

# Mobility Transformation

Circularity for critical metals



Ralph Kiessling

Rechargeable Battery Materials:  
**Capture profitable growth  
and create sustainable value**





# Agenda

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1.  
**Mobility  
transformation  
driving  
accelerated  
demand for  
cathode materials**

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2.  
**Rechargeable Battery  
Materials well positioned  
to capture profitable  
growth and create  
sustainable value in fast-  
growing market**

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3.  
**RISE 2030**

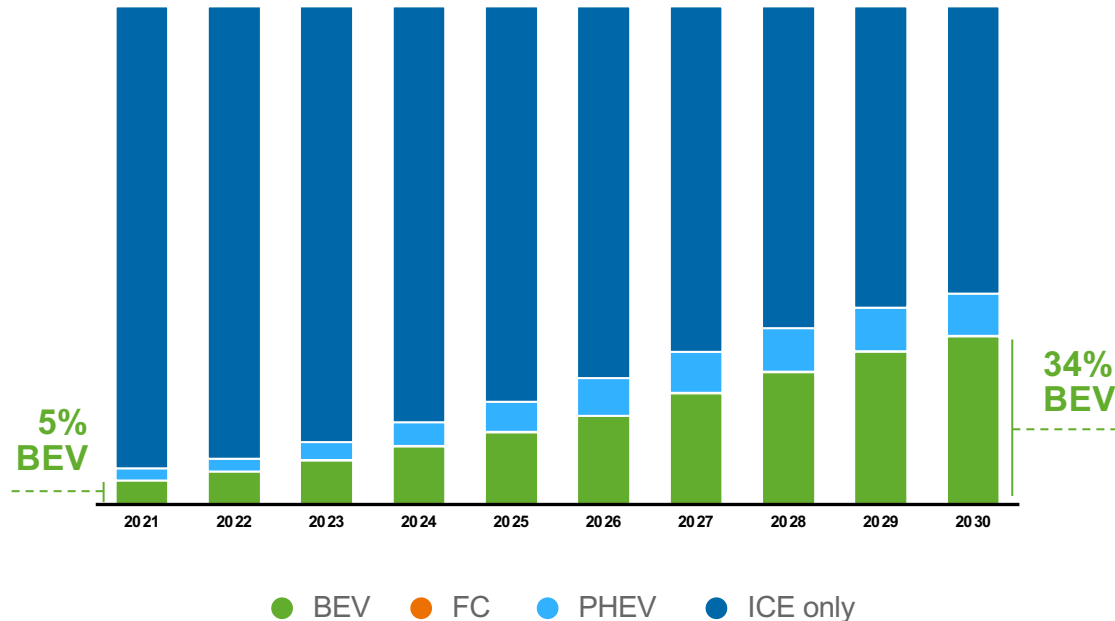


# Electrification increasing at fast pace, triggered by regulatory push and OEM commitments

## Light-duty vehicles

Proportion by powertrain in global car production

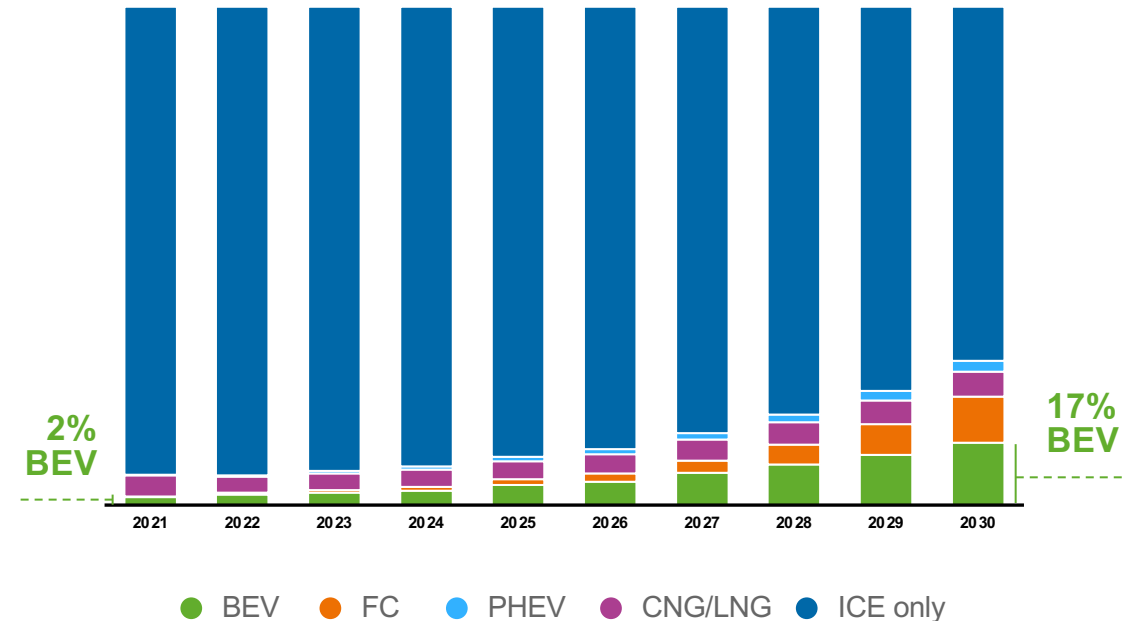
Source: Umicore market model



