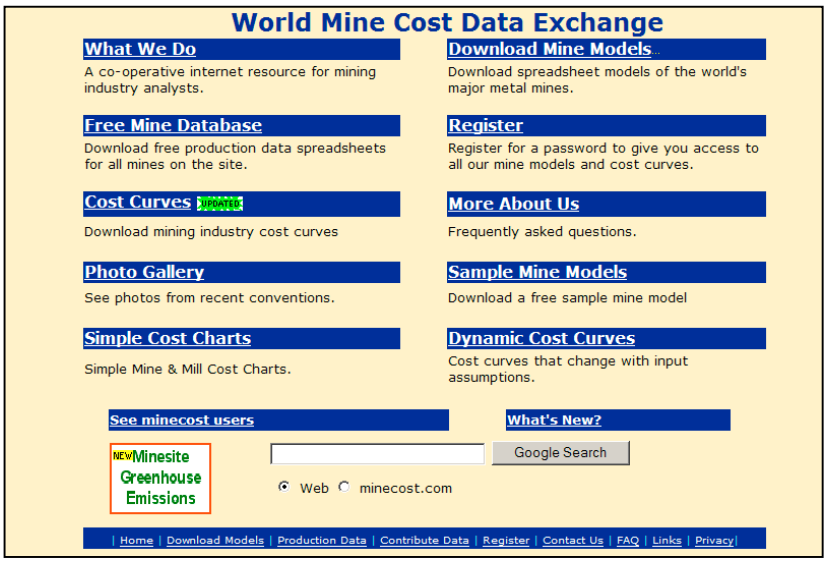
# MINECOST.COM: The Co-operative Internet Resource for Mining Industry Analysts

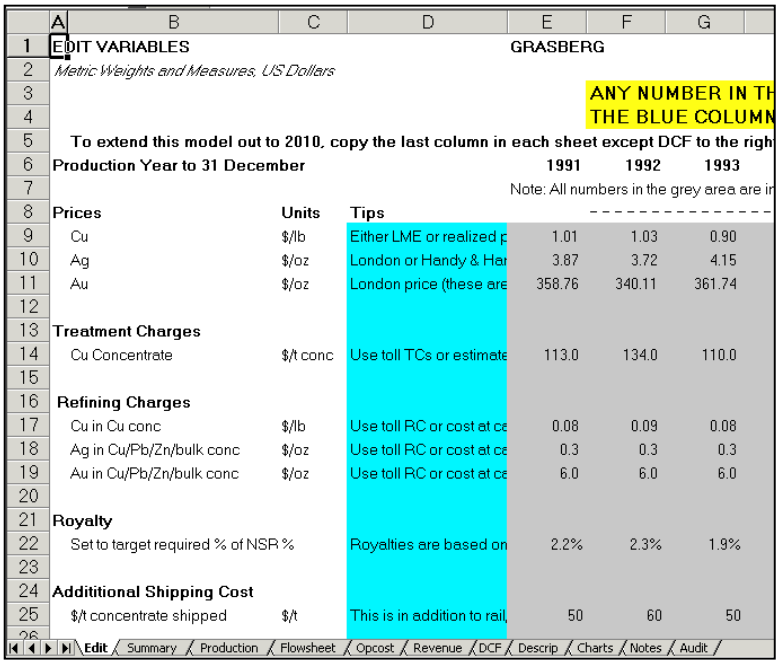
Minecost.com was established more than ten years ago to create mine cost spreadsheet models based on verifiable engineering and production data and peer review by mining industry analysts from around the world. Minecost now maintains models for well over 270 mines producing at least 90% of western world copper, zinc, lead, nickel and molybdenum and over 67% of western world silver, 29 mines producing at least 90% of world PGMs, and 84 mines producing at least 85% of western world iron and manganese ore, and up to 50 major mines producing uranium, gold and diamonds. All models are downloadable from the minecost website.




Minecost models are used to create downloadable industry cost curves for all the major metals, "dynamic" cost curve models that allow users to re-draw the cost curves according to their own input assumptions, and $CO_2$ emissions models that estimate $CO_2$ emissions from each minesite.

