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### Unlocking Europe's Battery Potential: Powering growth, Driving Sustainability Assessing the current state of the European battery value chain



**NOVEMBER 2023** 

# Creating a strong battery value chain in Europe could help ensure that the local demand is met reliably with products that are verifiably sustainable and efficient

REPORT CONTEXT	Lithium-ion batteries can be instrumental to help the world reach its <b>carbon neutrality objectives by 2050</b> . While the use of battery technologies reduce our emissions, the impact of their production, especially on a large scale, remains a key challenge to address. While it is obvious that true sustainability must <b>consider the technology's value chain</b> , reliability and transparency are just as important to ensure batteries can play the critical role we need them to.
REPORT SCOPE	Creating a strong battery value chain in Europe could help ensure that the local demand is met <b>reliably with products that are</b> <b>verifiably sustainable and efficient.</b> Additionally, increasing local activity within this sector can serve as a <b>true vector of economic</b> <b>growth</b> for the European region.
	Europe's political and economic stability as well as its access to capital, skilled labor and industry expertise serve as excellent <b>foundational elements to building a robust battery value chain</b> . There are however opportunities to further strengthen further specific steps of the value chain. This point of view deep-dives on the current state of the European value chain, to help industry stakeholders and candidates identify areas that can be further developed that leverages local strengths and expertise.
POV OBJECTIVE	We provide a high level-view on the current state of the European value chain and its development opportunities

### Table of content





4

The transition to a sustainable and circular economy is driving up the demand for batteries in Europe. A reliable and secure supply chain will be needed to meet this demand

### The demand for batteries is growing exponentially...



### The European Green Deal is supporting and reinforcing the adoption of clean technologies and li-ion batteries

The European Green Deal enshrines the EU's goal to meet economy-wide climate neutrality by 2050. To achieve this, the EU is setting rules and targets in all sectors, including mobility, providing certainty in the future demand for EVs in Europe.

EU legislation also includes funding mechanisms and other support schemes to boost the domestic production of clean energy technologies, including Li-ion batteries



### The automotive market is also shifting towards EVs, and the demand for stationary applications such as Energy storage systems is on the rise

The global push to reduce greenhouse gas emissions and avoid the most dangerous impacts of climate change is leading to a surge in demand for electric vehicles (EVs) and energy storage systems (ESSs), triggering a rapid acceleration of global demand for Li-ion batteries.

In 2021, EVs and ESSs surpassed 550 GWh globally.

### ... increasing the necessity to strategically strengthen the battery value chain in Europe



#### To meet this demand, Europe needs to support the development of secure and ethical value chains

Strengthening the European supply chain would increase security of supply reduce dependencies on outside countries. Furthermore, a domestic supply can potentially be more transparent, thereby enabling a better control over monitoring the true sustainability of the local value chain

# Europe is already experiencing a rapid increase in the demand for Li-ion batteries, as companies and consumers seek to reduce their climate impact

The last decade has seen an increase in the level of interest and engagement in the issue of climate change, including from governments, businesses and consumers. This has been triggered by the increasingly visible impacts of climate change within Europe, as well as scientific reports that emphasise the urgency of acting now to curb emissions and avoid the worst impacts.

As the graph indicates, consumers are switching to EVs in increasing numbers. This is being supported by increases in the number of Li-ion batteries imported by the EU, as well as



increases in domestic production capacity, with the number of Li-ion gigafactories in the EU rising from 26 to 30 in 2022.

Growth rate (%) of passenger electric vehicles number compared with previous years, 2021 Source: Eurostat Source: Wood Mackenzie

**European countries are scaling up grid-scale energy storage capacity** 2022 – 2031 (GWh), top 10 countries



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# Supporting the development of sustainable and reliable batteries supply chains is a key pillar of the European Green Deal (1/2)

Since 2017, the EU has brought forward a number of initiatives, set out below, which aim to boost the sustainable supply of batteries. This includes supporting domestic production.