## Medium- and Heavy-duty vehicles

Proportion by powertrain in global car production

Source: Umicore market model



BEV: battery electric vehicle

FC: fuel cell vehicle

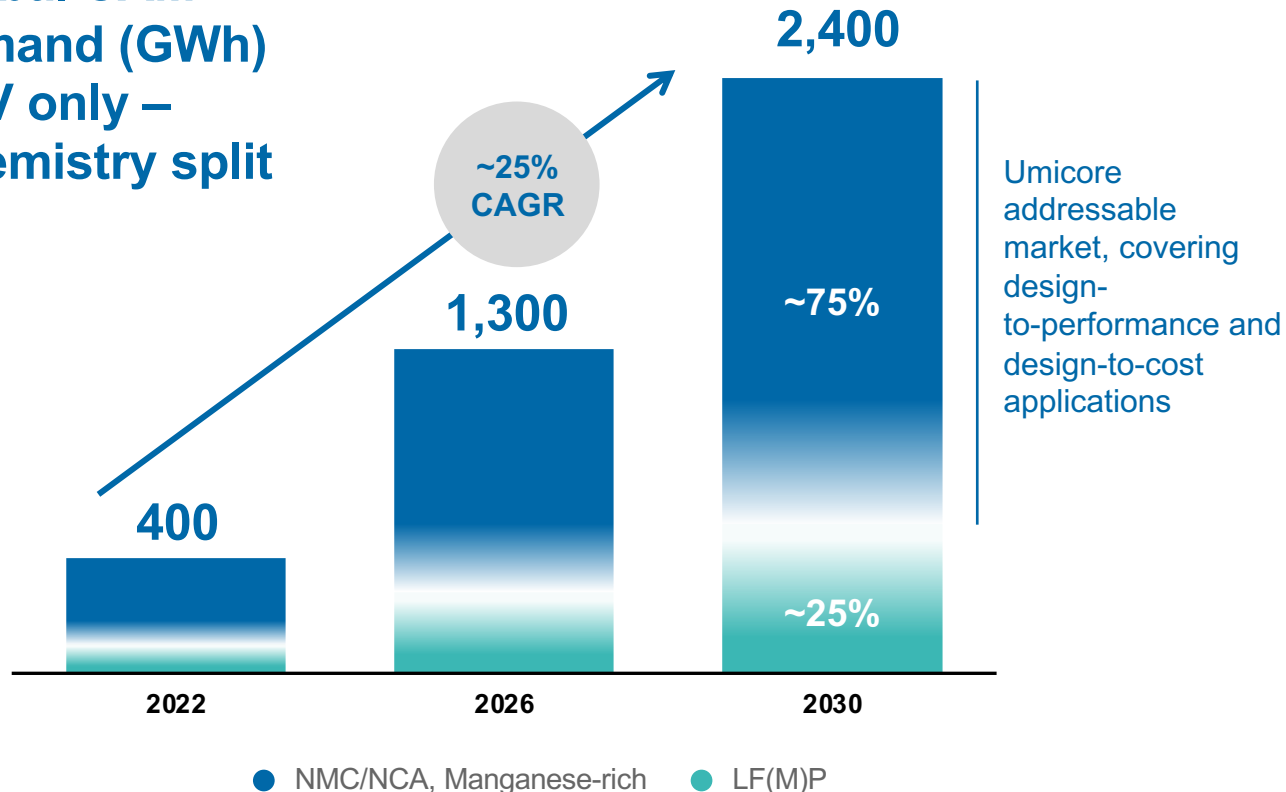
CNG/LGN: Compressed natural gas / Liquefied natural gas

PHEV: plug-in (hybrid) vehicle

ICE: internal combustion engine (gasoline/diesel) only

# Umicore chemistries addressing ~75% of total Light-duty EV CAM demand

Global CAM demand (GWh) LDV only – Chemistry split



Evolving technologies reflecting car OEMs' need for performance- and cost-focused solutions

NM(C) chemistries (incl. Mn-rich) represent vast majority of EV CAM demand in 2030

Solid-state batteries expected to gain traction based on NMC, with a single digit market share expected towards 2030



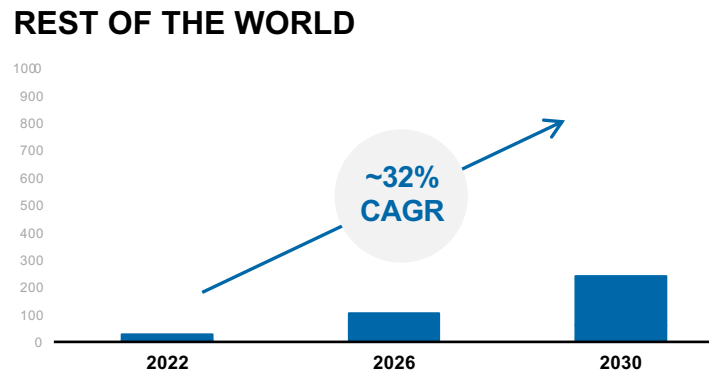
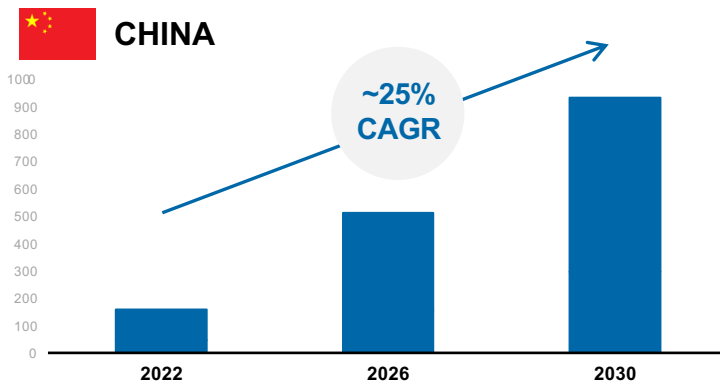
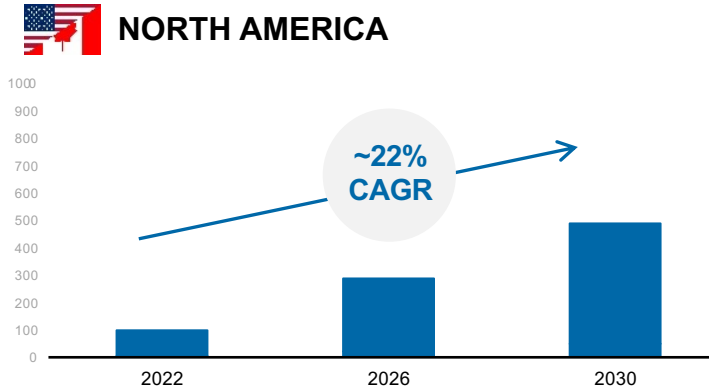
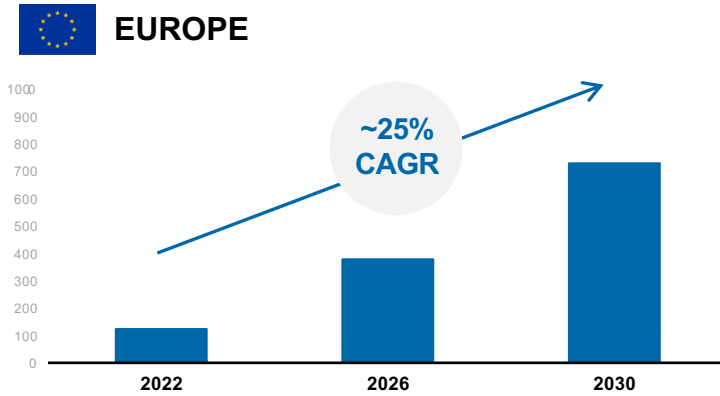
Source: Umicore market model



