



The latest developments in impact assessment methodologies for abiotic resource depletion

Workshop “Security of Supply and Scarcity of Raw Materials: a Methodological Framework for Supply Chain Sustainability Assessment”

Ranco, 13-14th November



Abiotic resources

- fossil resources
 - crude oil
 - natural gas
 - coal
- minerals
 - long list of metals
 - non-metals (phosphorus)



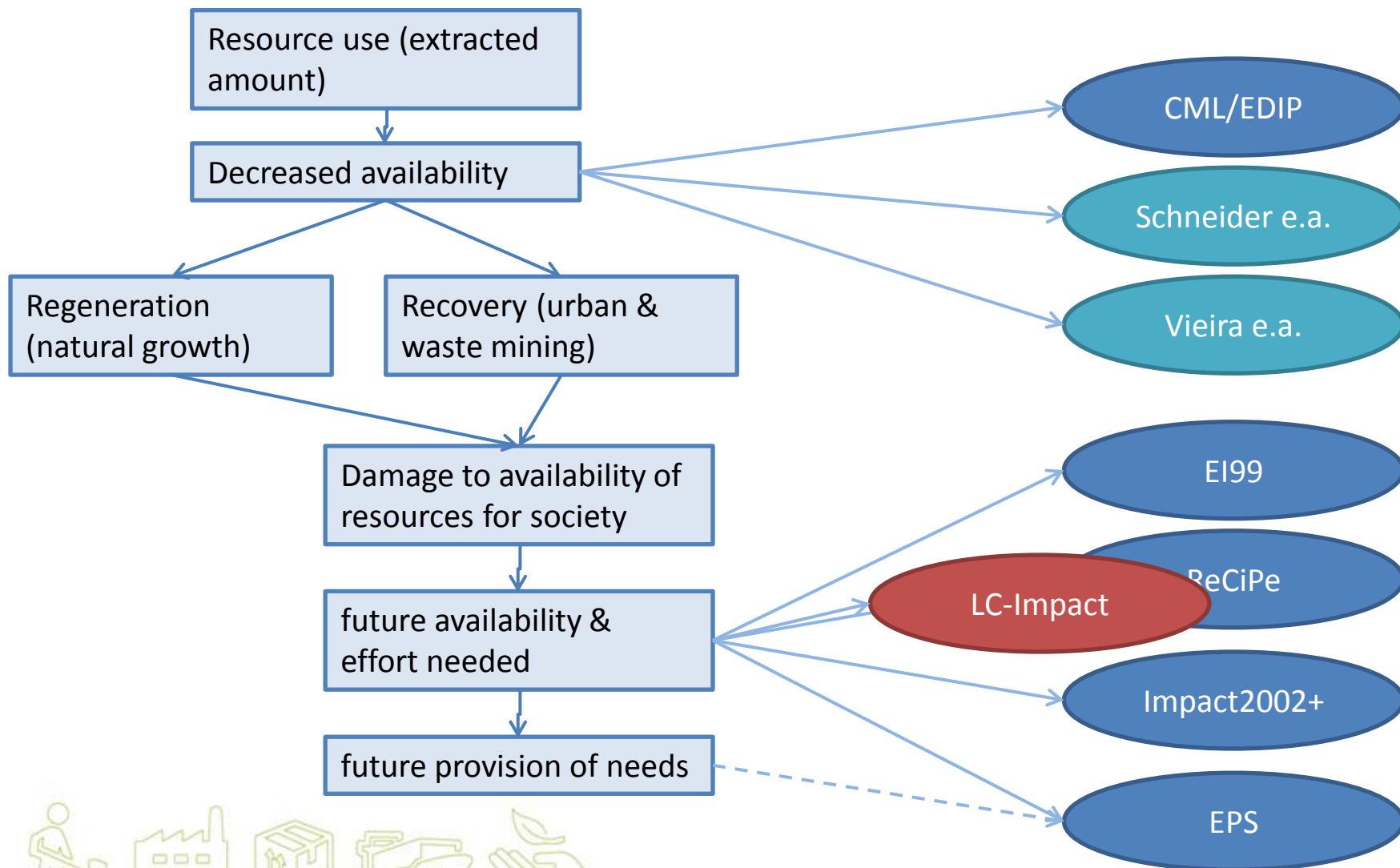
Stakeholder consultation

- 20 participants in total representing policy, industry and experts
- Selection of three indicators for minerals and two for fossil fuels using different time horizons:
 - For the **short term** (not greater than 5 years) perspective, an indicator that expresses availability of resources depending on political factors
 - the **midterm** (<20 years) focuses on the increase in effort
