

March 2022. A Technological Snapshot

Batteries

in Catalonia

Batteries in Catalonia: A Technological Snapshot

ACCIÓ
Government of Catalonia



The entire contents of this document are available under a Creative Commons licence. Unless otherwise stated, reproduction, distribution and public communication are permitted, provided appropriate credit is given, the material is not used for commercial purposes and derivative works are not distributed. A summary of the licence terms and conditions is available for consultation here:

<https://creativecommons.org/licenses/by-nc-nd/4.0/>

The brands and logos used in this report are for information purposes only. The brands and logos mentioned belong to their respective owners. None of them is owned by ACCIÓ. This report offers a partial overview of the companies, organizations and entities that form part of the battery ecosystem. Some companies, organizations and entities may not have been included in the study.

Prepared by
ACCIÓ's Strategy and Competitive Intelligence Unit

Barcelona, March 2022

1. Definition of Batteries

- Definition of Batteries
- The Importance of Batteries for Reducing the Use of Fossil Fuels
- Energy Storage Technologies
- Electrochemical Energy Storage Technologies
- Lithium-Ion Batteries
- Segmentation of the Value Chain for Batteries
- The Importance of Batteries to Industry

2. The Global Battery Market

- Global Lithium-Ion Battery Market
- Main Companies on the Battery Market
- Patents for High-Capacity Lithium Batteries

3. Initiatives Related to Batteries and Gigafactories

- International Initiatives
- Initiatives in the European Union
- Initiatives in Spain
- Rolling out Gigafactories

4. Applications by Sector

- Battery Applications by Sector
- Batteries and the SDGs

5. Batteries in the Mobility Sector

- Electric Mobility
- Rolling out the Electric Vehicle Ecosystem in Europe
- Infrastructure for Charging Electric Vehicles
- Main Disruptive Companies in Electric Mobility
- Strategic Projects for Economic Recovery and Transformation (PERTE) and MOVES Plans

6. Opportunities, Challenges and Risks of Batteries

- Opportunities and Challenges
- Risks

7. Batteries in Catalonia

- Mapping the Battery Ecosystem in Catalonia
- Main Companies on the Battery Market in Catalonia
- Actors in the Battery Ecosystem in Catalonia
- Publicly Supported Initiatives in Catalonia: Battech
- Main International Opportunities by Application Sector

8. Batteries for Mobility in Catalonia

- Catalonia, an Economy with a Powerful and Diverse Ecosystem
- Industrial and Manufacturing Opportunities
- R&D Opportunities

9. Success Stories in Catalonia

Interviews

Batteries are storage systems that store energy and create an electric current. The **lithium-ion battery** is the most widespread thanks to its high energy density. It also plays a key role in decarbonizing the economy.

Segmentation of the value chain



- 1. Raw materials
- 2. Active materials
- 3. Production of components
- 4. Production of cells
- 5. Packs and systems
- 6. Application and integration
- 7. Charging stations
- 8. Recycling and second life

Demand sectors



| Mobility | Energy storage | Electronics |
|----------------|----------------|--------------------|
| Automotive | Energy | Electronic devices |
| Light mobility | Home | Mobile telephones |
| Heavy mobility | Industry | Medical devices |



Global market

Revenues will double in 5 years and amount to \$91.9 billion in 2026, with a cumulative annual growth of 14.6%.

Battery capacity will increase more than tenfold between 2020 and 2030, and will reach a total capacity of 2,731 GWh, 1,500 GWh of which will be earmarked for electric vehicles.

Europe will be the second-largest manufacturing centre worldwide in 2025, with a market share of 25% (6% in 2020). China will lead the way with a market share of 65%.

The price of lithium-ion batteries fell to \$137 per kWh in 2020, an 85% drop compared to 2011.

China, the USA and Europe are the regions with the most advanced energy storage strategies and ambitious plans for rolling out gigafactories.

Catalonia has the **industrial, business and research infrastructure** to position itself as an important player in the European battery sector, which is still in its early stages.

212 companies



With revenues of €681.9 million and 3003 workers

More than 40% work in the application and integration of batteries

Of the companies, 70% are SMEs and almost 20% are startups

More than half of these firms are exporters

Pioneering, industry-leading companies in their business segments: SEAT, Ficosa, Wallbox, Silence, QEV Technologies, Millor Battery.

Initiatives to position themselves within the battery sector



Battery Hub (as part of Next Generation EU)

Battech

Automotive Round Table (Taula d'Automoció)

SEAT: manufacture of an electric model and battery research and development centre

18 technology and research centres



R&D&I and technology transfer activities

Research activities as part of the Horizon 2020 framework



54 Catalan entities participating in H2020 projects

Financing to the tune of €40 million, 2.6% of the European total (8th region)

Batteries in Catalonia

1. Definition of Batteries

Batteries are storage systems comprised of various electrochemical cells that store energy and can create an electric current

These devices allow for chemical energy to be transformed into electrical energy (and vice versa) through oxidation and reduction processes. In the oxidation process, with the release of electrons, chemical energy is stored as electrical energy and the battery is charged. In the reduction process, electrons are captured and the battery becomes discharged because this electrical energy is used as fuel.

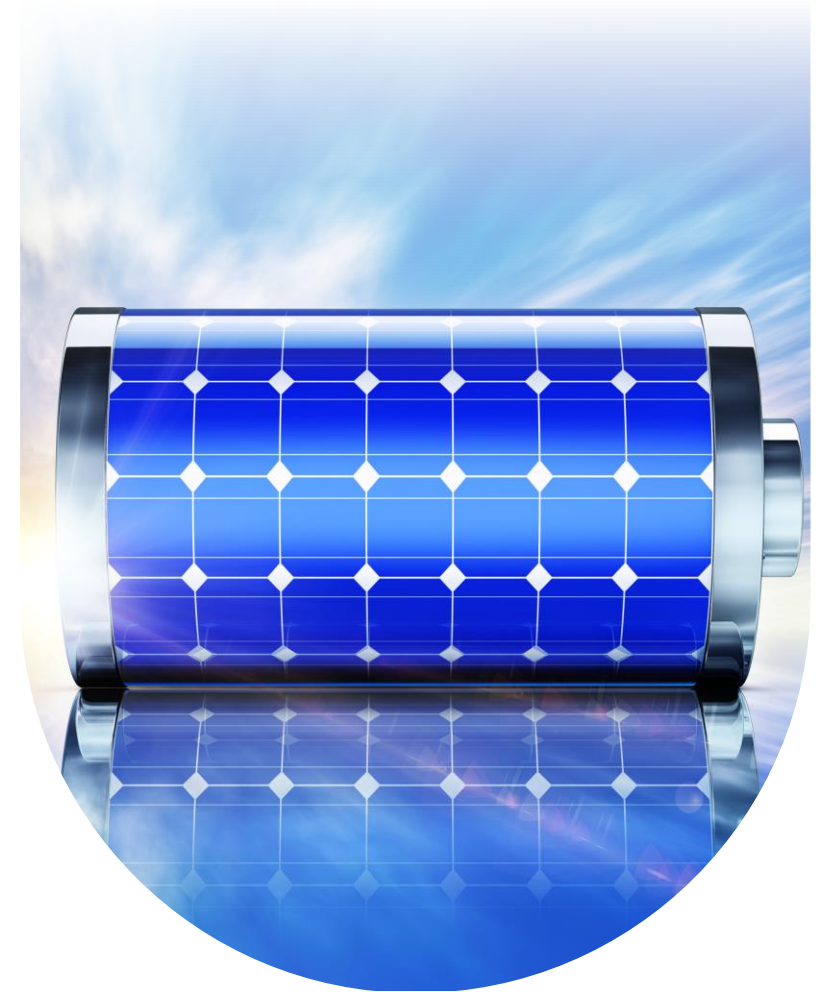
Energy storage systems can be classified in two categories according to how they are used:

1. **Behind-the-meter (BTM) storage:** this is a system connected behind the client's meter. It aims to optimize demand and save energy for users by storing energy when prices are lower and consuming it when they are higher.

Examples: Batteries for electric vehicles and solar panels for private consumption.

2. **Front-of-the-meter (FTM) or large-scale storage:** this is a system connected to distribution or transportation networks or to an energy-generating asset. It aims to provide service to the entire electrical grid.

Examples: large-scale electrochemical batteries (storing electricity for hours) and pumping batteries (compensating for seasonal changes).



Sources: IREC, ICAEN, MITERC and Naturgy

CataloniaConnects

The Importance of Batteries for Reducing the Use of Fossil Fuels

Batteries are a key element for achieving the goals set by the European Green Deal

The EU has established an objective of using **32% renewable energy by 2030** and has **increased its pollution reduction goal from 40% to 55% by 2030** (in comparison with 1990 levels). The **European Green Deal** therefore aims to make Europe the **first climate-neutral continent by 2050**.

Batteries are important in achieving these goals, as they can promote **competitive sustainability and are necessary for ecological mobility**; they are expected to help **reduce a large percentage of polluting emissions**.

The European Union has thus established the goal of ensuring that commercial batteries are **sustainable, high-performance and safe over their useful life**, and that they can be **remanufactured and reincorporated into the economy** at the end of their life cycle. In other words, the aim is to create a **circular battery value chain**.



What Can Countries and Regions Like Catalonia Do to Align Themselves with These Goals?

- **Ensure a long-term strategy and commitment among all major stakeholders** (industry, energy system suppliers, politicians and citizens) to establish a **competitive, sustainable battery value chain**.
- **Bring about cost reductions** for battery-based energy storage by also addressing **non-battery components** (e.g. power plant balance, energy management systems).
- **Take advantage of cost reduction opportunities** arising from **other synergies in the value chain**, such as **recycling and other aspects of the circular economy**.