# >20% annual market growth across all regions



## CAM demand (GWh) across regions LDV only



Europe, China and North America expected to represent ~90% of total LDV CAM demand

Ongoing regionalization of supply chain:

- Geopolitical context
- OEMs' sustainability considerations
- Security of supply



Source: Umicore market model



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# Cathode active materials crucial for the mobility transformation ...

## CAM critical component determining electrification success



Key technological lever for battery performance

Biggest single contributor to overall battery cost

Critical driver of long-term cell technology strategy



# ... requiring critical competences and skills for CAM producers to succeed

## Product



**High performance and quality** product with customized end specs

**Joint development** with customers and partners

Strong **technology and IP portfolio** and **continuous innovation**

## Process



Mastering **complexity and flexibility** of production process

Continuous **industrialization and process innovation**

Extensive **quality and purity control**

## Supply



**Strategic access to raw materials** – low carbon intensity, highest ESG requirements

**Metal refining expertise** enhancing supply flexibility

**Regionalized production footprint** along value chain

**Ample opportunities for differentiation and gaining advantage over competitors**



# Capture profitable growth and create sustainable value

## Where to play

### Extend leadership in Europe

Leverage strong first-mover advantage with long-term customer partnerships as cornerstone for growth

Expand regional footprint along the value chain to serve customer demand

### Enter North America with local production

Establish local presence in North America based on customer qualifications and platforms awards

Acquire land and build footprint for greenfield construction in North America

### Reinforce market position in Asia

Strengthen position by further diversifying customer and platform exposure

Ramp up production plants in China and Korea towards full capacity as of 2024, based on customer demand indications

## How to win



**Reliable**  
Transformation  
Partner



**Innovation**  
& Technology  
Leader



**Sustainability**  
Champion



**Excellence**  
in execution



# Capture profitable growth and create sustainable value



**R**

**Reliable**  
Transformation  
Partner

## VALUE CREATIVE STRATEGIC PARTNERSHIPS ACROSS THE VALUE CHAIN

Long-term OEM relationships and understanding

Deeply embedded customer centricity

Strategic partnerships and global footprint  
in fast-changing EV battery ecosystem





# Mobility transformation radically accelerating

## Uniquely positioned to help the world transition to cleaner mobility

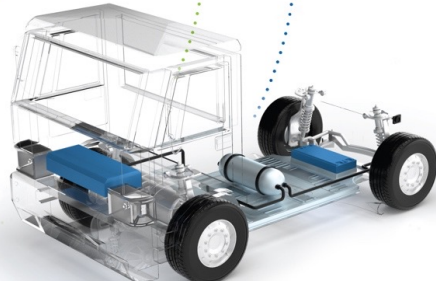
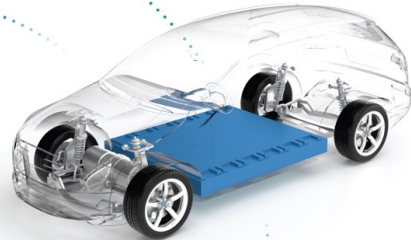
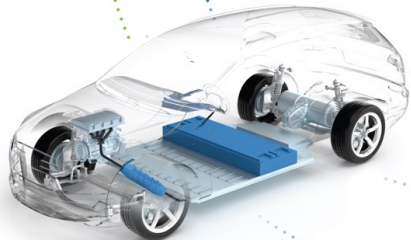
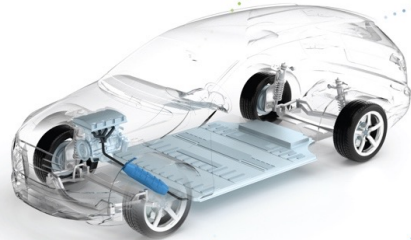
**ICE equipped vehicles will be the dominant clean mobility drive train for the next 10+ years**