# Supporting the development of sustainable and reliable batteries supply chains is a key pillar of the European Green Deal (2/2)

Since 2017, the EU has brought forward a number of initiatives, set out below, which aim to boost the sustainable supply of batteries. This includes supporting domestic production.



# Europe has a strategic incentive to strengthen its own lithium-ion battery value chain and reduce its dependencies on foreign suppliers

Reducing imports of critical raw materials and other value chain elements, would support batteries producers to ensure increases transparency, ethical working conditions, and security of supply.

#### Transparency

Having a fully European supply chain can make it easier for manufacturers and consumers to access reliable data on mineral extraction, manufacturing and the final steps of production.

This is facilitated by data sharing rules and systems that are being implemented within Europe.

### Ethical working conditions

As producers are increasingly required to implement supply chain due diligence policies (due to EU legislation as well as consumer expectations), risks can be mitigated through choosing suppliers where ethical working practices are ensured. This includes the EU, where legislation and monitoring processes ensure high working standards.



Security of supply

Shifting extraction of critical raw materials domestically would support security of supply in the long run, mitigating against the risks of trade disruptions.

### Focus on: lithium supply

Europe currently imports that vast majority of the Lithium it consumes, despite having the potential to greatly increase domestic production.



#### **Background information**

Rising prices and potential future shortages of lithium raise concerns. Only 4 countries control more than 95% of global production

#### Boosting European supply chain

By 2030, European projects have the potential to meet over 50% of Europe's refined lithium demand



# A complete and sustainable lithium-ion battery value chain is made of steps that make it completely circular



### Funding: Availability of local funds to support growth programs

The lithium-ion battery chain in Europe is active across all steps, but will need to overcome key challenges to scale-up and meet the demand of its local market

#### **Regulations:** Local regulation effectiveness is impacted by foreign policies such as Inflation Reduction Act in the US (IRA) I. Extraction & Refining VI. Battery charging + Effective charging solutions will increase battery lifetime and + Lithium can be found in Europe and other western countries limit disposal and additional production/recycling needs Europe is currently mainly dependent on controversial sources Batteries are sensitive and factors such as temperature, for critical minerals used in batteries charging current or number of charging cycles can damage the battery cell. Technological innovation will be required to breakthrough in the field of Battery charging V. Battery consumption **II.** Active material production + Strong global OEM players operating out of Europe Increasing domestic production of active and increasingly shifting their product lines to EVs material in Europe will be able to provide 2/3 of EV remain expensive for end consumers in Europe Europe's demand Active material production is dominated by China, South-Korea, and Japan, that hold 90% market share VII. Battery recycling Multiple project in development III. Battery cell production Rapid evolution of battery **IV. Battery assembling** design and composition makes • Growing number of domestic projects to create Battery + The largest battery cell producers in Europe also assemble recycling increasingly production factories in Europe their own battery packs, enabling greater cost efficiencies Most new potential capacity is focused on NMC chemistries, challenging High variance in requirements of battery packs for non-EV Additional recycling capacity worsening the dependency on cobalt and nickel applications creates a fragmented assembly market with required to follow market Need for policy to counter US subsidies and regulation to niche players, inhibiting scale advantages demand and consumption avoid losing investments in the European EV Supply Chain

*Funding:* While the economic conditions in Europe are currently under pressure, batteries are a key growth strategy for local funds

Despite having active lithium projects, Europe is heavily relying on controversial sources for many of the critical minerals used in Li-ion batteries



More than 90% of active materials for batteries used in Europe are produced in Asia indicating a clear need to increase production leveraging on Europe's competitive advantages



#### ACTIVE MATERIAL DEPENDENCE ON ASIA

Currently, European battery manufacturers **rely mainly on China, South Korea, and Japan** for sourcing the starting materials of battery cells



Source: Deloitte analysis, Fraunhofer ISI (2023), Transport & Environment (2023)

