

CAPITAL MARKETS DAY

2 September 2015

Andaz London Liverpool Street



Energy & Surface Technologies

Speaker

Marc Van Sande

*Executive Vice-President,
Energy & Surface Technologies*

Agenda



Business group profile



Energy & Surface Technologies

Thin Film Products
(TFP)

Electro-Optic Materials
(EOM)

Rechargeable Battery Materials
(RBM)

Cobalt & Specialty Materials
(CSM)

Electroplating
(EP)

In

Ge

Ni Co

Re Co Ni

Ag Sb Ta W

Sb Se

Li Mn

W Ta Cu

Au Ag Rh Ru
Pd Pt

Materials for energy and surface applications

	RBM	CSM	EP	TFP	EOM	
 <p>Electrification of vehicles</p>	✓	✓ ✓	✓	✓		<p>Wear and corrosion protection and decorative coating</p> 
 <p>Efficient portable devices</p>	✓	✓	✓ ✓	✓ ✓	✓	<p>Optics and electronics</p> 
 <p>High efficiency solar cells</p>				✓	✓	
 <p>Light emitting diodes (LED)</p>			✓		✓	
 <p>Energy storage</p>	✓	✓		✓		

Closing the loop

Rechargeable Battery Materials	Closed loop through Battery Recycling pilot ready for scaling up	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Ni</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Mn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Co</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Li</div> </div>
Cobalt & Specialty Materials	Residues from the tooling and aerospace industries and catalysts from the petrochemical industry	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Re</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Co</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">W</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Ta</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Ni</div> </div>
Electroplating	Residues from electroplating baths (other BU)	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Au</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Ag</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Rh</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Ru</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pd</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pt</div> </div>
Electro-Optic Materials	Ge bearing residues	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Se</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Ge</div> </div>
Thin Film Products	In bearing residues	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">In</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Sn</div> </div>

Asian presence increasingly important



Shift of several industries to Asia



Supply coming from Asia



Lower cost environment



Rechargeable Battery Materials

Cobalt & Specialty Materials

Electroplating

Electro-Optic Materials

Thin Film Products

Growth & profitability drivers

Business unit



Main growth drivers



Profitability drivers

**Rechargeable
Battery Materials**

Vehicle electrification

Scale effects, product and process technologies

**Cobalt & Specialty
Materials**

Growth in RBM
Plating and chemicals industries

Supply chain integration,
process excellence

Electroplating

Asian demand in electronics

Product & applied technology

**Electro-Optic
Materials**

Infra-red optics in consumer
electronics, new satellite programs

Supply chain integration, product
technology

Thin Film Products

Display industry growth,
thin film batteries

Scale effects, product
& process technologies

Key takeaways



All activities are related to the core competences of Umicore



Double digit revenue and earnings growth potential



Importance of Asian presence, integrated supply chain & scale



Rechargeable Battery Materials

Speaker

Kurt Vandeputte

*Vice-President,
Rechargeable Battery Materials*

Agenda



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A close fit with megatrends



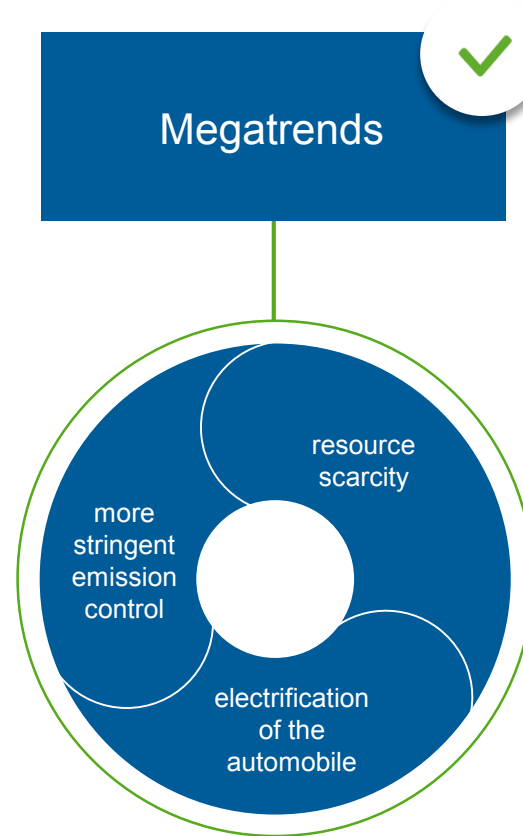
Transportation:
fuel-based towards
electricity-based



Electricity generation:
increasing share from
non-fossil sources
(wind, sun, bio, hydro,...)