 - the **long term** focuses on overall availability (*not for fossil fuels*)

Publication: Vieira M., Storm P., Goedkoop M. 2011. Stakeholder Consultation: What do Decision Makers in Public Policy and Industry Want to Know Regarding Abiotic Resource Use? In M. Finkbeiner, *Towards Life Cycle Management* (pp. 27-34). Springer Science+Business Media B.V.



ILCD handbook



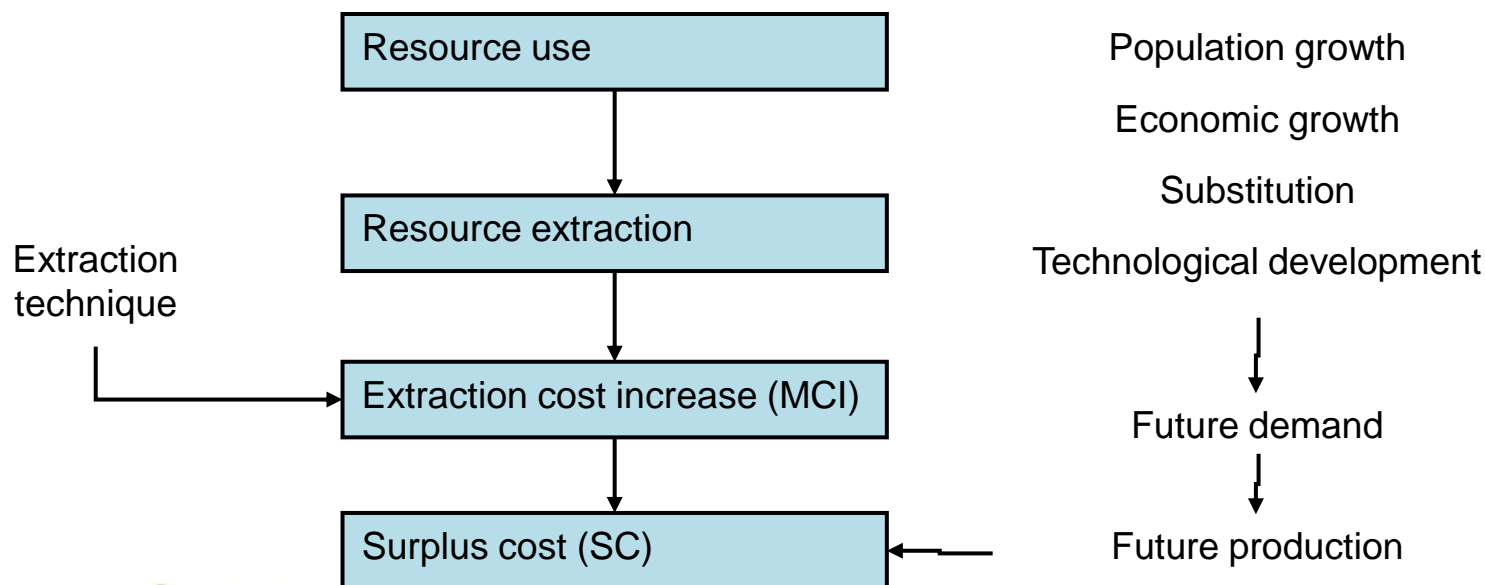
Developments since the ILCD study

- Schneider et al. (2011): The anthropogenic stock extended abiotic depletion potential (extension of “reduced availability” approach).
- Vieira et al. (accepted): Ore grade decrease – relation between marginal ore grade decrease and marginal increase of metal extracted – as a midpoint indicator (minerals only)
- LC-Impact (ongoing): Surplus cost as an endpoint indicator (fossil and minerals)



