

(H)EV battery recycling: a commitment for Umicore





Umicore is committed to become the worlds nr 1 recycler of (H)EV batteries by providing the following solutions to the customers:

- a safe and full service from battery collection to recycling, all complying with the strictest regulations
- •a unique recycling process with a maximum valorisation of valuable metals (Ni, Co, Li,...), minimum energy use, CO₂ and waste generation. "Best Available Technology"
- providing the customers with all relevant information needed (authorities, LCA,...)
- the best price/quality ratio
- a long term business relation
- •our ambition is world wide with a roll out in Europe, Asia and North America.

A full demo plant with a capacity of 7000 tons of batteries (equivalent to 150,000 cars), an investment of € 25 Mio, will be operational in Hoboken (Belgium) by H1 2011.



Why do people recycle? High cost, dedicated process VALU H) Low cost: mainstream process and/or export to Africa, India, LAW China and/or landfill OLUME

3

Recycling Drivers for Li-ion batteries



1. Value and Scarcity of the Metal

- Li-ion batteries contain Co, Ni, Li
- 2. Cost of Recycling (main stream versus dedicated processes)
 - Li-ion batteries require a dedicated process due to their complexity
- **3.** Legislation driven by ECO arguments: carbon footprint, toxicity, scarcity,...
 - Li-ion battery recycling is supported by : Battery directive, End of Life of Vehicles Directive, European Raw Materials Initiative and Waste Electrical and Electronic Equipment Directive

4. Volume of Waste

Multi-million battery cars will need some kind of recycling process. In this context landfill is not a sustainable solution





Umicore skills relevant to HEV battery recycling

Closed loop services is Umicore's business model.

Deep understanding of battery chemistry and fully compliant with all EHS and legal aspects.

 \geq More than a century industrially active in metals refining and recycling.

Managing metal value risk (hedging).

Extensive experience in national and international legislation regarding transport, storage, handling, customs,... with a full transport department available for advice, support and execution.

 \succ Finding an output for slag in construction.

> Supplier of materials to and recycler for the automotive industry.

>International network.

>Excellent reputation with customers and authorities as a reliable partner dealing with metals containing waste.



Why HEV/EV Battery Recycling in a B2B relation?

Push by legislation forces to transparent processes and certification

 \succ Value and increasing scarcity of the materials

Safety aspects and materials value of the battery is reason to keep it out of the traditional collection and recycling "grey" circuits

Cost reduction by avoiding intermediates and economy of scale

>World wide approach is possible: same high standard everywhere

materials for a better life



Reduce Metal value exposure





Ensure ethical supply chain



The best GUARANTEE of ethical supply chain:

YOUR metals stay YOURS

We return your recycled metals transformed in active cathode materials to you or to your battery manufacturer No risks of dubious sources, no blames because of unsafe or environmentally hazardous recycling

Umicore HEV Battery Recycling January 2010 8

materials for a better life



materials for a better

HEV recycling: the Umicore Approach



9



The Umicore approach applied to Battery Materials





Umicore drop-off points





materials for a better life



Umicore drop-off points

Europe:

- Belgium
- Germany
- Sweden

Middle-East:

Israel

Africa:

- Tunisia
- Kenya
- South Africa

N-America:

- Canada
- US (East Coast)

Asia:

- Thailand
- P.R.C.
- Singapore
- Taiwan
- Japan
- Korea
- Malaysia

South America:

Brazil

Oceania:

Australia

- Additional drop-off points can be defined according to market needs
- Umicore is ready to collect batteries at Customer defined collection points

materials for a better

Umicore HEV Battery Recycling January 2010 12



Safety – Environment – Health first!

Energy content



Transport

inside

Chemicals

- Supplier: knowledge of battery composition, safety precautions
- Umicore: knowledge transport rules
- Safe procedure to be developed for larger quantities

Dismantling

- Supplier: to supply relevant information (BOM, MSDS, safety instructions)
- Umicore: to design safe process with zero risk



The Role of Umicore

- Takes ownership at drop off point or after collection
- Advice on Packaging and transportation according to legislation
- Temporary storage at drop off point, consolidation of volumes and transport to recycling plant
- Treatment and recycling according to agreed procedures
- Certification of auditable processes towards authorities
- Metal value hedging (when applicable)



The Role of the Customer

- Identification of collecting points or delivery of batteries at drop off point
- Packaging and transportation to drop off point according to legislation
- Packing list specifying the battery-types
- Provides technical information:
 - BOM
 - MSDS
 - Safety instructions (discharging; dismantling)
 - Notification in case of material changes or a-typical situations



Partnership

Umicore

- Will design treatment process, adapted to battery design of the HEV manufacturers
- Will adapt recycling process to evolution in battery chemistry
- As a minimum, all treatment and recycling processes will meet EU, national and regional standards; higher standards to be agreed with partners
- Will invest in sufficient capacity to meet partner's minimum forecasts, also outside Europe

HEV manufacturer

- Will make minimum and 'best guess' forecasts and will respect minimum forecast
- The financial compensation for guaranteed minimum capacity will either be expressed as a lump sum or a price for a minimum volume to be processed

Both

- Will respect each other's IP (even if not protected)
- Will enter into a formal agreement in order to confirm reciprocal commitments
- One face (Umicore and Customer) to authorities
- Will work together to investigate "2nd life" opportunities for used batteries

Umicore HEV Battery Recycling January 2010 16

materials for a better life

Cost structure



