



ECOMONDO - KEY ENERGY 2022

**Materie prime critiche: tavolo nazionale,
strategia, sviluppi e prospettive**

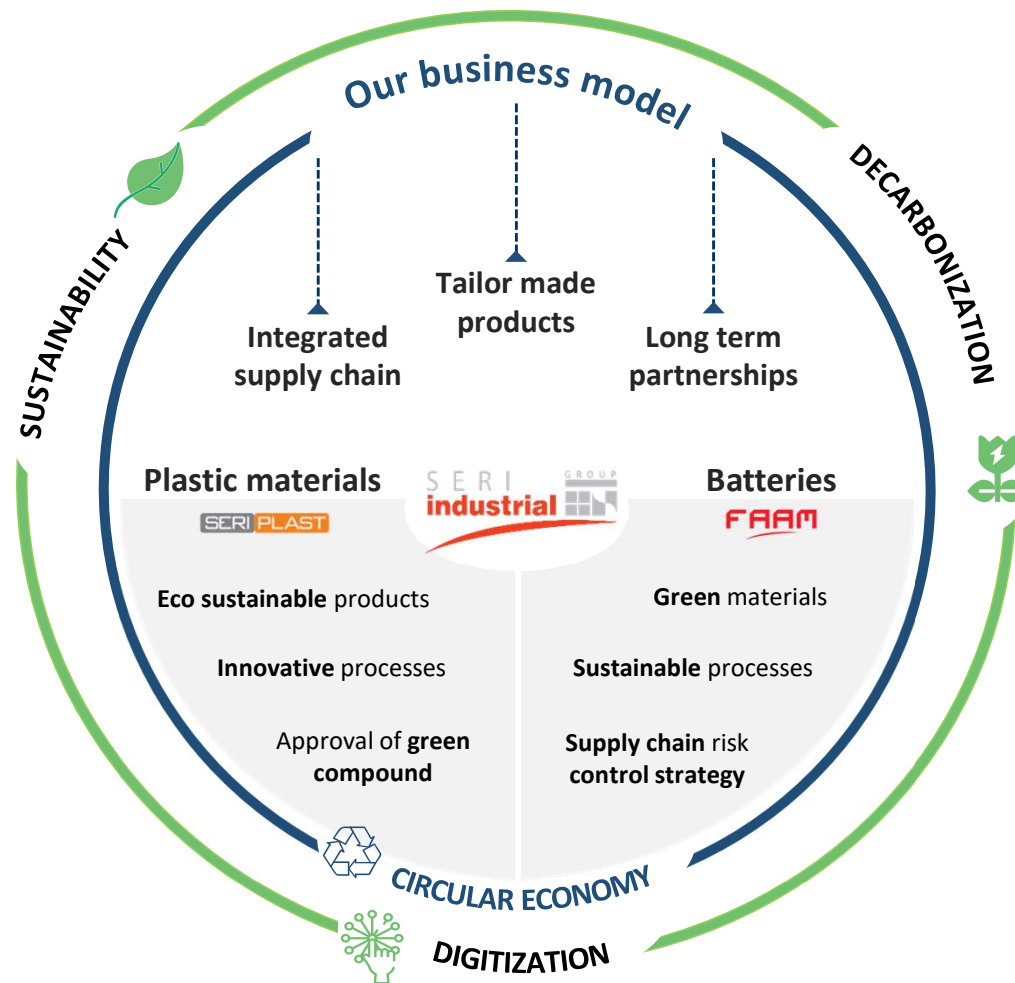
S E R I **industrial** GROUP



Mission

Mission

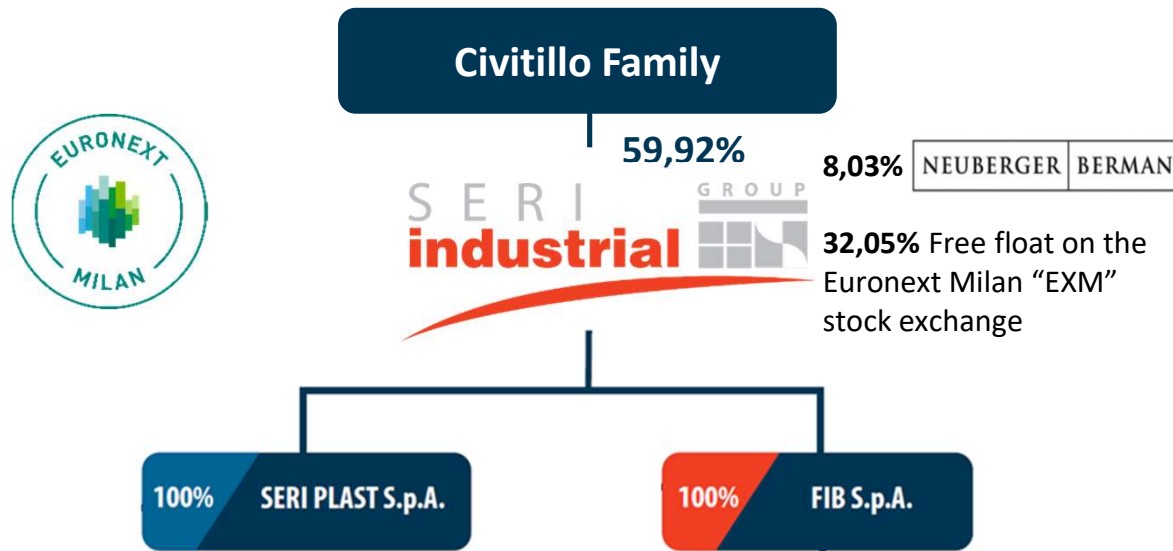
A new way of thinking the economy, with **sustainable processes and products** and supporting the **transition** of the paradigm from a linear model (take, transform and throw) to a full **circular economy model**



Seri Industrial is pursuing strategic goals to **accelerate the energy and ecological transition** in line with the Paris Agreement and recent European and Italian initiatives