### Internal Combustion Engine

Emission control catalyst

### Plug-in Hybrid Electric Vehicle

Battery active materials and emission control catalysts



### Full Electric Vehicle

Battery active materials

### Fuel Cells Vehicle

Electro-catalyst and battery active materials

**Prime electrification path for light transportation**

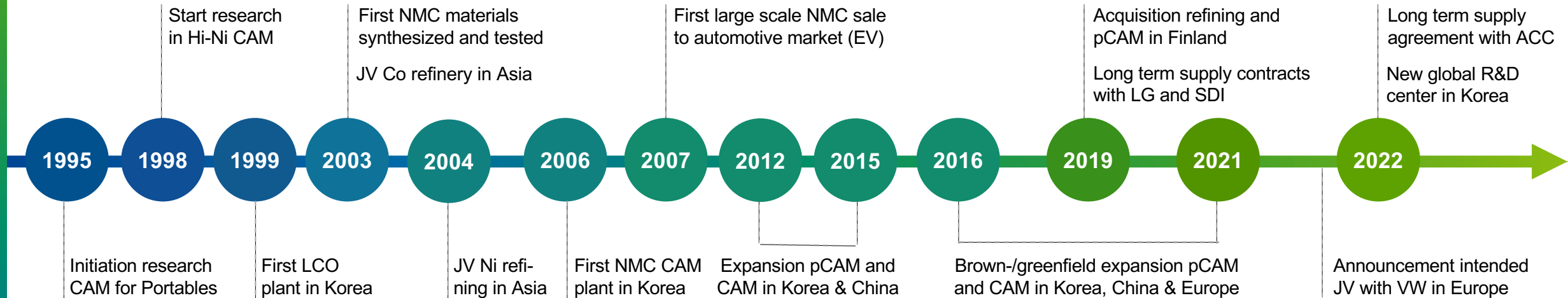
**Prime electrification path for heavy transportation**





# R

# Supporting customers on the path to electrification, right from the start



## Supporting our customers from the start

1995-2015

- Longstanding track record in CAM technology with integrated business model including upstream integration
- Vast experience in producing at scale

## Accelerating with our customers

Since 2016

- Continuously pushing product and process technology
- Accelerated expansion of CAM/pCAM production footprint and upstream refining capabilities



R

# Strategic partnerships key to accelerate decarbonization and electrification



Building **profitable and long-term strategic partnerships** with customers along the value chain



Aligning on **leading sustainability standards** as well as **technology and capacity roadmaps**

## Recent examples

JV intention with Volkswagen



Long-term agreement with ACC



... and further opportunities being discussed

## Long-term partnerships enhancing value for Umicore through:

Secured long-term customer demand

Valorization of technological innovation and industrial know-how, while protecting critical IP