Electrical

Supercapacitors

Superconducting magnetic energy storage (SMES)

Thermal

Latent heat storage

Sensible heat storage

Thermochemical storage

Mechanics

Adiabatic compressed air

Cryogenic energy storage

Pumping

Diabatic compressed air

Flywheels

Chemistry

Synthetic natural gas

Alternative fuels

Ammonia

Methanol

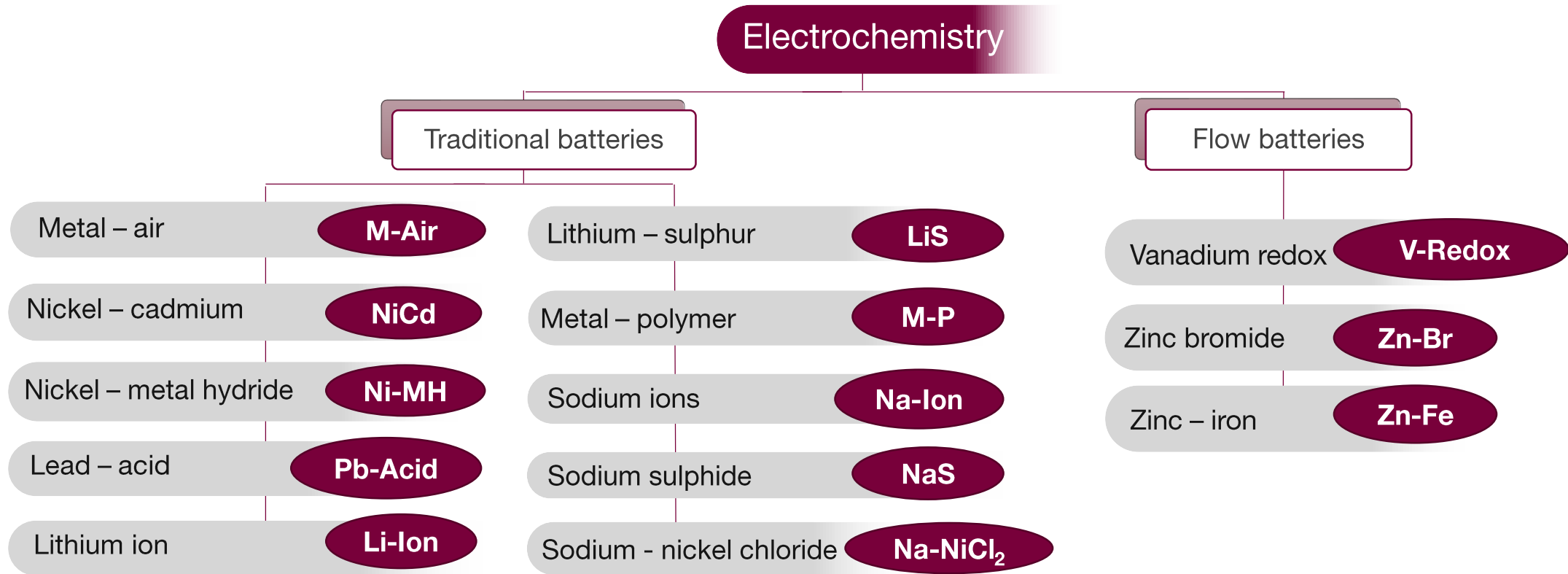
Synthetic fuels

Hydrogen

Electrochemistry

Traditional batteries

Flow batteries



Traditional batteries work using the flow of electrons through each cell (charge/discharge reactions). These cells are made of a container, a liquid or solid electrolyte material, a positive electrode (cathode) and a negative electrode (anode). The electrodes are separated by a permeable membrane that allows the flow of ions. The electrolyte material is in contact with the electrodes, which enables an external current to be generated through oxidation and reduction reactions.

The lithium-ion battery is the most widespread thanks to its high energy density

The lithium-ion battery, an innovation that earned its developers the 2019 Nobel Prize in Chemistry, has not only transformed electronics and accelerated the transition to electric mobility, but is also considered an essential piece of the puzzle of integrating renewable energies into the traditional electric grid.



Source: IEA, 2021

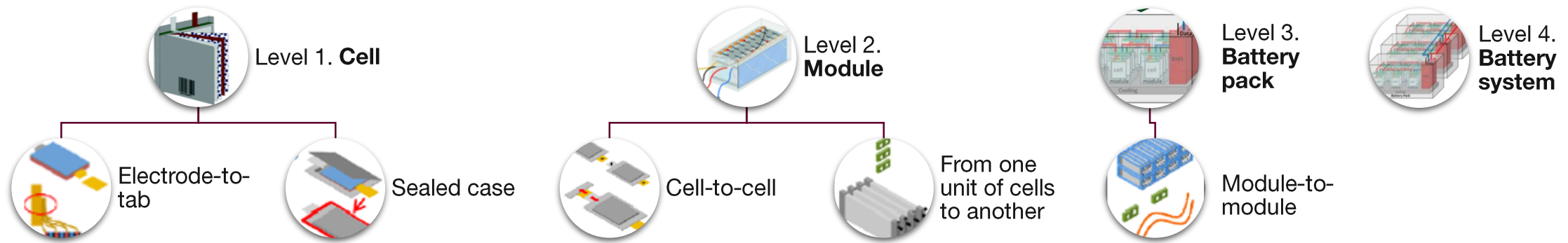
Description of a Lithium-Ion Battery

As energy storage systems, all lithium-ion batteries have the same structure with interconnected cells that form a module. These modules are then connected to form a battery pack. This battery works through a series of processes and/or levels of connections with the aim of creating an electrical charge.