Group Structure



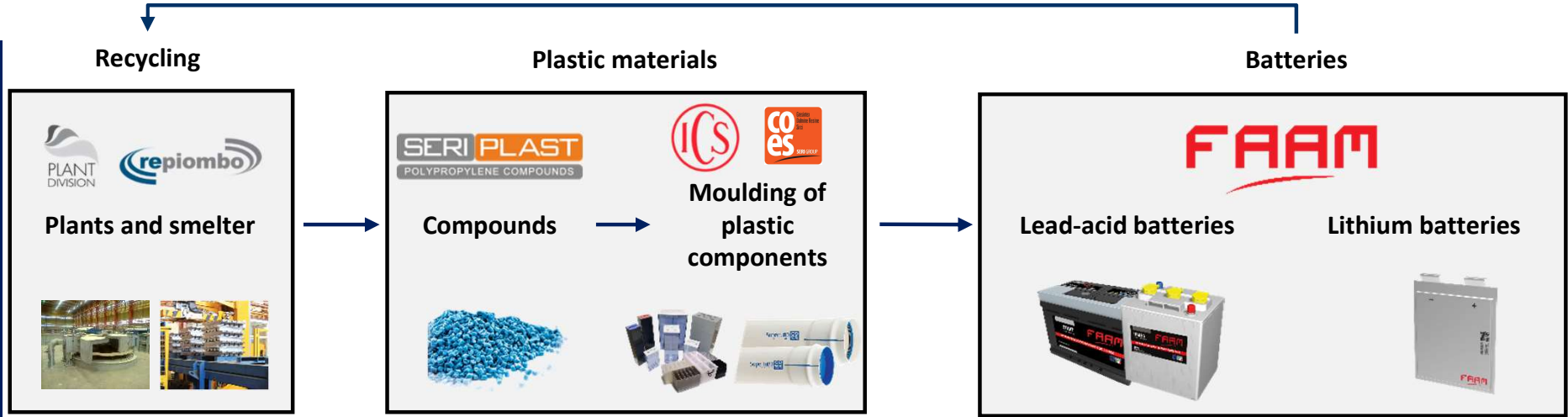
SERI industrial GROUP

A fully integrated circular economy player listed on the stock exchange, able to control the value chain of plastic (recycled from end-of-life batteries and packaging) and batteries (li-on and lead acid)

SBU	ACTIVITY
<p>SERI PLAST</p>	<p>Plastic Materials</p> <ul style="list-style-type: none"> Production of special compounds for the moulding of boxes and lids for batteries Production of special compounds for the automotive and packaging Production of special compounds for the moulding and extrusion of pipes and fittings for the thermo-hydro sanitary market
<p>FIB</p>	<p>Batteries</p> <ul style="list-style-type: none"> Production and recycling of lead-acid and li-ion batteries for motive power, storage, starter and special applications Design and construction of plants for the recycling of exhausted batteries

Footprint

PRODUCT RANGE & CIRCULAR ECONOMY



16 Production sites*

800 People**

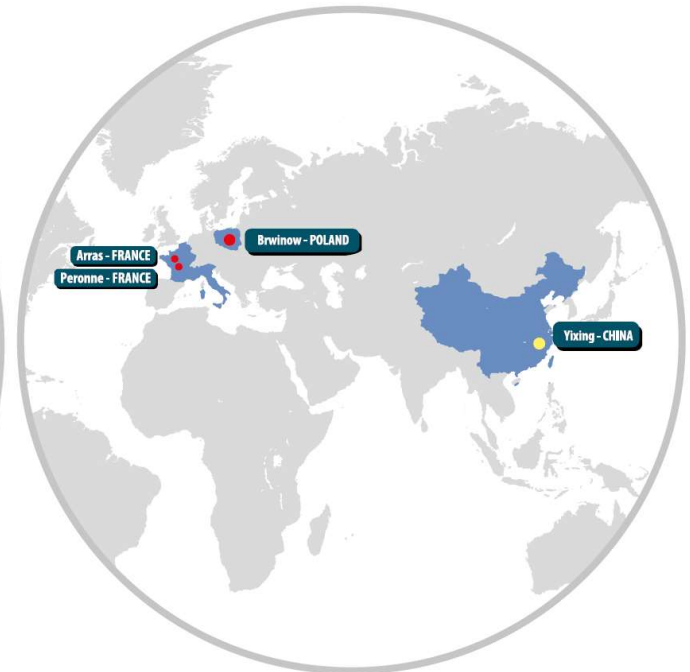
Plastic Materials



●	Canonica d'Adda (BG)	73 FTE
	Pioltello (MI)	98 FTE
	Gubbio (PG)	46 FTE
	Alife (CE)	17 FTE
	Arras (France)	17 FTE
	Peronne (France)	40 FTE
	Brwinow (Poland)	25 FTE

Batteries

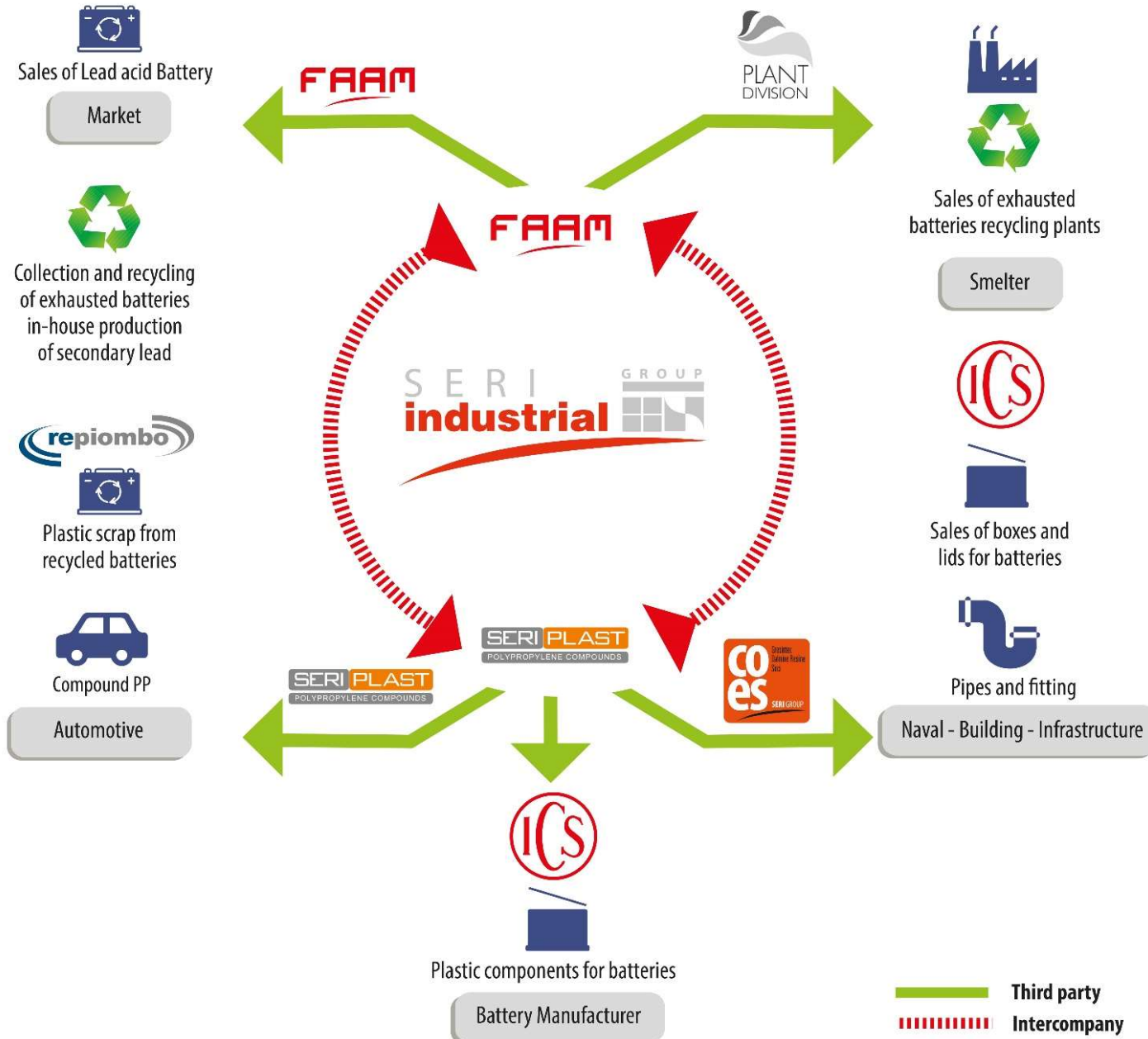
●	Monte Sant'Angelo (FG)	75 FTE
	Monterubbiano (FM)	63 FTE
	Teverola 1 (CE)	112 FTE
	Yixing (China)	53 FTE
	Calitri (AV)	8 FTE
	Alife (CE)	13 FTE



