Supplementary Materials

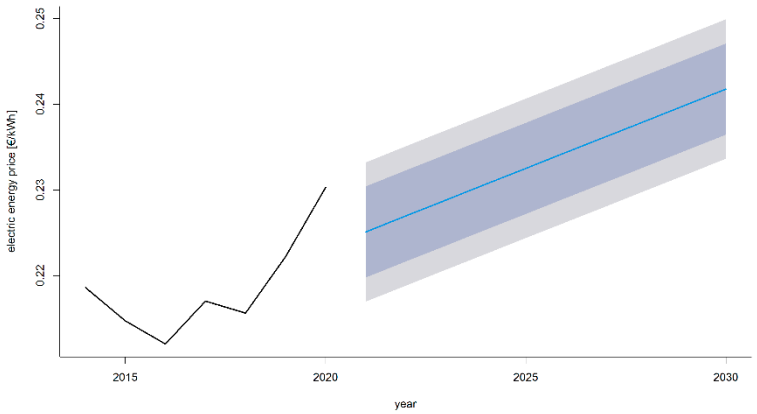

Figure S1. Results of autoregressive electric energy price forecast based on yearly historical data from 2014 to 2020 from Statista [85]. The blue line on the right-hand side depicts the mean price forecast, and the blue and grey areas represent the 95% and 75% confidence intervals, respectively.

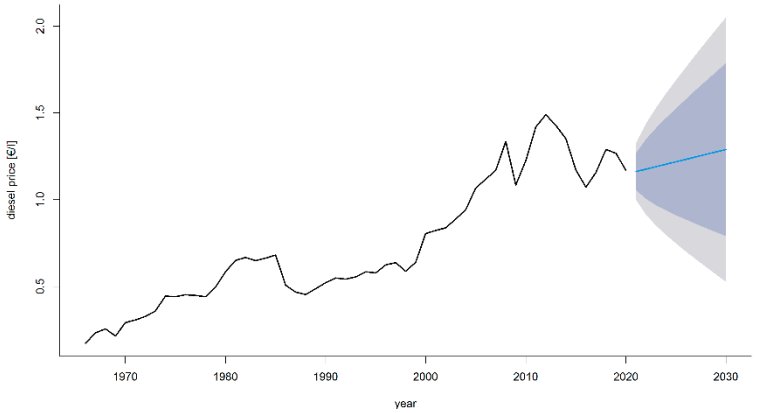

Figure S2. Results of autoregressive diesel price forecast based on yearly historical data from 1950 to 2020 from Statista [86]. The blue line on the right-hand side depicts the mean price forecast, and the blue and grey areas represent the 95% and 75% confidence intervals, respectively.

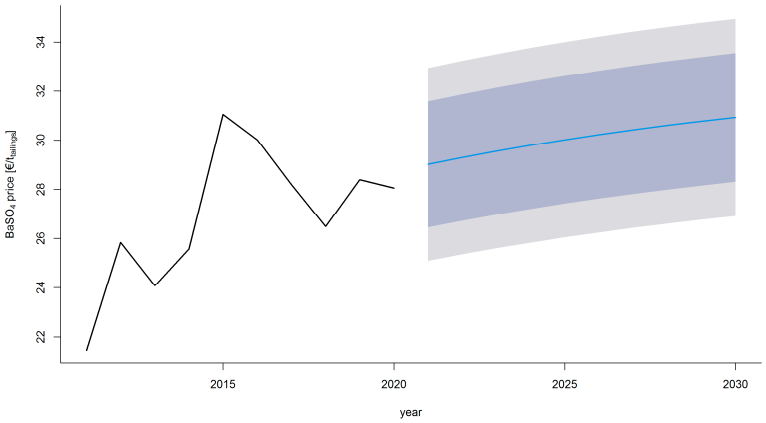

Figure S3. Results of autoregressive $BaSO_4$ price forecast based on yearly historical data from 2011 to 2020 from the USGS [87–90]. The blue line on the right-hand side depicts the mean price forecast, and the blue and grey areas represent the 95% and 75% confidence intervals, respectively.

