



Towards an EU Battery Industry: How can recycling contribute to Europe's ambitions?

Session: 1.14b) Battery recycling: challenges and opportunities

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Umicore

A global materials technology and recycling group



One of three global leaders in emission control catalysts for light-duty and heavy-duty vehicles and for all fuel types



A leading supplier of key materials for rechargeable batteries used in electrified transportation and portable electronics



The world's leading recycler of complex waste streams containing precious and other valuable metals



The EU Battery Alliance, 12/02/2018

Vice-President for Energy Union Maroš Šefčovič at the Industry Days Forum:

“Our objective for the Alliance is simple, but the challenge is immense. We want, almost from scratch, to create a competitive and sustainable, battery cell manufacturing in Europe supported by a full EU-based value chain.”



"No single actor can build Europe's battery market alone. But if we act together across Europe, we can capture an emerging battery market of €250 billion per year!"

The European Battery Alliance provides an umbrella for prospective partnerships throughout Europe's battery value chain."

#EUBatteryAlliance

Maroš Šefčovič
Vice President, in charge of the #EnergyUnion



xEV: the 10 000X change factor



cathode material: 15 grams



150 kilograms

Even if expected lifetime is 10 x longer, and only 1 on 10 mobile phone users would drive an EV, we'll need 100 x more battery materials!



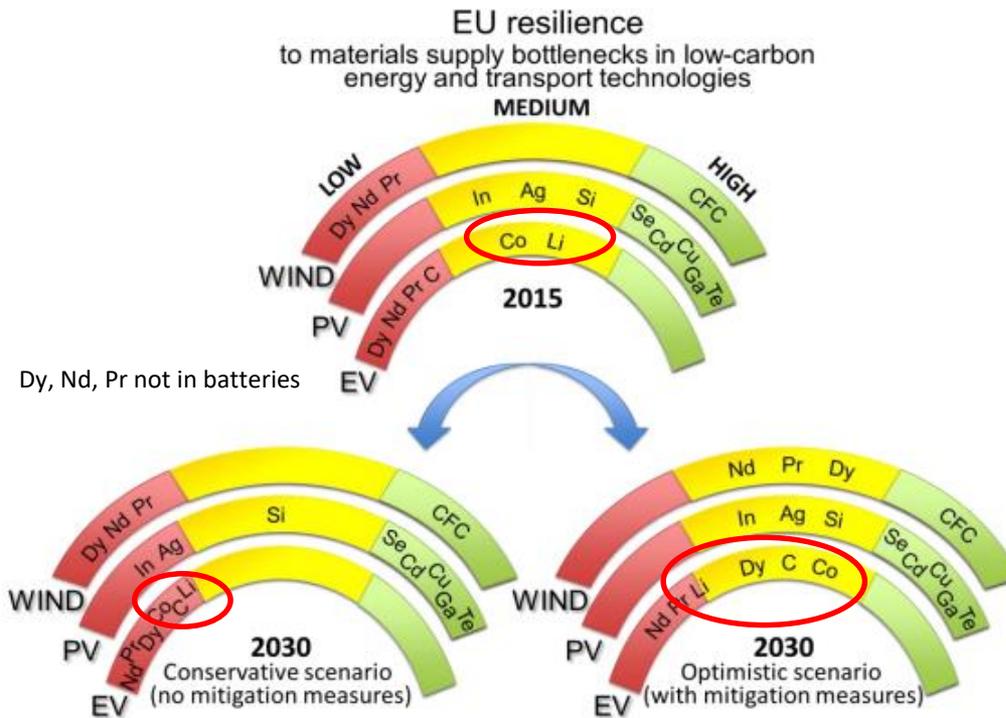
Will there be enough raw materials?

An analysis made by the **Joint Research Centre (JRC)** shows a medium resilience for Co and Li and a poor resilience for C (other low resilience elements are from the magnets, not the batteries)

However, if no mitigation measures will be taken, resilience towards Co and Li will be poor by 2030.