* including 4 after-sales branches

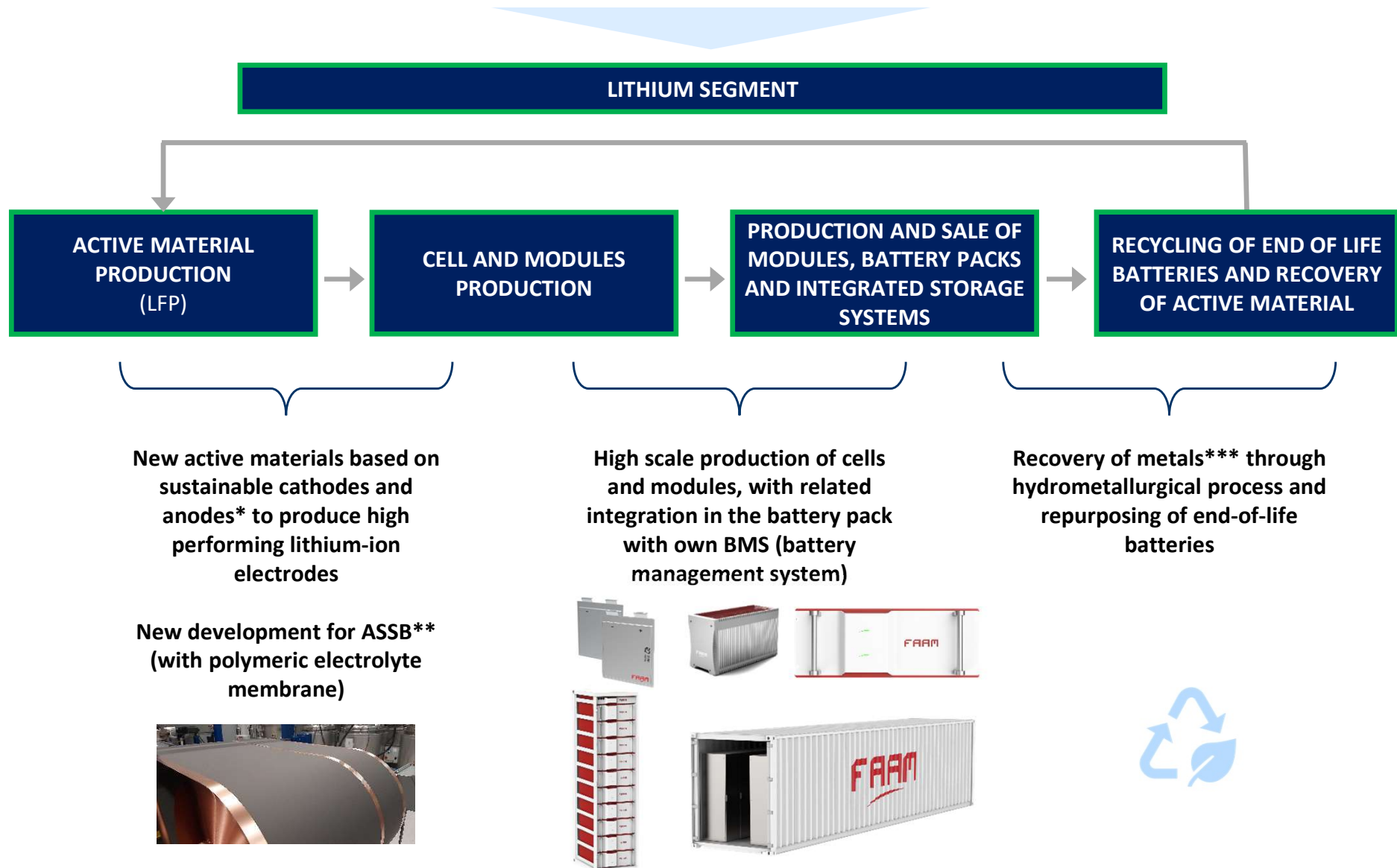
**including FTEs in the HQ (San Potito Sannitico office), Board members of the Group's companies, and external staff

Circular Economy



Vertical integration in the Lithium

The goal is to replicate the successful vertical integration achieved in the lead-acid/plastic



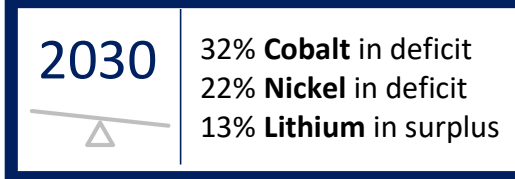
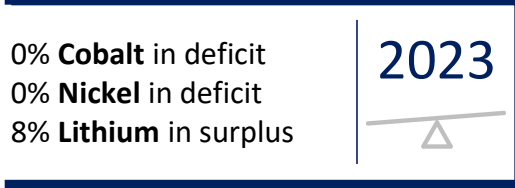
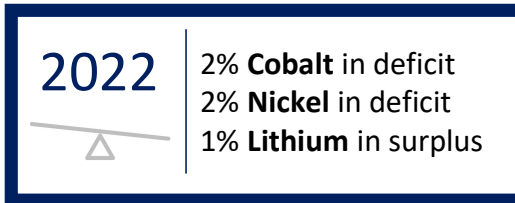
* Mainly LMFP on cathode and Si/C on anode

