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Materials Science and Technology

Developing material recovery projects: Lessons learned from processing municipal solid waste incineration residues





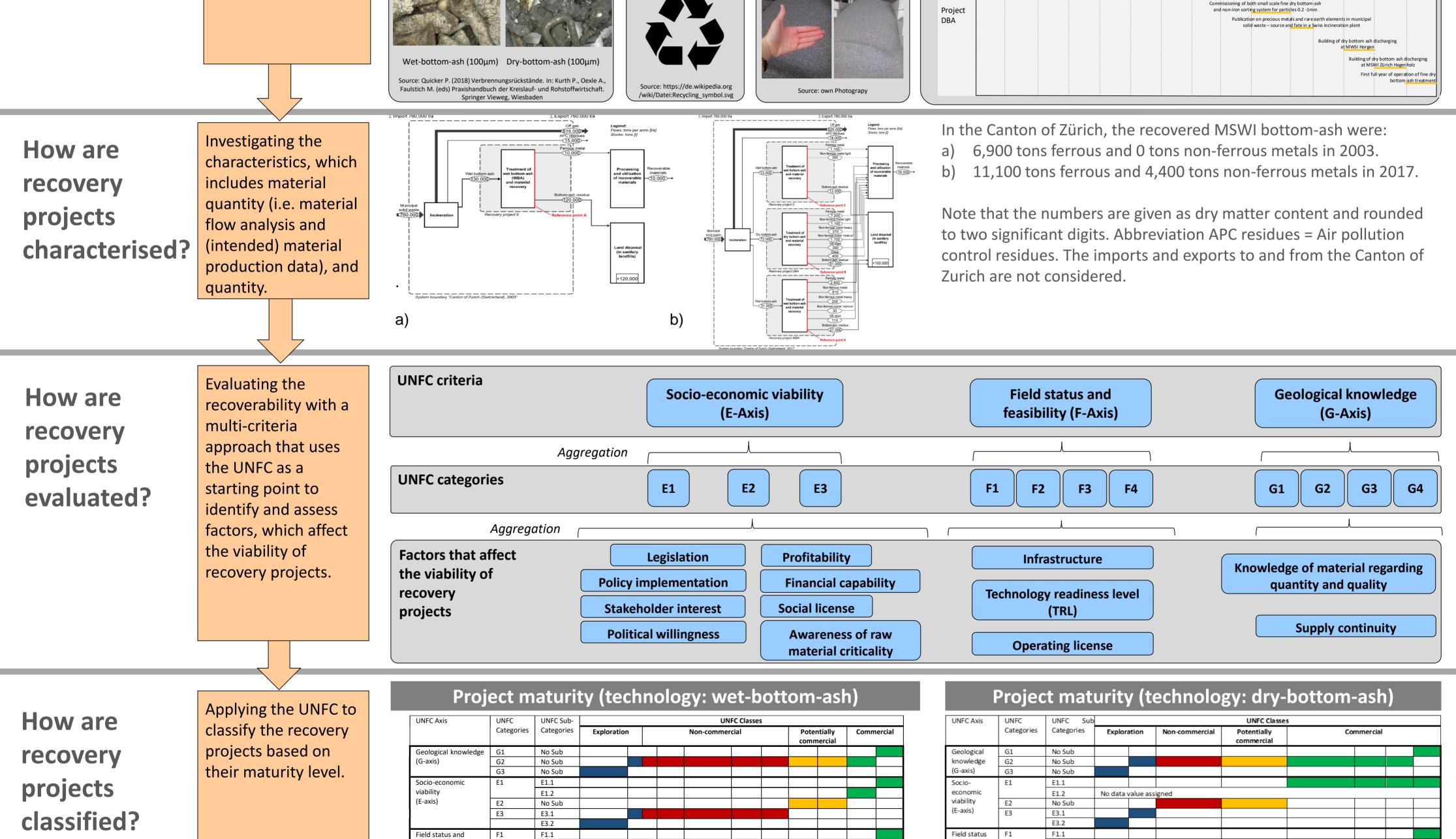
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The production of secondary raw materials requires material recovery projects. The development of material recovery projects is a complex task. Researchers, industry stakeholders, legislators and policy makers join forces to identify recovery potential as well as implement recovery projects in reality. This poster shows the development of real recovery projects from the early stage of exploration to the final stage of production. The retrospective view from 2003 to 2017 identifies challenges and enablers to recover materials from municipal solid waste incineration (MSWI) bottom-ash in the Canton of Zürich. We focus on recovery of wet and dry bottom ash and use the United Nations Framework Classification for Resources (UNFC) to communicate the different phases of recovery project development including the phases exploration, non-commercial, potentially commercial and commercial. The findings of this research disclose the complex interactions during recovery project development. We conclude with lessons learned for the development of future recovery projects beyond the Canton of Zurich and provide suggestions for applying the UNFC in the future.