**MINECOST MODELS**

Mine operating data is collected from technical information published in the mining engineering press and technical reports and from mining companies and incorporated into detailed engineering-based mine cost models. These models are available for download by registered minecost.com users. The models are in Microsoft Excel spreadsheets with embedded mine descriptions and cost curve charts.



| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | EDIT VARIABLES | | | | GRASBERG | | |
| 2 | *Metric Weights and Measures, US Dollars* | | | | | | |
| 3 | | | | | ANY NUMBER IN TH | | |
| 4 | | | | | THE BLUE COLUMN | | |
| 5 | To extend this model out to 2010, copy the last column in each sheet except DCF to the righ | | | | | | |
| 6 | Production Year to 31 December | | | | 1991 | 1992 | 1993 |
| 7 | | | | | Note: All numbers in the grey area are in | | |
| 8 | Prices | | Units | Tips | | | |
| 9 | Cu | | $/lb | Either LME or realized p | 1.01 | 1.03 | 0.90 |
| 10 | Ag | | $/oz | London or Handy & Har | 3.87 | 3.72 | 4.15 |
| 11 | Au | | $/oz | London price (these are | 358.76 | 340.11 | 361.74 |
| 12 | | | | | | | |
| 13 | Treatment Charges | | | | | | |
| 14 | Cu Concentrate | | $/t conc | Use toll TCs or estimate | 113.0 | 134.0 | 110.0 |
| 15 | | | | | | | |
| 16 | Refining Charges | | | | | | |
| 17 | Cu in Cu conc | | $/lb | Use toll RC or cost at ce | 0.08 | 0.09 | 0.08 |
| 18 | Ag in Cu/Pb/Zn/bulk conc | | $/oz | Use toll RC or cost at ce | 0.3 | 0.3 | 0.3 |
| 19 | Au in Cu/Pb/Zn/bulk conc | | $/oz | Use toll RC or cost at ce | 6.0 | 6.0 | 6.0 |
| 20 | | | | | | | |
| 21 | Royalty | | | | | | |
| 22 | Set to target required % of NSR | | % | Royalties are based on | 2.2% | 2.3% | 1.9% |
| 23 | | | | | | | |
| 24 | Additional Shipping Cost | | | | | | |
| 25 | $/t concentrate shipped | | $/t | This is in addition to rail | 50 | 60 | 50 |

Edit | Summary | Production | Flowsheet | Opcost | Revenue | DCF | Descrip | Charts | Notes | Audit

Each downloadable spread sheet model contains detailed production data and mine economics for historical years back in many cases to 1991 and projections for future years to 2012. All models are based on a serious attempt to model the flowsheet for the operation. The models show the data sources used to create them and, where available, comparisons between reported and modelled cost numbers and. In addition to cash costs, the models calculate the labor requirement for each step in the flowsheet and the levels of consumables such as fuel, power, explosives, reagents, grinding media and other consumables that are implied in our conceptualization of the flowsheet. These can then be verified against actual experience, and in many cases against reported numbers for fuel and power usage in company sustainability statements.

The models have been extensively road-tested by minecost.com users and through strategic alliances with lead and zinc analysts CHR Metals, copper analysts Bloomsbury Mineral Economics, precious analysts GFMS and nickel and iron ore specialists Metalytics. Minecost models are constructed as multi-sheet Excel spreadsheets, with each sheet reporting an aspect of the modelled result - production, the flowsheet, operating costs, revenue and so on. There is also an Edit sheet that allows users to change model input variables and adjust the model operating assumptions. The model itself is in sheets A, B, C ..., depending on how many mining units feed the mill. These sheets are normally hidden to reduce screen clutter, but you can always unhide them to see the model calculations and formulas.

The model tabbed sheets are:

- The ***Summary*** sheet is a short-form bottom line result containing basic production data and operating cost per ton of ore milled and per pound of paid metal.
- The ***Edit*** sheet shows all the operating variables and inputs that can be changed by the user.
- The ***Production*** sheet shows ore mined and milled, mill grades, mill recoveries and metal production in concentrate.
- In the ***Flowsheet*** section of the model you can see the specific operating assumptions and information used at every step in the mine flowsheet to construct the model, and model estimates of labour numbers and productivity, and fuel, power and other consumables. Where available we also compare modelled and reported numbers for fuel and power usage.
- The ***Operating Cost*** sheet contains line-by-line cost estimates for each step of the flowsheet plus offsite shipping, smelting and refining costs in dollars per day and in dollars per ton of ore milled. The major aggregates are shown in terms of dollars per day, dollars per ton of ore milled and cents per pound for paid metal production.