**Metal-based functional
materials enable
recyclability**



A leading player in the industry

Market characteristics

- Li-ion battery technology is established reference for portables and automotive applications
- Cathode material is important to performance and cost of a Li-ion battery

Umicore offering



A **broad spectrum of metal-based materials** used in Li-ion batteries



Umicore is a leading cathode material supplier with a large industrial footprint. We have produced enough cathode materials to:



Provide a smartphone **to every person on the planet**



Power more than **1 million EVs**



Technology leadership and a proven **quality track** record combined with a **strong application know-how** are key for business success

A global presence

R&D and Industrialization

- Product R&D (KR, JP, BE)
- Process Development (BE, KR)
- Engineering (KR)

Operations

- LCO, NMC (KR, PRC)
- LFP (BE)
- ISO9001/14001/18001
- TS16949

Application Technology

- Battery Lab (KR, JP, BE)



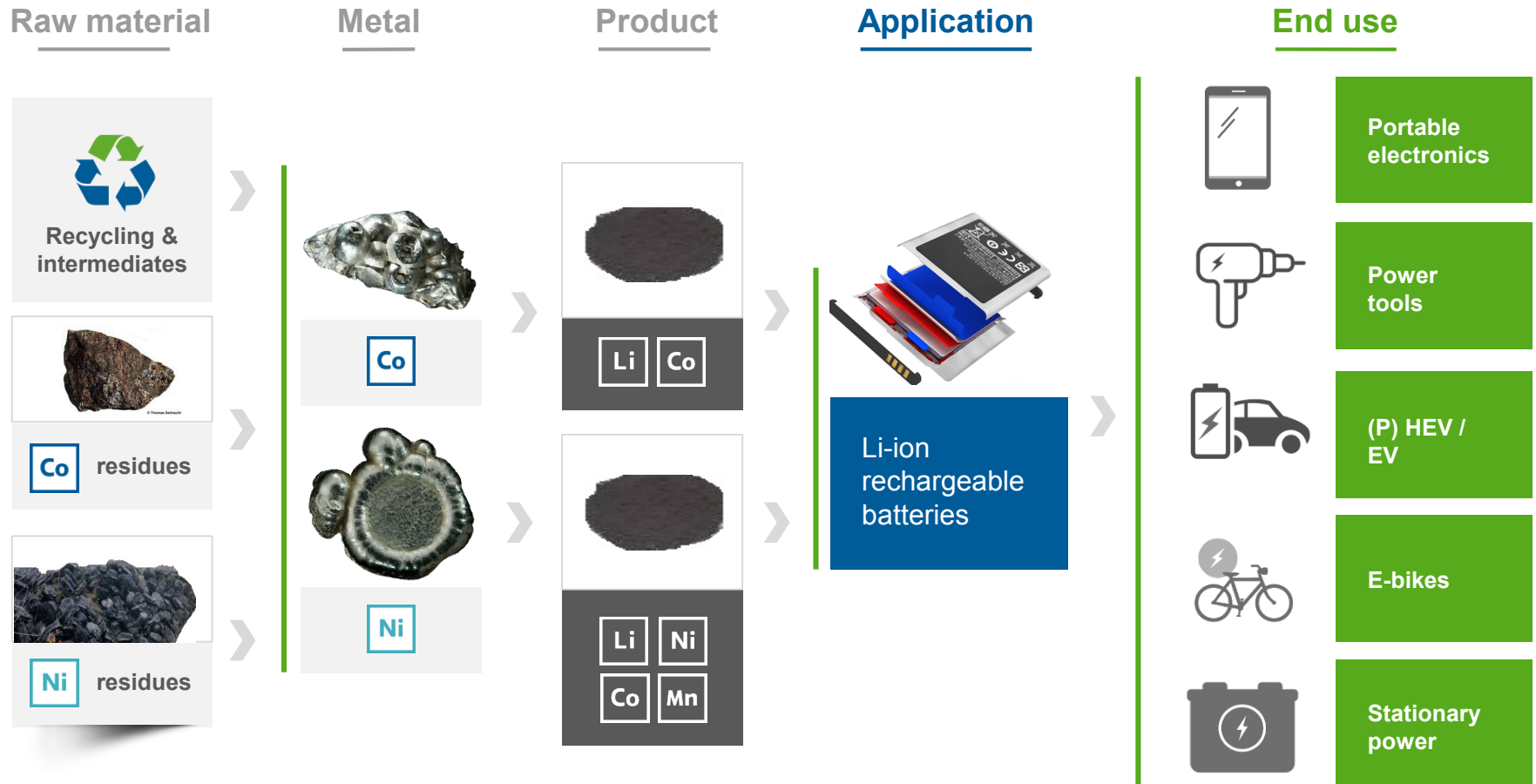
Customer Teams

- Dedicated teams
 - Sales & Marketing
 - Applied Technology
- in EU, US, KR, JP, PRC, TW



Total RBM workforce:
approx. 500 people

Unique integration in the value chain



Umicore occupies a unique position in the value chain guaranteeing high speed to market, supply security, and responsiveness to customer needs

Unique industrialization capabilities



Two decades of market presence in cathode materials for Li-ion batteries



Established industrial footprint close to the customer



Strong industrialization capabilities building on historical Umicore key competences



Process innovation fuels productivity improvements while maintaining highest quality standards (stringent automotive standards)



Integrated process flows with guaranteed access to critical raw materials allows an **agile market approach**

Umicore's production plant in Cheonan



The biggest cathode material production facility in the world

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Supportive market conditions