** All solid state batteries

*** Target metals are Co, Ni, Mn, Al, Li, Cu, Fe

Battery Metals in the Green Transition

Key Trends

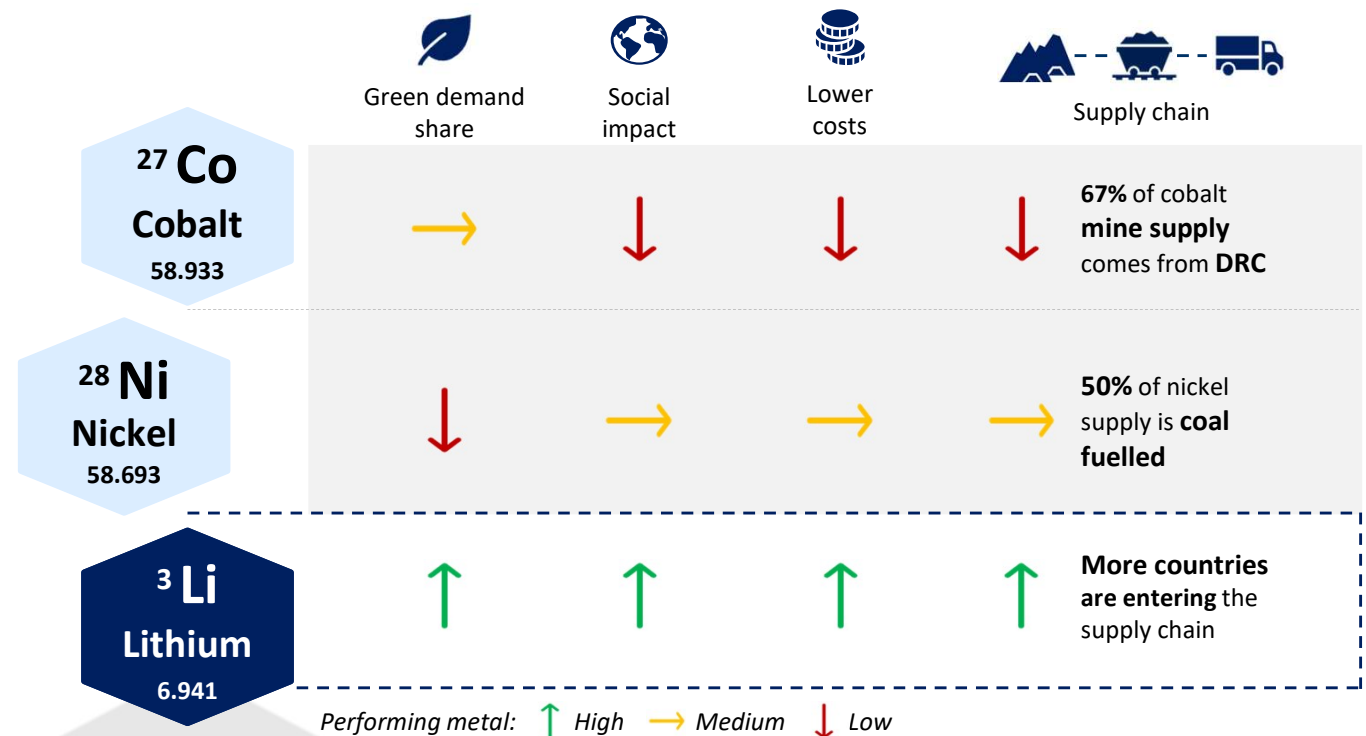


Even as recycling supply accounts for **18%** of cobalt, **15%** of lithium & **7%** of nickel demand by **2030**

Lithium-Iron-Phosphate LFP Active Material

Smooth supply chain, higher safety, cost competitiveness and an increased attention to social responsibility **will increase LFP market share, in EVs and ESS applications.**

Seri Industrial Group has chosen to focus on LFP active material, developing a 'water-based' production process with the aim of achieving a green footprint, reducing atmospheric emissions, increasing safety and flexibility in the battery recycling process.

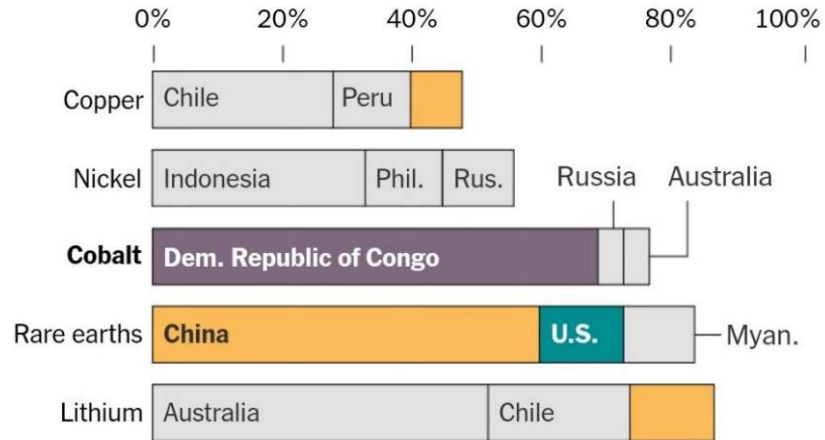


Source: «Battery Metals Watch: The end of the beginning», Goldman Sachs, May 2022

Why Cobalt agnostic?

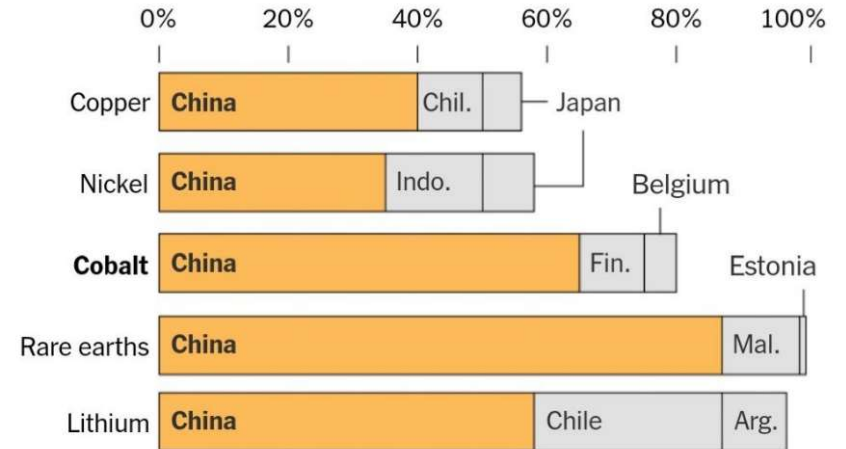
Where Clean Energy Metals are produced*

The production of key mineral resources is highly concentrated today. Chart show top three producers.