Conceptual relationship

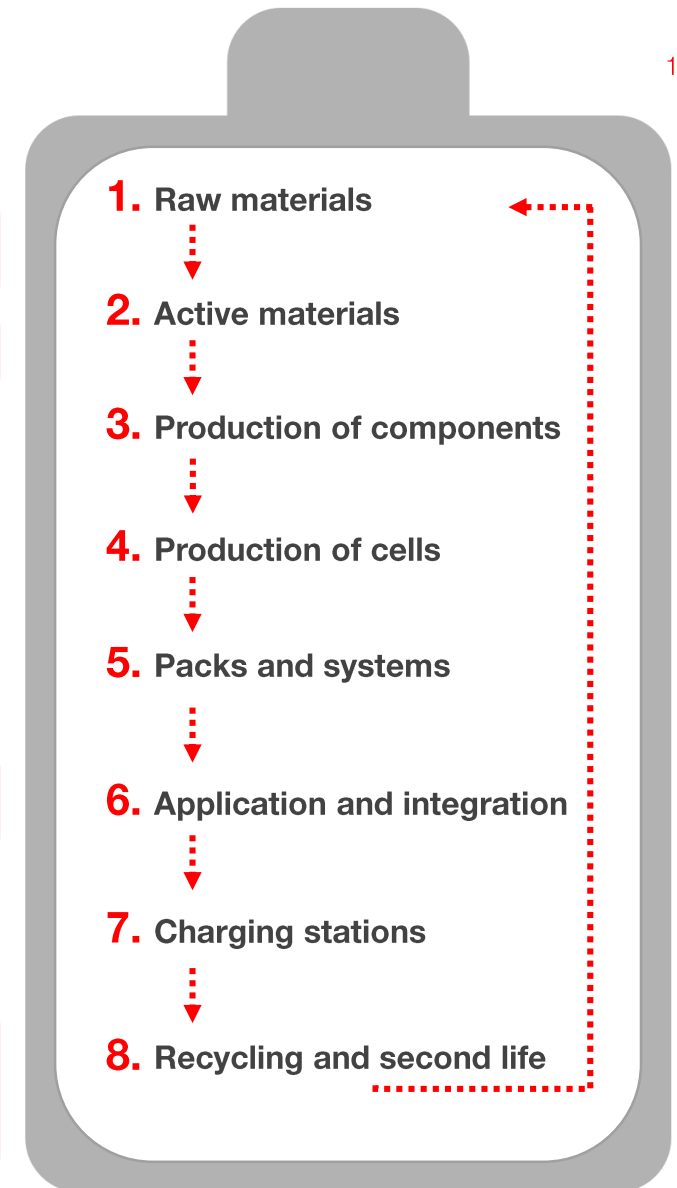


Levels of connection for batteries



Eight Segments

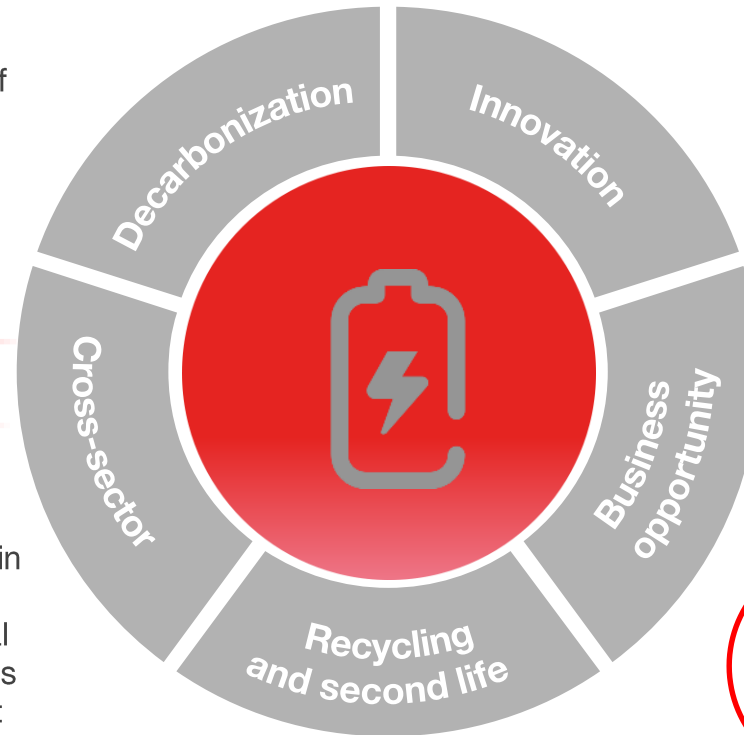
- 1.** The most commonly used batteries are lithium-ion batteries, which use critical materials such as lithium and cobalt. Many of these materials are geographically concentrated in few countries.
- 2.** Material that reacts chemically to produce electric energy when the cell discharges.
- 3.** Manufacture of the anode, cathode, electrolytes, membranes and separators.
- 4.** Production and/or assembly of individual cells.
- 5.** The individual cells are connected in a series or in parallel arrangements, in modules. Various modules and other electrical, mechanical and thermal components are assembled to form a pack. Each pack has a different design based on the performance or functions required.
- 6.** Integration of a battery into an electric vehicle or its application. Connections to the vehicle's wiring to control the motor and charge management system.
- 7.** The infrastructure of charging stations is essential for maintaining the electric vehicle ecosystem. There are different types: portable, wall-mounted and free-standing.
- 8.** Cell recycling: hydro or pyrometallurgical processes and recovery of raw materials (especially nickel, cobalt, aluminium and copper).
Second life: use in other areas such as stationary energy storage.
Remanufacturing: later use of individual components.



Source: ACCIÓ, based on EBA250
CataloniaConnects

Batteries are a key technology for advancing towards decarbonization. This is because they facilitate the integration of renewable energy into production processes, and provide stability and resilience to electrical systems. They are also a fundamental element in transportation for all kinds of electric vehicles.

Batteries are used in a huge number of devices. They've become essential for our everyday lives by playing an important role in everything from mobile phones and laptop computers to electric vehicles and industrial instruments. The thousand uses for batteries will have a cross-cutting impact on different economic sectors.



Batteries are giving a strong boost to research and innovation, as they have become a greatly important technological area in the fight against climate change. This is thanks to their applications in transport and energy storage, not to mention the role they play in the digitalization process. Research is currently looking into new techniques, chemical processes and proposals of new materials that minimize the risks associated with strategic materials and shortages thereof. The aim is to improve energy production, capacity, durability, charge and discharge capacity, and recycling.

New businesses and business models related to batteries and electrification are cropping up. Of particular importance are those working on charging systems, remanufacturing and preparing for a second life.

Battery recycling will become key, both to minimize the environmental impact of batteries and to extract critical components and raw materials. In addition, the use of electric vehicle batteries for stationary uses can lengthen their useful life.

Batteries in Catalonia

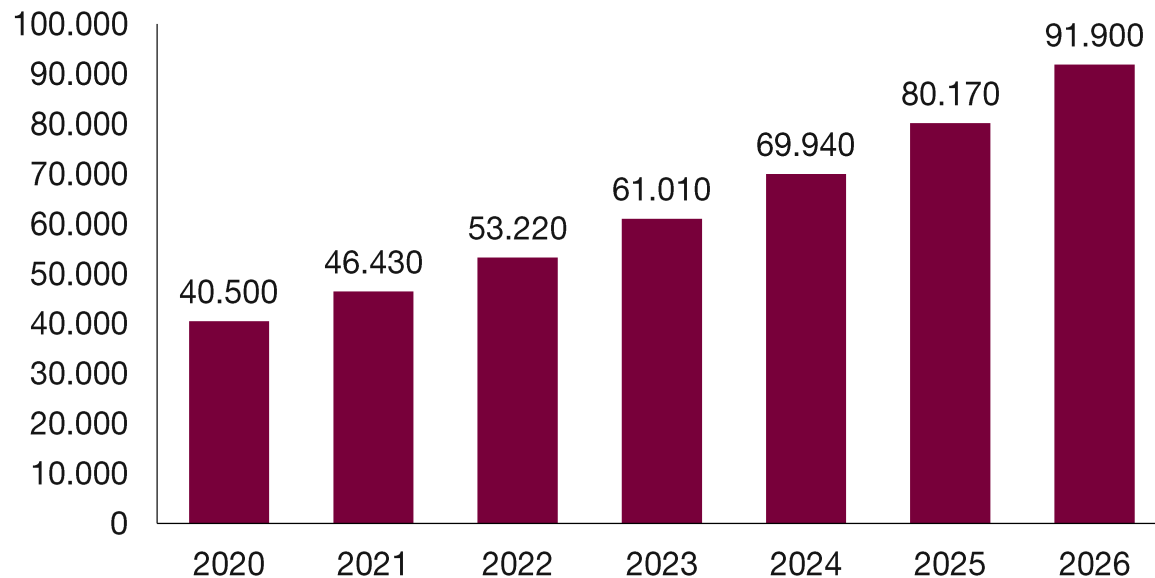
2. The Global Battery Market

Market size

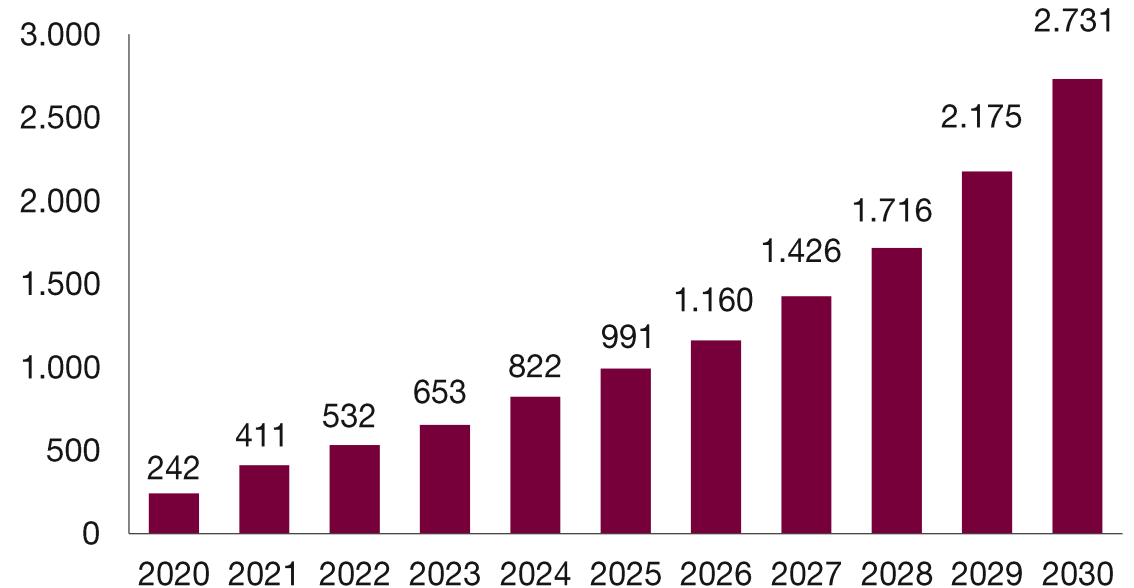
Sales will double every 5 years, reaching **\$91.9 B** in 2026, with a cumulative annual growth of **14.6%**

Battery capacity will multiply tenfold between 2020 and 2030, reaching a total capacity of **2,731 GWh**

Revenues in the lithium-ion battery market (M\$)*



Capacity of lithium-ion batteries (GWh)*



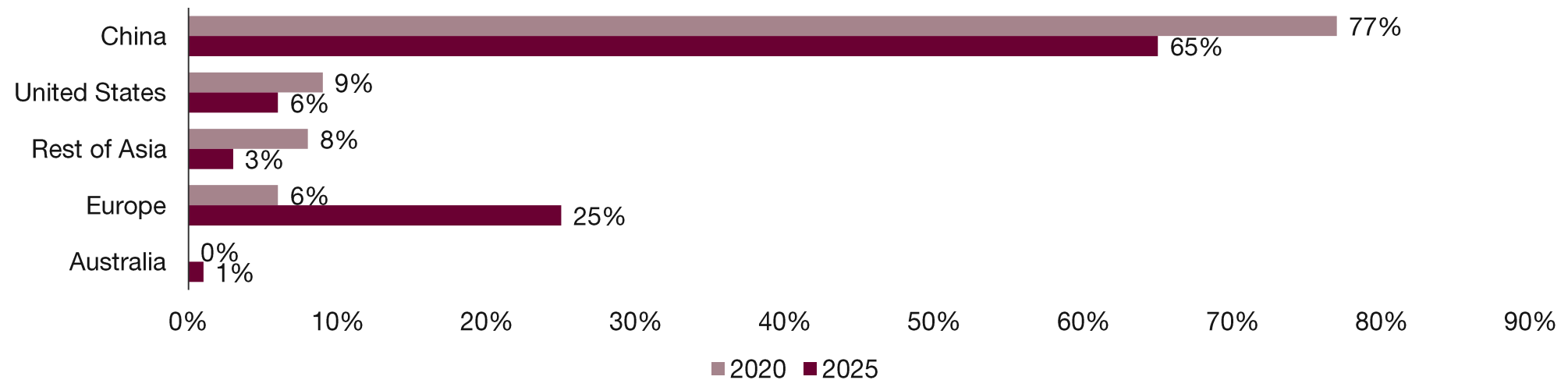
*Data for 2021 onwards are estimates

Sources: Statista; Research and Markets; Our World in Data

Geographical distribution of lithium-ion battery manufacturing centres

Europe is expected to be the world's second-largest manufacturer in 2025, with a market share of **25%**

