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Precious Metals Refining

Koen Demesmaeker – Senior Vice President

Capital Markets Event on Recycling – 18-19 Nov 2010

Precious Metals Refining

Largest and most complex precious metals recycling operation in the world

- Proprietary processes mastering a complex feed with the highest degree of flexibility
- Global customer base

Processes around 350,000 tonnes/year of more than 200 different types of raw materials

- Wide range of complex precious metals bearing materials
- Efficient recovery of 17 different metals
- Focus on high added value processes (throughput time, efficiency)

Applying world class environmental and quality standards

Agenda

- Business model & competitive position
- Supply streams
- Metals market
- Environmental & ethical aspects
- Conclusion

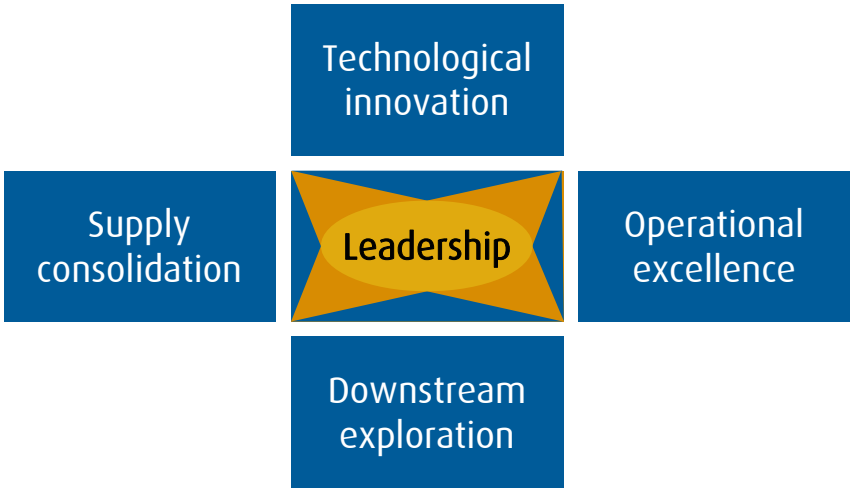
Business model & competitive position

Business strategy

Umicore Precious Metals Refining aims to be recognized as the international reference in the sustainable refining of complex precious metals materials

UHT-technology platform

- Focus on partnerships
- Master the supply chain



- Business excellence
- Process robustness
- Process optimization
- Competence management