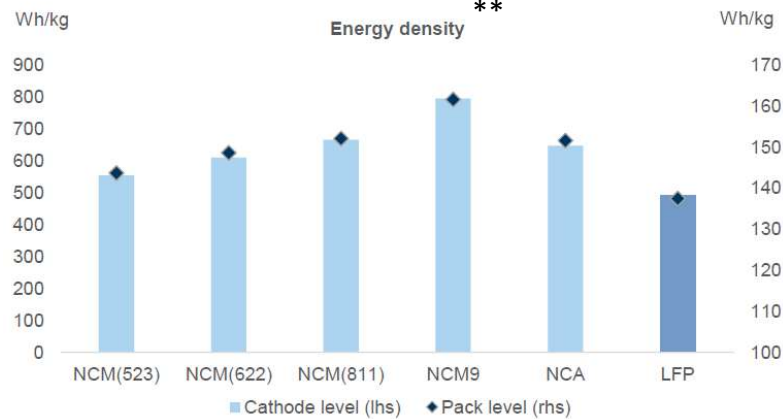


And where they are processed*

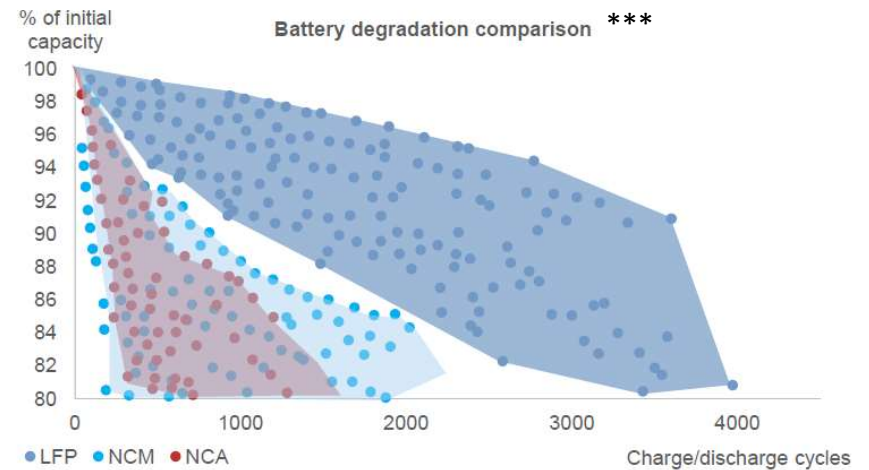
China dominates the refining and processing of key metals.



2022



LFP has a lower energy density than NMC...



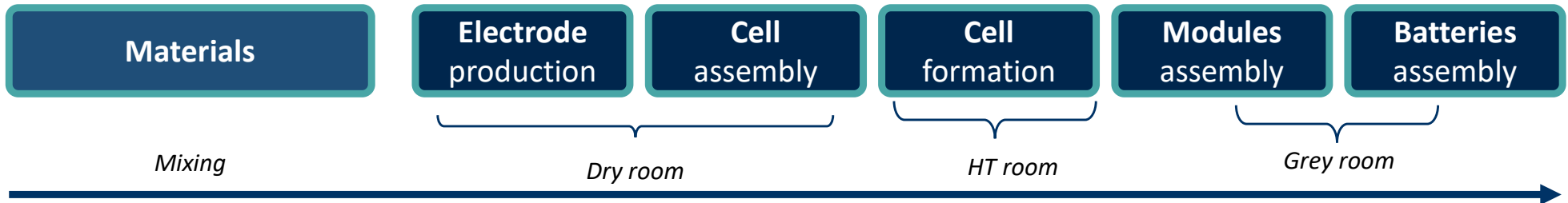
...but degrades at a much lower speed

*Source: International Agency – By The New York Times

**Source: Company data, Wood Mackenzie, SNE Research, Goldman Sachs Global Investment Research

***Source: Pregel et al. (2020)

Lithium battery manufacturing process in Teverola



- Lithium-Iron-Phosphate
- Graphite
- Water
- Aluminum (collector)
- Copper (collector)

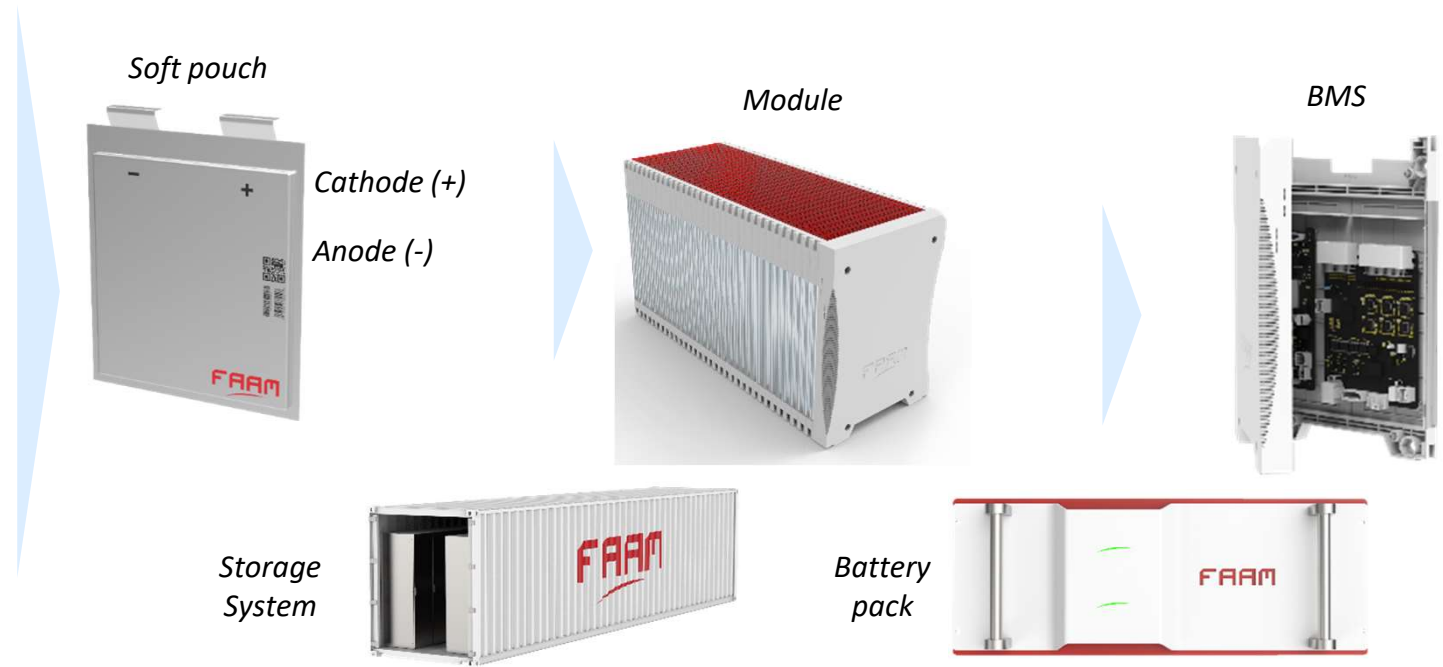
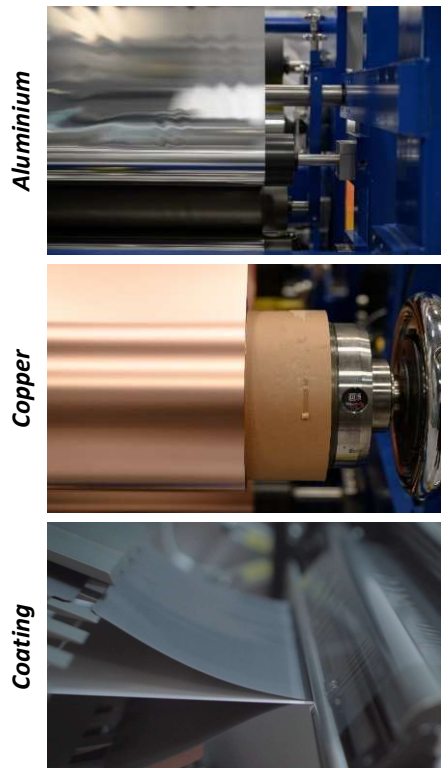
Slurry
Coating
Slitting
Notching