In an optimistic scenario (adequate mitigation measures) EU resilience towards Co and Li stays medium. Mitigation measures include recycling

→ Focus on recycling of Li and Co
(Graphite C can be synthesized)



Source: http://publications.jrc.ec.europa.eu/repository/bitstream/JRC103778/materials%20supply%20bottleneck_online%20version.pdf

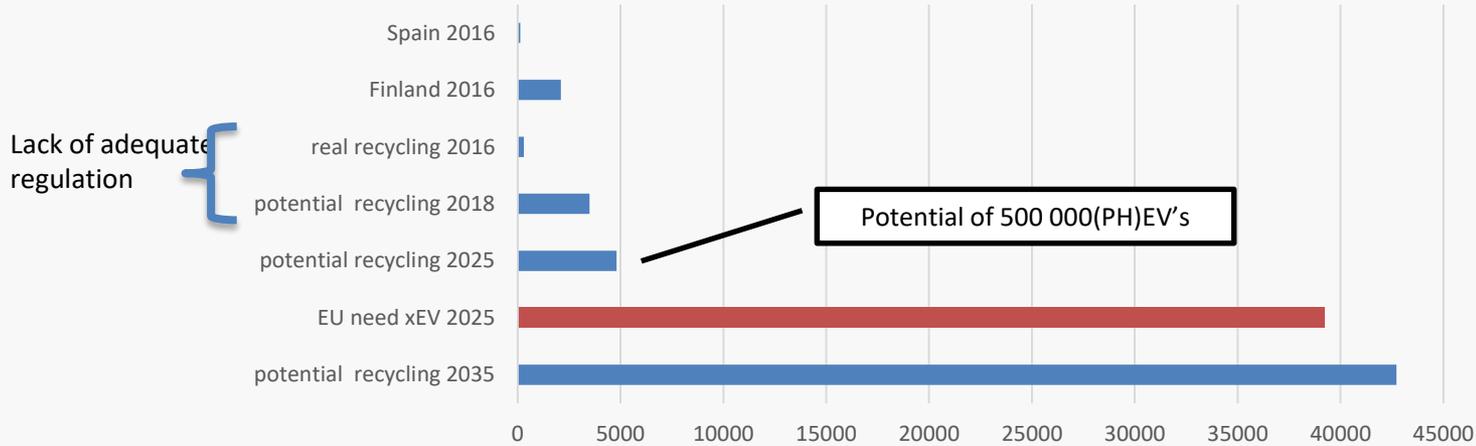
Recycling: the good news



Closed loop recycling of Co, Li, Ni, Cu is technically feasible and environmentally sound

Can recycling contribute to an EU supply chain?

EU Co production and needs, in ton



Lack of adequate regulation

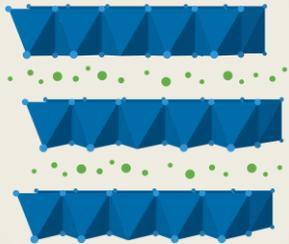
Massive Co recycling from xEV's will start only > 2030, but already today, recycling **portable** rechargeable batteries **could** contribute significantly to Co supply

Sources: primary production: DERA; recycling: Umicore estimates; future needs: McKinsey