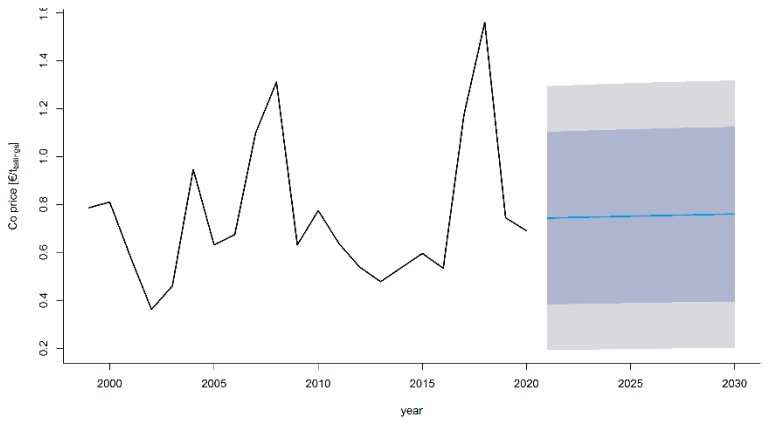

Figure S4. Results of autoregressive Co price forecast based on yearly historical data from 1996 to 2020 from the USGS [87,89–93]. The blue line on the right-hand side depicts the mean price forecast, and the blue and grey areas represent the 95% and 75% confidence intervals, respectively.

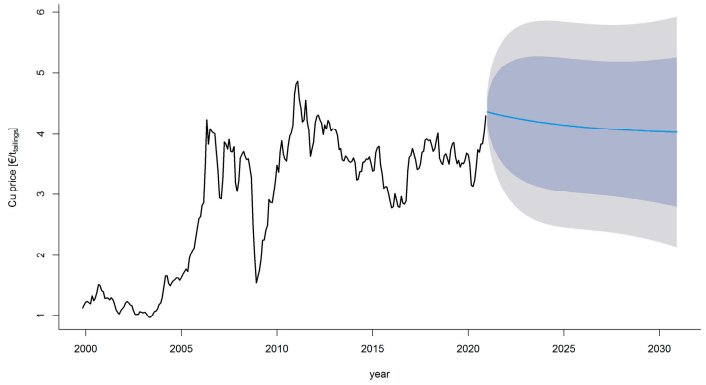

Figure S5. Results of autoregressive Cu price forecast based on monthly historical data from 1999 to 2021 from IndexMundi [94]. The blue line on the right-hand side depicts the mean price forecast, and the blue and grey areas represent the 95% and 75% confidence intervals, respectively.

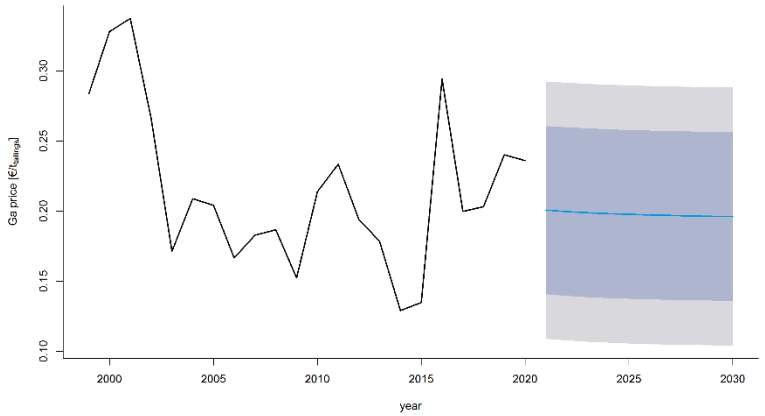

Figure S6. Results of autoregressive Ga price forecast based on yearly historical data from 1999 to 2020 from the USGS [87,89–93]. The blue line on the right-hand side depicts the mean price forecast, and the blue and grey areas represent the 95% and 75% confidence intervals, respectively.

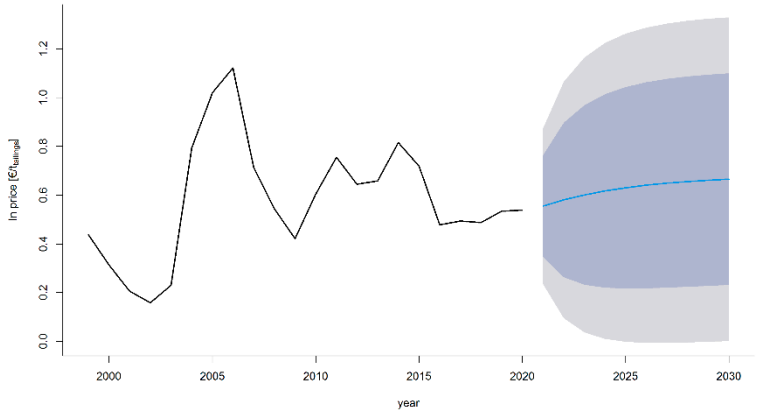

Figure S7. Results of autoregressive In price forecast based on yearly historical data from 1999 to 2020 from the USGS [87,89–93]. The blue line on the right-hand side depicts the mean price forecast, and the blue and grey areas represent the 95% and 75% confidence intervals, respectively.