Lamination
Stacking of electrodes

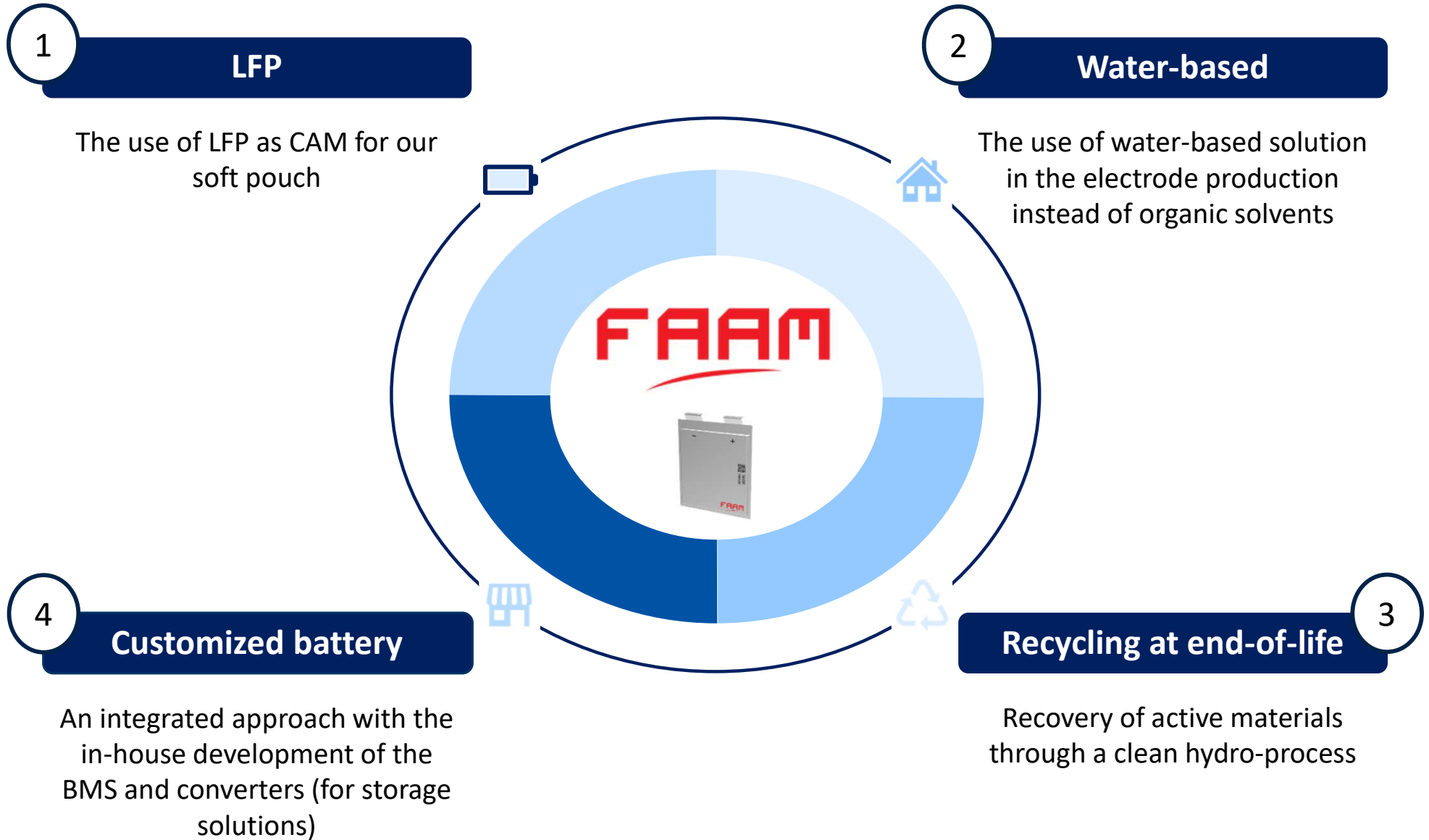
Formation

Charge and discharge of modules
Battery packs and BMS

Electrodes production is based on a green and innovative water-based solution process



Our 4 pillars vision on lithium batteries



Why Water-based?

Already in **Teverola 1** we have adapted the electrode production to **water-based formulations** – using only water as a main solvent both for the cathode and anode, eliminating the necessity for solvent treatment

Main advantages



No NMP emissions



Reduction of energy required and consequent CO₂ footprint reduction



Increasing of the safety



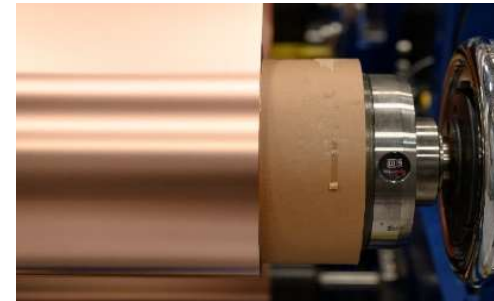
Differentiation of the product



Easier recycling



Regulatory anticipation (what will happen when all the Gigafactories in EU will start mass production with NMP-based li-on cells?)