Cathode material optimization

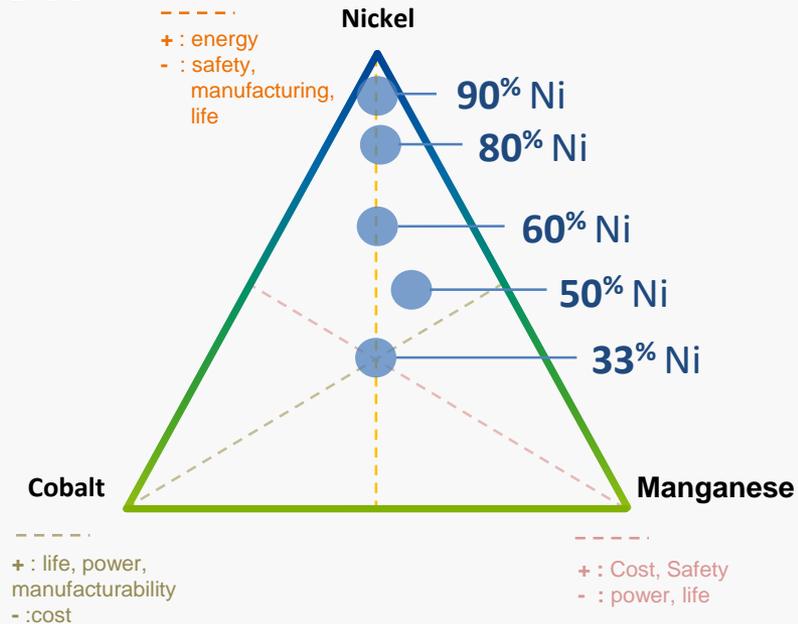
- One big family of products



LCO, all grades of NMC, NCA: all layered materials sharing:

- crystal structure
- base manufacturing concepts

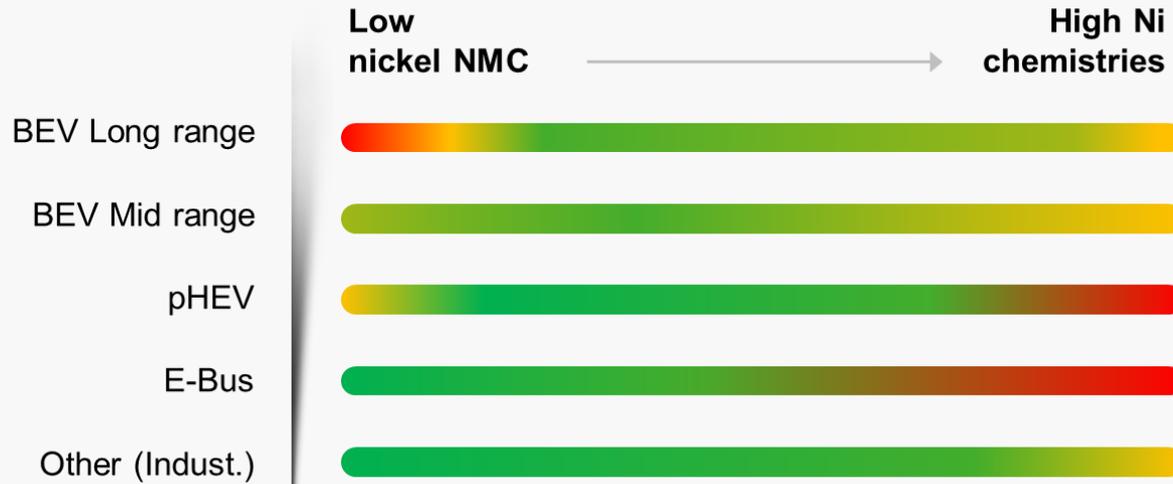
Exact properties depend, among others, on relative ratio metals in metal site



Umicore has the full spectrum of materials in portfolio

Do we need Co?

- Substitution is often considered as way to avoid issues with some materials. However: Co has unique properties that makes Co-containing cathode materials superior in terms of performance and durability → more sustainable batteries