#### STATE OF MATERIAL PRODUCTION IN EUROPE

- Active material production activity in Europe is limited compared to Asia for battery cells, nevertheless some European companies are leading in terms of research and development on new technologies for active materials for Li-ion batteries
- Given the increasing demand for high-performance Li-ion batteries and the need to decrease dependency on outside regions, opportunities emerge for European players to capture a larger part of the future demand of the European battery value chain
- Looking at the current pipeline of projects, it is expected that 66% of all cathode active material could be produced in Europe by 2027



\* are defined as companies that (will) do one of the following activities in Europe: 1) manufacture active materials, 2) supply resources for manufacturing of active materials, 3) R&D aiming to commercialize innovative active materials

# European capacity is too dependent on cobalt, while two-thirds of local projects are at risk of being delayed, scaled down, or cancelled due to IRA subsidies



# European players in battery assembly are either vertically integrated and serve mainly the largest markets, or they are specialized in assembly and service niche market segments

	EXTRACTION & ACTIVE CELL REFINING MATERIALS PRODUCTION BATTERY ASSEMBLING CONSU	MPTION BATTERY CHARGING BATTERY RECYCLING FUNDING			
BATTERY ASSEMBLING ARCHETYPES					
<ul> <li>Estimate value generated per step of a full battery solution production is higher for cell production compared to assembly -&gt; cell production accounting for 21% vs module assembly for 11% and pack assembly for 7%</li> <li>Most manufacturers that produce battery cells are vertically integrated, meaning they assemble packs from cells they've produced themselves. Most large players focus on the consumer EVs and electronics markets, which are the largest markets for batteries</li> <li>The few players that specialize solely in battery assembling usually service one or more niche markets, providing specialized or custom battery packs to smaller markets</li> </ul>					
	ARCHETYPE 1 Integrated battery producer	ARCHETYPE 2 ARCHEtype 2 Niche battery assembler			
Presence in value chain	Battery cell production Battery assembling	Battery assembling			
Strategy	Leverage economies of scale for low-cost production of large quantities of battery cells and battery packs for of a limited range of applications	Dominate smaller niche markets by assembling specialized battery packs for a diverse range of applications, while outsourcing capital-intensive battery cell production			
Company size	Mid – Mega cap (+ ventures in R&D and financing phase)	Micro – Mid cap			
Markets	Largest markets: consumer EVs, consumer electronics	Niche markets: industry, agriculture, telecom, railway, marine, construction, health, aerospace etc.			
Examples	TESLA     CATL     Image: Constraint of the set of th	THE INNOVATION GROUP			

Source: Deloitte analysis, United States International Trade Commission (2021)

# While OEMs are increasingly converting their product lines to EVs, affordability will impact the rate at which end-users adopt electric solutions



Source: OECD (2022), ChargeUp Europe (2023, ICCT)

# With the surge of public and private charging infrastructure, Europe will need to invest in its public charging infrastructure, power grids and renewable energy capacity



# The number of active European recycling plants is increasing and currently represents 70% of the world's total capacity



Company	Sizing	Key partnerhsips	
ACCUREC RECYCLING GmbH Krefeld, Germany	About 8,000 tons of battery materials recycled per year	Cooperation partnership with Currenta Environment	?
<b>FORTUM</b> Espoo, Finland	New hub in Germany with capacity to process 3,000 tons of battery per year	Key recycling partnerships with Terrafame, Valmet, BASF, etc.	A more comprehens Producer Responsit
<b>GLENCORE</b> Baar, Switzerland (HQ in London)	Developing EU's largest plant capable of processing 70,000 tons per year (600,000 EVs every)	Alliance with Li-Cycle to form EU's first closed-loop solution	EU. This dictates <b>hig</b> over time. For batte will be 51% in 2028
<b>STENA RECYCLING</b> Gothenburg, Sweden	Swedish plant has an initial battery recycling capacity of 10,000 tons/year	Automotive companies like Volvo	for lithium will be 50 high levels of <b>recycl</b>
UMICORE	Battery recycling capacity of 7,000 tons per year eq. to	Key south a stand with ACC Deverter Terreforments	
Brussels, Belgium	<i>ls, Belgium</i> 35,000 EV batteries		Source: I