Base case

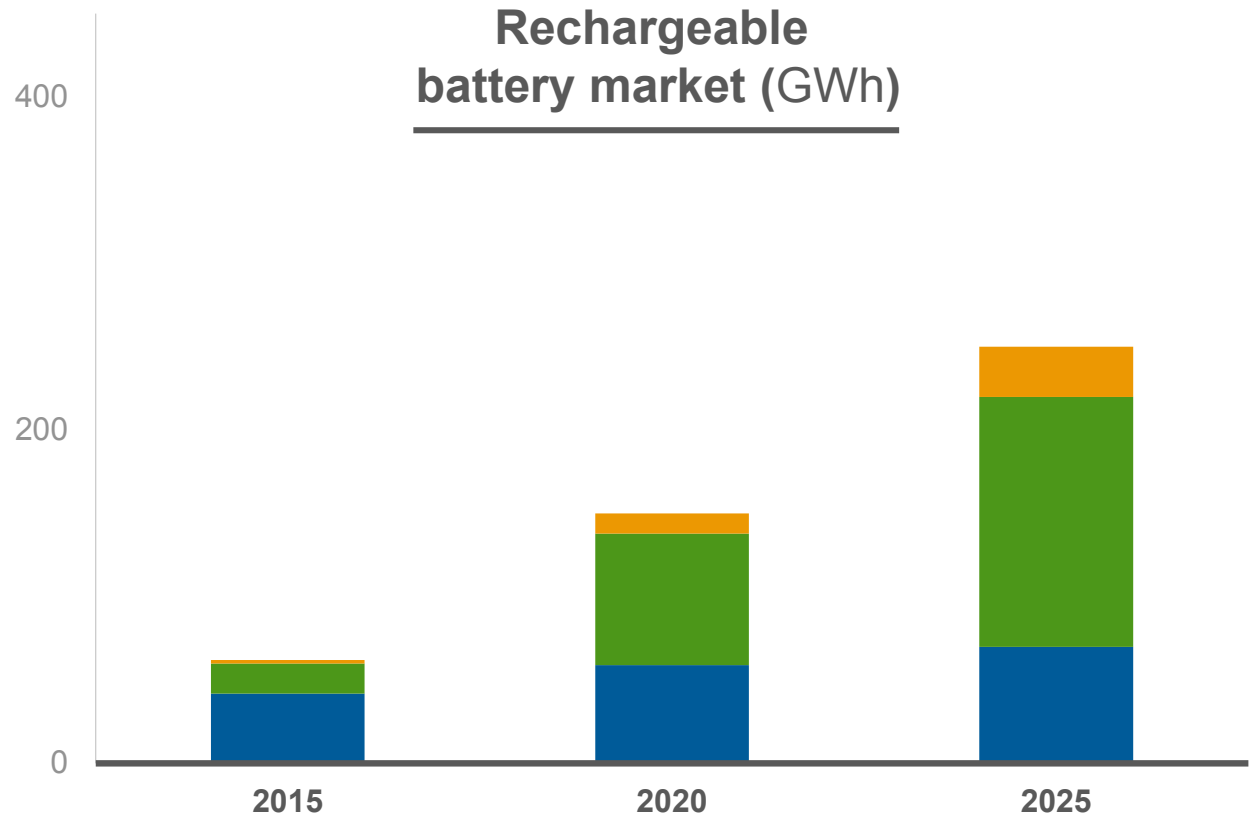
Portable
Societal driver



Electrification
Regulatory driver



Energy Storage System
Regulatory driver



The main growth driver will be **vehicle electrification**

Exciting upside potential

High case

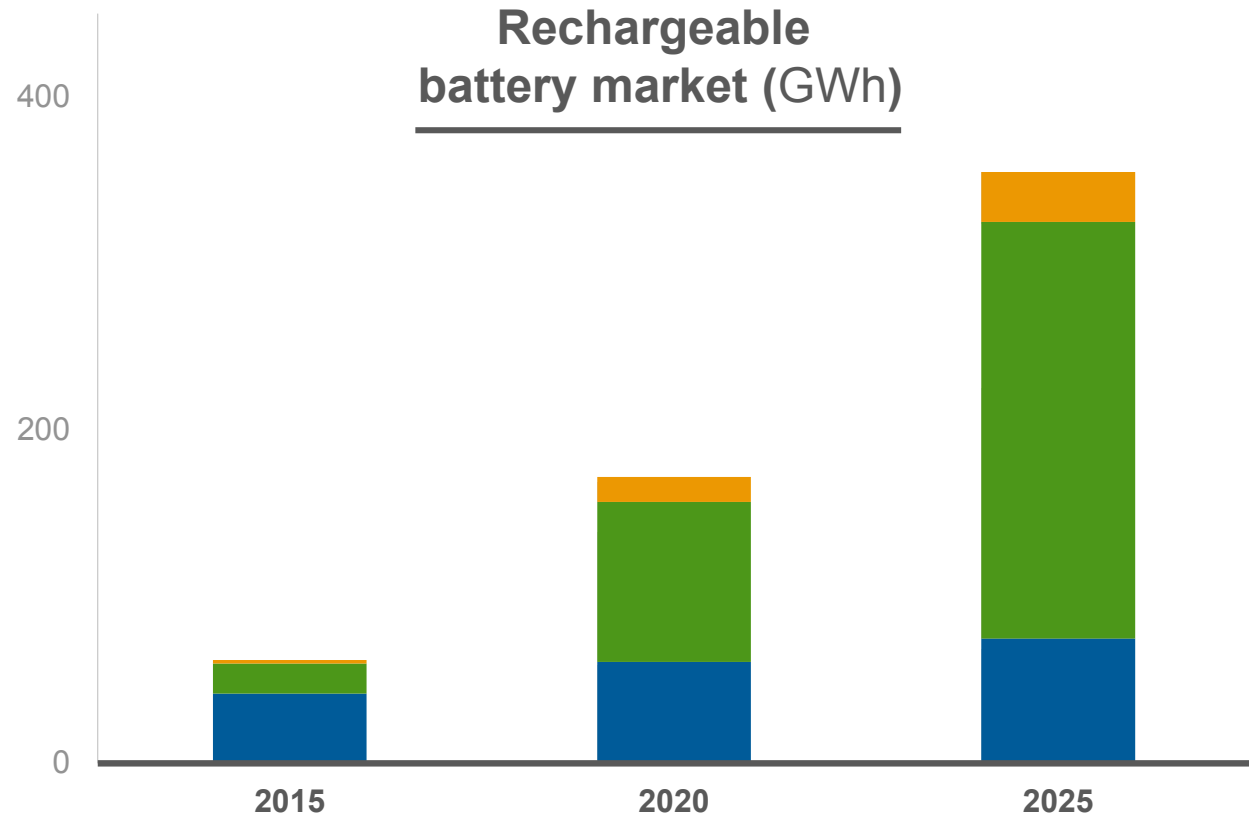
Portable
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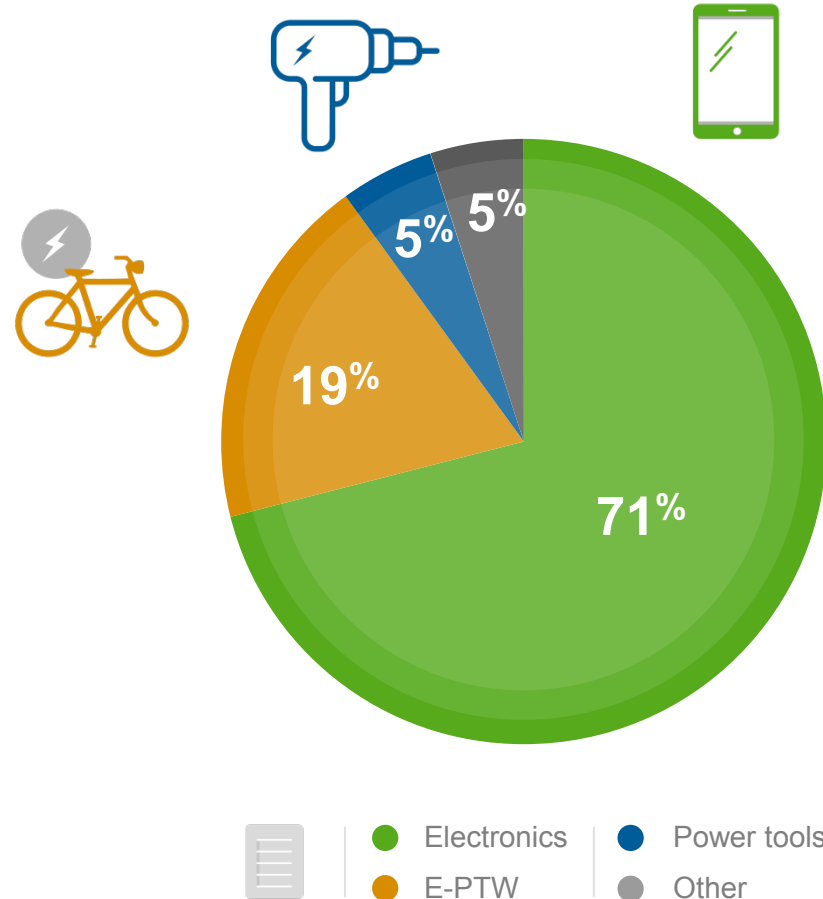


The main growth driver will be **vehicle electrification**



Market focus: Portables

- Main Li-ion market segment today **driving material technology directions**
- Smart phone, tablet and notebook applications are **the volume drivers** in the electronics subsegment
- Electric Power Two-Wheels is **a new growth driver** based on similar battery and material technologies
- Market growth rates **stabilizing towards 4-6% p.a.**