Market share by geography of lithium ion battery manufacturing (GWh)*



*Data for 2021 onwards are estimates

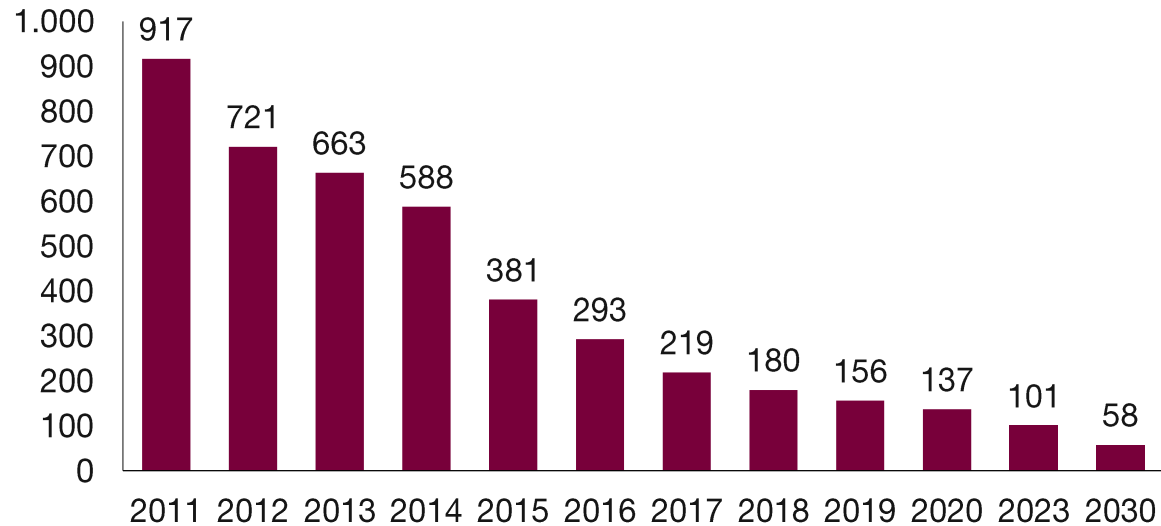
Sources: Statista; S&P Global Market Intelligence; Benchmark Minerals

Price of lithium-ion batteries

The price of lithium-ion batteries fell to **\$137** per kWh in 2020, an **85%** drop compared with 2011

The critical point at which electric cars will outperform combustion engine cars (kWh under **\$100**) will be after 2023.

Price evolution of lithium-ion batteries (\$ per kWh)*



Tesla Model S 75D. 75 kWh battery

Battery Price*:

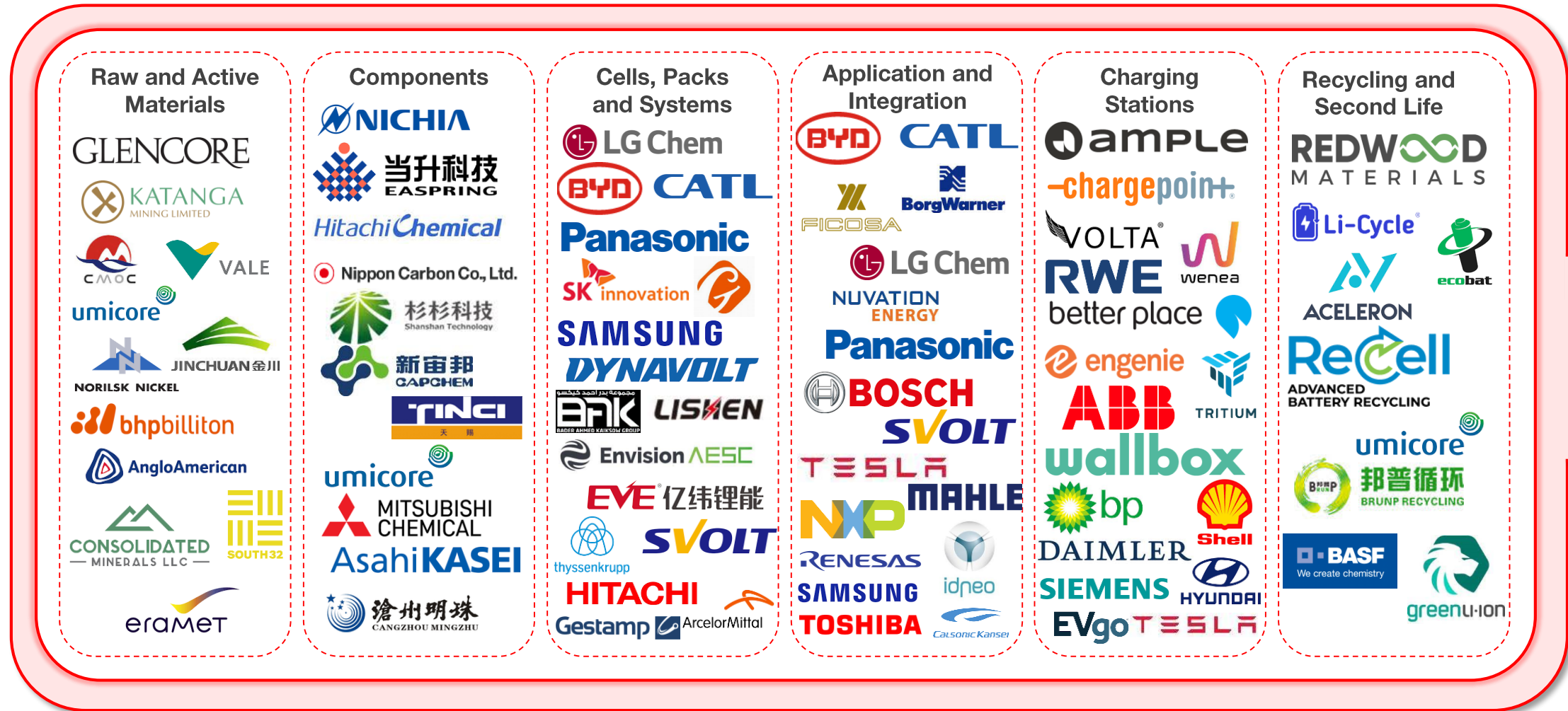
| | | |
|------|---|----------|
| 2011 | → | \$68,775 |
| 2020 | → | \$13,500 |
| 2030 | → | \$4,350 |

*Data for 2021 onwards are estimates

Sources: Statista; BloombergNEF

Main Companies on the Battery Market (I)

Asian companies dominate most of the battery value chain



Disruptive Companies

Battery materials

| | | | |
|--|---|--|--|
| Sodium-ion  | Solid-state  | Silicon  | Zinc  |
|--|---|--|--|

Flow



Hydrogen



Li-ion lifecycle

Li-ion manufacturer




Reuse



Mining



Recycling



Li-Cycle



Battery management



Supercapacitor



Thermal



Compressed air



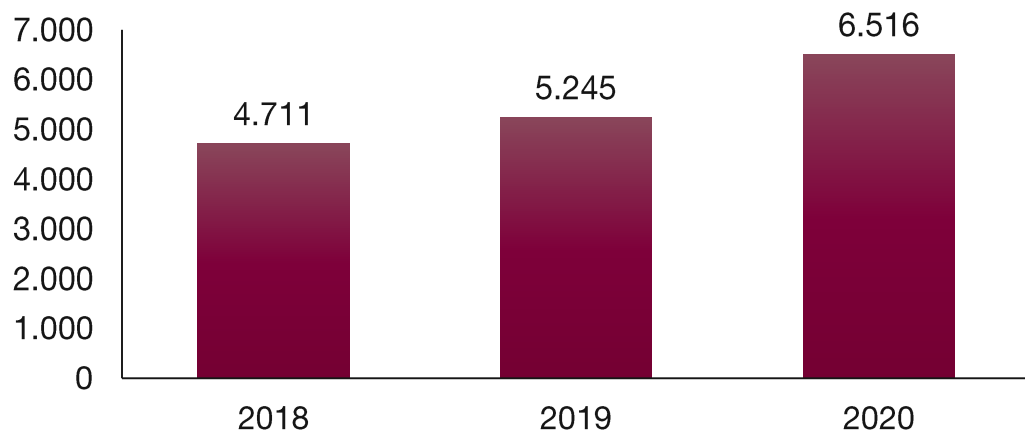
Flywheel



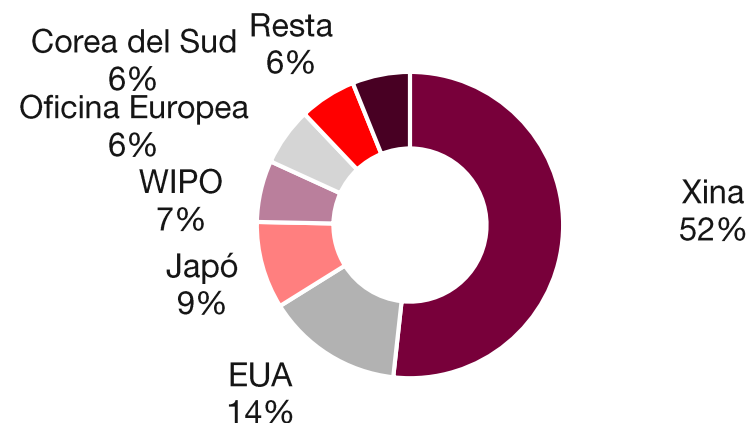
Startups are emerging that aim to make energy storage more efficient and accessible for automobile manufacturers and other vehicle manufacturers and electric companies

clusive and companies are business area. Special-purpose acquisition companies (SPACs) have yellow boxes around them.