- The ***Revenue*** sheet shows revenues and net smelter return for each mine product, and the allocation of smelting, refining and shipping costs, plus royalties where applicable.
- The ***DCF*** sheet calculates net cash flows after capital investment expenditure and tax and net present values for the life of the mine.
- The ***Charts*** sheet contains the industry cost curves for each production year.
- A brief ***Description*** of the mining property is included in most, but not all, of the models.
- In the ***Notes & References*** sheet you can compare our modelled costs with reported numbers and see the ***data sources*** used to construct the model.
- Finally, in the ***Audit*** sheet you can see a reconciliation and verification of the model calculations.

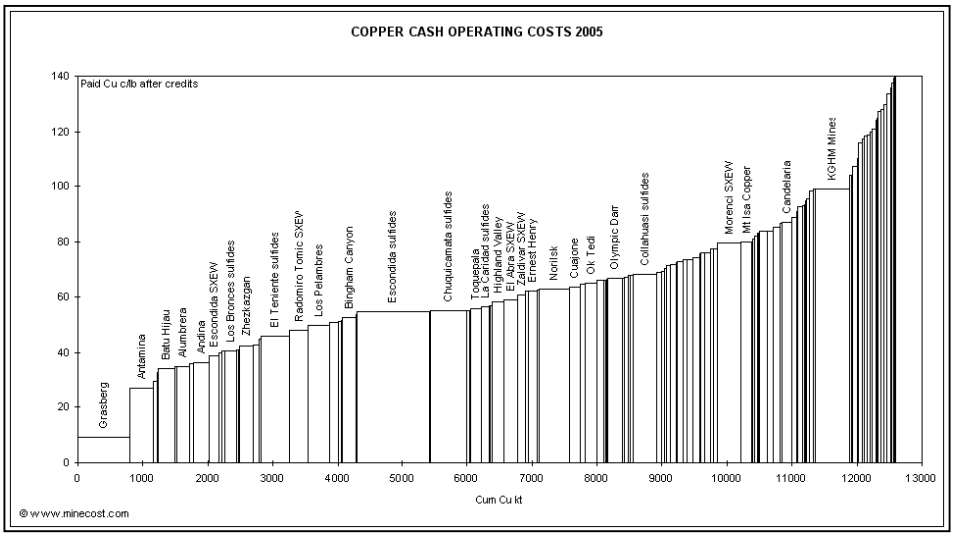
**MINECOST USER GUIDE**

Minecost models go into more detail than you will see from the "Name" research organizations. The detail is there because we model every step in the flowsheet, and because we aim to provide maximum transparency to model users. The more detail we put in, the harder it is to fudge the numbers.

All minecost.com models are constructed to work as consistently as practicable across all metals. Since it is our practice to model each separate mining operation feeding the mill - and each separate mill, where necessary - many minecost models are very large with multiple sheets for each mine. But we try to present the models in as comprehensible form as possible to the user. This means that we hide the "working" sheets containing all the calculations to make the presentation as standard as possible. But this also means that the models become less transparent and sometimes difficult for users to satisfy themselves that the models and their internal calculations are consistent and make sense. Although the Audit section is there to verify the model arithmetic, people often need to have a better understanding of the model calculations. Many users are interested in performing benchmarking exercises with minecost.com models and need to know exactly what is included in each cost item as shown in the model.

For these reasons, and in the interests of model transparency, we have set up a sample model in a free downloadable ***Minecost User Guide*** showing just how the formulas and calculations work. The user guide contains all the standard sheets presented in the models, with comments and explanations beside each item displayed in yellow cells. We have also annotated the (normally hidden) model working sheets to let you see just what is included in each flowsheet item modelled, and the composition of labor, supplies and materials associated with each flowsheet item.

**MINECOST COST CURVES**




Cost curves show ranked mine operating costs plotted against cumulative production. They show in graphical form the comparative operating cost performance of all operations in the industry and can be thought of as an industry supply curve. Minecost models are used to create industry cost curves for copper, zinc, lead, nickel, silver, PGM, platinum, palladium, rhodium, molybdenum, manganese and iron ore for 2000 up to 2009. The cost curves for each year come in an Excel spreadsheet containing production and cost data for each mine in the industry, cost curves that automatically re-draw themselves after you have changed the data or re-sorted it, and formatted tables showing each mine by name, its production and cash cost, plus the name of the operator and country of location.