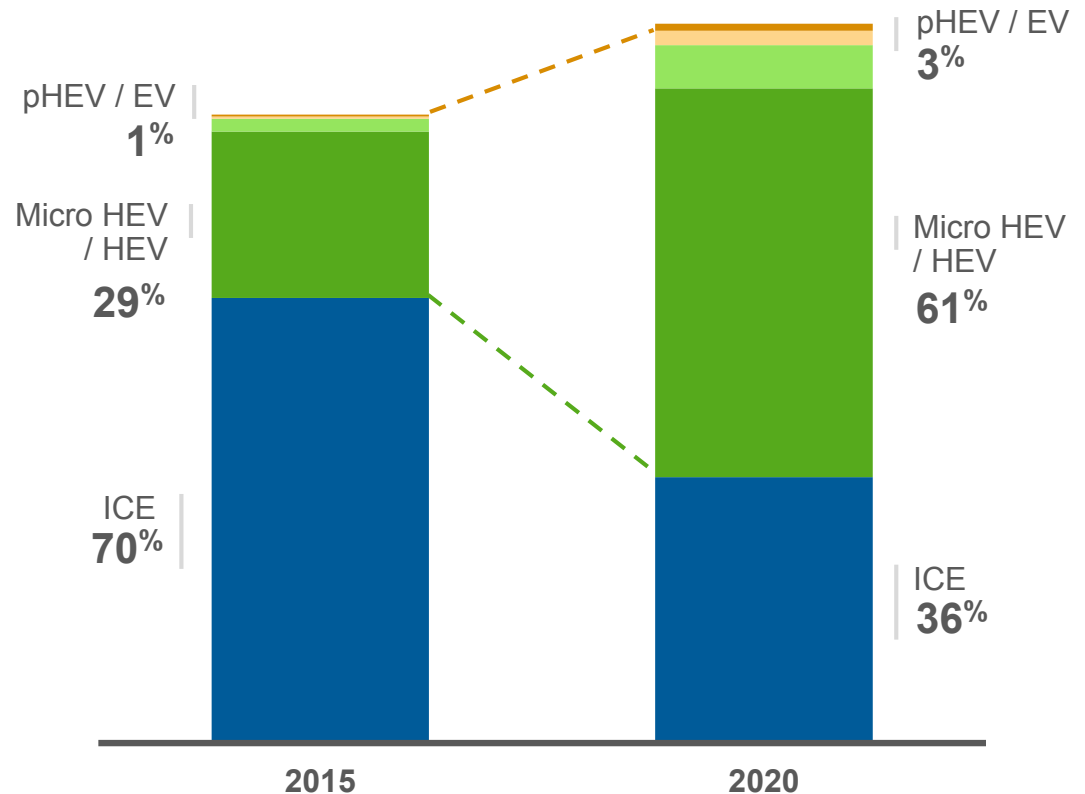




Market focus: Electrified transport

- **Market segment is very diverse** (automotive, heavy duty, marine, aviation) though near-term driven by automotive
- Car market **continues on growth track**
- Electrification roll-out **geographically and technologically diversified**

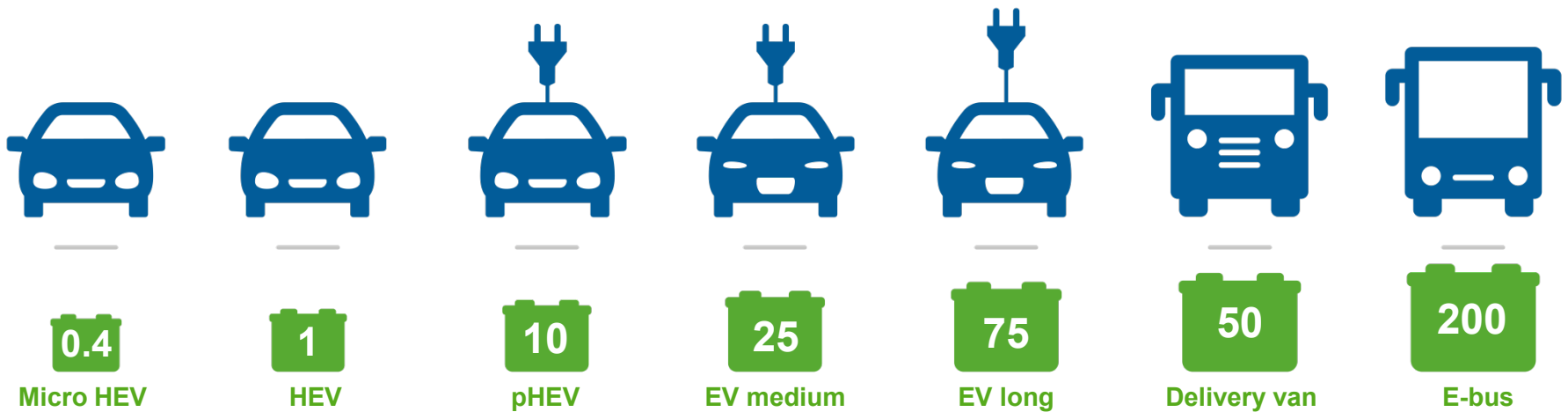
**Total automotive production
by drivetrain**





Market focus: Electrified transport

Segments Battery Size (kWh)



Understanding Li-ion battery requirements for automotive subsegments

Selecting most cost effective Li-ion battery system for a given Power to Energy requirement

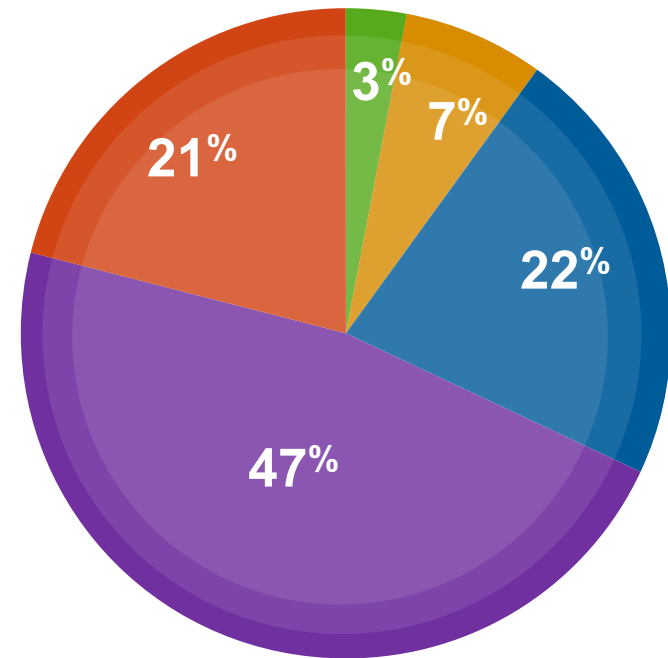
Expanding to small delivery vans, utility vehicles and e-buses



Market focus: Electrified transport

- **Aligning the right material technology and production capacities** with the specific market demand profiles is crucial
- Energy, more specifically 'Cost of Energy' (\$/kWh), is a **key driving force for material choices** in Li-ion battery technology
- Additional user requirements determine **material technology decisions** (eg. fast charge capability, cold cranking,...)