Opportunity driven approach based on our PM intermediates

PM = Precious Metals

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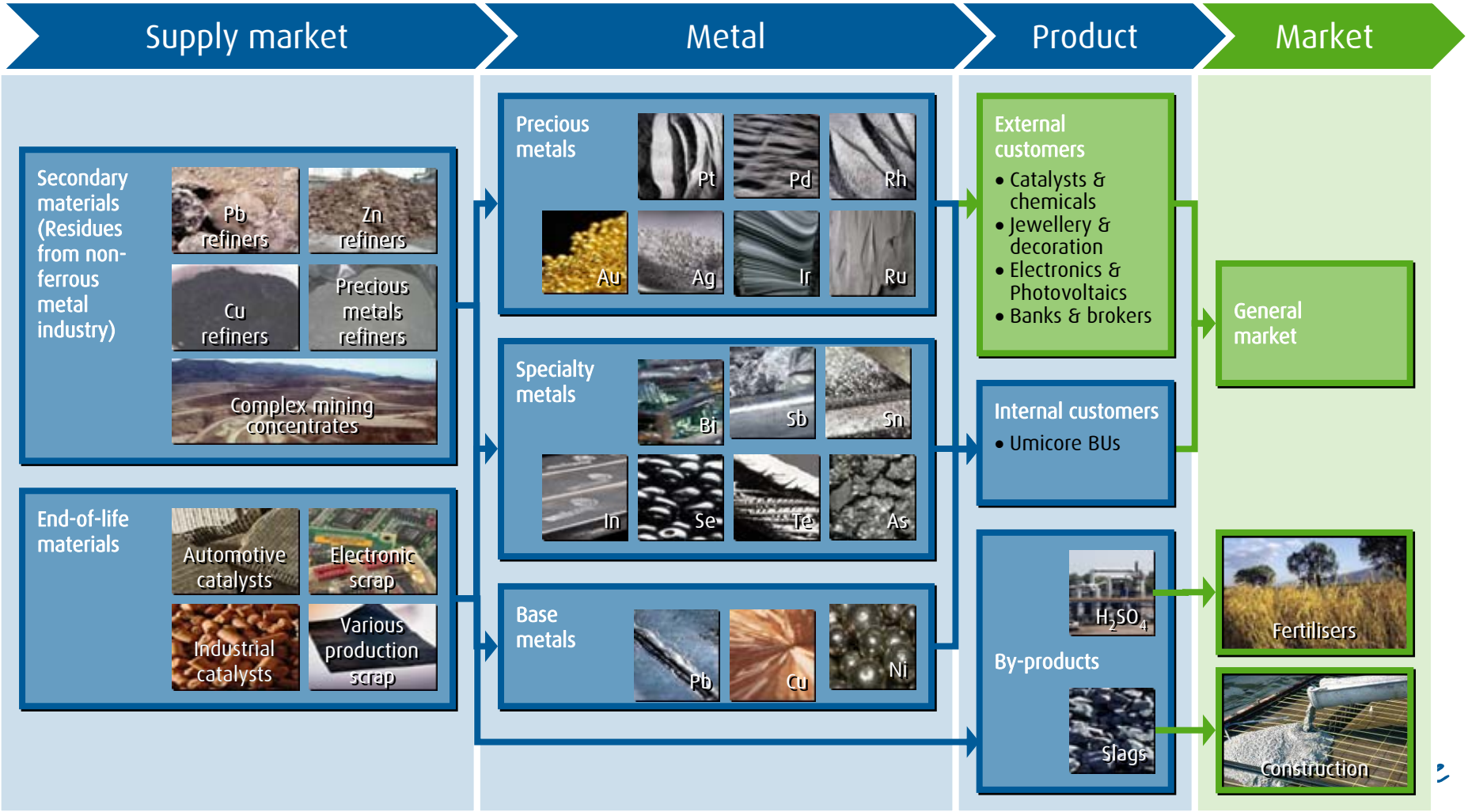
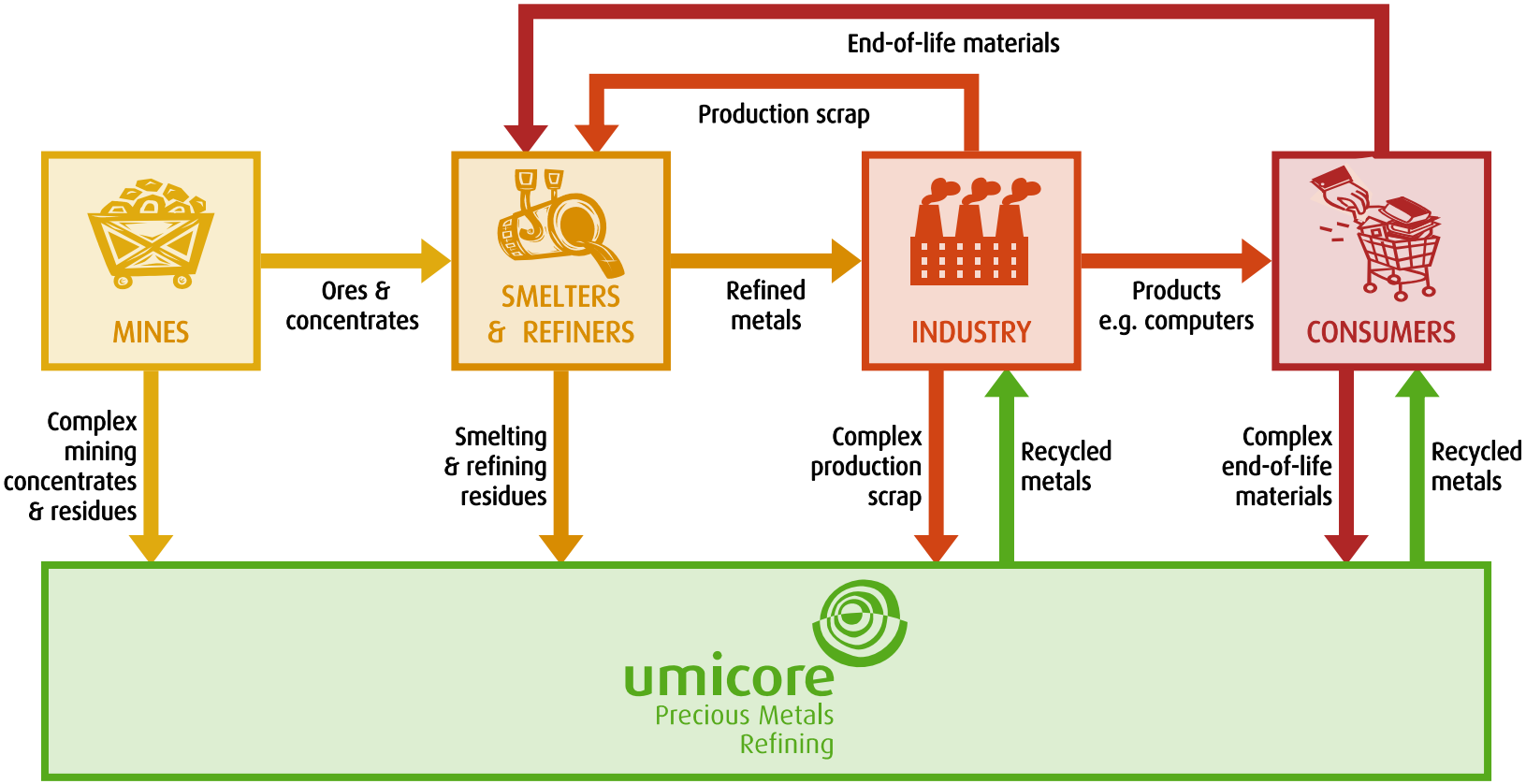
Supply streams and metal output



Position in the market



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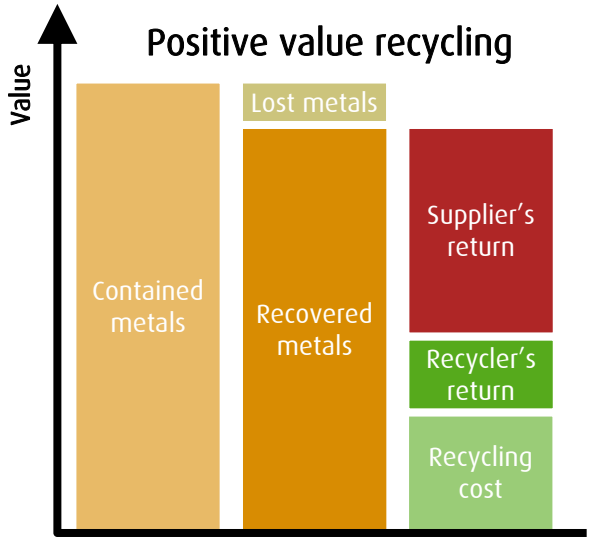
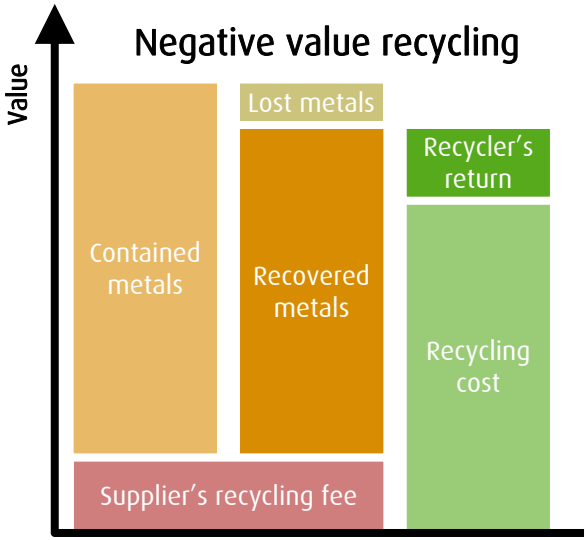
Positive value recycling