The base and precious metals cost curve spreadsheets show cash costs in c/lb or $/oz metal with and without by-product credits to produce more reliable and accurate rankings, plus cash operating costs for onsite mine and mill costs in $/t ore milled. The iron ore and manganese ore sheets show cash costs in c/mtu for each product plus cash operating costs for onsite mine and mill costs in $/t ore.

The cost curves are based only on the mines we model. We do not plug numbers from annual reports. This necessarily means that our coverage of western world production in each industry is limited to the mines we model ourselves. But our coverage is still pretty good. In copper, the coverage averages 91% of western world mine production and 83% of total world production. For lead, the coverage is just on 86% and for zinc 83%. Nickel mine coverage is over 85% of western world mine production, including Japanese ferronickel production and by-product Ni production from South Africa. Molybdenum coverage is 89% of western world output, while silver coverage is lowest at just over 72% of western world production, with the gaps being by-product silver from the many very small base metals producers. The PGM, Pt, Pd and Rh cost curves coverage is very high at over 90% of total world production.

In iron ore, we have modelled just over 82% of western world production as concentrates and agglomerates, which include virtually all production from North America, Australia, Latin America, Sweden, Africa and the Indian export producers. The iron ore spreadsheets contain three sets of data and charts, one for ROM ore onsite costs, and two for saleable product FOB port - fines, lump, concentrate and pellets, in both c/dmtu and $/mt.

Minecost cost curves are continually updated to reflect the results from the latest models. You can check the date of the cost curve spreadsheets and see which mines are included by clicking on the industry name on the cost curves web page.

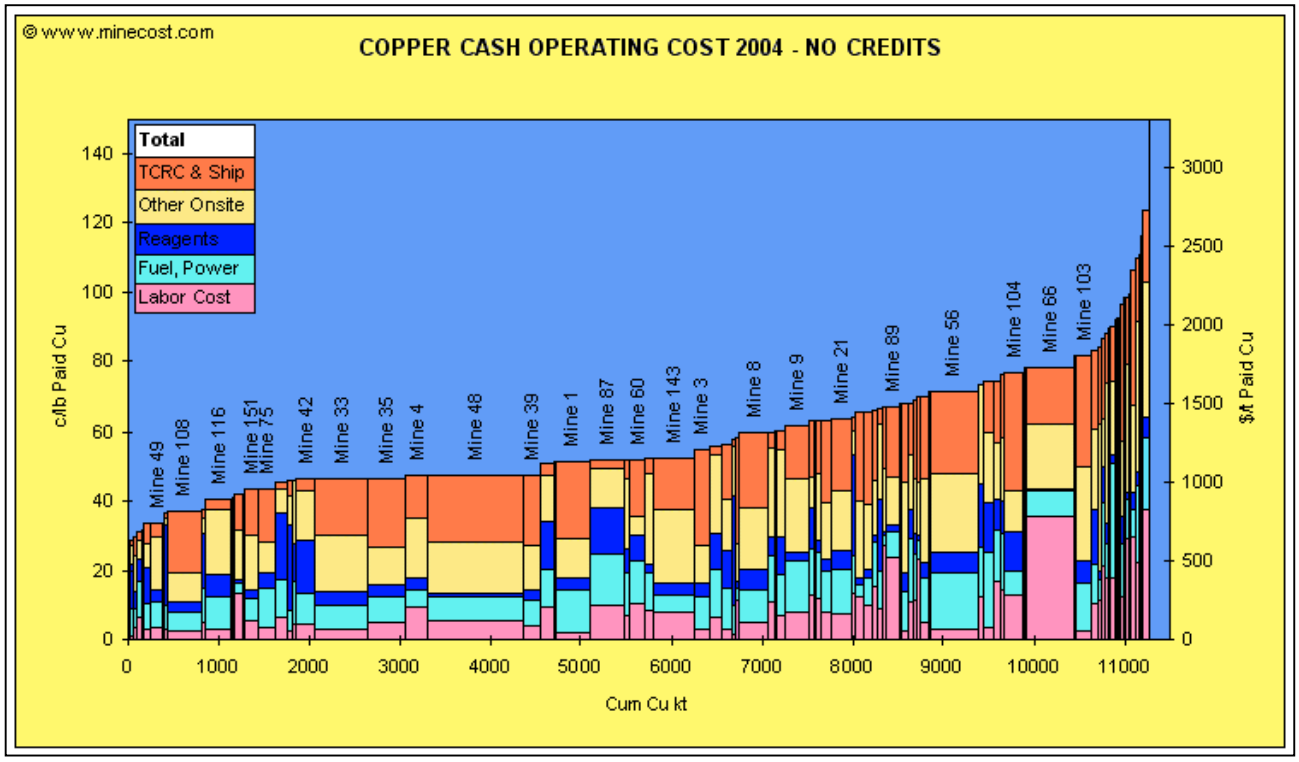
Minecost cost curves are flexible! You can re-sort the data according to your own criteria, change the input numbers and even add new mines. The cost curve charts show all mines in the industry but you can change the settings to display all or only some of the mine names on the cost curves according to your preference. And because the mine names dynamically re-position themselves correctly after sorting the data, you can create your own cost curves as required.