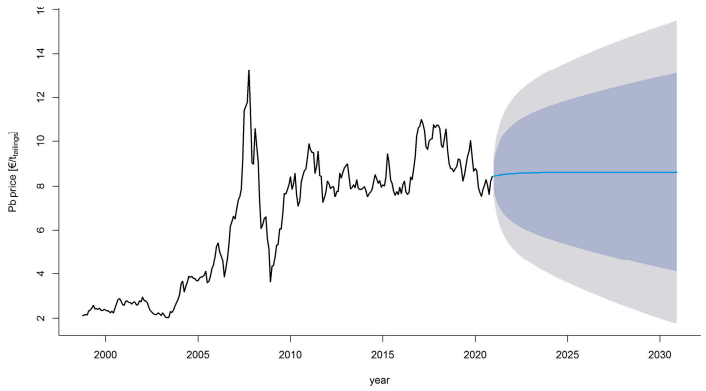

Figure S8. Results of autoregressive Pb price forecast based on monthly historical data from 1999 to 2021 from IndexMundi [95]. The blue line on the right-hand side depicts the mean price forecast, and the blue and grey areas represent the 95% and 75% confidence intervals, respectively.

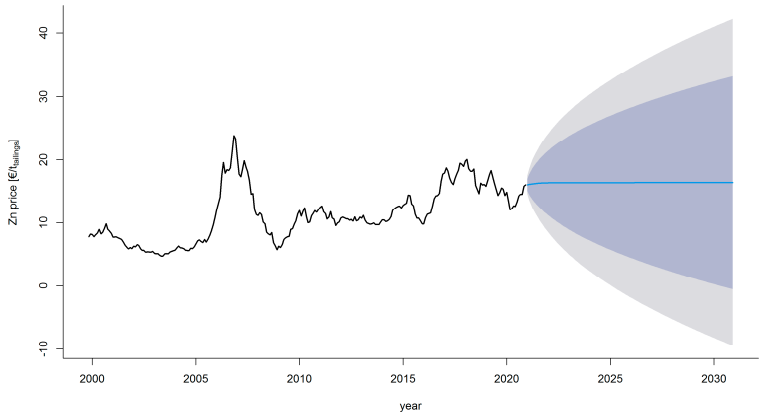

Figure S9. Results of autoregressive Zn price forecast based on monthly historical data from 1999 to 2021 from IndexMundi [96]. The blue line on the right-hand side depicts the mean price forecast, and the blue and grey areas represent the 95% and 75% confidence intervals, respectively.

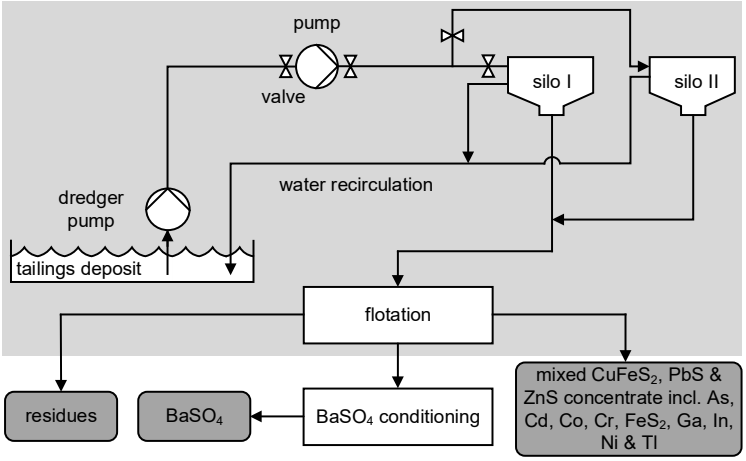

Figure S10. Conceptual mine plan and processing schematic. The light grey shaded field indicates the spatial system boundaries and the dark grey shaded fields indicate products (adapted after Goldmann et al. [53]).