Collaboration along entire value chain

Shared investments and value creative for both partners







# Upstream know-how and integration closing the loop

## Supporting customers from upstream sourcing to manufacturing and recycling



**Providing our customers sustainable sourcing and guaranteed supply of critical materials**



# R

## Expanding our global manufacturing and R&D footprint along the value chain, close to customers

Planned expansions by 2030

Existing footprint

Footprint set up North America 2025+



Footprint expansion Europe 2023+



Cheonan, KR



Jiangmen, CN



Ganzhou, CN



Footprint expansion Asia 2024+



Olen, BE



Nysa, PL



Kokkola, FI



Refining & Leaching



Precursor & Cathode active materials



R&D and Tech Centre

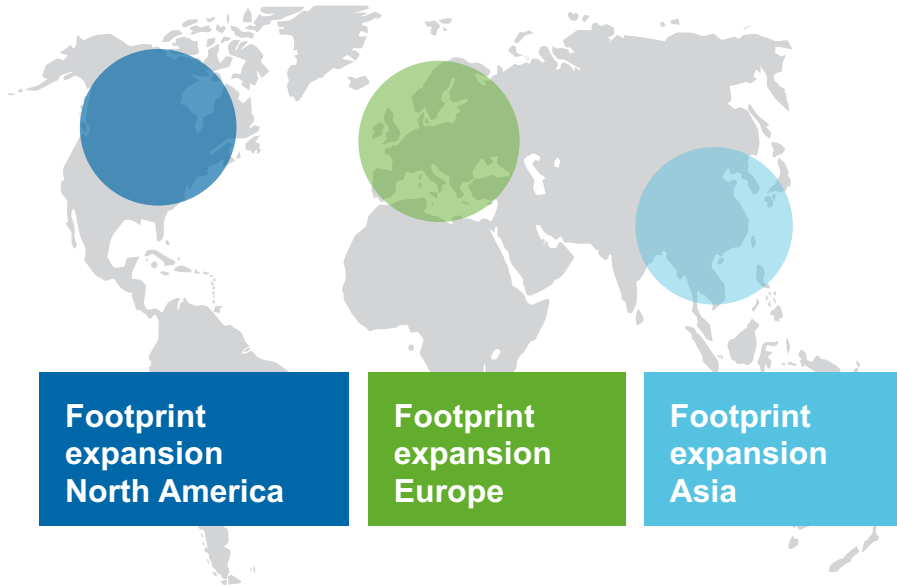




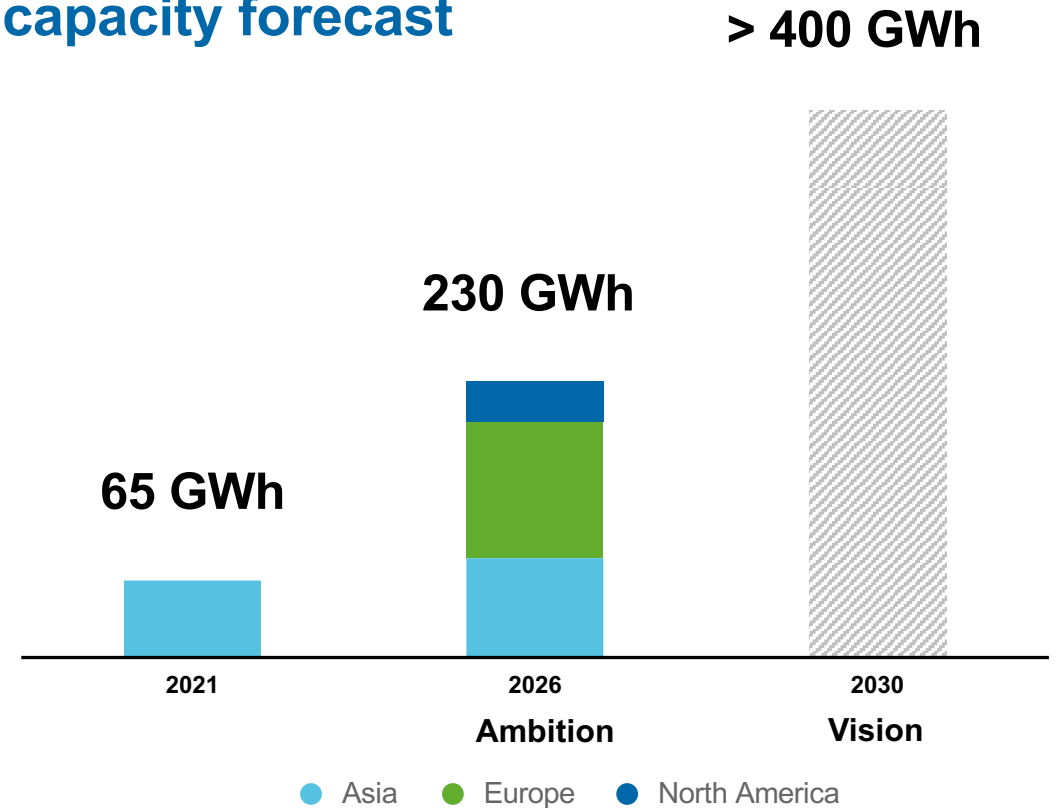
R

# Transformational growth serving our customers in all regions

## Expanding our global manufacturing footprint 2022-2030



## Umicore CAM capacity forecast



# Capture profitable growth and create sustainable value



**Innovation**  
& Technology  
Leader

## TECHNOLOGY & IP PORTFOLIO COVERING PERFORMANCE & COST

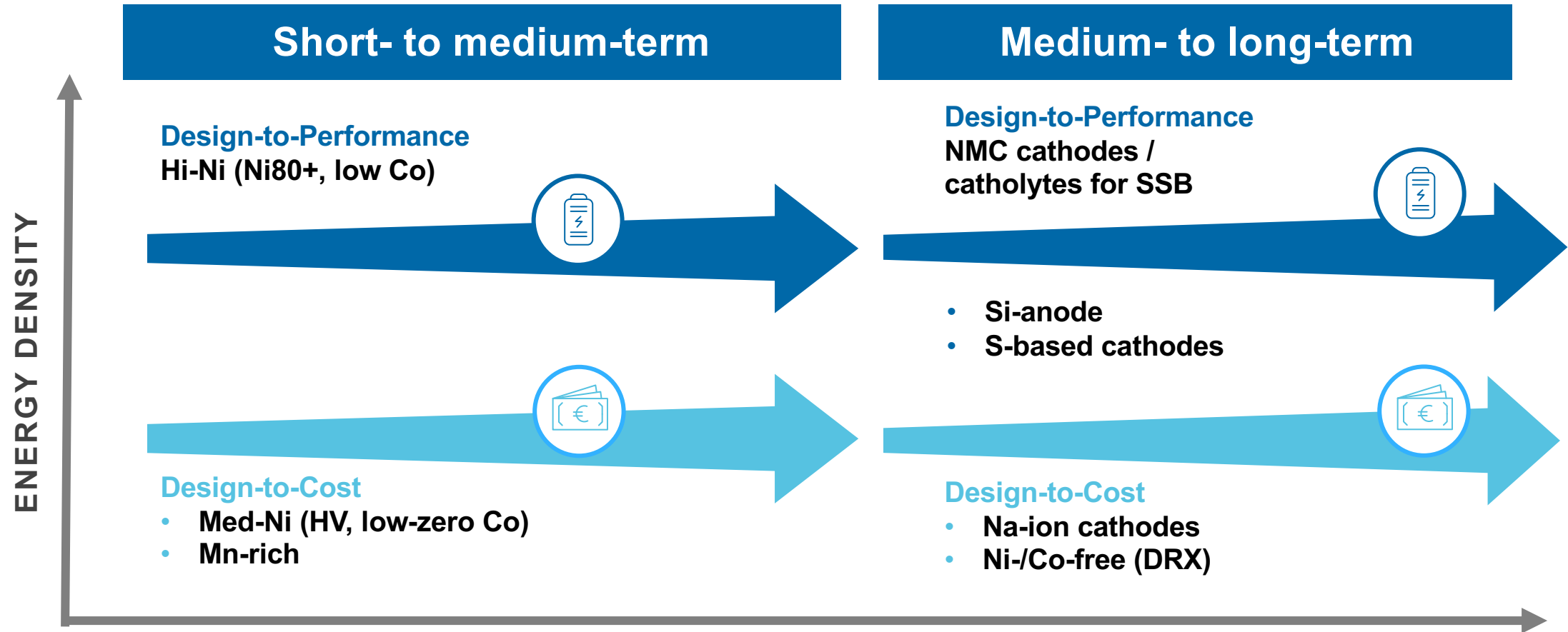
**Broad technology portfolio covering design-to-performance and design-to-cost applications**

**Next generation technologies with solid-state battery cathodes and catholyte materials gaining traction**





# Broad technology and IP portfolio covering current and future's chemistry spectrum





Source: Umicore  
Note: Hi-Ni = High Nickel; Med-Ni = Medium Nickel; Mn-rich = Manganese-rich; DRX = Disordered Rock Salt





# Complete portfolio for performance and cost on short- to medium-term



 <b>Design-to-performance</b>	Hi-Ni: 80-95 Staged approach depending on customer
 <b>Design-to-cost</b>	Med-Ni (HV, low-zero Co)
	Mn-rich
Optimization to next generation	

Start of customer supply / mass production



**Umicore fully on par with key competitors in design-to-performance Hi-Ni; technology leader in design-to-cost med-Ni and Mn-rich applications**



Note: Hi-Ni = High Nickel; Med-Ni = Medium Nickel; Mn-rich = Manganese-rich



# Manganese-rich/HLM leading technology portfolio for design-to-cost

Manganese-rich/HLM technology offering best of both worlds ...

