

Midpoint calculation

Table S1. Calculation for mid point indicators in IMPACT 2002+

| Midpoint | Unit | LiCoO ₂ /C | LiFePO ₄ /C | LiFe _{0.98} Mn _{0.02} PO ₄ /C | FeF ₃ (H ₂ O) ₃ /C |
|--------------------------------------|--------------|-----------------------|------------------------|--|---|
| Human toxicity | kg C2H3Cl eq | 0.6507114 | 0.40548469 | 0.399384806 | 0.1729442 |
| Respiratory effects | kg PM2.5 eq | 0.0227339 | 0.01290616 | 0.012731948 | 0.0071119 |
| Ionized radiation | Bq C-14 eq | 255.22266 | 286.943551 | 263.1607185 | 276.76079 |
| Ozone depletion | kg CFC-11 eq | 7.613E-07 | 7.0677E-07 | 6.66527E-07 | 5.259E-07 |
| Photochemical oxidation | kg C2H4 eq | 0.0056416 | 0.00159494 | 0.001557746 | 0.0009892 |
| Water ecotoxicity | kg TEG water | 6005.1706 | 512.290919 | 500.8113483 | 379.46661 |
| Surface ecotoxicity | kg TEG soil | 1515.8489 | 109.656827 | 106.6936275 | 87.21105 |
| State water acidification | kg SO2 eq | 0.468517 | 0.17822767 | 0.174215473 | 0.1157995 |
| Water eutrophication | m2org.arable | 0.4173564 | 0.17905741 | 0.174006268 | 0.0934724 |
| Surface acidification/eutrophication | kg SO2 eq | 0.1123386 | 0.06151454 | 0.060006632 | 0.0496293 |
| Land use | kg PO4 P-lim | 0.0032014 | 0.00247137 | 0.00237106 | 0.0020997 |
| Global warming, | kg CO2 eq | 12.652772 | 9.27204369 | 8.914848611 | 5.5023823 |
| Non-renewable energy consumption | MJ primary | 176.40804 | 149.882076 | 142.2997999 | 104.08848 |
| Minerals refinement | MJ surplus | 0.7296549 | 0.23919379 | 0.23892968 | 0.4516492 |

Table S2. Calculation for midpoint indicators in EI-99.

| Midpoint | Unit | LiCoO ₂ /C | LiFePO ₄ /C | LiFe _{0.98} Mn _{0.02} PO ₄ /C | FeF ₃ (H ₂ O) ₃ /C |
|------------------------------|------------|-----------------------|------------------------|--|---|
| Carcinogenic substances | DALY | 3.0532E-05 | 2.101E-05 | 2.08001E-05 | 8.01371E-06 |
| Respirable inorganic | DALY | 1.2504E-08 | 3.805E-09 | 3.71278E-09 | 2.31372E-09 |
| Respirable organic | DALY | 1.9512E-05 | 1.053E-05 | 1.04024E-05 | 6.28082E-06 |
| Climate change | DALY | 2.7695E-06 | 2.024E-06 | 1.94657E-06 | 1.19613E-06 |
| Radiation | DALY | 5.3013E-08 | 5.956E-08 | 5.46313E-08 | 5.73902E-08 |
| Ozone depletion | DALY | 8.9894E-10 | 8.114E-10 | 7.73429E-10 | 5.02074E-10 |
| Ecological toxicity | PAF*m2yr | 4.04006344 | 2.1151216 | 2.070632637 | 2.273878079 |
| Acidification/Eutrophication | PDF*m2yr | 0.48793955 | 0.1857021 | 0.181519418 | 0.132170485 |
| Land occupation | PDF*m2yr | 0.2610441 | 0.0803996 | 0.077905111 | 0.041985928 |
| Mineral resource | MJ surplus | 0.54394482 | 0.1824286 | 0.18346272 | 0.353537718 |
| Fossil fuels | MJ surplus | 10.9017266 | 8.4571665 | 8.124715617 | 5.037344674 |

Table S3. Calculation for midpoint indicators in ReCiPe.

| Midpoint | Unit | LiCoO ₂ /C | LiFePO ₄ /C | LiFe _{0.98} Mn _{0.02} PO ₄ /C | FeF ₃ (H ₂ O) ₃ /C |
|---|------------|-----------------------|------------------------|--|---|
| Climate impacts on human health | DALY | 4.39902E-05 | 3.19686E-05 | 3.0725E-05 | 1.91575E-05 |
| Ozone depletion | DALY | 1.92739E-09 | 1.71648E-09 | 1.6296E-09 | 1.12749E-09 |
| Human toxicity | DALY | 0.000161709 | 0.000113016 | 0.00010702 | 0.000117894 |
| Formation of photochemical oxidizing substances | DALY | 2.96868E-09 | 1.24543E-09 | 1.2192E-09 | 7.26243E-10 |
| Particulate matter formation | DALY | 1.1915E-05 | 6.27748E-06 | 6.1843E-06 | 3.86337E-06 |
| Ion radiation | DALY | 4.14057E-08 | 4.65162E-08 | 4.267E-08 | 4.4802E-08 |
| Climate impacts on Ecological system | species.yr | 2.3436E-07 | 1.70314E-07 | 1.6369E-07 | 1.02063E-07 |
| Land oxidation | species.yr | 1.62804E-09 | 8.54902E-10 | 8.3391E-10 | 6.81693E-10 |
| Eutrophication of Freshwater | species.yr | 2.53578E-10 | 2.19329E-10 | 2.0679E-10 | 1.86719E-10 |
| Land toxicity | species.yr | 1.17925E-09 | 7.59892E-10 | 7.3501E-10 | 5.46611E-10 |
| Freshwater toxicity | species.yr | 1.15615E-10 | 8.33565E-11 | 8.0795E-11 | 8.61394E-11 |
| Marine ecological Toxicity | species.yr | 2.87353E-08 | 2.17242E-08 | 2.0933E-08 | 2.16833E-08 |
| Agricultural land occupation | species.yr | 4.80008E-09 | 2.97351E-09 | 2.8346E-09 | 2.7932E-09 |
| Urban land occupancy | species.yr | 9.61307E-09 | 3.18951E-09 | 3.1718E-09 | 9.50167E-10 |
| Natural Land Transformation | species.yr | 3.83802E-07 | 9.6552E-08 | 9.517E-08 | 3.99265E-08 |
| Metal resource consumption | \$ | 0.099174293 | 0.049183718 | 0.13536457 | 0.056770754 |
| Fossil fuel exhaustion | \$ | 0.54685897 | 0.431827046 | 0.41451446 | 0.258879836 |