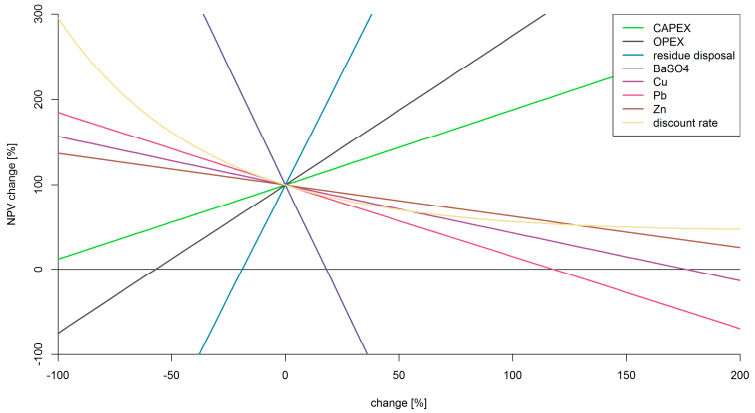

Figure S11. Results of the sensitivity analysis of the conventional mineral RMs recovery scenario (CRR1p) with pessimistic price forecast and a discount rate of 15%.

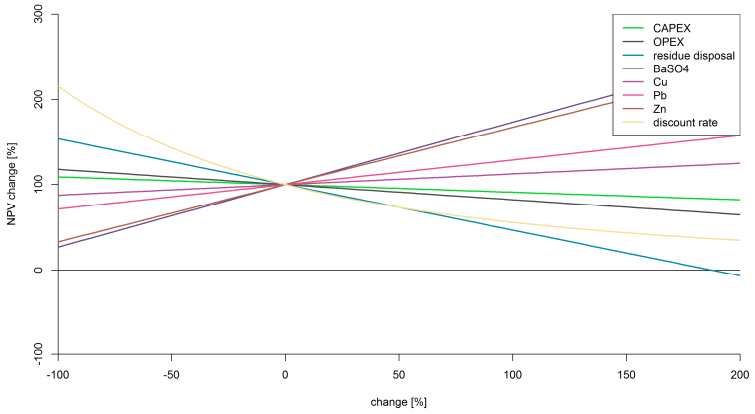

Figure S12. Results of the sensitivity analysis of the conventional mineral RMs recovery scenario (CRR1o) with optimistic price forecast and a discount rate of 15%.

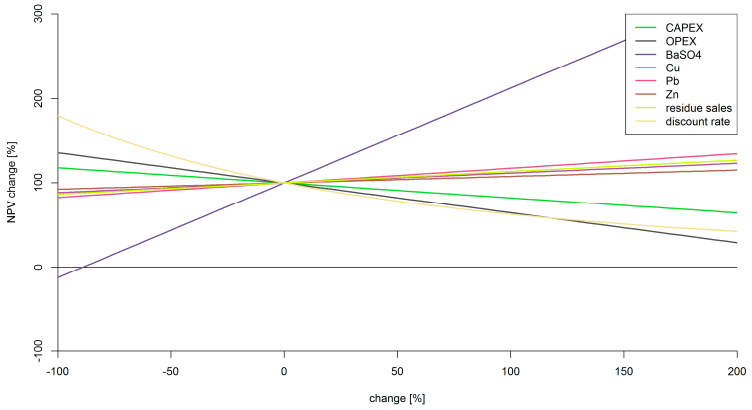

Figure S13. Results of the sensitivity analysis of the enhanced mineral RMs recovery scenario (ERR2p) with pessimistic price forecast and a discount rate of 15%.

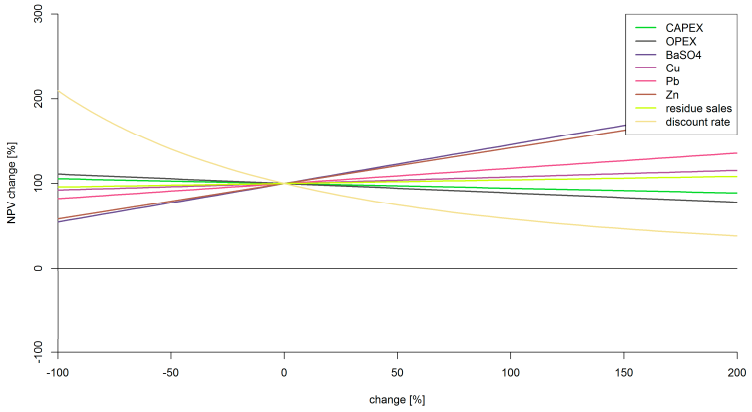

Figure S14. Results of the sensitivity analysis of the enhanced mineral RMs recovery scenario (ERR2o) with optimistic price forecast and a discount rate of 15%.

