Rethinking circular supply chains
lessons from consequential LCA
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Context
Method
Results
Discussion and conclusion
CONTEXT
forward supply chain
closed loop supply chain
open loop supply chain
How to select by-products suppliers given the complexity of circular supply chains?

need for new selection criteria

Case: shift from conventional fuels to refuse-derived fuels for cement production
METHOD
technosphere with waste markets
waste market model

Decreasing waste supply market

Industries and municipalities

Materials recovery facility

$\rightarrow$$\rightarrow$$\rightarrow$ Cement

Plastic

Increasing waste supply market

Industries and municipalities

Materials recovery facility

$\rightarrow$$\rightarrow$$\rightarrow$ Gas

Cement

Plastic

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european marginal waste trade
our study case: one cement factory, four potential waste suppliers

Material: mixed plastics/paper
Cal. value: 15.5 MJ/kg
Moisture: 17.6%
Bio carbon: 45%

Market: decreasing
Average cal. value: 9.7 MJ/kg
Affected technology: landfill
Type: end-market

Market: increasing
Average cal. value: 11.7 MJ/kg
Affected technology: incineration with energy recovery

Avoided petroleum coke
Additional gypsum
Productivity loss (moisture)
Emissions...
RESULTS
Avoided incineration with energy recovery

Indirect truck

Productivity loss

Waste combustion

Avoided petcoke combustion

Avoided landfilling

Direct ship

Direct truck
Affected waste treatment technology
Is the by-product fully reused?
What are the competing reuse applications?
Are they demand or supply driven?
What are the alternatives for the affected application?

How does the quality of the by-product affect the productivity of the receiving process?

Reusability

Direct and indirect transport
Is the by-product traded between other markets?
What type of markets: end market, trading market, importing market?

suggested criteria for suppliers selection
we thank you for your attention!

references

Model built in OpenLCA v.1.5, developed by GreenDelta GmbH
StepWise2006 v.1.5 impacts monetization method developed by 2.0 LCA consultants, available at lca-net.com
Data on transboundary waste shipments available at ec.europa.eu/eurostat/
Primary data from European cement producer and materials recovery facility
Supplementary inventory data from EcoInvent v.3.2 (consequential)