Share of automotive battery in 2020 in GWh



- Micro hybrid
- Hybrid
- Plug-in hybrid
- Full electric
- E-bus



Market focus: Energy Storage Systems

- Li-ion based storage systems serve only **a niche segment**
- Industrial power grid connected systems offer **the main opportunity**
- Increasing non-fossil electricity forces regulators to define ‘minimum’ connected electricity storage **buffers to guarantee power grid stability**
- **Reliability and long-term TCO** form the value proposition
- Technical requirements and market size **do not require application specific material design optimization**



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Umicore cathode material heat map

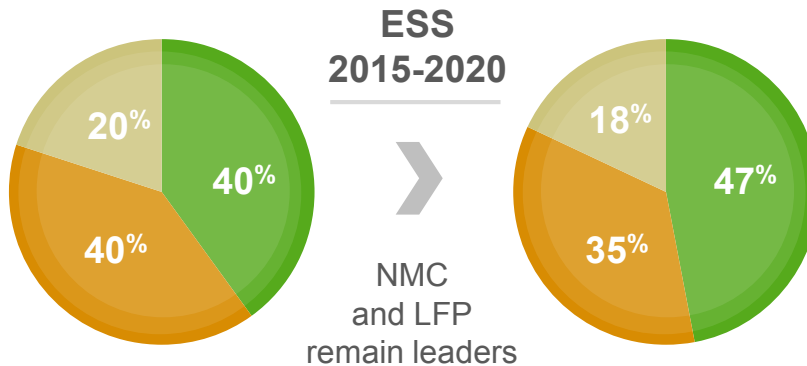
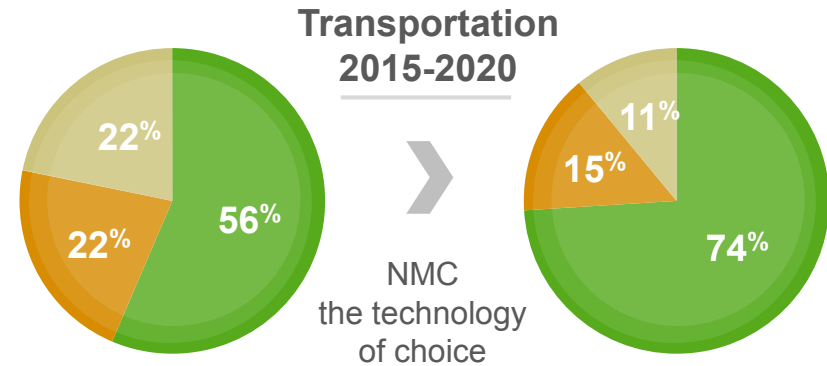
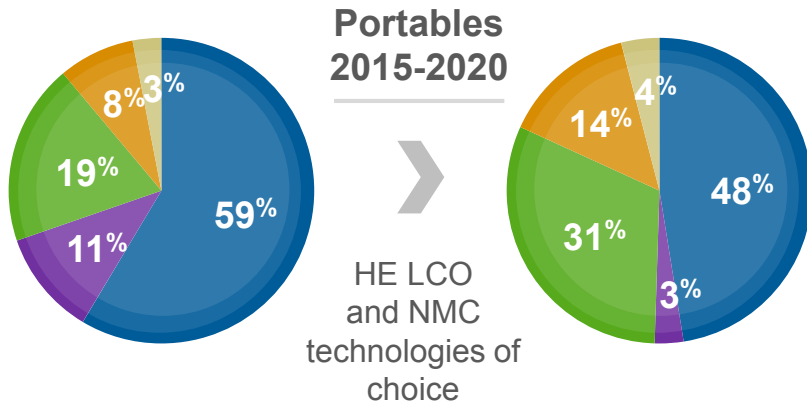
Segment	Cathode Material Options		
Portables Premium	HE LCO ✓		NMC/NCA ✓
Portables Standard	NMC	LCO	LMO
Automotive 'Energy'	NMC/NCA ✓		LMO
Automotive 'Power'	NMC/NCA ✓	LMO	LFP ✓
Energy Storage System	LFP ✓	NMC/NCA ✓	LMO



● Umicore present

Umicore's portfolio focuses on **sizeable segments offering significant market growth**