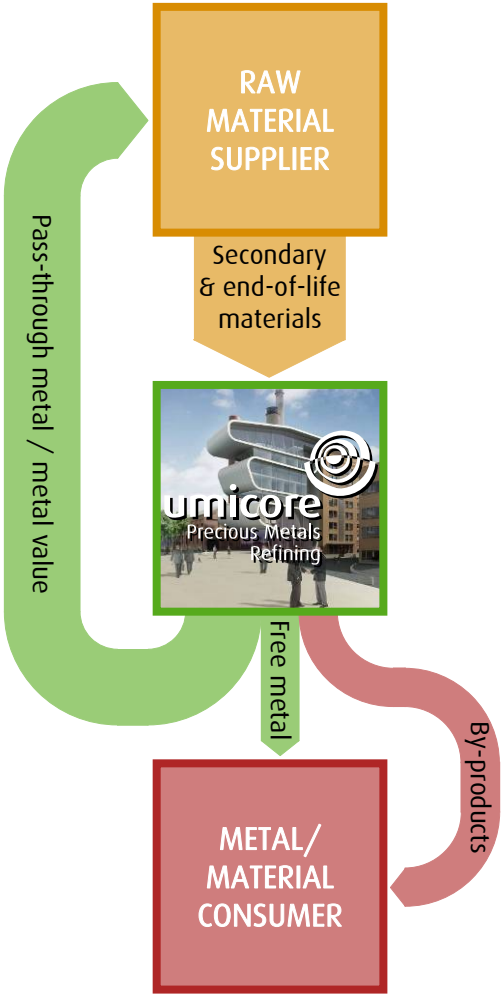
Umicore Precious Metals Refining is mainly a positive value recycler

⇒ Customers are incentivised to come to Umicore through the return they get
There is no direct need for regulation or incentives

In case of negative value recycling, government incentives or legislation is needed

E.g.: Battery recycling business

Pricing mechanism



Umicore offers a treatment and refining service to the raw material supplier, returning the metal (value) to the supplier
→ **Toll refining** or **purchase contracts**

- Umicore charges the supplier a charge for this service
  → **Treatment/refining charge (TC/RC)**
- Umicore returns metal to the supplier according to a contractually agreed recovery rate per metal (or returns the metal value)
  → **Pass-through metal**
- Umicore assumes the risk of recovery under or above the contractually agreed recovery rate
  → **Metal yield**
- Umicore also recovers non-metallic **by-products**, which are sold

Return split between TC/RC and metal yield (vs contractual recovery rate) varies per contract and per metal in the contract, depending on commercial negotiation

Supply contracts

Contract determines

- Period: spot, long term (0.5 – 2 years), evergreens (with notice period)
- Quality of raw material: metal concentrations, ...
- TC/RCs, including recovery rates
- Volumes, within certain margins

B to B business, with mostly industrial counterparts

- Either directly with industrial residue producer or consumer (e.g. industrial catalysts)
  These tend to be longer term
- Or through collectors (e.g. e-scrap or automotive catalysts)
  These tend to be somewhat shorter term

Umicore offers toll refining services or purchases the raw material, at the customer's discretion

- Purchase price is based on toll refining mechanism
- Main difference is that raw materials have to be financed in working capital

Metal price impact

Umicore Precious Metals Refining has a metal price exposure

- Directly through metal yield component
- Indirectly on availability of raw materials
  - Certain materials are only worth recycling when the metal price crosses a certain threshold (i.e. value of metal contained becomes higher than the cost of the recycling)
  - Changing metal prices thereby impact the supply environment

Securing metal price exposure on earnings

- Systematic hedging of transactional exposure to eliminate residual risk on pass-through metal
- Metal price sensitivity is mitigated by securing the metal price component over a longer time period, through contractual arrangements

Managing metal price impact on working capital

- Certain contracts are toll refining → Metals remain the property of the supplier
- In case of purchase contracts payables/receivables terms are optimised vs throughput time to limit impact on net working capital

Core competitive strengths

Umicore Precious Metals Recycling creates value through

- High recovery yields for metals
- Short throughput times
- Recovery of 17 different metals

Supply of raw materials therefore focused on

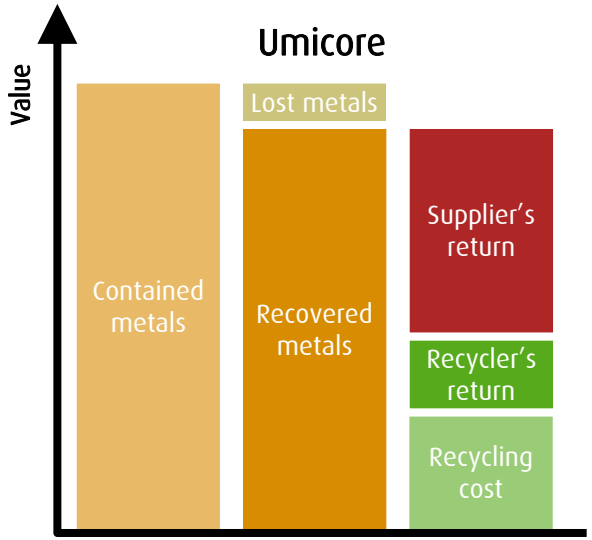
- High value metals contained: precious & specialty metals
- Complexity (multiple metals contained)