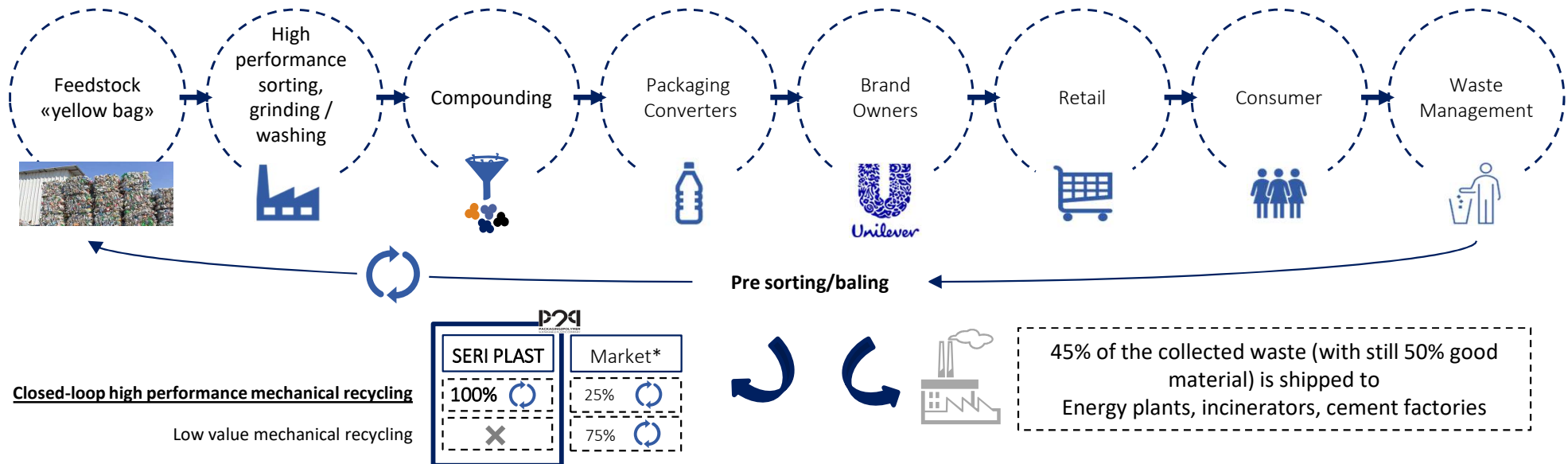


JV and Off-take agreement with Unilever (2/2)

Plastic material division



POZZILLI PROJECT



Closed-loop high performance mechanical recycling

Low value mechanical recycling

Mechanical recycling 130k ton/y capacity

- Advanced presorting process.
- Grinding/washing/decontamination (food grade targeting on PET/HDPE/PP) – 4 lines
- Compounding/colouring – 5 lines
- Odour removal – 2 lines

Products

- rPP, rHDPE, rLDPE, rLLDPE, rPET
- Food Grade rPET

Technologies ready to produce also HDPE and PP food grades - when EU regulations will be ready to accept polymers from mechanical recycling into food packaging.

*Bain & Company, 2019

Teverola Plant – present and future

TEVEROLA 1 - present

Capacity: 330 MWh

Technology: LFP soft pouch (50Ah) – high energy density applications with integrated BMS

70 M€ of realized Capex

Applications: Motive Power, ESS, Public transport, Naval and Defense



265.000 sqm
of complex
area (82.000
indoor)

TEVEROLA 2 (IPCEI)

Project timesheet: 2020 – 2027

Industrial Deployment: 2020 -2023 (2 years)

R&D: 2020 - 2027

Capacity: 8/8,5 GWh

Technology: Gen 3b and 4 (solid state)

505 M€ of investments (Capex for 358.55 M€ and Opex for 147.29 M€, funded by grants)

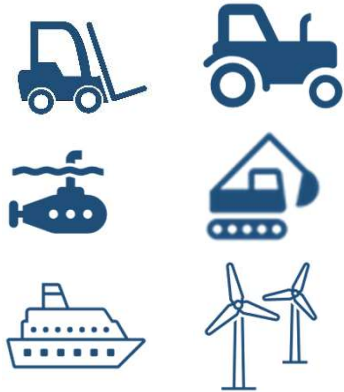
50 ton/day of battery treatment in the **recycling pilot line**

Applications: Motive Power, Storage, Automotive, Public Transport, Naval and Defense



Applications and business model

Applications - present



Recycling of li-ion batteries and recovery of active materials

Teverola plant

Active material production

Cell production

Modules production

Battery Pack

Applications - future

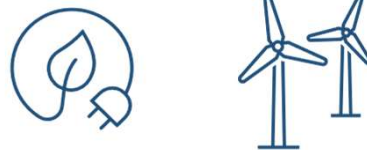
Long-term partnership with OEMs

Automotive, public transport, shipping, etc.



Long-term partnership for inverters e smart metering

Storage



Long-term partnership for charging stations

Charging stations



Long-term partnership for military and naval

Naval and military



IPCEI Project

Key Highlights

FAAM project has been approved for the production of **beyond the state-of-the-art li-ion cells** and **recycling of end-life li-ion batteries**



Commission approves €3.2 billion support by seven Member States for project of common European interest for **battery value chain**



- Member States: Belgium, Finland, France, Germany, Italy, Poland and Sweden
- Integrated project comprising 4 workstreams, covering the battery value chain
- 17 undertakings (some active in more than one Member State) will receive State aid
- Cumulated maximum State aid: EUR 3.2 billion

A EUROPEAN BATTERY VALUE CHAIN

Cell Technology Development

Teverola 1



Features of the plant	Cell Shape	Key highlights
0.3 GWh	Soft Pouch	LFP chemistry
Water based solutions From cell to module to pack		Own BMS

