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ProSUM - Prospecting Secondary raw materials in the Urban mine and Mining wastes

5th PROMETIA Scientific Seminar, 13th December 2018
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Why ProSUM...

Verb

prōsum
(with a dative) I am useful or of use, do good, help, benefit, serve, profit.
(of medicines) I am good or beneficial.
UMKDP - What is it and why do we need it?

- Aim of the ProSUM project was to provide a state of the art knowledge base, using best available data in a harmonised and updateable format.
- The Urban Mine Platform provides in a single place, all data and information related to urban wastes – WEEE, ELV, spent batteries – and mining wastes

→ An inventory for state of the art data on secondary raw materials with a focus on CRMs
Approach

Product Characterisation
Factors and trends in composition that affect the CRM content for products and components. Protocols for assessing CRM parameters in products for EEE, vehicles and batteries.

Stocks and flows
Past sales, current stocks and future waste stocks and their flows around the EU. Protocols to identify future stocks and flows.

Waste Characterisation
The CRM content of treated wastes and mining wastes. Protocols for assessing CRM parameters in wastes.

http://www.prosumproject.eu
http://www.urbanmineplatform.eu/
ProSUM Consortium
An EU Secondary Raw Materials Inventory

- An inventory of CRMs to improve the knowledge base
  - WEEE
  - Batteries
  - ELVs
  - Mining wastes
- Interoperable
- Available data
- New data classification system
- Updating protocols
A big step forward...

- Definitions and languages
- Scope
- Classifications
- Data quality
- Meta-data

- All latest available data from >800 sources processed!

@ Automatization of consolidations
@ Uncertainty and error propagation
## Data availability/coverage

<table>
<thead>
<tr>
<th>Part of data model</th>
<th>BATT</th>
<th>ELV</th>
<th>EEE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Products placed on market (POM)</strong></td>
<td><strong>19,364</strong> records: 29% of data points are considered original. Gaps related to national data and years before 2011</td>
<td><strong>9,702</strong> reported records plus <strong>4,158</strong> computed projected records</td>
<td><strong>43,507</strong> records: 33% of data points are considered original. Plus external sources</td>
</tr>
<tr>
<td><strong>Product Average Weight</strong></td>
<td><strong>819</strong> records based on market statistics and samplings</td>
<td><strong>26,460</strong> actual records (stock information) and 11340 computed records</td>
<td><strong>2,750</strong> records: compared with product register data based on millions of data points</td>
</tr>
<tr>
<td><strong>Lifespan information</strong></td>
<td><strong>1,248</strong> records, 51% based on age determination of collected waste batteries</td>
<td><strong>26,460</strong> actual records (stock information) and 11340 computed records</td>
<td><strong>108</strong> records: based on extensive multi-variate stock and flow modelling</td>
</tr>
</tbody>
</table>
| **Compositions**          | **272** records  
Data for 17 electrochemical systems (subkeys), not differentiating time and regions | **1,764** records  
Data for 28 elements over 63 vehicle keys | Cat I, C&F: **4,680** records  
Cat II, Screens: **5,460** records  
Cat III Lamps: **3,016** records  
Cat IV LHA: **10,868** records  
Cat V SHA: **14,820** records  
Cat VI **4,662** records |
| **Stock/ Waste Generation** | **2x 26,000** computed records, plus measured data for some countries and years on stocks of batteries in pieces per household | **23,000** of which 11000 are computed | **2x 54 M** records: computed |
| **Waste collected and reported** | **1,356** records in tonnes per country, year and battery family (key) | **450** records (28+2 countries and 15 years) | **1,080** records (2010-2015, 6 collection categories, 30 countries) |
| **‘Other’ whereabouts Scavenging** | Some data on percentage of batteries in residual household waste (%), no data on other whereabouts | **600** records (28+2 countries and 20 years) | **6,630** records: Based on 665 original data points/sampling |
http://www.urbanmineplatform.eu/homepage

This platform displays all readily available data on products put on the market, stocks, composition and waste flows for electrical and electronic equipment (EEE), vehicles and batteries for all EU 28 Member States plus Switzerland and Norway. Iceland is also included for vehicles.

