against climate change and towards a transition to cleaner energy sources, offering the flexibility to navigate this changing energy landscape. Energy storage helps us use energy more wisely, ensuring we get the most out of every watt. It acts as a stabiliser, keeping energy prices stable and guaranteeing a steady power flow. Beyond that, it boosts energy security and empowers customers. With energy storage, individuals and communities can take charge of their energy consumption, making greener choices. As Europe intensifies its efforts to reduce carbon emissions, energy storage becomes even more critical. It seamlessly fits renewable energy into our systems, reducing our dependence on fossil fuels and opening the door to a greener Europe.

## WHERE IS ENERGY STORAGE USED?

Energy storage is at the heart of Europe's drive for sustainability, with applications spanning various sectors. It fuels the eco-friendly revolution in transportation, propelling electric vehicles forward. Solar energy systems give homeowners newfound control over their energy use, while energy-intensive industries optimise their operations, cut costs, and improve efficiency with energy storage solutions.

Batteries, usually associated with our gadgets, are becoming central players in the energy storage game. They are making headlines, offering dependable, cost-effective energy storage. Lead batteries support backup power systems and remote off-grid installations. With the closed loop recycling, they contribute to our energy independence, smooth out the bumps in intermittent energy supply, and create a reliable energy landscape. With battery energy storage in the spotlight, cleaner energy goals are within reach.

## EUROPEAN ENERGY STORAGE MARKET TRENDS

Europe is chasing ambitious energy goals, which cannot be met without an increase in energy storage. This means the energy storage market is blooming, marked by new trends that are shaping the way we will store and use energy. These include:



Renewable  
integration



System  
decentralisation



Innovative battery  
technologies



Grid  
modernisation



Policy  
support

**Renewable integration:** As Europe strives to fulfil its ambitious renewable energy goals, energy storage solutions have become indispensable companions to wind and solar power systems. These solutions ensure the stability of energy supply by effectively storing excess energy generated during favourable conditions, mitigating the challenges posed by intermittency.

**Decentralisation:** Distributed energy storage systems are on the rise, empowering individuals to take control of their energy production, storage, and consumption. This decentralisation is a significant shift, granting households and businesses greater autonomy over their energy usage.

**Innovative battery technologies:** Europe is exploring new technologies that promise better stability, greater energy density, and extended battery lifespans for energy storage applications. This surge of interest in advanced battery technologies represents a shift from conventional lithium-ion batteries.

**Grid modernisation:** The integration of energy storage systems is aligning with the advancements in smart grids and grid updates. These enhancements are bolstering grid resilience and efficiency, ensuring an interplay between energy generation, storage, and distribution.

**Policy support:** Governments and the European Union are stepping up with proactive policies and incentives designed to promote the adoption of energy storage technologies. These measures encourage the integration of energy storage solutions and create fertile ground for research and development).

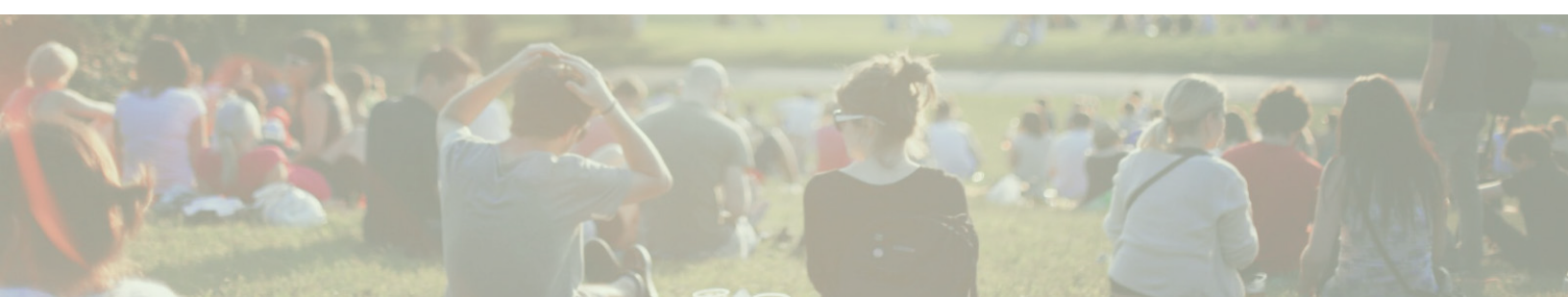
## ENERGY STORAGE MARKET

Energy storage is a rapidly growing market with the potential to support our transition to clean energy. The USA, China, India, and the EU are leading players, each with a distinctive policy landscape and market dynamics. The EU's energy storage market, while poised for expansion, faces several challenges. It's smaller and fragmented, with 27 member states operating under diverse energy policies and regulations. This forces industry players to navigate differing regulations across multiple member states. The USA also grapples with fragmented policies, spanning federal and state levels. Additionally, the EU maintains stringent environmental and safety regulations. Both the EU and China have ambitious energy storage goals, but China's centralised approach allows quicker policy implementation. While the EU's policy landscape is more mature than India's, India's relatively new energy storage market is developing rapidly, with several supporting policies.

New energy storage technologies are on the horizon. Battery energy storage systems are set to take centre stage in the energy storage story. As Europe shifts toward a greener energy landscape, **battery technology** is at the forefront, boosting the sustainability of our energy systems. Battery systems, when paired with renewable energy sources, enhance grid stability and are readily available. Recent global events, such as Russia's ban on energy resource exports, are pushing EU member states to accelerate their transition away from fossil fuels, placing even greater emphasis on renewable energy sources. Innovative startups and research institutions are driving these advancements, tackling issues like battery performance, environmental concerns, and grid reliability.

Undoubtedly, **challenges** persist, including the cost-effectiveness of these technologies, energy price fluctuations, limited data from individual countries, and regulatory complexities. To fully unleash the power of energy storage, Europe must recognise the value of flexibility, streamline regulatory frameworks, and adapt swiftly to market dynamics. The concept of flexible energy storage is essential as we transition to cleaner energy sources.

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## ABOUT CBI

The [Consortium for Battery Innovation](#), (CBI) is the world's only global pre-competitive research organisation funding advanced research into lead batteries for energy storage.

For more than 30 years, with its global membership of battery manufacturers, industry suppliers, research institutes, and universities, CBI has delivered cutting-edge research pushing the boundaries of innovation in lead battery technology, setting the standard for advanced lead batteries, and promoting the next generation of energy storage.

CBI members and partners all share the common aim of inspiring the latest research to help develop the next generation of advanced lead batteries that will meet energy storage demands.