Teverola 2

Prismatic Soft Pouch




Cylindrical



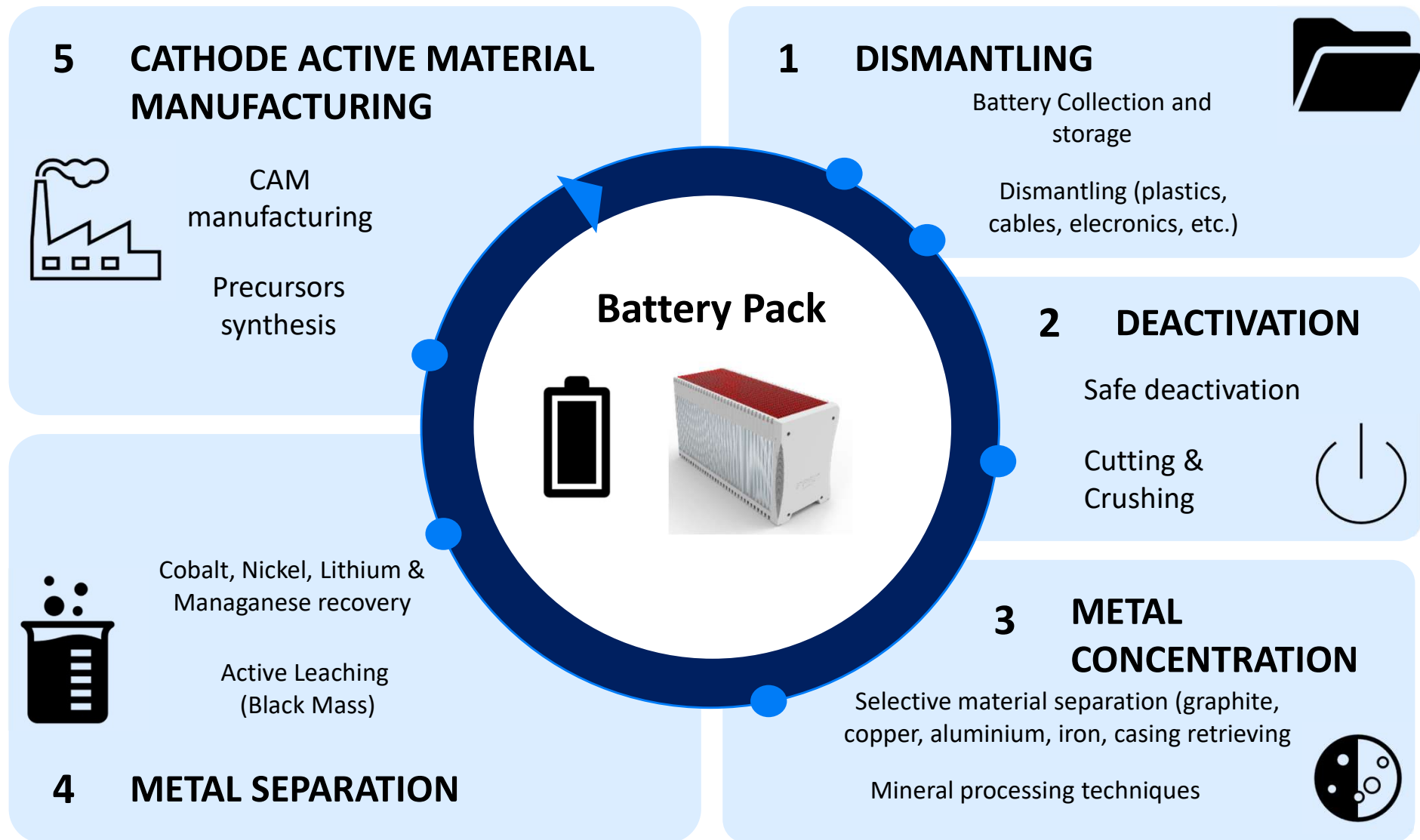


Features of the plant	Cell Shape and cap.	Key highlights
8/8,5 GWh/year	Prismatic Soft Pouch Cylindrical	High energy LFP/LMFP – C/Si (Li) chemistry (plant designed flexible also for NMC – high nickle)
Compliant with Water based/organic solutions	Pilot recycling plant included	Own BMS
Target with car makers – directly from cell to pack could be an option		



High Flexibility for customized applications

Recycling (HIGHLY CONFIDENTIAL)

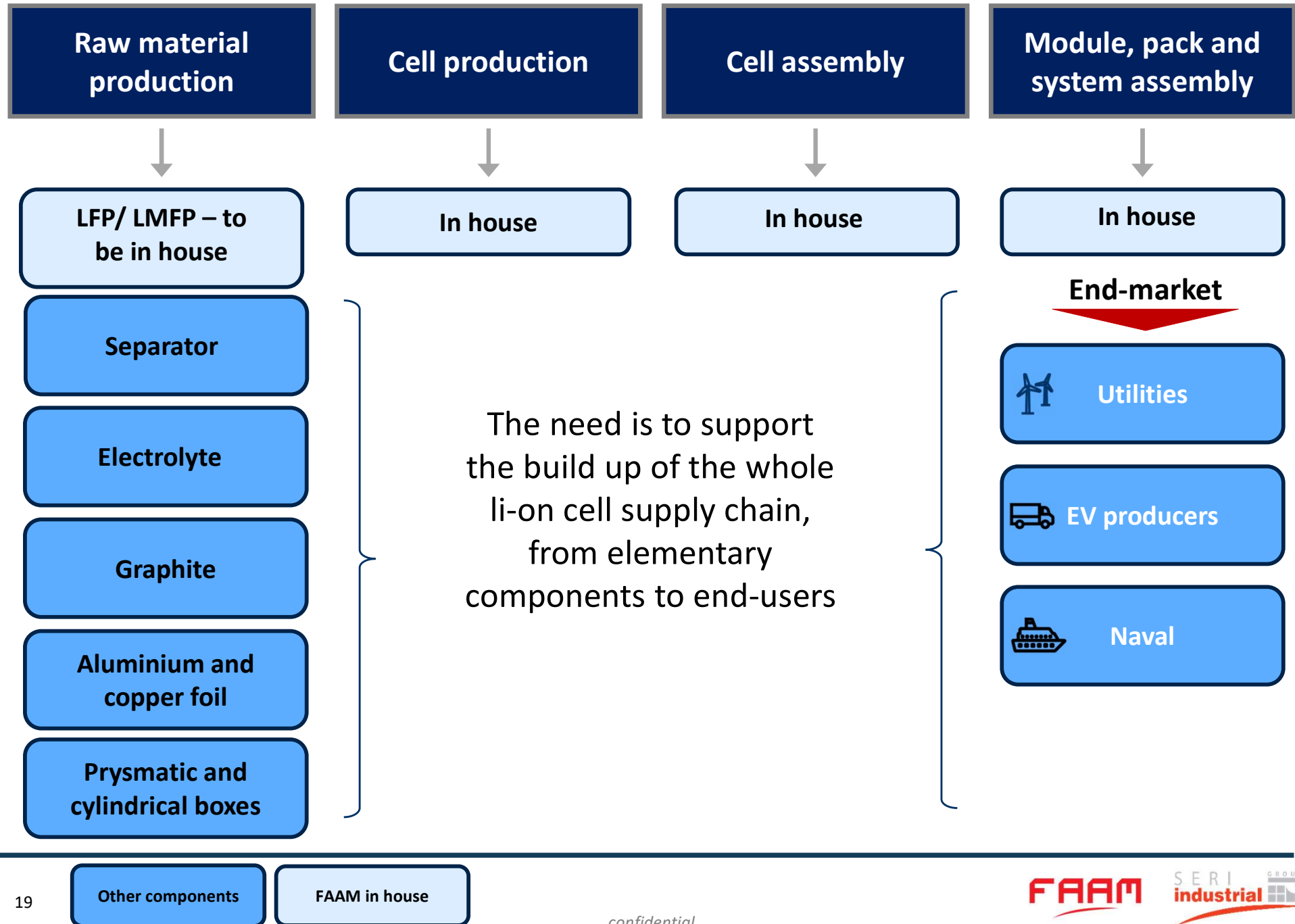


Lithium Batteries Recycling – Targets

- Pre-treatment / comminution circuit:
 - **Flexible, stand-alone and mobile comminution circuit**, capable of neutralizing, **shredding the battery cells/modules** with recovery of the electrolyte and separating the plastics
 - **Installed at or adjacent the sites of the battery collectors**, to reduce the transport of dangerous goods
- Hydrometallurgical process:
 - Process and plant able to **treat different battery chemistries**
 - **Lower energy consumption** compared to current pyrometallurgical processes
 - **Minimized water consumption**
 - Selection of suitable leaching agents and operation sequence
 - If possible, substitution of mineral acids with organic acids for the leaching process

TOTAL RECOVERY > 85% in mass

Next challenges – is IPCEI enough?





THANKS FOR THE ATTENTION