Worldwide registration of patents related to high-capacity lithium-ion batteries (2018-2020)



Registration of patents related to high-capacity lithium-ion batteries by jurisdiction (2018-2020)



Between 2018 and 2020, **16,472 patents** related to high-capacity lithium-ion batteries were registered worldwide. **China** led the way with approximately **52%** due to its strong presence of battery manufacturers. The main segments are automotive, materials for batteries and electronics.

Main Applicants



Source: Frost & Sullivan, 2021

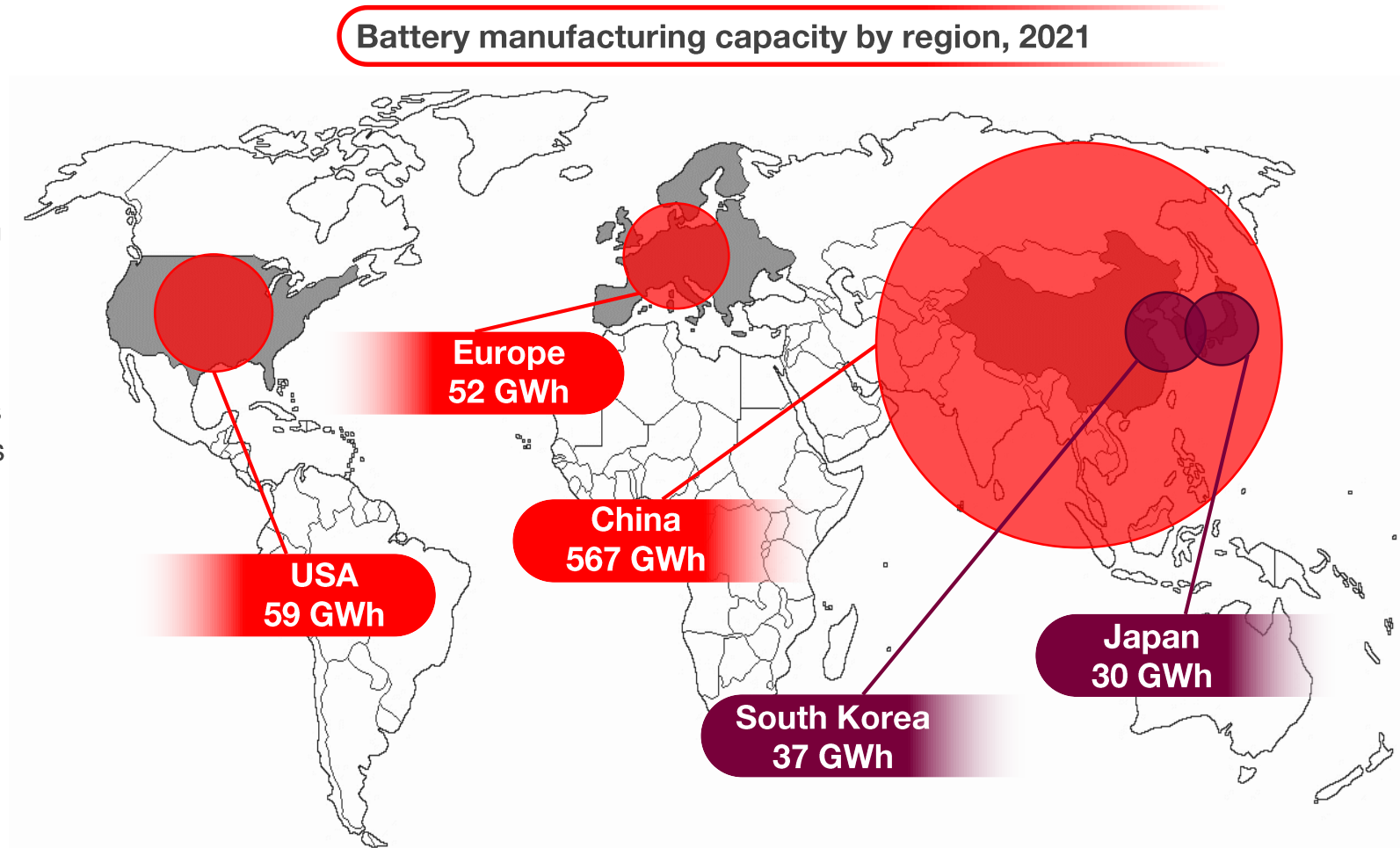
CataloniaConnects

Batteries in Catalonia

3. Initiatives Related to Batteries and Gigafactories

China, the USA and Europe are the regions with the most advanced energy storage strategies

- The **USA** has a **specialized national strategy** to develop a **fair, sustainable lithium-ion battery value chain**. This is being executed by the Federal Consortium for Advanced Batteries (FCAB) and its goal is to guide investments in batteries through different incentives and public-private collaborations.
- **China's** plans hinge on its industrial strategy **Made in China 2025**, which seeks to increase national capacity and considers gigafactory infrastructure to be essential. Between 2019 and 2020, **46 gigafactories** were constructed in the country, **almost one per week on average**.
- **South Korea** expects to invest **€29 B** by 2030 to develop and consolidate its own **battery industry**.



Source: Benchmark Mineral Intelligence, FCAB, MERICS, Donga

Initiatives in the European Union

The four most important EU initiatives on batteries are:

The European Battery Alliance (EBA) is the EU's main tool to develop its strategy within the value chain



- Backed by: The European Commission and EIT InnoEnergy

The Advanced Materials for Batteries Partnership (AMBP) fosters international cooperation to develop innovative materials for batteries used for electromobility



- Backed by: The European Commission and JRC

In 2021, the project BATT4EU was created, a public-private association that operates within the framework of the Horizon Europe strategy



- Backed by: The European Commission and the European Battery Association

BATTERY 2030+ is a large-scale, long-term research initiative that aims to develop the sustainable batteries of the future to achieve the goals set by the Green Deal



- Backed by: The European Commission and Uppsala universitet



Source: The European Commission, BEPA, S3 Smart Specialization Platform and Battery 2030+

Energy Storage Strategy

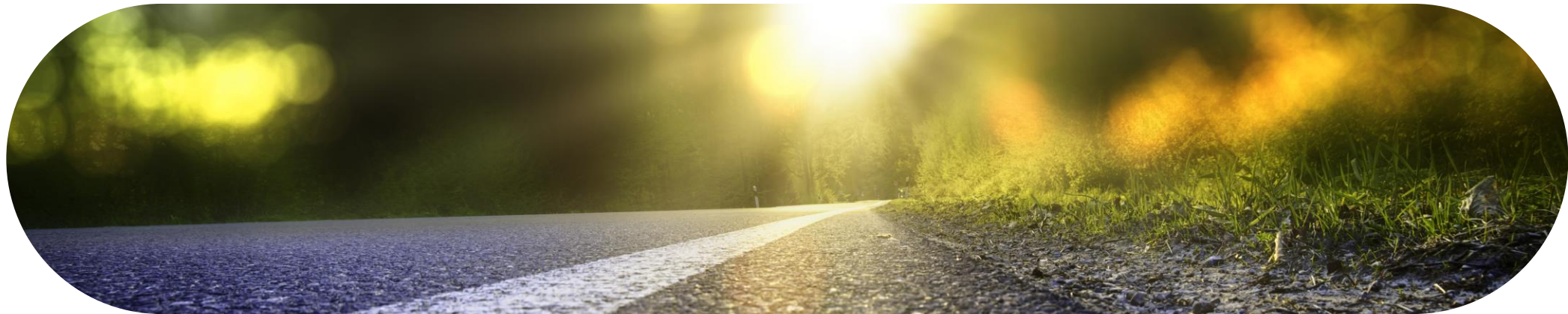
Defining measures to facilitate efficient energy storage and its full integration into the energy system

Identifying all aspects to be reinforced or that may be used as a springboard for the development of technologies

BatteryPlat

Consolidating the main Spanish actors working in all energy storage technologies

Accelerating the industry's innovative development to situate it among the world's foremost energy storage leaders



Rolling out Gigafactories

A gigafactory is a **battery production facility with a total capacity over 1 GWh** (1,000,000 kWh).

These factories are **focused on the electric mobility sector**, but do not merely produce batteries for cars; they also **recycle components** to reduce their environmental impact and give them a second life.










They are **also the heart of the future of renewable energy**, since they will **make energy supply possible and store the energy produced on a massive scale**, e.g. energy produced by solar and wind farms.

Each year, new projects arise in different countries to construct these gigafactories.