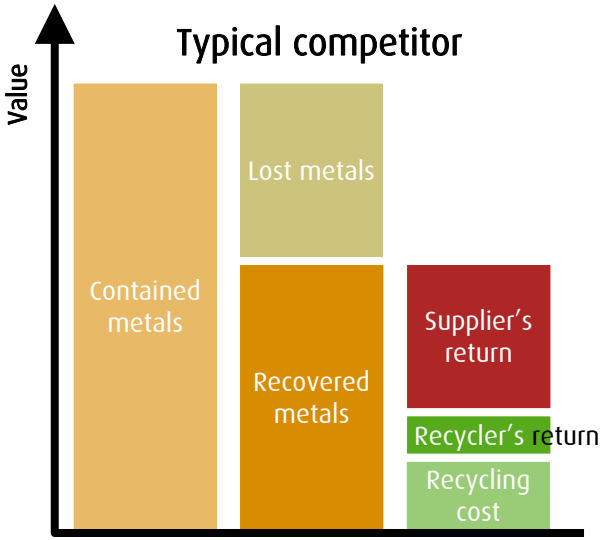
Operational flexibility in supply is key to optimise and sustain profitability

- Short term: to continuously optimise profitability depending on market circumstances
- Long term: to be able to treat new types of recyclable materials

The recycling plant works continuously at maximum capacity optimising its returns by selecting the best feed

Competitive position





Umicore is a dedicated recycler with focus on higher value supply streams

- Competitors typically are dedicated smelters with focus on high volume base metals
- Umicore's complex flowsheet allows **higher recovery yield** on **highest added value metals** in a **shorter throughput time**

Umicore's operation is highly competitive due to its operational excellence which enables higher returns and the sharing of these with suppliers

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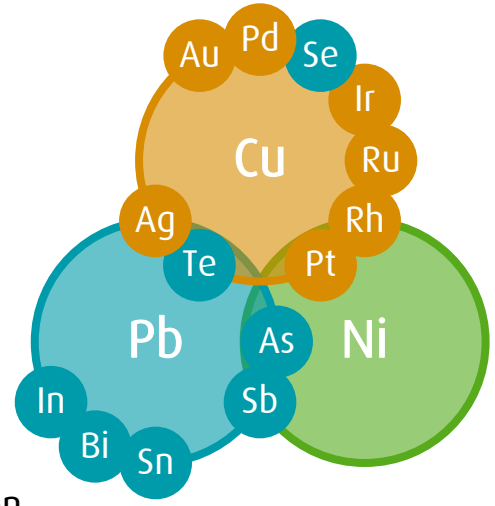
Core enablers

State-of-the-art technology

- Combination of pyro- and hydrometallurgy
- Knowledge management is essential (knowhow, IP)



Market intelligence

- Supply market
- Metals market

Integrity, reliability & risk management

- Sampling and assaying essential to determine return distribution
- Credit worthiness important in business where high (metal) values are in the loop

Environmental management excellence

- Resource efficiency
- Eco-efficiency
- Ethical supply

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Supply market

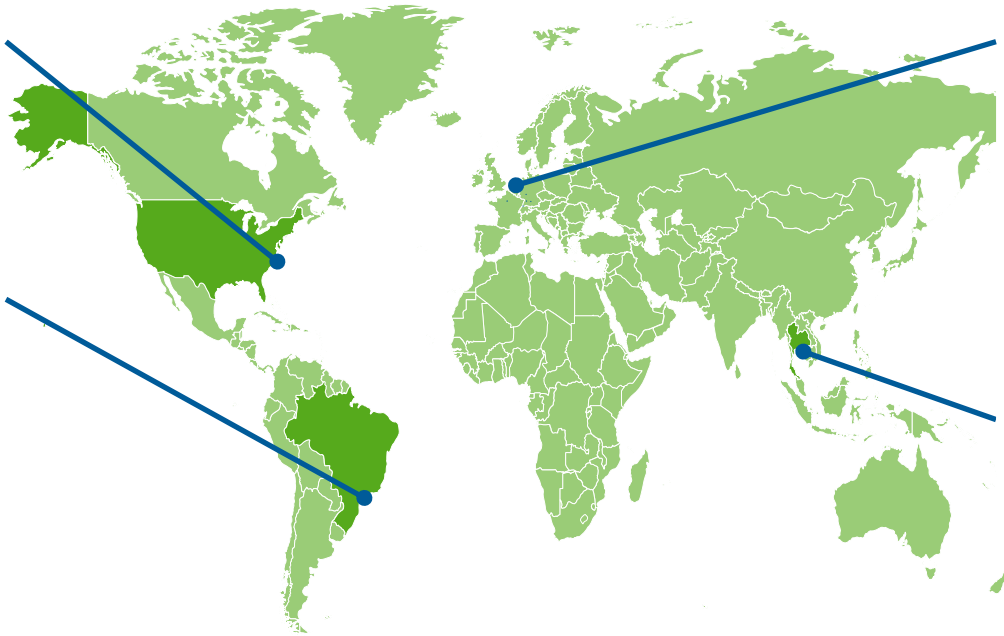
Production configuration

Maxton
USA # 7

- Autocat collection & pre-processing

Guarulhos
Brazil # 113

- Smelting & pre-processing of Au, Ag & PGM containing materials
- Au refining
- Sampling & assaying
- Autocat collection & pre-processing



Hoboken
Belgium # 1294

- Headquarters
- R&D centre
- All metals refining
- Sampling & assaying
- Autocat collection & pre-processing