A more comprehensive **regulatory framework on Extended Producer Responsibility** will start applying by mid-2025 in the EU. This dictates **higher collection targets** being introduced over time. For batteries for light means of transport, the target will be 51% in 2028 and 61% in 2031. Material recovery targets for lithium will be 50% by 2027 and 80% by 2031 to achieve high levels of **recycling efficiency and material recovery**.

ource: Fraunhofer ISI (2023), European Commission (2022)

# While private funders are ready to make large investments, the lack of robust European subsidy programs put local projects at risk of being relocated to the US



Funding for new ventures in the battery space has also risen sharply, as **venture capital** firms recognize the potential for substantial returns

Source: Deloitte analysis, Transport & Environment (2023), International Energy Agency (2023), Benchmark Source (2023), European Commission (2023)

![](_page_20_Figure_0.jpeg)

Based on the current state of the battery value chain in Europe, we see three key pillars of improvement opportunities to strengthen the ecosystem

### **IMPROVEMENT OPPORTUNITIES**

### CIRCULAR BUSINESS MODELS

- Develop battery as a service models, where producers keep ownerships of the systems, thereby lowering upfront costs for manufacturers, increasing total revenues for producers, enabling additional services and maximizing the life span and sustainability of batteries
- Encourage local partnerships to ensure traceability and track the circularity of the local offering
- Strengthening the European recycling sector further with the intention of taking advantage of the current momentum to set-up a regional recycling center of excellence

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- Need for battery cell innovations that lower Europe's dependency on critical minerals sourced internationally and make our production more resilient to geopolitical events
- Vertical integration to secure active material supply chain, create competitive advantages and lower dependency on Asia
- Investigate modularization potential to expand battery lifecycle and uses as well as standardize recycling requirement and treatments
- Increase local production of active materials using local recycling as a source

![](_page_21_Picture_12.jpeg)

### PUBLIC SUPPORT

- Additional investments in renewable energies to support the development of a sustainable grid for the charging network.
   Develop and use carbon credit schemes
- Additional efforts are needed to nudge the EU and local government to put in place measures that compete with the United States IRA
- Increase ecosystem partnerships that can advocate the interest of local players in a way that can truly influence local policy makers towards increasing local sustainable activity and expertise

# European battery companies can solidify the local value chain while generating additional value for themselves by adopting circular business models

### PILLAR I: THE DEVELOPMENT OF CIRCULAR BATTERY MODELS

#### BATTERY AS A SERVICE MODEL EXAMPLE

Circular battery business models requires a certain degree of control over the complete lifecycle of the battery. While leasing options have primarily benefited cost-conscious consumers, the battery as a service (BaaS) model presents opportunities to both OEMS and battery producers to generate additional value.

One specific type of BaaS model that is gaining traction is founded on the idea of battery swapping. Customers lease into a battery plan that allows them to swap their drained batteries for a fully charged one. The BaaS company owns the battery and is therefore responsible for its maintenance and recycling.

#### Advantages of the battery as a service model using battery swapping

![](_page_22_Figure_6.jpeg)

![](_page_22_Picture_7.jpeg)

"CATL is stepping up preparations to launch battery rental services for electric vehicles which will allow drivers to rent and swap out batteries under a subscription pricing model. A depleted battery can be swapped for get a fresh one in as little as a minute" CATL Press release, August 2022

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There is an opportunity for European battery players to innovate and lower their dependency on internationally sourced minerals and materials

### **PILLAR II: INDUSTRY INNOVATION**

![](_page_23_Figure_2.jpeg)

Players of the European battery value chain must work together with industry influencers to secure funding and nudge policy makers towards creating a more supportive economic environment

PILLAR III: PUBLIC SUPPORT

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#### Strategic Cost Transformation

Not all business costs are the same since they drive results in different ways. Therefore, there is no "perfect" portfolio of costs or investments.

#### Organic Growth

We help our clients drive transformational growth leveraging deep and textured customer insights, actionable segmentation, operating model changes

### GET IN TOUCH WITH US

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