Batteries in Catalonia

4. Applications by Sector

| | | | |
|------------------------------|---|--|--|
| <p>Mobility</p> | <p> Automotive</p> <p>Vehicles with internal combustion engines already use batteries to provide electric energy so that the engine and auxiliary elements can function correctly. In the electrification of mobility, the battery assumes a key role, with applications in automobiles, light mobility (such as bicycles and electric scooters) and heavy mobility, such as trains, lorries and even seafaring vessels and aeroplanes. The development of new technologies for electric batteries in the transport sector, along with automation, will allow for the continued reduction in battery costs and improved battery performance.</p> | <p> Light mobility</p> | <p> Heavy mobility</p> |
| <p>Energy Storage</p> | <p> Energy</p> <p>Stationary batteries are designed to offer a steady current over a long period of time, in addition to being able to be completely discharged several times. Stationary batteries are adapted to applications within the fields of telecommunications, wind energy and photovoltaic systems, alarms and security systems, remote control applications, automatic teller machines, call centres, food sources and medicine.</p> | <p> Home</p> | <p> Industry</p> |
| <p>Electronics</p> | <p> Electric and electronic devices</p> <p>The evolution of battery technologies is directly linked to the miniaturization of mobile electronics such as mobile telephones, laptop computers, tablets and medical devices. The current stars of electronics are lithium-ion batteries, the technology which has not only filled the need for increasingly smaller batteries, but also offers higher battery density and energy efficiency compared with older technologies such as NiCd and NiMH.</p> | <p> Mobile telephones</p> | <p> Medical devices</p> |

Sources: Frost & Sullivan, International Energy Agency

Energy storage systems, electric and electronic devices, and electric mobility devices have become an integral part of our everyday lives and what they all have in common is their use of batteries:

|  Energy storage |  Electronic devices |  Mobility |
|---|---|---|
| Stationary energy storage | Computers | Electric vehicles |
| Portable energy storage | Wearables | Buses |
| Portable solar energy storage | Smartphones and tablets | Motorbikes |
| | Payment systems | Electric bicycles |
| | Devices for personal care and hygiene | Scooters |
| | Toys | Golf carts |
| | Tools, machinery | Forklifts |
| | Alarms | Wheelchairs |
| | Audiovisual devices | Drones |
| | Medical devices and equipment | |



3. Good Health and Well-Being

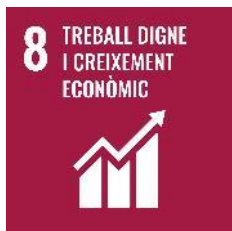
Batteries will aid electrification and therefore the reduction of emissions. This will have a positive impact on human health.

Proper management, traceability, recovery and recycling will prevent potentially hazardous components from reaching the environment or harming human health.



7. Affordable and Clean Energy

The electrification of transport will be a key contributor that will significantly reduce emissions and facilitate the use of renewable energy sources.



8. Decent Work and Economic Growth

The battery market will experience huge growth, both for energy storage and transportation. This will not only affect cell production, but will also lead to the growth of industries producing auxiliary equipment, raw materials and facilities. It will also provide opportunities for the value chain and local industries.



9. Industry, Innovation, Infrastructure

New technologies that are more efficient and less dependent, along with lighter batteries that can have a circular life cycle.



11. Sustainable Cities and Communities

The development of more efficient and affordable batteries will favour more sustainable mobility and help create cleaner, more sustainable cities with better living conditions.



12. Responsible Consumption and Production

This implies the re-use and recycling of batteries, along with their traceability throughout their entire life cycle.



13. Climate Action

The storage of renewable energy is necessary to accomplish these climate goals.

Batteries in Catalonia

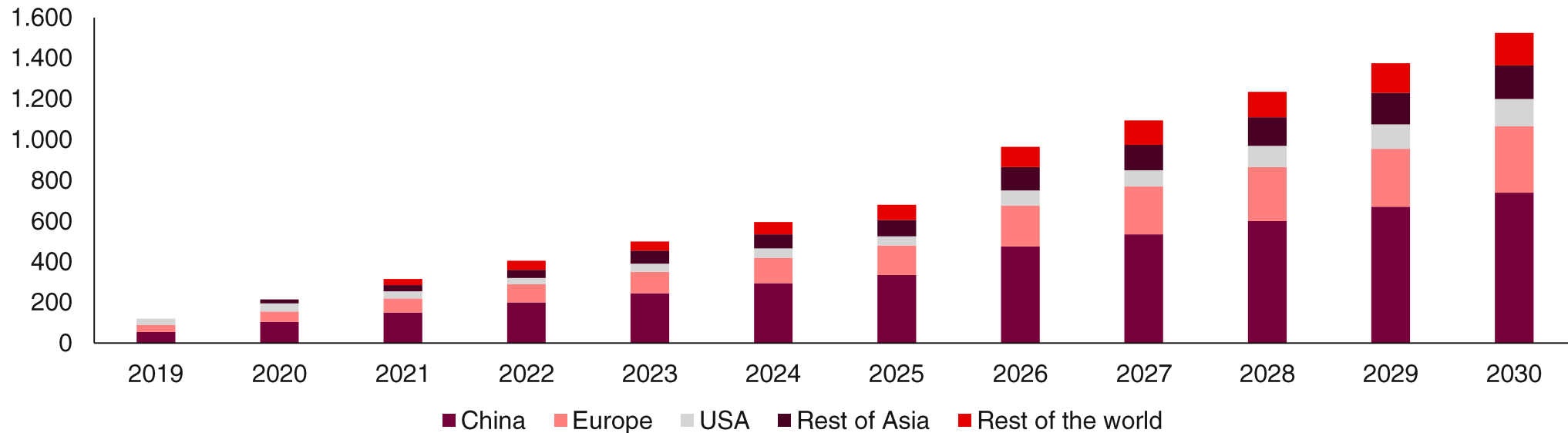
5. Batteries in the Mobility Sector

Lithium-ion batteries for electric vehicles

Worldwide demand for lithium-ion batteries for electric vehicles will grow exponentially over the remainder of this decade and surpass **1,500 GWh** by 2030.

More than half of this global demand will be concentrated in China by 2030, with Europe in second place. The USA will trail behind the Rest of Asia.

Demand for lithium-ion batteries for electric vehicles by geographical area (GWh)*




*Data for 2021 onwards are estimates

✓ The electric vehicle market in Europe has accelerated and is now at or past its turning point

| Variables | Turning point | 2017 >50% of market | 2019 >50% of market | 2020 >50% of market | 2021 >50% of market |
|-------------------------------|--|------------------------|------------------------|------------------------|------------------------|
| Cost/Price | Parity with combustion engine vehicles | Below turning point | In development | Past turning point | Past turning point |
| Range | > 350 km | Below turning point | Below turning point | Past turning point | Past turning point |
| Charging station availability | > 1 public station / 10 EVs | Below turning point | Below turning point | In development | In development |
| Charging time | Range of 200 km in 20 minutes | Below turning point | Below turning point | In development | Past turning point |
| Models available | 50% of main OEMs | Below turning point | Below turning point | In development | Past turning point |

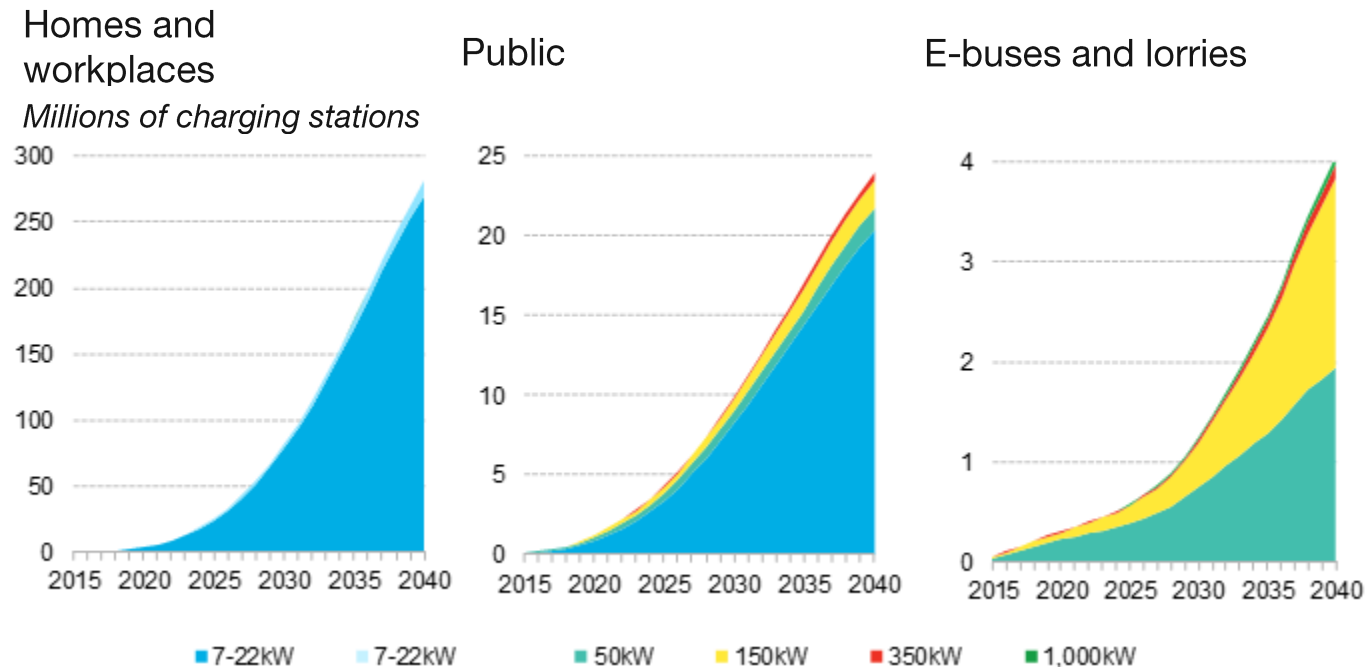
| Key | |
|---------------------------------------|---------------------|
| ■ | Below turning point |
| ■ | In development |
| ■ | Past turning point |

 The availability of charging stations is the only aspect with a margin for improvement. This is expected to be resolved in the medium term.

Source: EBA250

The global charging network will grow to include 309 million charging stations by 2040. Of these, 87% will be in people's homes. To achieve this goal, more than \$589 B in cumulative investment will be required.

Accumulated global charging infrastructure (installed), by category



Passenger vehicles



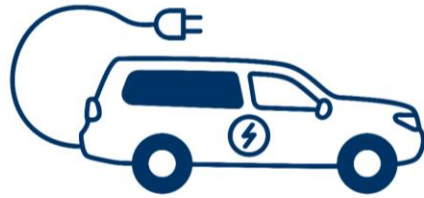
Commercial vehicles



Mobility services



Charging infrastructure



Vehicle-to-grid tech



Lithium-ion batteries



Solid-state batteries



Charging networks



Fleet management



Supercapacitors



Charging station management



End-life battery tech



Battery management & analytics



The strong commitment of many governments to electrifying mobility means that more and more startups are entering the market

Source: CB Insights, 2020

PERTE

The Spanish recovery plan, backed by Next Generation funds, features the PERTE initiative (Strategic Projects for Economic Recovery and Transformation), whose objective is to create and reinforce different value chains within the country.