Questions	Methods	Results									
	Defining the scope of the recovery project,	Spatial scope	Temporal scope	Project milestones 2003 2004 2005 2006 2007 2008 2009 2011 2012 2013 2014 2015 2016 2017							
How are	which includes: project cornerstones,		2003 2017 Time	Projects Monitoring at incineration plant Thurgau, resource potential in fine bottom ash recognised Publication of two cantonal urban mining action plants of Kt. Zurich, not initiating of cooperation for handling of 'market' waste for incineration of social transmission association) Publication of sampling, sample preparation and analysis of solid residue for othermal waste treatment samples Publication of solid residue for solid residue for othermal waste treatment samples Publication of solid residue for solid residue for othermal waste treatment samples Publication of solid residue for solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste treatment samples Publication of solid residue for othermal waste							
recovery	material flow system, and chronicling a	and the second	Exploration Production Recovery project development	Building landfill 'Hauli', Recognizing potential from wet bottom-ash treatment Recognizing potential from wet bottom-ash treatment (i.e. supersort fine)							
projects	timeline of the	Source: https://commons.wikimedia.org/wiki /File:Canton_Z%C3%BCrich_in_Switzerland.png	development	Project WBA First full year of operation of large, separation (i.e. supersort) First full year of operation of large, small and non-ferrous wet bottom ash fraction treatment (i.e. supersort) - Commissioning of large scale wet bottom ash treatment (i.e. supersort) - Commissioning of large scale wet bottom ash treatment (i.e. supersort) - Single factor in the system of the system							
defined?	project development.	Materials at the so	technologies (selection)	Source and fate in a Swiss incineration plant source and fate in a Swiss incineration plant Source and fate in a Swiss incineration plant Research and development of large scale dry bottom-ash treatment system - Building of dry bottom ash discharging at KEZO, - Demionstration of increased Zn, Cui, Pb, and Cd metals in dry bottom-ash, due to leaching metals to the water bath after furnace of the wet discharge incineration plant Establishment of foundation centre for sustainable waste and resource use [ZAR] Commissioning of dry bottom-ash treatment system Research and development of small scale fine dry bottom-ash separation system							



Socio-economic	E1	E1.1										
viability		E1.2										
(E-axis)	E2	No Sub										
	E3	E3.1										
		E3.2										
Field status and	F1	F1.1										
feasibility (F-axis)		F1.2										
	F2	F2.1										
		F2.2										
	F3	No Sub										
	F4	No Sub										
Year			2003, 2004,	2007,	2010	2011	2011,	2012	2013,	2012,	2014,	2017
			2005	2008			2012,		2014	2013,	2015,	
							2014			2014	2016	

Socio-	E1	E1.1										
economic viability (E-axis)		E1.2	No data value assigned									
	E2	No Sub										
	E3	E3.1										
		E3.2										
Field status	F1	F1.1										
and		F1.2										
feasibility	F2	F2.1	No data value assigned									
(F-axis)		F2.2										
	F3	No Sub	No data value assigned									
	F4	No Sub										
Year			2003, 2004, 2005	2009	2011, 2012, 2013	2011, 2012, 2014	2012, 2013, 2014	2013, 2014	2015	2016		

Conclusions

Lessons learned

- A) A clear driver for metal recovery projects was the continuous increase of knowledge especially regarding analytical characterization, effectiveness of recovery technology and changes in the legal environment.
- B) Central factors for material recovery were identified as (i) 'knowledge of material regarding quantity and quality', (ii) 'supply continuity', (iii) 'profitability', (iv) 'stakeholder interest', (v) 'social license', and (vi) 'operating license'.
- C) Key milestones were identified as (i) establishment of donor and technical foundation; (ii) technological development and (iii) launch of full operation.
- D) Social and environmental considerations are important for material recovery.

Reference: Mueller S. R., Kral U., Wäger P. A., – Developing material recovery projects: Lessons learned from processing municipal solid waste incineration residues, accepted at Journal of Cleaner Production, 2020.

Suggestions for applying the UNFC

- A) Standardised terminology and principles for communicating the development status of physical resource projects for markets.
- B) UNFC allows the categorization of entire quantities at the source as 'sales' and 'non-sales quantities'.

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