**DYNAMIC COST CURVES**

If you need even more flexibility, the minecost Dynamic Cost Curves models allow you to change any of the industry input assumptions such as prices, TCRCs, exchange rates, ocean freight rates, oil prices and by-product crediting assumptions to produce industry cost curves for individual mines and producer companies, and producer countries.

The standard features of the dynamic cost curve models include:

- Single "live" spreadsheet containing all data and modelling inputs
- Production data and detailed cash costs and curves for individual copper, zinc, lead, nickel and molybdenum mines
- Production data and detailed cash costs and curves aggregated by company
- Production data and detailed cash costs and curves aggregated by country
- Ability to change all metal prices, exchange rates and treatment and refining charges
- Ocean freight rates and diesel fuel prices may be factored up or down
- Selectable cost curve options to display detailed cost breakdown or total cash costs
- Draw cost curves showing mines, producer company and producer country
- Complete control over what products are credited and which mines are displayed - ensure your project is in the bottom quartile!
- Copy cost curves into Powerpoint, company presentations and reports
- Regular model updates of production, costs and prices as they becomes available




The dynamic cost curves model is currently based on 2009 production data, prices and exchange rates.

Dynamic Cost Curves are a great tool for presentations. Assume you want to show a couple of mines on the cost curve drawn on your price and TC assumptions. Simply plug in your own price, TC/RC and exchange rate assumptions, set your own by-product credit assumptions, and the use the names display switches to display only the names you want. You can then copy the cost curve chart into Paintshop or Photoshop to add colours and copy the result into Powerpoint.

**MINECOST SUSTAINABILITY MODELS**

Minecost now produces downloadable Excel-based Carbon Emissions Models which generate mine-by-mine carbon emissions data tables and emissions curves for the western world copper, iron ore, zinc, lead and nickel mining industries. Mining is a significant emitter of greenhouse gases and is the focus of increasing attention from green groups and regulators. Miners need to know their own carbon emissions and how they compare with the rest of the industry. Miners and mining companies need to know where they fit in the emissions curve. Are you in the bottom quartile?

The carbon emissions model is based on minecost model estimates of direct onsite fuel, power and explosives consumption for each mine, plus the indirect emissions associated with the identified electricity suppliers to each mine. For mine complexes that include a smelter we include emissions estimates for metallurgical processing. All estimates are audited against published sustainability statements wherever possible.

Fuel and power consumption and carbon emissions data are tabulated and shown in the form of emissions curves that rank mines by their emissions consistent with each producer's sustainability reporting and GRI requirements. This allows each producer to be

compared meaningfully with its competitors. The carbon emissions data is then used to measure the impact of carbon taxes and penalties on the cash operating cost of each producer.

Data tables and emissions curves and the carbon tax implications are shown for all mines, producer companies and producer countries for 2009. The results are presented in tables and charts for mines, companies and countries showing:

- site energy inputs and power generation sources for all mines;
- site energy consumption per tonne of ore treated;
- site carbon emissions per tonne of ore treated;
- metal share of site carbon dioxide per tonne of ore treated and per tonne of contained metal produced;
- total carbon emissions per payable tonne of refined metal;
- unit cash cost of refined metal, with carbon penalties at various levels.

The Emissions Model generates the data tables and emissions curves displaying attributable carbon output for each mine, company and producer country. All major energy and carbon input variables, power generation sources, mine byproduct credits, carbon taxes, ranking order and the way all the charts display, may be changed by the user.