The user can select and produce charts and download data as CSV files. It is also possible to access the extensive library of more than 800 source documents and databases used to populate this platform. You can also see the metadata allowing you to review the key underlying information and to understand the data quality.

The data includes those elements and materials found to be of high abundance in those waste products. This includes mainly base metals, precious metals and those also listed as Critical Raw Materials. Some data on glass and plastics is also recorded and provided, although this was not a focus of the project.

The data for batteries, EEE and vehicles is presented under three broad headings:
The Case of Batteries....
The EU Urban Mine Knowledge Data Platform

Urban Mine Platform - Weight of battery cells

Weight of battery cells - In Stock in EU28 + Norway and Switzerland

- Primary lithium-based batteries
- Rechargeable lithium-based batteries
- Nickel-cadmium batteries
- Nickel-metal hybrid batteries
- Lead-acid-based batteries
- Zinc-based batteries

2012
- Primary lithium-based batteries: 14,000 t
- Rechargeable lithium-based batteries: 180,000 t
- Nickel-cadmium batteries: 72,000 t
- Nickel-metal hybrid batteries: 52,000 t
- Lead-acid-based batteries: 1.2 million t
- Zinc-based batteries: 460,000 t
The EU Urban Mine Knowledge Data Platform
The EU Urban Mine Knowledge Data Platform

Urban Mine Platform

Percentage of collected batteries from waste generated in 2015 for Lead acid based batteries

Year: 2015
Type: Lead acid based batteries

Percentage of waste generated

Country: AUT, BEL, BGR, HRV, CYP, CZE, DNK, EST, FIN, FRA, DEU, GRC, HUN, IRL, ITA, LVA, LIT, LUX, MLT, NLD, NOR, POL, PRT, ROU, SVK, SVN, ESP, SWE, CHE, GBR
Battery Stocks und Flow Model
Cobalt Stock and Flows in Li-ion Batteries

Source: P. Chancerel, C. Chanson, P. Binnemans, J. Emmerich, P. Mählitz et al., 2017
Challenges for batteries

• Periodic update of the data is challenging due to the complex data sourcing
• All records have an uncertainty (5-50%) which should never be forgotten!
• Data need to be harmonised and improved, e.g.:
  • Industrial batteries
  • Complementary flows
  • Lifespan distribution (better consideration of hoarding, time and geographical area)
  • Changes over time of composition and average weights
• Go beyond collection and provide data on recycling/recyclability of the CRM contained in the waste batteries?
ProSUM “I am useful” – next steps

• Efforts are still needed regarding:
  • The definition and harmonisation work
  • A more structured view can be gained e.g. on the potential for improved recovery of CRMs (and on where this is not!)
  • Improved understanding of ‘leakages’ in the system and possible interventions
• Need to ensure that the urban mine platform is kept up to date on the long term and upscaled
• Activate the links to other platforms
Who benefits from an Urban Mine Knowledge base?

<table>
<thead>
<tr>
<th>Industry</th>
<th>Policy-makers</th>
</tr>
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</table>
| • Users of CRMs and raw materials  
• Recyclers, pre-processors, materials producers  
• Smelters  
• Manufacturers of batteries, electrical and electronic equipment and vehicles  
• New markets entrants (start-ups)  
• Producer compliance schemes  
• Concentrators (mines) | • Member States: Ministries for Economic Affairs (CRM supply), Environment Affairs, Foreign Affairs, Defense, Statistics, Research  
• European Commission: European Innovation Partnership on Raw materials, DG Grow, DG Environment  
• Eurostat, Member States statistics agencies |

Researchers  
• DG Joint Research Centre of the European Commission  
• Research Institutes  
• Universities  
• Competence Centres  
• Consultants  
• LCA software providers
Conclusions and key messages

➢ Informed decisions for policy making must be based on solid data!

➢ In order to work towards circular material loops from secondary sources in the future we need better data, e.g. on unknown whereabouts:
  • Updates on battery lifespan (e.g. considering re-use)
  • Improved data collection methods (e.g. compliance schemes)
  • Current level of scavanging, cherry picking and export channels?
  • Future resource flow scenarios?

If we do not know the whereabouts of material flows from secondary sources
if we do not know the magnitude of EU Urban Mine,
if we do not know what is coming and where to make efforts –
we cannot move on to circular material flows!
Thank you!