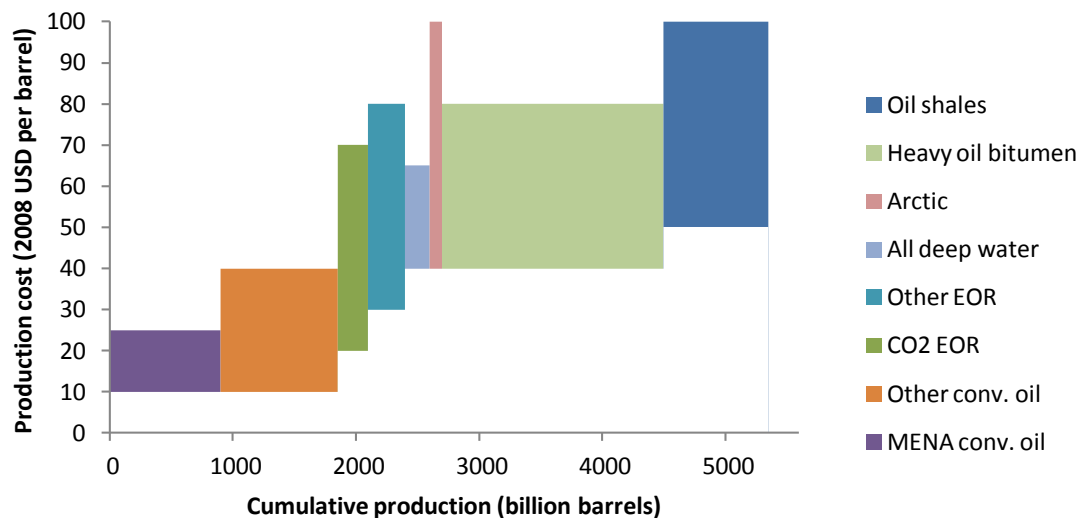
LC-IMPACT work

- Surplus cost (SC): future additional cost of extracting fossil resources due to the marginal cost increase
- $SC = \sum (MCI * P_t * 1/[1+d]^t)$
- MCI = marginal cost increase; P_t = annual production; d = discount rate; t = years after present

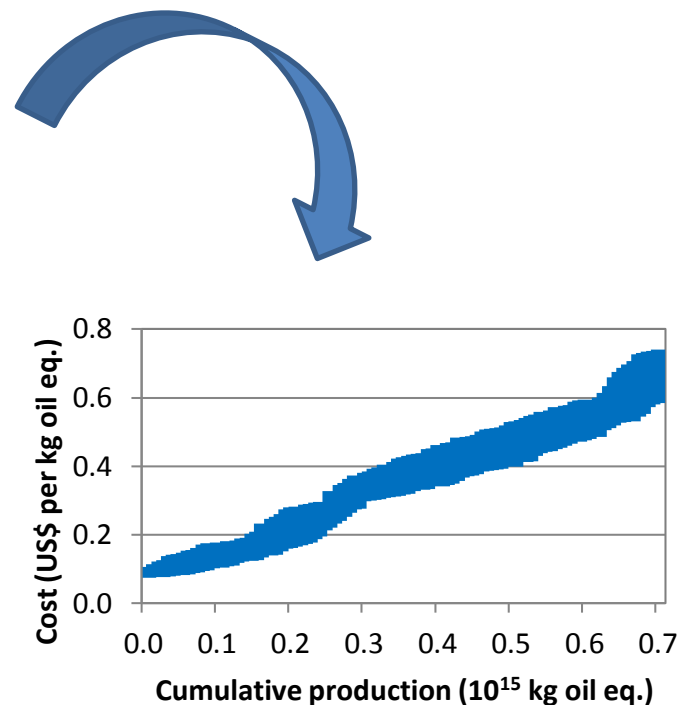


LC-IMPACT work

- MCI example for crude oil:

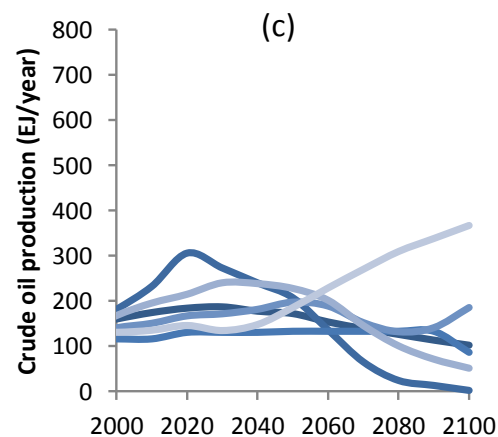
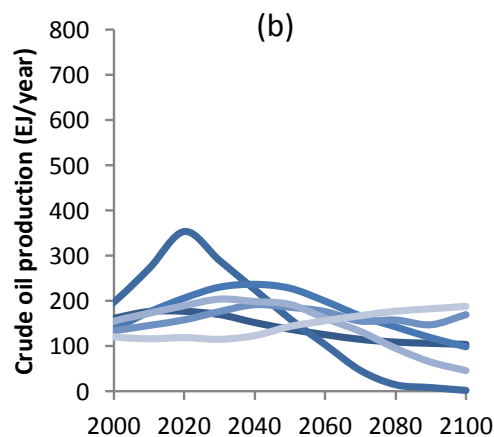
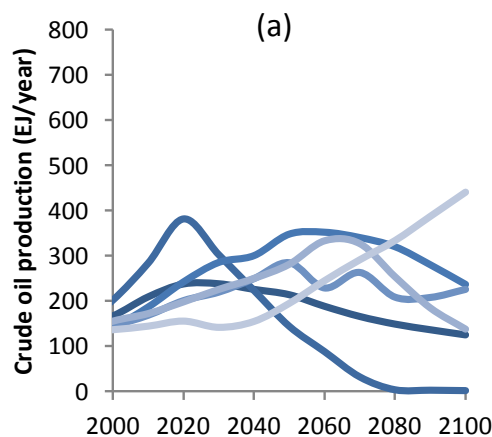


Source: IEA, 2010. Resources to Reserves 2010. Oil, Gas and Coal Technologies for the Energy Markets of the Future. To be released Autumn 2010.



LC-IMPACT work

- Future production scenarios (IPPC, 2000)
- Societal perspectives (individualist: A1, hierarchist B2, egalitarian: B1)