## ... NMC-like technological advantages ...

- ✓ High energy density
- ✓ Fast charging suitability
- ✓ High recycling potential
- ✓ Global supply chain

## ... and LFP-like comparable cost

- ✓ Cost competitiveness (\$/KWh)



“High-manganese represents the **optimum cost-benefit ratio.**”  
*Volkswagen, March 2021*



Li-Mn-rich technology shown as “**cost**” solution in electrification roadmap.  
*BMW, November 2021*




Tesla is **working on new manganese battery cell.**  
*Tesla, March 2022*



# Leader in next generation performance technologies – Zoom in on Solid State Batteries

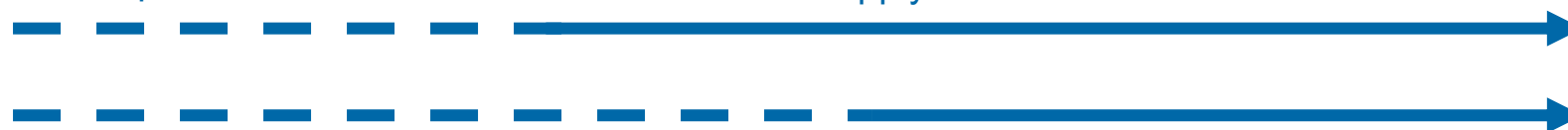


  
**Design-to-performance**

**SSB cathode**  
Staged approach depending on electrolyte technology

R&D / qualifications

Start of customer supply



## Developing the right chemistry for SSB

- Next to CAM, development of catholyte materials for SSB
- CAM and electrolyte materials chemically matched and pre-integrated

## Being a solution provider through partnerships

- Strong collaborations and customer traction ranging from high-profile start-ups to OEM
- Partnerships with Idemitsu for catholytes





# Capture profitable growth and create sustainable value



**S**

**Sustainability**  
Champion

## KEY PARTNER IN TRANSITION TO LOW CARBON MOBILITY

Pioneering responsibly-sourced materials increasing standards for Umicore and the industry

Becoming the driving force to decarbonize the battery value chain

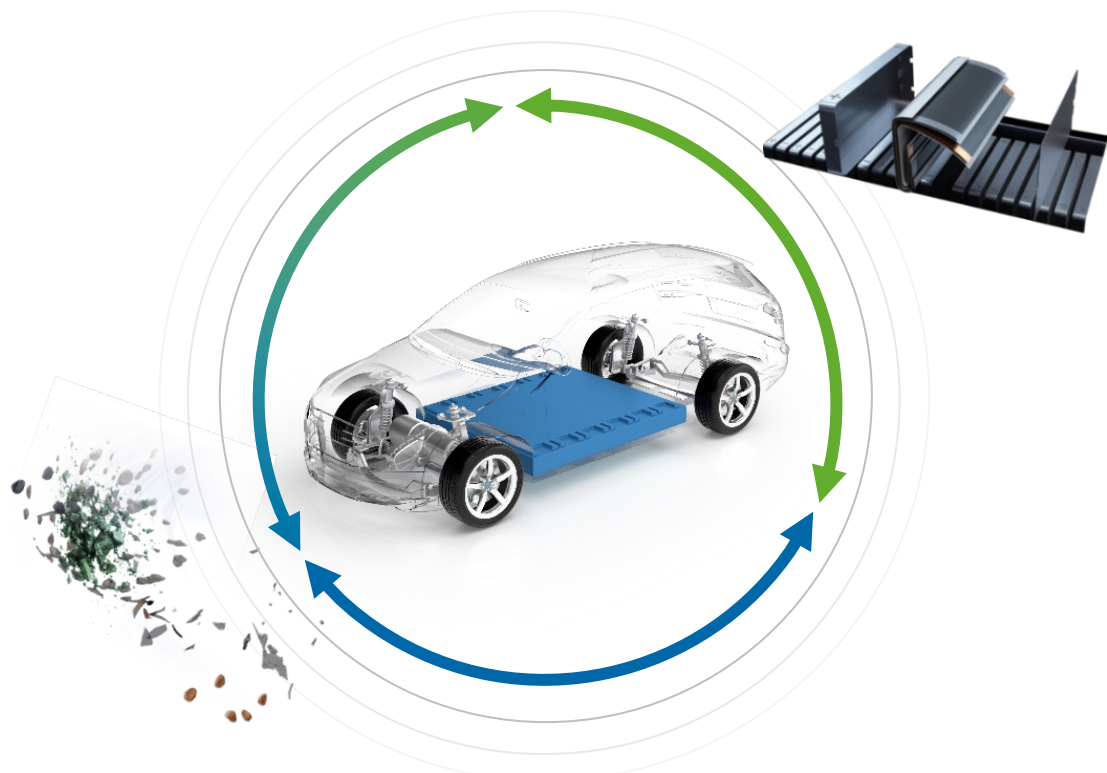


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# Decarbonizing the battery value chain



Accelerating our journey towards net zero  
& transforming our rechargeable battery materials business



Scope 1: identifying and implementing energy efficiency improvements

Scope 2: Signing long-term PPAs  
Cathode plant in Poland to operate on 100% renewable electricity

Scope 3: Securing a supply of sustainable battery materials sourcing low-carbon Nickel & long-term supply agreements for zero-carbon Lithium