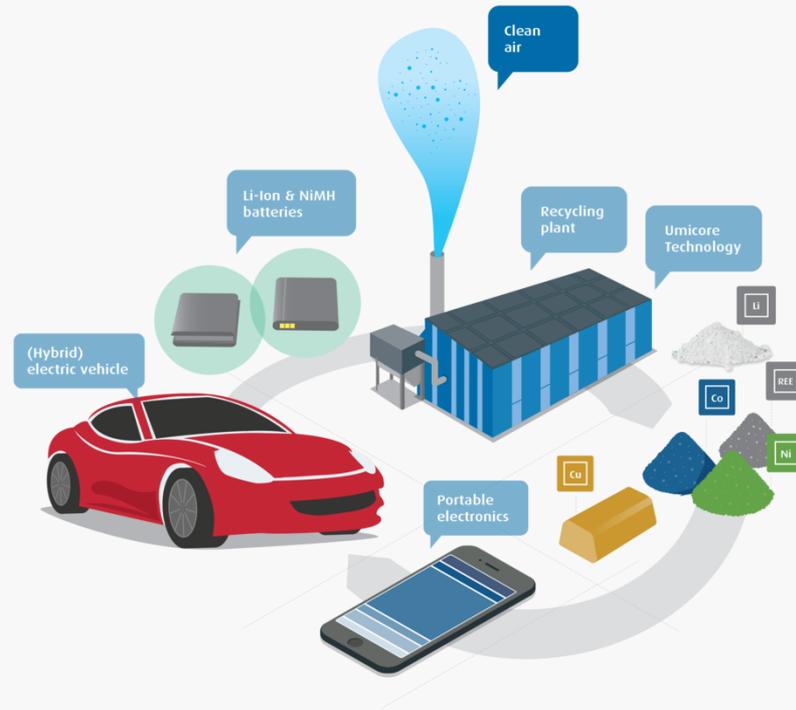
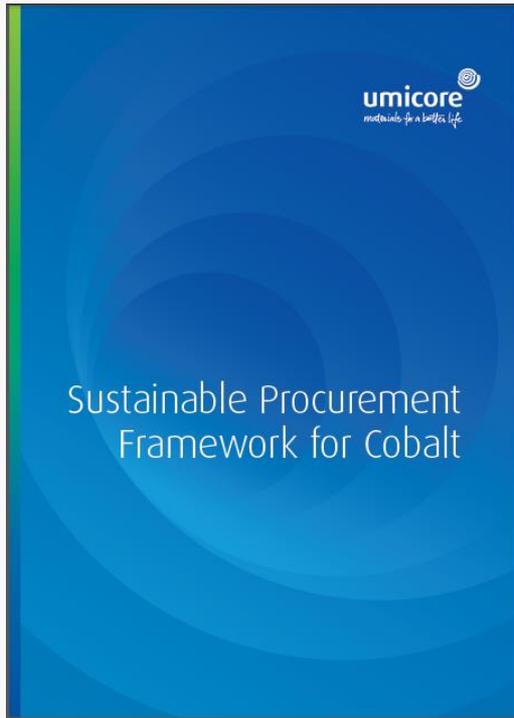


Wide spectrum of cathode materials is and will be needed

With excellent product quality on 20+ specs

Do we need Co?

- It is easier to tackle the Co-related issues with proper precaution measures, than to substitute Co completely



What is recycling?

Collection

Preparation

Processing

Portable batteries



EV batteries



Main issues related to recycling

Collection

Preparation

Processing

Portable batteries

- < 10% of portable rechargeable batteries (PRB's) are collected
➔ *Need for specific collection target PRB's*
- Leakage: (il)legal export

- Removal of batteries from WEEE is not always done
➔ *Better design, better law enforcement*

- Several processes exist but run on low volumes
➔ *Better collection and separation from WEEE*

EV batteries

- Reverse logistics is expensive
➔ *Distinction to be made between 'retired' and 'damaged' batteries*

- Dismantling is labour intensive
➔ *Need for 'design for disassembly' and automation*

- Health and safety risks
➔ *Compulsory EHS-standards*
- Regulatory focus on 'kg'-recycling
➔ *Focus on metals that matter: Co, Li, Ni, Cu*



Leakage of batteries outside EU

- 2nd hand use outside EU is justified, illegal export of waste isn't
 - What about Extended Producer Responsibility after 2nd hand use?
 - EU waste treatment outside EU should be done under 'equivalent conditions' as in EU
- ➔ Avoid creating an environmental time bomb



Conclusions

- Already today, recycling **could** contribute significantly to the supply of essential raw materials. However, some regulatory measures to be taken:
 - Target for collection of PRB's
 - Focus on metals that matter
 - Regulation on 2nd use and recycling outside EU
- Metallurgical and chemical recycling processes exist and are being rolled out, but scaling up suffers from small volumes.
- Research focus on 'design for recycling', automation of dismantling



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