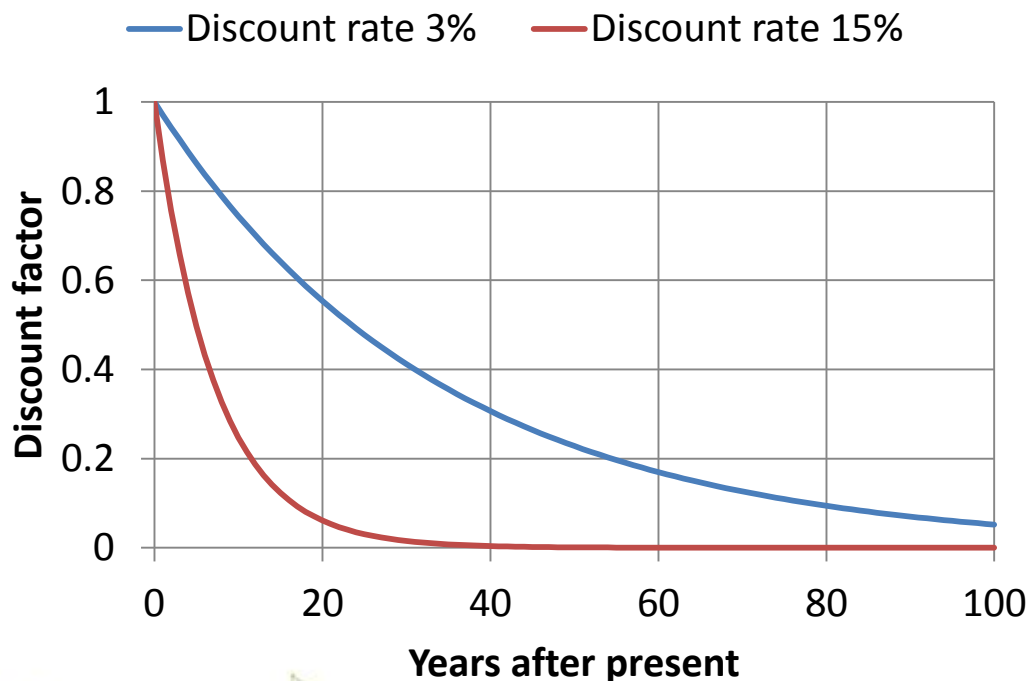


Crude oil production scenarios A1 (a), B1 (b), and B2 (c) for all six macro-economic models (source: IPCC, 2000. Emission scenarios. A special report of the IPCC working group III.)



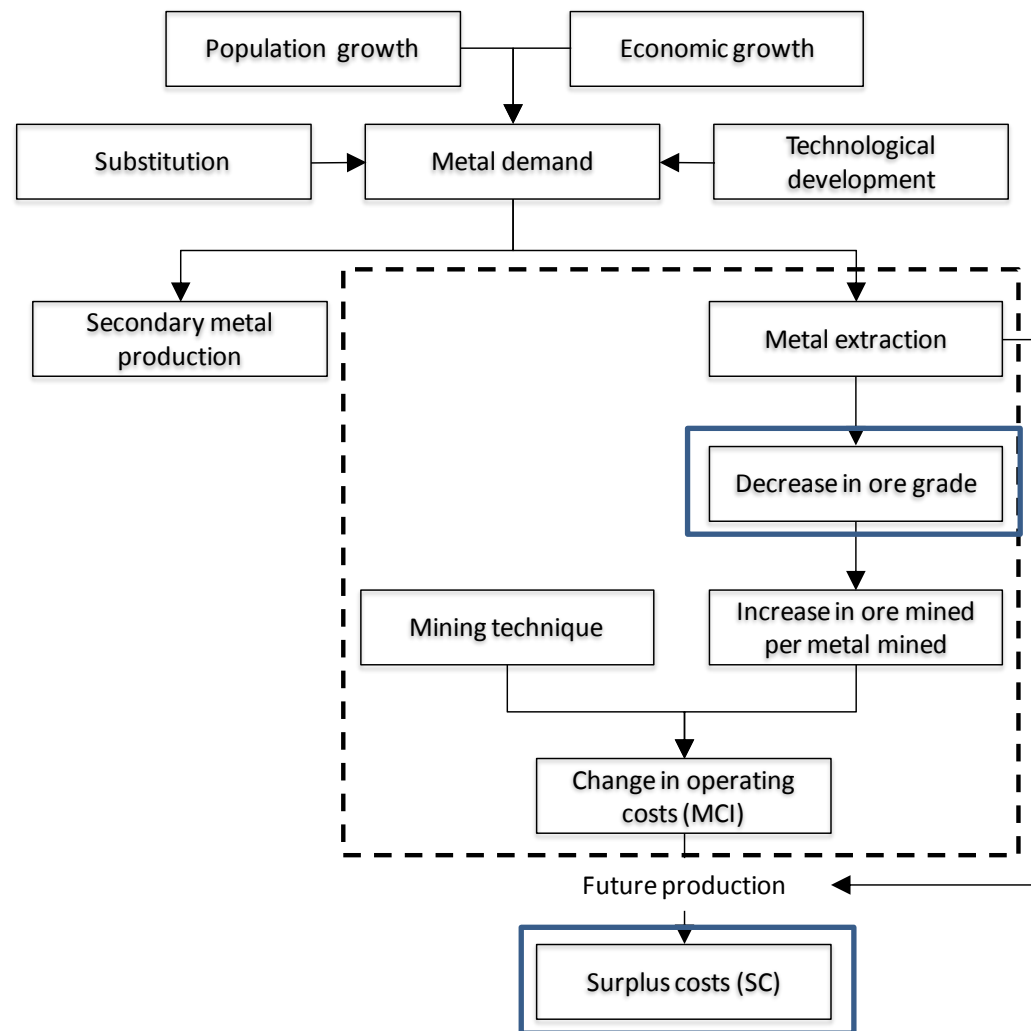
LC-IMPACT work

- Discount rate: inflation/opportunity cost correction
- Societal perspectives (individualist: 15%, hierarchist 3%, egalitarian: 0%)