PERTE for Electric and Connected Vehicles

€24 B in investment (2021-2023)

PERTE for Renewable Energy, Hydrogen and Storage

€1.61 B in investment (2021-2023)

MOVES Plan

The Spanish government has activated subsidies through its MOVES plans. These provide the autonomous communities with financing to promote the purchase of electric and hybrid vehicles by citizens, and to roll out more environmentally friendly charging stations.

MOVES Plan II

€100 M budget

*valid until 2021

MOVES Plan III

€400 M budget

*valid until 2023

6. Opportunities, Challenges and Risks of Batteries

Opportunities

Job creation and attracting talent

Strengthening the industrial value chain

Fomenting the circular economy

Benefits for electrical power management

Promotion of R&D

Reuse of batteries and second life

Challenges

Lack of raw materials and active materials

Battery industry too new

Changes in the automotive industry

Improving battery safety

Waste management

Effects of quick charging



Value chain risks: critical points for key minerals and high EU exposure



Supply risks: related to the supply of raw materials



Demand risks: increased demand for raw materials



Price risks: rising raw material costs



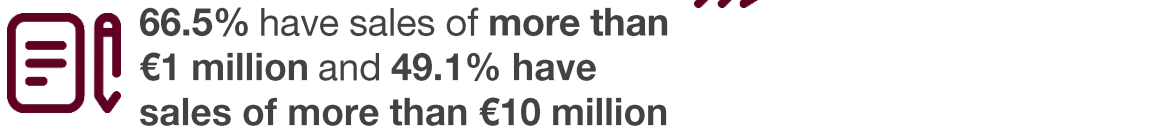
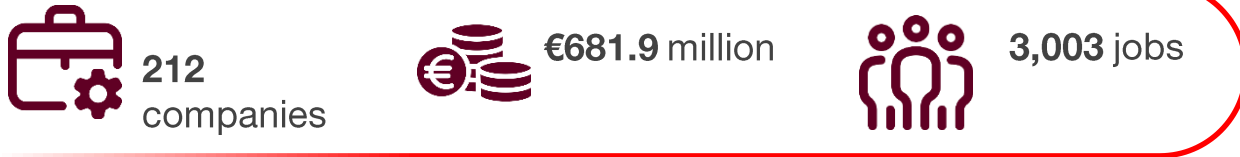
Risks in deploying **charging stations** for batteries



Batteries in Catalonia

7. Batteries in Catalonia

Mapping the Battery Ecosystem in Catalonia



By segment*, **43.9%** of the companies work in the **application and integration of batteries** (more than half of them in mobility). **22.6%** operate within the first stages of the value chain, including **materials and battery systems**. It's also worth mentioning that **18.4%** of these companies deal in manufacture and management of **chargers for electric vehicles**.

*Companies can be classified in more than one segment within the battery value chain.



Main Companies on the Battery Market in Catalonia (II)

Among segments, the largest is the application and integration of batteries in devices and vehicles

Active Materials

- Lubrizon
- BASF
- rimsa
- RENISHAW
- Nouryon
- covestro

Batteries and Systems

- TAB batteries
- maxell
- Mundilec
- SCUTUM
- Eternity
- Shell
- MILLOR
- Fuelium
- BOLD
- WATTIUS
- EXIDE
- Systems
- isovolt
- teknoCEA
- FIGOSA
- DENSO
- KNAUF INDUSTRIES
- SIEMENS
- elringklinger
- KAUTEX
- cinergia
- DÜRR
- KELLA
- Farguell GROUP
- PREMO
- Dow
- ZEISS
- volta
- FAE
- starke
- socomec
- Premium
- FREUDENBERG
- RENISHAW
- IBERFLUID
- BTWICE
- nvision
- bertrandt
- estamp
- Gestamp
- AVL

Application and Integration

- POWER ELECTRONICS
- GASGAS
- Mobility
- inelec
- urbaser
- SCUTUM
- SANTAFIXIE
- bassols
- RIEJU
- ALSTOM
- RAY
- CC
- gar-bus
- TNT
- RIFA
- Formel D
- Audi
- TORROT
- VELA Mobility
- mobike
- freeel
- BENTELER
- beo
- LEGEND
- (e)B
- PURSANG
- MKF
- LEAR CORPORATION
- LUPA
- Linite
- MIMe
- meep
- Aspaso Sava
- CARMELA
- AAM
- Circle
- vooss
- bikebitants
- by shibike factoria st
- SEAT
- ayats
- DOGA
- TAG
- INDCAR
- enagas
- Naturgy
- BayWa.r.e.
- capital energy
- IBERDROLA
- POWER ELECTRONICS
- Inycom
- LOXONE
- inelec
- SMA
- factorenergia
- EMELCAT
- acciona
- SCUTUM
- biorenovables
- kasaka
- estabannell energia
- pr+energy
- aliter
- VAillant
- efibat
- S&P
- greenenergi
- RUBATEC
- VIESSMANN
- QKSOL
- starke
- FEE
- uestra
- LUPA
- engiaux
- VINCI
- Shell
- solideo
- elecnor
- bassols
- SCHNELLECKE LOGISTICS
- POWER ELECTRONICS
- Schneider Electric
- Other
- gdp
- SANDVIK
- RM

Charging Stations

- REPSOL
- ecopel
- FIGOSA
- etra
- BONAL
- efacec
- endesa
- CEPSA
- GEWISS
- ABB
- FERVE
- Fronius
- MANTISE
- VILALTA GREENENERGY
- blaudrive
- enide
- SECE
- wallbox
- justa energia
- Premium
- placetoplug
- citelum
- simon
- AGAD BARCELONA
- SCAME
- bia
- apar car
- etecnic
- RUBATEC
- ecoNext
- heliox
- Serenovables
- selba
- CIRCONTROL
- solideo
- YAZAKI
- enchufing

Recycling and Second Life

- ferimet
- urbaser
- BASF
- LAFARGA
- UNIBAT
- Druids
- soriguè
- SUEZ
- COMSA CORPORACIÓN
- TERSA
- VEOLIA
- URBAN RESILIENCE

Cells and Components

- GORE
- TAB batteries
- Lubrizon
- venAir
- Graphenica

Cells

-

Consulting/Engineering

- Applus IDIADA
- FLUOR
- IDOM
- accenture
- BETWEEN
- engie
- iGrid
- T&D
- ALTRAN
- idneo
- Deloitte
- ADYMUS
- electromaps
- esi
- Ehertips
- BAX & COMPANY
- BECHAINED
- eks
- RLE INTERNATIONAL
- fives
- kmU
- ecoserveis
- edenway
- HOLTROP
- ARC
- ebe
- btech
- JU Group

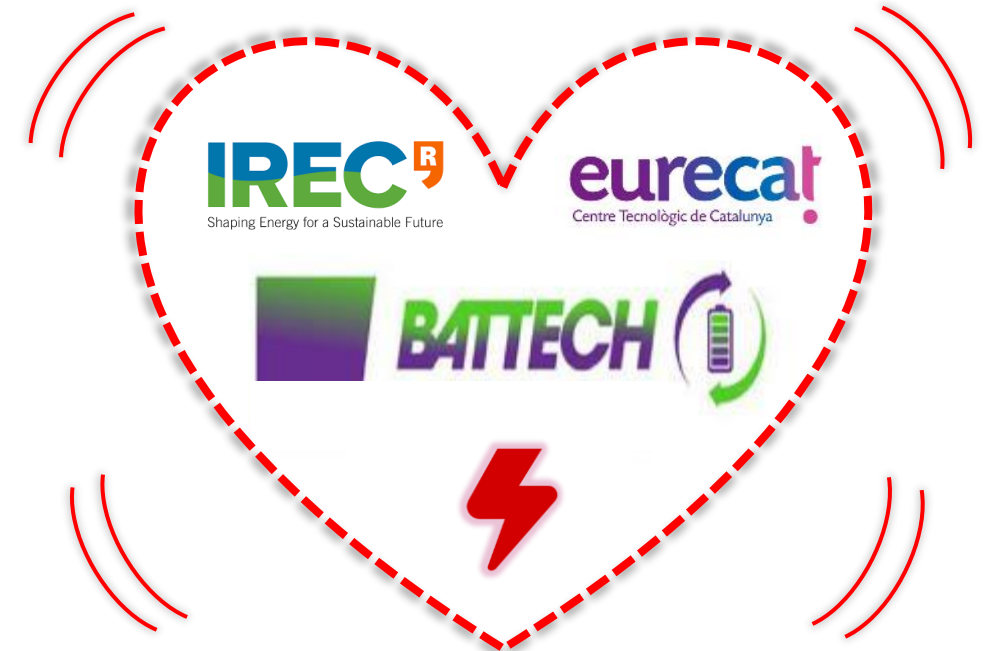


The IREC and Eurecat provide funding for Battech, the new R&D reference centre for batteries in Southern Europe

This technology centre aims to cover the entire battery ecosystem by taking action in **research, innovation and the development of the value chain for the next generation of electric cells and batteries.**

The goals of Battech are to:

- Position itself internationally as a reference hub.
- Lead the electricity storage strategy in Catalonia.
- Promote the transfer of knowledge within the industry.
- Spur investment and create new jobs.
