Bangkok
Thailand

- Autocat collection & pre-processing

Total headcount en of June 2010: 1469 people

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International supply base

Europe

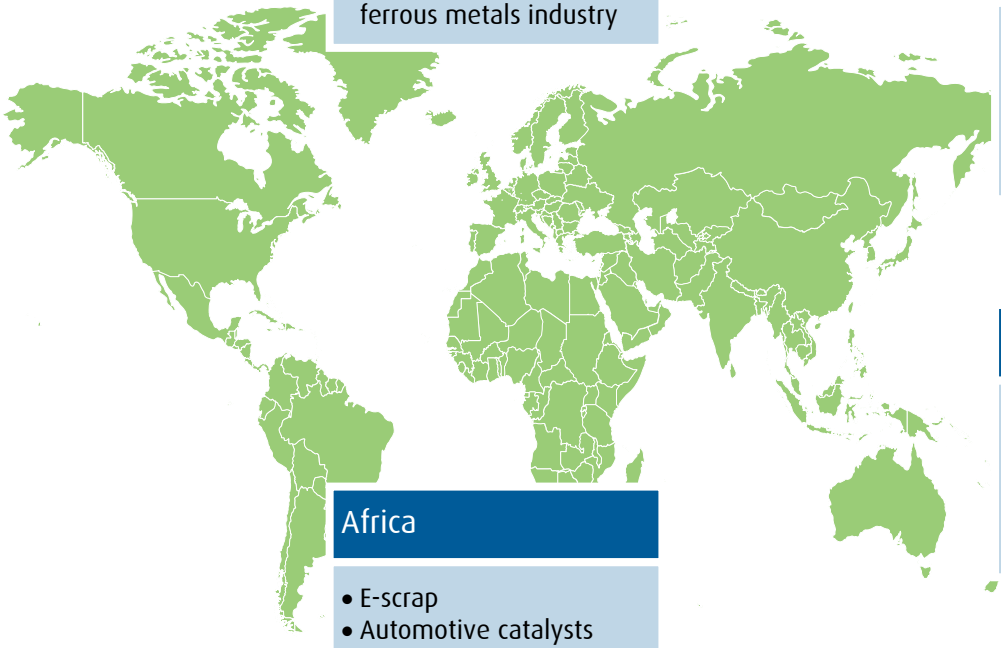
- E-scrap
- Automotive catalysts
- Industrial catalysts
- Residues from non-ferrous metals industry

North America

- E-scrap
- Automotive catalysts
- Industrial catalysts
- Residues from non-ferrous metals industry
- Residues from non-ferrous metals mining

Asia

- E-scrap
- Automotive catalysts
- Industrial catalysts
- Residues from non-ferrous metals industry



South America

- E-scrap
- Automotive catalysts
- Industrial catalysts
- Residues from non-ferrous metals industry
- Residues from non-ferrous metals mining

Oceania

- Automotive catalysts
- Residues from non-ferrous metals industry
- Residues from non-ferrous metals mining

Africa

- E-scrap
- Automotive catalysts
- Industrial catalysts
- Residues from PGM industry

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Supply market

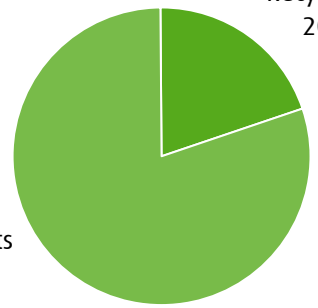
Umicore is supplied from a wide range of sources of two main categories

- Secondaries:
  Waste/residues from industry/refining/mining
- End-of-life materials

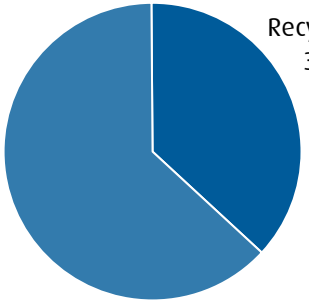
Environmental aspects

- The more complex the raw material, the more environmental “hazards" involved
- Some competitors have trouble operating seen the environmental impact and the strengthening of the legislation worldwide
- Customers are looking for transparent supply streams

Breakdown by volume



Breakdown by revenues



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Residues from the non-ferrous metals industry

Umicore focuses on complex residues containing different metallic substances

- Residues from non-ferrous metal smelters and refiners mainly containing lead, nickel, copper, zinc and precious metals
- Certain complex primary materials which are difficult to treat by conventional smelters and refiners

Often in partnership to create win-win situation

- Residue treatment is optimized using Umicore's technical expertise and tailor-made treatment
- Umicore provides economies of scale and flexible processing capacity
- Umicore's dedicated business model supports development of partnerships
- Partnerships are built on Umicore values: commitment, openness, innovation, team work and respect, thus takes time to develop.

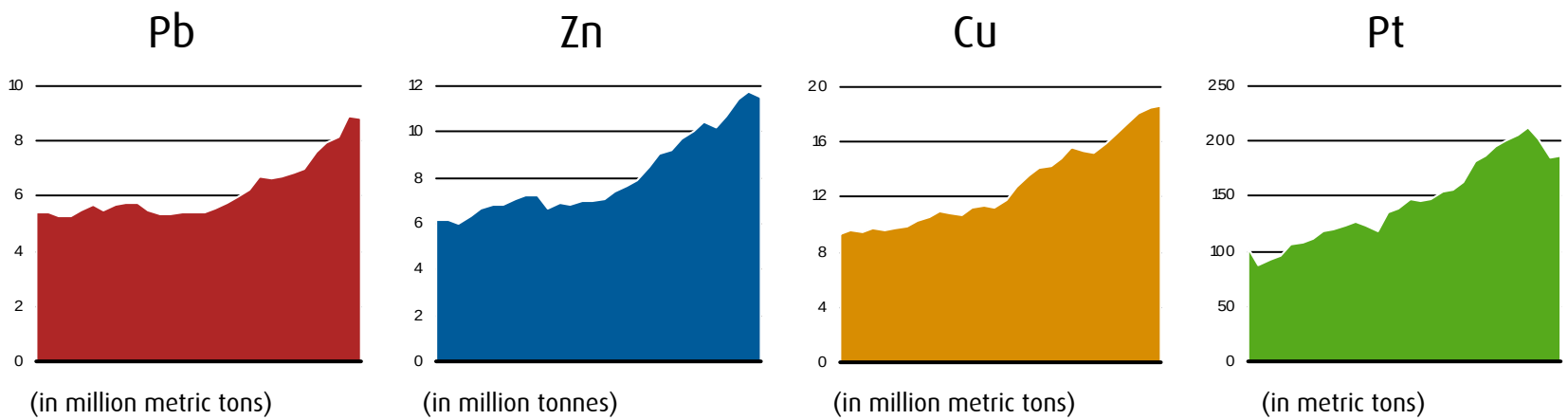
Global supply base directly with non-ferrous metal industrial players

Residues from the non-ferrous metals industry

Non-ferrous metal residues supply driven by

- Growing demand and production of primary refining for base metals, precious metals and specialty metals
- Increasing complexity of feed, leading to more complex residues to treat