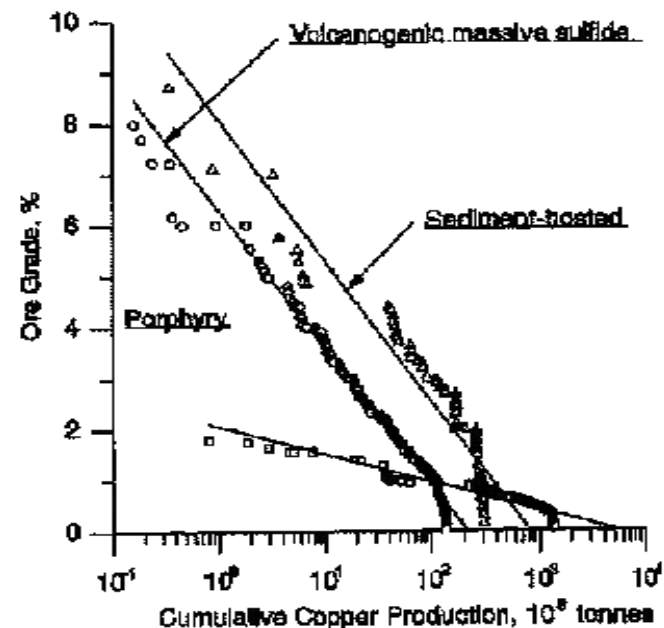
Environmental mechanism minerals

- Decrease in ore grade in % (midpoint)
- Marginal cost increase
- Surplus cost in US\$ (endpoint)



Ore grade decrease of minerals

- Ore grade decrease per deposit type



Source: Gerst, M. D. Revisiting the cumulative grade-tonnage relationship for major copper ore types. *Economic Geology* **2008**, 103 (3), 615-628.

- Future production for 3 cultural perspectives following IPCC 2000 scenarios for population and wealth growth
- Discount rate: individualist 15%, hierarchist 3%, egalitarian 0%



Summary analysis of ReCiPe against criteria for resources

Method name	ReCiPe	LC-Impact work
Completeness of the scope	B The model is relatively complete for minerals and fossil. Additional substance flows can be added.	No change
Environmental relevance	C The model focuses on deposit depletion and, from this, mineral depletion. It has a short time-horizon.	3 time-frames worked out: B?
Scientific robustness & certainty	B Relatively novel approach that develops theory on a basis of data from 500 mines, and takes into account the important co-products from deposits. Uncertainties due to economic-based weighting exist.	New data & uncertainty analysis added: A?
Documentation, transparency & reproducibility	A The model documentation and results are easily available	No change
Applicability	B Characterisation factors are available and can be easily applied	So: why not A?
Overall evaluation of science-based criteria	B Relatively complete scientific model described in all details, based on large dataset of mining data	Even more so now: A?
Overall evaluation of stakeholders' acceptance	C The principles of the method are complex. The model is recent and thus not accepted yet. Not endorsed by an authoritative body.	Working on dissemination
Completeness of the scope	B The model is relatively complete for minerals and fossil. Additional substance flows can be added.	No change

Discussion

- Midpoint selection for surplus cost as endpoint
 - Constant mid- to endpoint factor not found for fossil fuels
 - For minerals, there is a constant factor for all minerals
- Discount rates or fixed time frames?
- Future production scenarios may be revised in the future:
 - expected substitution
 - expected technological development
- Geopolitical effects are out of scope!
- Relevance of LCIA methods for policy making?





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