Umicore cathode materials prevented **over 9.5 million tons of GHG emissions** from being emitted in 2021



Considering recycling, production, processing into batteries and the use of batteries in full EVs

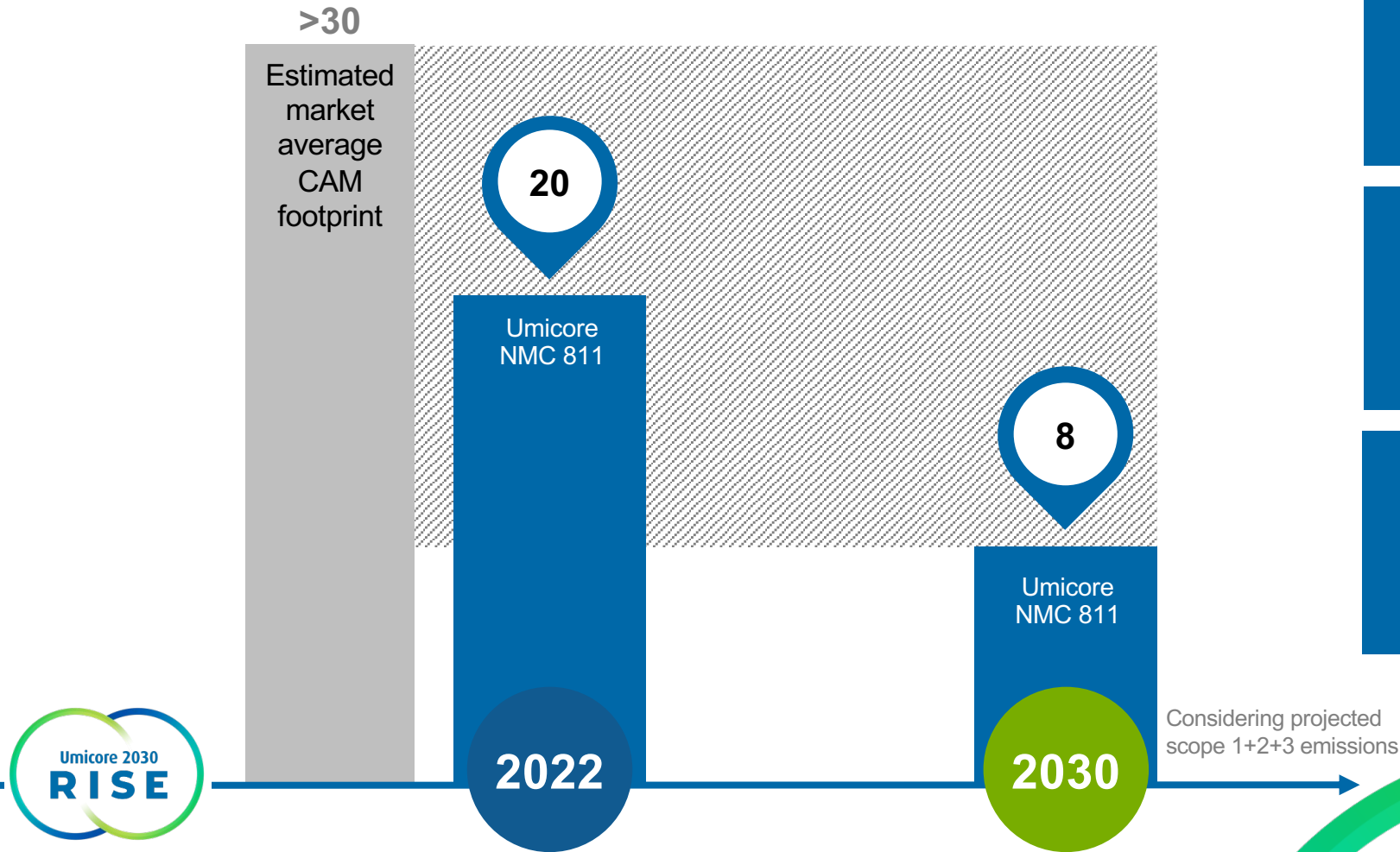


# Decarbonizing the battery value chain

## Becoming the leading supplier for low-carbon batteries



**NMC carbon intensity,**  
average kg CO<sub>2</sub>e/kg NMC 811



Reducing the Umicore CAM carbon footprint by >50% compared to today's levels

Recycling batteries to feed low-carbon and recycled metals into our cathode materials

Scope 3 reduction potential of >3 million tons CO<sub>2</sub>e by 2030



# Capture profitable growth and create sustainable value



**E**

**Excellence**  
in execution

## STEP-CHANGE IN PROCESS, OPERATIONAL AND ORGANIZATIONAL EXCELLENCE

**Continuous improvement delivered over last years**

**Set up for further operational optimization and innovation**

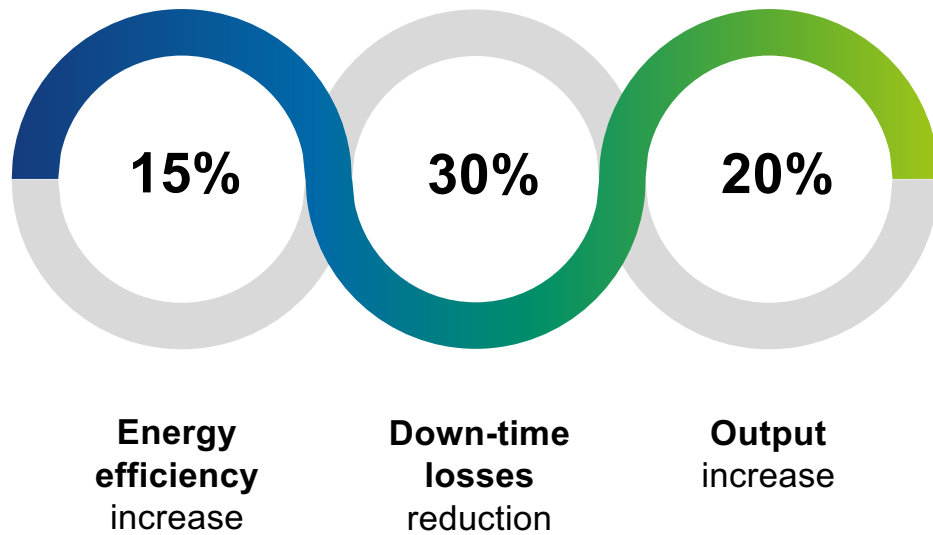
**Building organization of future for transformational growth**