Evolution of global production level 1980-2009



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Electronic Scrap

Umicore focuses on complex, high-end scrap, containing multiple metals/elements

- Mobile phones
- Printed circuit boards
- Shredded e-scrap fractions

Supply through professional collector organisations

- Collection of electrical equipment
- Dismantling (and pre-processing) the material
- Supplying the high-end fractions to Umicore

Main competitors are copper smelters that have adapted their flowsheet to be able to handle e-scrap to fill up their capacity. Their focus remains on simple, high copper fractions

Electronic Scrap

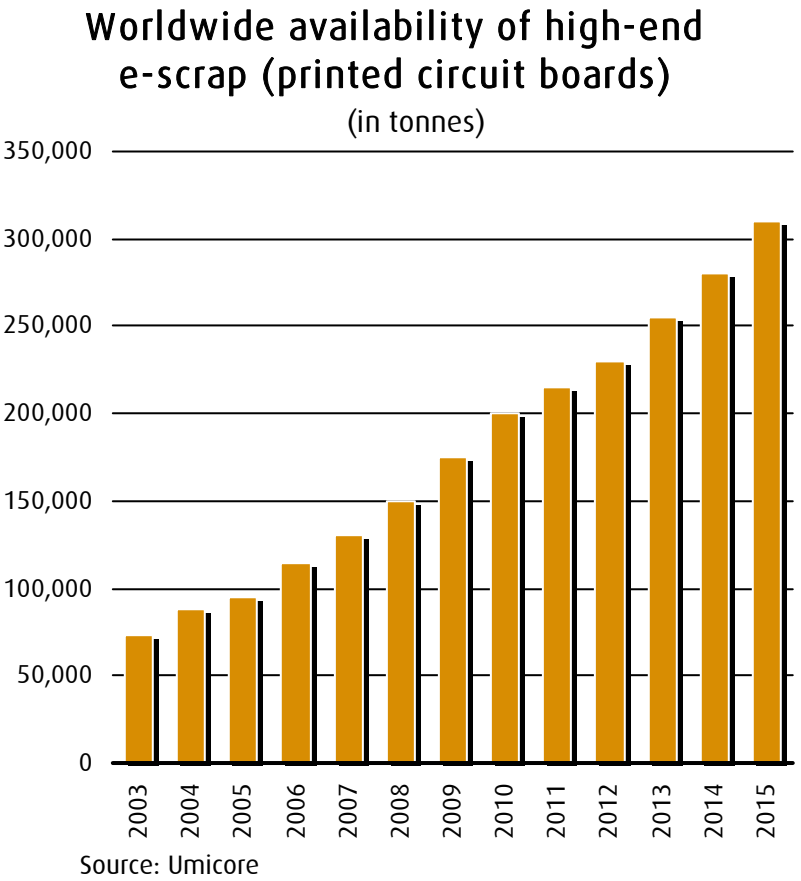
E-scrap supply driven by

- Growing use of electronic products
- Increasing complexity of electronic products
- Legislation

E-scrap recycling situation in EU today

- ± 40% of total e-waste is recycled
- < 10% of mobile phones are recycled
- Non recycled part is either dumped, not collected or exported as "re-use"

⇒ Hardly any recycling or "backyard" recycling



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Spent automotive catalysts

Spent automotive catalysts primarily contain platinum, palladium and rhodium

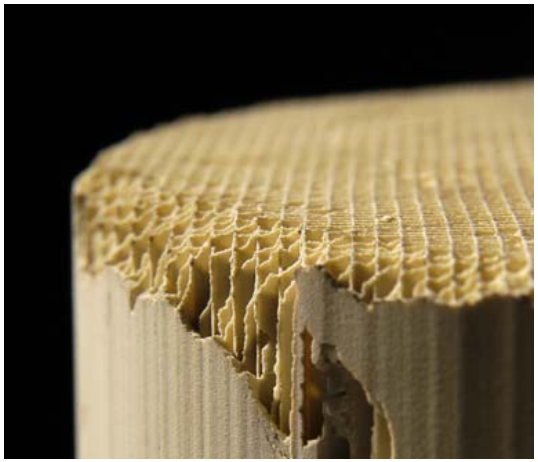
Supply comes from collectors and through own collection network

- It is the only supply stream where Umicore is partially vertically integrated for the whole recycling process:

  Collecting → Pre-processing → Concentration → Refining

Most of the competition covers only part of the flowsheet

- A1 (US): Collection - Pre-processing
- Multimetco (US), Nippon PGM (Japan): Collection – Pre-processing - Concentration
- Inco (Ca), Impala (SA): Concentration - Refining
- Johnson Matthey (UK), Heraeus (De), Tanaka (Ja): Refining

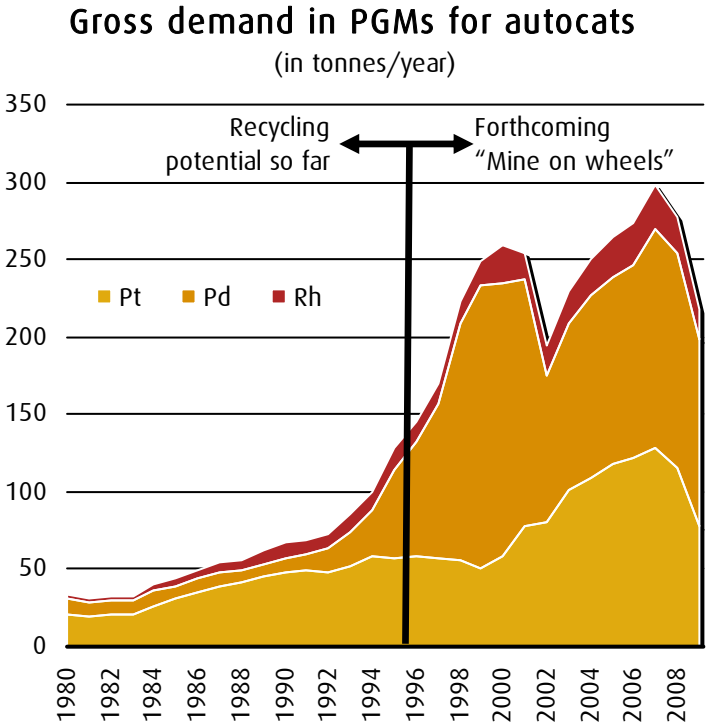


Spent automotive catalysts

Autocat supply driven by

- Growing automotive production
- Larger and more complex engines
- Tightening legislation increases metal loading per car

Only some 50% of spent car catalysts are recycled today, with significant regional variances



Source: Based on Johnson Matthey data

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Spent industrial catalysts

Spent industrial catalysts can contain different metals; Umicore targets the ones containing platinum, palladium and rhodium

Current recycling rate above 90%

- Industrial loops are very efficiently organized
- Close cooperation between catalyst manufacturers, catalyst users and spent catalyst reclaimers.