Material specific market opportunity evolution

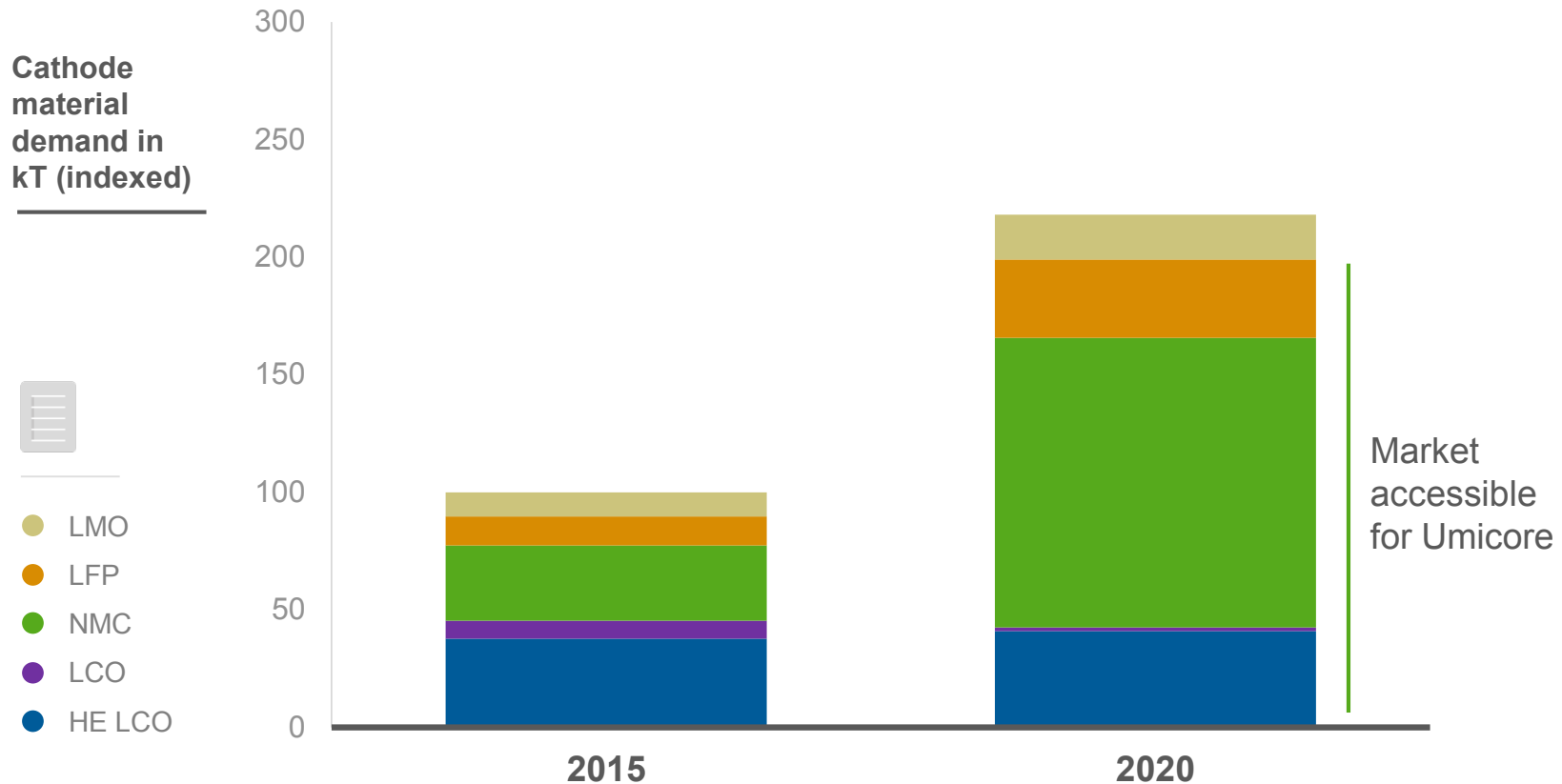


Umicore covers the main market segments with its HE LCO, NMC and LFP materials with **freedom to operate** and is **well positioned for future material trends and market growth**