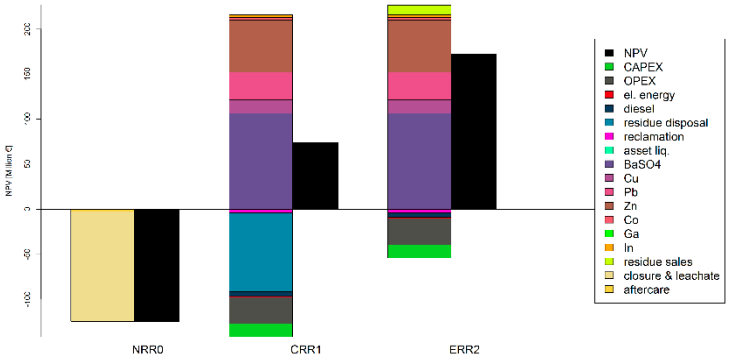

Figure S15. Comparison of costs, revenues and NPVs for the mean price forecast of the 3 scenarios with no mineral RMs recovery (NRR0), conventional mineral RMs recovery (CRR1m) and enhanced mineral RMs recovery (ERR2m). With a discount rate of 15%, NRR0 is discounted over a period of 35 years, and CRR1m and ERR2m over a period of 11 years.

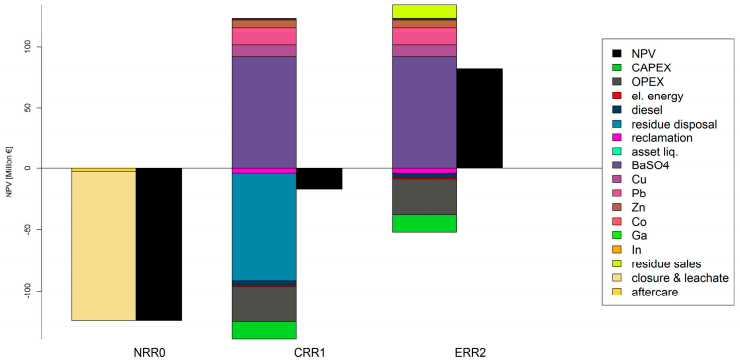

Figure S16. Comparison of costs, revenues and NPVs for the pessimistic price forecast of the 3 scenarios with no mineral RMs recovery (NRR0), conventional mineral RMs recovery (CRR1p) and enhanced mineral RMs recovery (ERR2p). With a discount rate of 15%, NRR0 is discounted over a period of 35 years, and CRR1p and ERR2p over a period of 11 years.

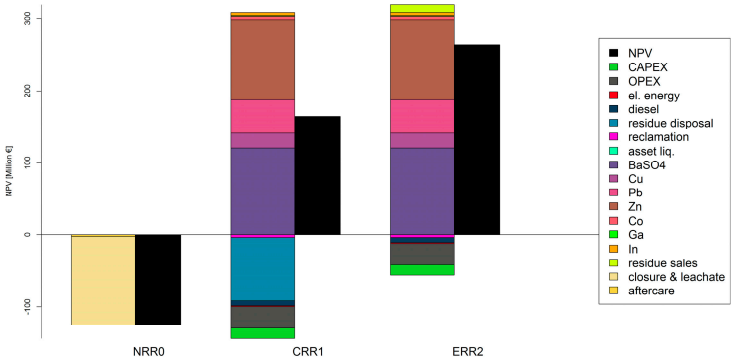

Figure S17. Comparison of costs, revenues and NPVs for the optimistic price forecast of the 3 scenarios with no mineral RMs recovery (NRR0), conventional mineral RMs recovery (CRR1o) and enhanced mineral RMs recovery (ERR2o). With a discount rate of 15%, NRR0 is discounted over a period of 35 years, and CRR1o and ERR2o over a period of 11 years.