Umicore's original sampling capabilities are unique in the market, assuring accurate and reliable assaying of metal contents

Different competitors in the different sub-segments of this market, such as Johnson-Matthey (UK), Heraeus (De), Sabin (US), local Chinese refiners, ...

Overview competitive landscape

Supply market	Competi-tive landscape	Base metal refiners				Manufacturers with PM/PGM refinery	Specialised recycling companies	Umicore
		Pb	Cu	Ni + PGM	Complex			
Residues from non ferrous metals industry	ex Pb							
	ex Zn							
	ex Cu							
	ex PGM							
	Various							
	Mining							
End-of-life materials	E-scrap							
	Ind. cats							
	Autocats							
	Various							
	Examples of competitors	Stolberg, Penoles,Xstrata Zn, Glencore, Korea Zn Teck Cominco	LS Nikko, Xstrata Cu, MC, Brixlegg	Anglo Platinum, Stillwater, Vale Inco, Xstrata Ni, Amplats, Lonmin, Norilsk	Aurubis, Dowa, Boliden	Johnson Matthey, BASF, Heraeus, Chimet, Saxonia, Tanaka-Nippon PGM	Techemet, Multimetco, Sabin, JBR, Gemini	

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Metals market

Umicore's metal portfolio well aligned with "critical" technology metals

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La-Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
K	Ca	Ac-Lr	Rf	Db	Sg	Bh	Hs	Mt									

Technology metals	EU critical materials (RMI)	Metals recovered by Umicore	Precious metals / Specialty metals / Base metals / Metals recovered in other BUs

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Precious metals

	Ag	Au	Pt	Pd	Rh	Ir	Ru	
Capacity	2,400	100	25	25	5			tonnes / year
Output	1,200	25	20	20	4			tonnes / year

Flexible capacity for precious metals allows flexibility in the feed composition and volume

Production volumes are determined by the supply of materials, not by demand from the metal markets

End-of-life materials, particularly catalysts, are an important source of PGMs

Recovered metal is used primarily in Umicore's product businesses

Specialty metals

Capacity	3,000	1,000	400	50	600	150	tonnes / year

The main source of these metals are the residues of the non-ferrous industry.

Specialty metals are key metals in the production of photovoltaic cells, electronics (such as LCD displays), and metallurgical applications (processes & alloys).

Primary supply is constrained, which can lead to high prices when demand increases.

Indium is used by the Thin Film Products business unit to make ITO targets, other metals are mainly sold to external customers

Base metals

Capacity	125,000	30,000	2,000	tonnes / year

Base metals are important as they form the core of the technology for recovery of precious and specialty metals

Base metals can, however, be considered as a by-products:
Although high in volumes, they are less important for direct value creation

Produced metal mainly sold on the market

- A large part of the Umicore lead is sold to the battery industry
- Umicore sells its copper in the form of copper cathodes
- Nickel is further transformed in chemical compounds in the Cobalt & Specialty Materials business unit

By-products

Capacity	100,000	140,000	tonnes / year

Umicore's valorises its waste products through the production of by-products

Sulphuric acid (H_2SO_4)

- Sold in the region
- Share of voluntary production has decreased in past decade,
  as result of involuntary production increase (e.g. as by-product from Hoboken plant)

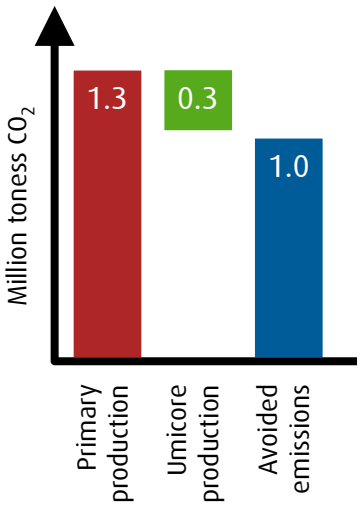
Slags are used in the concrete industry (certified product)

Environmental & ethical aspects

Eco efficiency
"Doing more with less"

Focus on efficient recovery of metals that have a high environmental footprint in primary production

- High metal recovery yields in the process
- The production of metals from by-products and recyclables at Umicore avoided emissions of 80% of primary footprint.



Precious Metals Refining operates best in class environmental facility (ISO 14001, ...)

Highly efficient on-site resource management

- Organic compounds in feed materials partially replace fossil fuel and reducing agents
- Waste heat management system to use heat produced in smelters in other parts of the plant
- Extensive water and gas emission management (& recycling) limits river water use

Minimising metal emissions to air and water is a win/win situation as metals not lost to the environment are found back in the output

Umicore's role in business ethics

Recycling (sourcing from the urban mine) can provide materials from a resource with better known origin, mitigating the issues around conflict minerals, provided that the recycling chain is transparent.

Umicore actively participates and supports initiatives for more transparency and 'sustainability' in the recycling chain, among others

- Audits from OEMs
- Dialogue with OEMs, policy makers and other stakeholders
- Contribution of expertise to projects in developing countries relating to e-waste recycling

Umicore green procurement and business partner screening

- Practical implementation of Umicore's commitment to promote honest and ethical business conduct.
- to avoid hidden risks such as treatment of materials of doubtful origin, conflict of interest, money laundering schemes, or waste treatment in breach of legislation etc.