Significant accessible market for Umicore

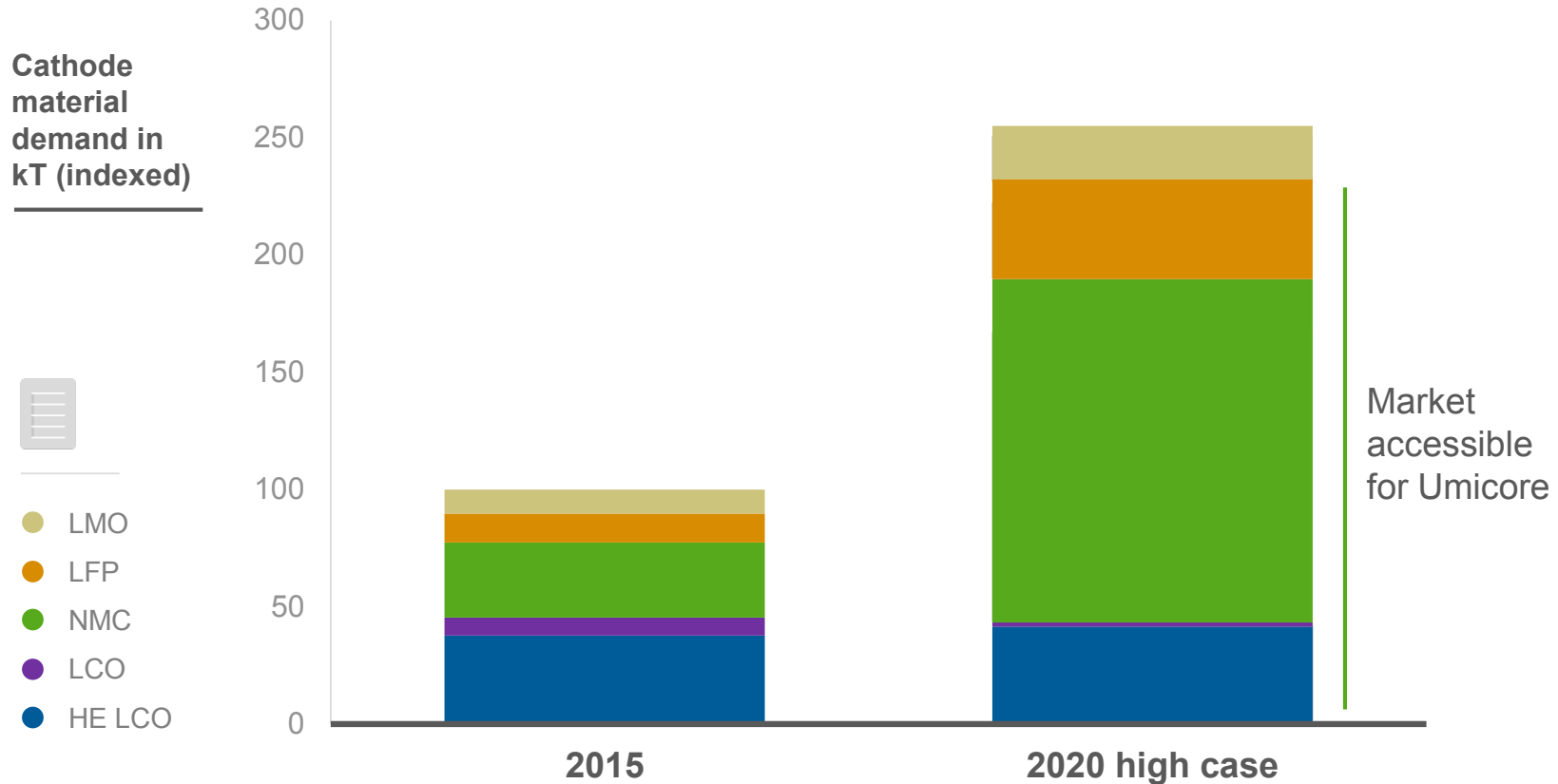
Base case



Umicore is well positioned to participate strongly in the market growth

Significant accessible market for Umicore

High case



Umicore's supply chain integration and industrialization competences support a transformational growth scenario

Growth strategy 2015-2020



Maintain leadership in portable applications



Establish technology-based leadership in xEV and continue massive industrial expansion

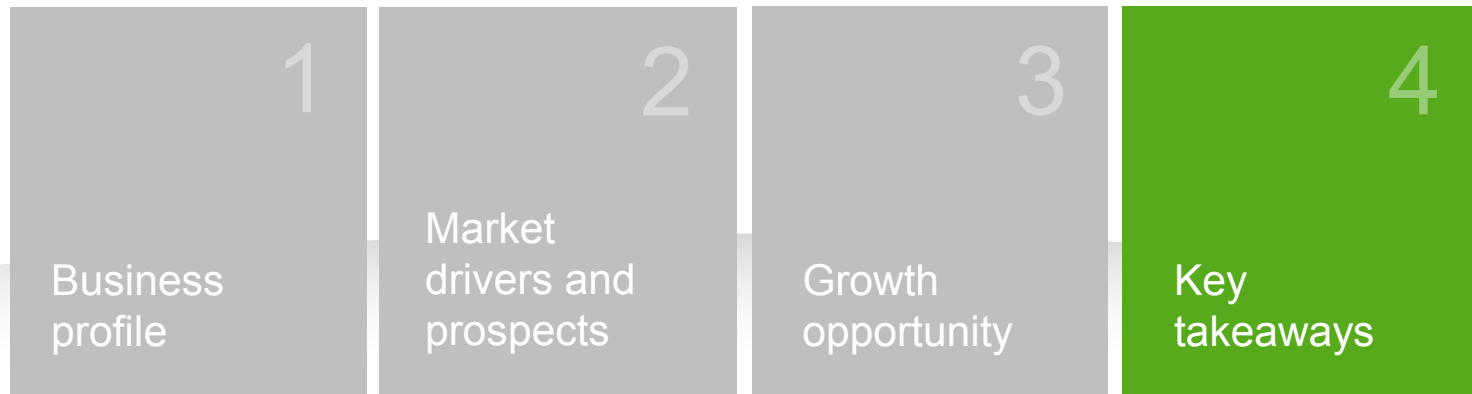


Reach sustainable profitability



Cost leadership through economies of scale, process development, competitive sourcing (jointly with CSM) and operational excellence

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Key takeaways



Li-ion is the technology of choice for portable and automotive segments in the coming decade



Market demand remains strong and transport electrification is the main growth driver



Umicore is **uniquely positioned** to capture this growth due to its customer proposition

- Excellent cathode materials technology and freedom to operate
- Production expertise and ability to scale up volumes
- Integrated supply chain