Battech is currently working on two important projects:

Manufacture and assembly of reusable modular batteries for electric vehicles



Cobalt-free batteries for application in the automobiles of the future

Main International Opportunities for Catalan Companies by Battery Application Sector

| | | |
|--|---|---|
|  <p>Digital processes in the automotive industry, batteries and industrial subcontracting</p>  |  <p>Dynamic automotive industry with a focus on autonomous, connected, electric and intelligent vehicles</p>  |  <p>Hydrogen, renewable energy and energy efficiency: production, storage and distribution opportunities</p>  |
|  <p>The vehicle of the future: electric, hydrogen and autonomous</p>  |  <p>Investments in renewable energy and storage</p>  |  <p>Opportunities in electric vehicles to restructure the automotive industry</p>  |
|  <p>Country with the most sustainable mobility in the world. Oslo is the world's electric vehicle capital</p>  |  <p>Innovative solutions for automobiles and mobility</p>  |  <p>Japan is a reference centre in the development of next-generation batteries (solid-state)</p>  |
|  <p>Cutting-edge sustainable mobility and plenty of charging stations</p>  |  <p>Innovation on wheels in the USA. Electrification and automation of the automobile market</p>  |  <p>China is beginning a new era of high-level electrification</p>  |
|  <p>An industry in the process of adapting to the connected and electric vehicle</p>  |  <p>Technological innovation and development opportunities through an increase in electric mobility</p>  |  |

Source: ACCIÓ, based on the 2021 Global Map of International Business Opportunities

Batteries in Catalonia

8. Batteries for Mobility in Catalonia

1. Catalonia, a leading automotive ecosystem



Catalonia is a powerful automotive leader thanks to its technical and research centres, manufacturing plants and high-quality associations.

- It produces **17% of the vehicles manufactured in Spain**

Leading Catalan automotive companies

Orbis, 2020

2. World-class innovation ecosystem



Catalonia is one of **Europe's main automotive engineering and R&D hubs** and is also a hub for **IT solutions and software development** for vehicles and mobility.

- It boasts a critical mass of **technology and research centres** specialized in the automotive industry.
- It is **ranked fourth in the EU among startup hubs** and is the **fourth most innovative European city**.

3. Unbeatable export capacity and logistics



- Catalonia accounts for **19% of Spanish automotive exports** and **30%** of regular exporters.
- **Excellent communications network** with completely integrated transport systems.
- The Port of Barcelona is the **second-most attractive European port** for logistics investment.

4. On the world's radar for FDI in the automotive industry



- It is ranked **fifth region** in Western Europe in **capital investments for automobiles**.
- **It's the top** destination in Spain for **FDI in the automotive industry** (representing **41%** of projects).
- **The best region in Southern Europe to invest.**

Financial Times *The best global investors in the industry*

fDi markets, 2020

5. Privileged location for specialized talent



- **Barcelona is ranked fifth** among world cities for expats to work. *BGC, 2019*.
- Barcelona's **excellent quality of life and universities** attract a **large number of qualified international workers**.
- **Barcelona, a highly innovative city**, boasts **amazingly talented scientists** with a wide research scope. The city is ranked among the leading European cities in science.

6. An excellent response to the COVID-19 crisis



- COVID-19 has had a major impact on the global automotive industry.
- **Sustainable, high-tech mobility** is key.
- Catalan companies have developed **new initiatives in response** to the impact of the pandemic.



An ideal place to centralize automotive battery operations

Catalonia's **robust industrial ecosystem** and wide-ranging scope allows for access to knowledge, technology and service providers and suppliers to efficiently develop and operate in **battery manufacture and distribution**.

Privileged location

- An opportunity for a market with potential in Southern Europe and North Africa.
- The best region in Southern Europe for battery factories supplying the EU.
- Rapid commercial routes to the European and North African markets.

Industrial ecosystem

- First-rate auxiliary equipment suppliers for all kinds of industrial cell and module manufacturing projects.
- Chemistry hub for the development of materials and components.
- Initiatives to foster change in battery technology.
- Leaders in laboratory testing for car batteries.
- A lithium-ion battery value chain is being created in Catalonia.
- A consolidated electric charge business model.

Government commitment

- Value chain for packs and batteries: a government priority.
- Ability to adapt technology transfer based on industrial priorities.
- Public initiatives supporting electric vehicles.
- Creation of the Automotive Round Table (Taula d'Automoció).

Main goals for battery production and the supply chain:

To attract FDI to the battery value chain

To guide industry towards the battery sector

To develop new technological capacities

To develop capabilities for testing, authorization and certification

To create new business models in the battery value chain



The vehicle of the future (I)

The sustainable electric vehicle

- Technical and research centres, along with professionals and organizations from around the world, **make Catalonia the best location to develop and create more energy-efficient vehicles.**
- SEAT (an automobile manufacturer with headquarters in Catalonia that is preparing to launch an urban electric car in 2025), the **automotive industry** and the **government of Catalonia** are actively promoting **the attraction of a battery production plant to Catalonia.**
- Catalonia currently has **3,280 charging stations for electric vehicles** and 2% of its newly registered vehicles are electric. The goal is to **increase this percentage to 30% by 2025.** To accomplish this goal, Catalonia is **promoting sustainable mobility** and the purchase of electric and hybrid cars. It also provides support for the installation of charging stations.

Catalan carmaker SEAT will launch its urban electric car in 2025 and has opened the first Volkswagen battery development centre outside Germany.



- With this automobile, the company will enter an essential segment to make electromobility accessible for the general public and achieve the goals of the European Green Deal. SEAT has presented an ambitious plan, called Future Fast Forward, to lead electrification of the automobile industry in Spain. It not only intends to produce electric vehicles, but will also lead the Volkswagen Group project across all its phases.
- In the city of Martorell, SEAT has inaugurated the only **battery innovation and development centre for the Volkswagen Group outside Germany.** It is the first of its kind in the country and features a laboratory, called Test Center Energy, with an area of **1,500 m²** and the capacity to carry out more than **6,000 tests a year** to ensure optimal performance of electric and hybrid vehicles for the different brands in the Volkswagen Group.

Source: ACCIÓ: “The Automotive Industry in Catalonia: Sector Report”



Strong presence of R&D centres focused on the automotive industry (II)

Automotive specialization of technology centres:

| | Optimizing manufacturing | Autonomous vehicle | Electric vehicle | Sustainability | Vehicle safety | | Optimizing manufacturing | Autonomous vehicles | Electric vehicle | Sustainability | Vehicle safety |
|---|--------------------------|--------------------|------------------|----------------|----------------|--|--------------------------|---------------------|------------------|----------------|----------------|
| AMADE ANALYSIS AND ADVANCED MATERIALS FOR STRUCTURAL DESIGN | ✓ | | | | | inLab [®] FIB Fabrics & Tech | | | | | ✓ |
| CD6 UPC | | ✓ | | | | easy | | | | ✓ | |
| CIMNE [®] | ✓ | | | | | CTTC [®] | | | | ✓ | |
| UB CEM II C | | | | ✓ | | GREia [®] | ✓ | | | ✓ | |
| i2cat [®] | ✓ | | | | | INEM CIPIA | ✓ | | ✓ | | |
| CITCEA | | | ✓ | | | IREC [®] Sharing Energy for a Sustainable Future | | | | ✓ | ✓ |
| CVC [®] | | ✓ | ✓ | | | laSalle RAMON LLULL UNIVERSITY | | ✓ | | ✓ | |
| Grup de Compatibilitat Electromagnètica UNIVERSITAT POLITÈCNICA DE CATALUNYA | ✓ | | | | | ISI Institut de Robòtica i Informàtica Industrial | | | | | ✓ |
| CREB | ✓ | | | | | MCIA | ✓ | | ✓ | ✓ | |
| Centre de Disseny i Optimització de Processos i Materials | ✓ | | | | | | | | | | |

Note: This classification is based on specialization of technology centres in the automotive industry. The table does not show the specializations these centres may have in other industries.

Source: ACCIÓ: “The Automotive Industry in Catalonia: Sector Report”

Batteries in Catalonia

9. Success Stories in Catalonia

Application Success Stories in Catalonia



The first major brand of electric cars in Catalonia.



Graphene and lithium batteries to charge electric bicycles.



AutoGraph - Graphene-based electrodes for energy storage devices.



The new Catalan electric sports car.



Pilot test to regulate the energy of a library using an electric car battery (second life).



E-Miles – Prototype of an electric car with an extendable chassis.



This Catalan unicorn has a presence on Wall Street and expects growth in chargers for electric cars.



Alternative to single-use batteries with ecological and sustainable batteries made of paper.



A project about to receive an international patent for recycling mobile phones and batteries.



New rigid sail powered by renewable wind energy.



MARBEL Project – More sustainable and efficient electric batteries.



COBRA Project - Cobalt-free batteries for application in the automobiles of the future.



Manufacturer of motorbikes and electric batteries.



Sustainable charging through modular batteries.



Design of flexible-use batteries that can be adapted to different applications.



Collective system that works towards implementation and management of fuel cell and battery recycling.



Spain's first R14 authorization for applications that give a second life to electric and hybrid batteries.



Collaborates with Endesa on installation of the first electric battery recycling plant in Spain.

Batteries in Catalonia

Interviews

We would like to express our thanks to the following for their willingness to help and for providing us with data and information, which made it possible to create this technological snapshot:

Companies



Research and Technology Transfer



Technology Platforms



Associations and Entities



Thank You

Passeig de Gràcia, 129
08008 Barcelona

accio.gencat.cat
catalonia.com

 @accio_cat

 @catalonia_ti

More information about the sector and related news
<http://catalonia.com/industries-in-catalonia/sectors/sustainable-mobility-and-smart-cities-industries/>