Active member in security committees of industry associations

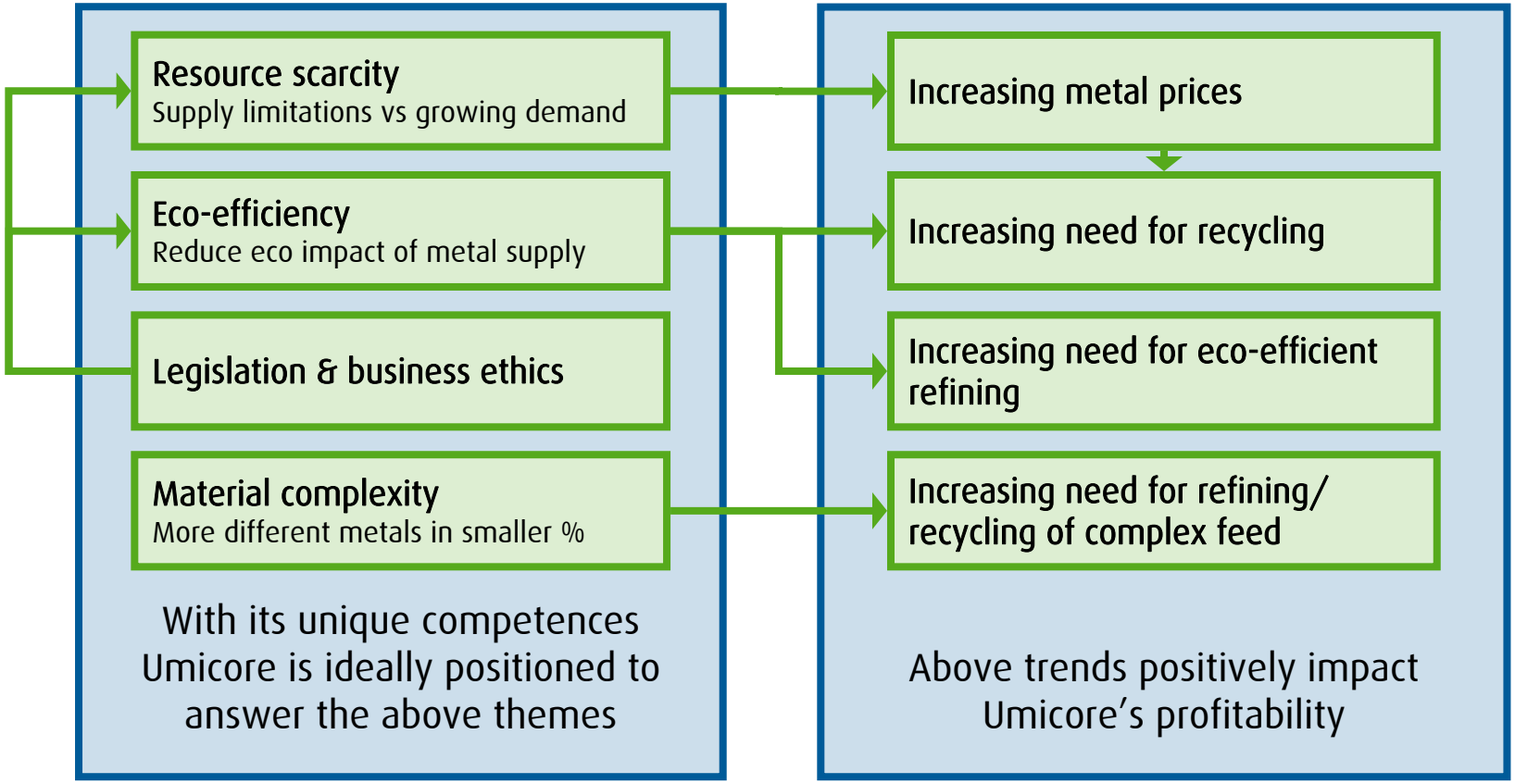
Stakeholder cooperation

Umicore proactively impacts the market via participation in different organisations

- **Industry associations**
  - IPA
  - IPMI
  - Minor Metals Trade Association
  - European Electronics Recyclers Association
  - Eurometaux
  - EPIA
  - …
- **Workgroups and initiatives**
  - StEP initiative (Solving the e-waste partners)
  - Partnership on Computing Equipment (PACE)
  - Mobile Phone Partnership Initiative (MPPI)
  - World Business Council for Sustainable Development
- **EU & government workgroups**
  - Member of Raw Materials Initiative (RMI) expert group
  - Expert in working groups of the OECD-UNEP Resource Panel.
- **Projects with research institutes and other companies/stakeholders in the life cycle**
  - Study on fate of precious metals in pre-processing of e-scrap with TU Berlin & pre-processor
  - Study on informal e-scrap processing sector in India with EMPA
  - Project on closed life cycle of LCD/LED TV with Philips, Van Gansewinkel and KU Leuven, VITO
  - Study on e-waste recycling practices in Africa by Oko Institute & EMPA

Conclusion

Business drivers and impact on Umicore



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Forward-looking statements

This presentation contains forward-looking information that involves risks and uncertainties, including statements about Umicore's plans, objectives, expectations and intentions.

Readers are cautioned that forward-looking statements include known and unknown risks and are subject to significant business, economic and competitive uncertainties and contingencies, many of which are beyond the control of Umicore.

Should one or more of these risks, uncertainties or contingencies materialize, or should any underlying assumptions prove incorrect, actual results could vary materially from those anticipated, expected, estimated or projected.

As a result, neither Umicore nor any other person assumes any responsibility for the accuracy of these forward-looking statements.

Koen Demesmaeker
Senior Vice President Precious Metals Refining

Koen Demesmaeker was appointed Senior VicePresident Precious Metals Refining in October 2010. He holds a masters degree in commercial sciences from the Lessius University College in Antwerp and joined Umicore in 1981. He has held several positions in sales and raw materials supply, and was the Commercial Director of Precious Metals Refining since 2003. In this capacity, Koen has led the outstanding development of the supply base of the business unit.