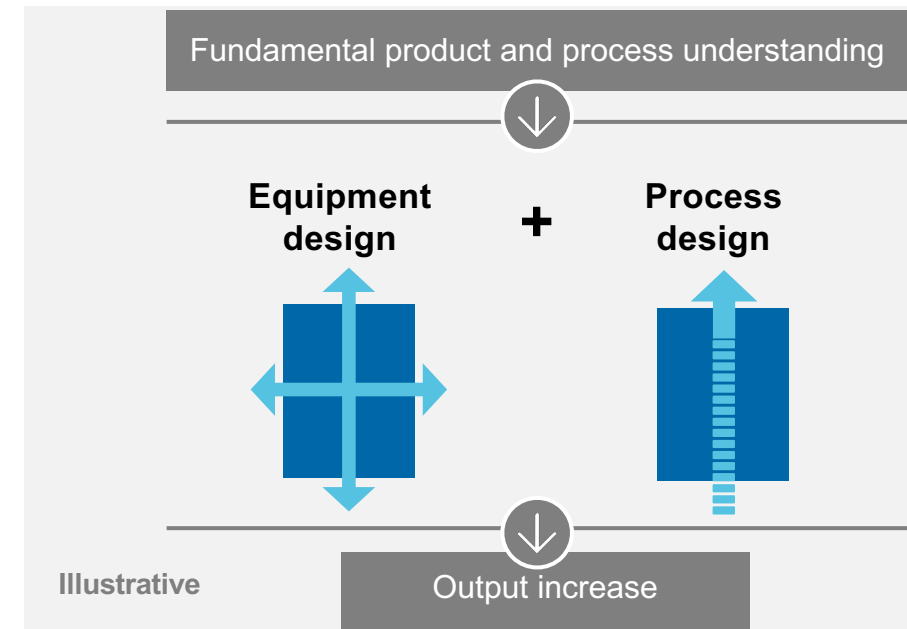
# Continuous improvements delivered ... ... and further to come

World-class execution building on more than 20 years running large-scale CAM factories

Continuous improvements along key operational dimensions over the last 5 years, e.g.



... and further improvements to come, e.g.





# Set up for further optimization and innovation

## Operational excellence

- Cost optimization and debottlenecking
- Maintenance and Capex Procurement strategy
- Digital roadmap: further improvements in efficiency, visibility and analytics



**Continuous improvement and break-throughs of operational and cost efficiency**



## Plant design

- Larger plants leveraging scale
- Modular design of plant and equipment
- Net zero carbon greenfield plant
- Smart location selection



## Process innovation

for next generation (p) CAM processes targeting cost, energy usage and scalability



**30% expected improvement in capex efficiency<sup>1</sup> and significant optimization of operational costs between 2022-30**



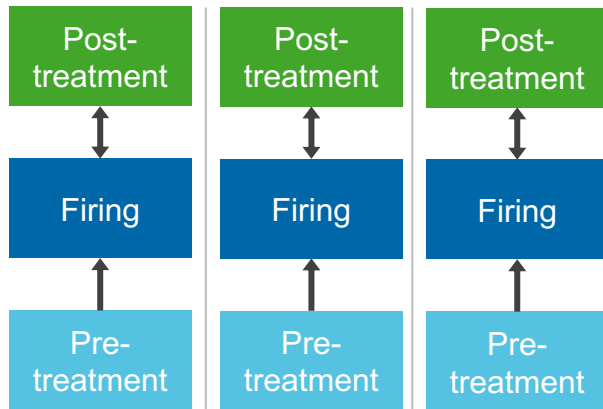
1. Expected capex efficiency excluding inflation impact



# E

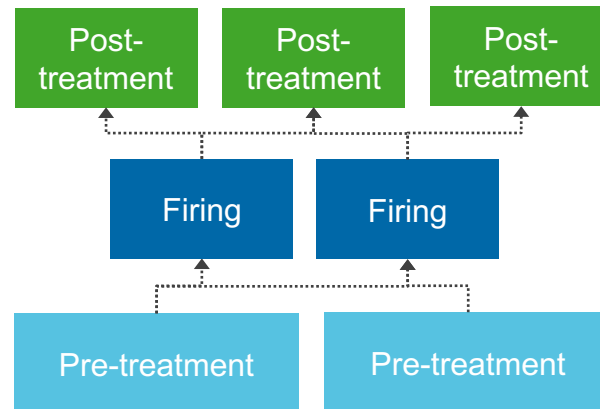
## Modular plant design leverages footprint expansion

Traditional line design



Modular design

+ upscaling of process steps



NYSA, PL

**Modular design of firing, pre- and post-treatment steps:**

**Flexibility** in combining different process steps  
**Higher utilization, efficiency and scalability**

**Standardized concept for multiple sites**  
**Transferability** of operational excellence initiatives



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# Rechargeable Battery Materials – RISE

Capture profitable growth and create sustainable value



**Sustainable EBITDA growth with margins ~ 20% in 2030**  
**Value accretive after 2026**



umicore<sup>®</sup>

materials for a better life