



Greenhouse Gas Emissions from **World Copper Mining**

A mine-by-mine analysis

Metalytics Pty Limited and **minecost.com**
have joined forces
to produce the first comprehensive analysis of
energy consumption and **CO₂ emissions**
of global primary copper production

Greenhouse Gas Emissions from World Copper Mining

Carbon Emissions are Now of Critical Strategic Importance

This timely analysis, unavailable elsewhere, combines the ten-year mine modelling experience of minecost.com with the analytical expertise and detailed industry knowledge of [Metalytics](http://Metalytics.com). It examines the pattern and range of energy consumption and greenhouse gas emissions at every step in the copper production chain from mining to production of finished primary metal.

The 372 page report presents 128 tables and 72 coloured charts that list and graphically illustrate:

- mining and full onsite energy consumption and GHG emissions
- copper's share of mining and site energy consumption and GHG emissions
- copper's share of energy consumption and GHG emissions (on- and off-site) through to finished metal production per tonne of contained copper (allocated both on a mass basis and according to value)
- unit cash cost of production of refined copper (with carbon penalties at various levels).

Clients buying this report also receive a powerful MS Excel-based spreadsheet model that can generate the data tables as well as energy, emission and cost curves displaying individual mine-by-mine data and weighted averages by company and producer country, under various forecast scenarios.

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The Report Appendices give detailed results for the years 2007 and 2012 set out as follows:

Tables Only

- Mine Production – Details
- Copper Mine Operations – Energy Inputs per tonne Ore
- Copper Mine Downstream Activities

Charts with Tables

Each chart is accompanied by two tables, one ranked in ascending order of the results (i.e. in the same order as each producer appears on the chart) and the other sorted alphabetically by mine within country, by company or by country as appropriate.

Mine Operations Results

This section compares the energy consumptions and CO₂-equivalent emissions of the activities that produce "mine output" (i.e. copper in concentrates and SX-EW cathode).

These include excavation and ore extraction and transport, disposal of waste rock, and ore crushing and concentration, as well as on-site leaching/ SX-EW operations, but not the downstream metallurgical activities required to produce cathode copper from concentrates.

Copper Mine Operations –

- Final Energy per unit Ore
- CO₂-e Emissions per unit Ore
- Final Energy per unit Ore: by Mining Company
- CO₂-e Emissions per unit Ore: by Mining Company
- Final Energy per unit Ore: by Country of Mining
- CO₂-e Emissions per unit Ore: by Country of Mining
- CO₂-e Emissions (allocated by metal mass) per unit Copper: by Mine
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All Onsite Activities & Transport Results

In this section we take a broader “whole-of-site” perspective, including the energy consumptions and CO₂-equivalent emissions of integrated smelting and refining activities that take place at the same location as mining operations, and adding the transport necessary to deliver site products to market or to a smelter. These results are presented only on a site-by-site basis – comparing Company and Country totals and averages would be meaningless because of the inclusion of smelters co-located with the mines that feed them.

All Onsite Activities & Transport –

- Final Energy per unit Ore
- CO₂-e Emissions per unit Ore
- CO₂-e Emissions (allocated by metal mass) per unit Copper

Finished Copper Results

For full like-with-like comparisons, this section compares the final energy consumptions and CO₂-equivalent emissions associated with entire production chains from mining ore to the refining of cathode copper, on a mine-by-mine basis, along with totals and weighted averages by company and country of mining. Offsite activities such as concentrate transport, metallurgical processing at dedicated or representative smelters and refineries, and the transport of SX-EW cathode to market are all included in the analysis.

Copper Production –

- Final Energy per unit Ore: by Mine
- CO₂-e Emissions per unit Ore: by Mine
- Final Energy per unit Ore: by Mining Company
- CO₂-e Emissions per unit Ore: by Mining Company
- Final Energy per unit Ore: by Country of Mining
- CO₂-e Emissions per unit Ore: by Country of Mining
- Final Energy (allocated by metal mass) per unit Copper: by Mine
- CO₂-e Emissions (allocated by metal mass) per unit Copper: by Mine
- CO₂-e Emissions (allocated by metal value) per unit Copper: by Mine
- Final Energy (allocated by metal mass) per unit Copper: by Mining Company
- CO₂-e Emissions (allocated by metal mass) per unit Copper: by Mining Company
- CO₂-e Emissions (allocated by metal value) per unit Copper: by Mining Company
- Final Energy (allocated by metal mass) per unit Copper: by Country of Mining
- CO₂-e Emissions (allocated by metal mass) per unit Copper: by Country of Mining
- CO₂-e Emissions (allocated by metal value) per unit Copper: by Country of Mining

Production Costs

Cost curves and data tables illustrate the impact that would have resulted from the application of a universal penalty of US\$50/tonne CO₂-equivalent on all emissions associated with evaluated copper production in 2007.

Copper Cash Costs of Production –

- by Mine
- by Mining Company
- by Country of Mining
- by Mine (Carbon Tax \$50/t CO₂-e)
- (Carbon Tax \$50/t CO₂-e) by Mining Company
- (Carbon Tax \$50/t CO₂-e) by Country of Mining

Mines included in the analysis

Argentina

Alumbrera

Australia

Cadia

Ernest Henry

Golden Grove

Mt Garnet/Thalanga

Mt Gordon

Mt Isa Copper

Nifty

Northparkes

Olympic Dam

Peak

Prominent Hill

Ridgeway

Rosebery

Sally Malay

Telfer

Tritton

Botswana

Phoenix

Brazil

Sossego

Canada

Brunswick

Flin Flon

Gibraltar

Highland Valley

Huckleberry

Kidd Creek

La Ronde

Langlois

Manitoba Division

Montcalm

Myra Falls

Ontario Division

Raglan

Sudbury Mines

Voiseys Bay

Chile

Andina

Candelaria

Cerro Colorado

Chuquicamata

Collahuasi

El Abra

El Soldado

El Teniente

El Tesoro

Escondida

Gabriela Mistral

Lomas Bayas

Los Bronces

Los Pelambres

Mantos Blancos

Mantoverde

Quebrada Blanca

Radomiro Tomic

Salvador

Spence

Zaldívar

Congo

Tenke Fungurume

Finland

Pyhäsalmi

Indonesia

Batu Hijau

Grasberg

Laos

Sepon Copper

Mexico

Bismark

Cananea

Charcas

La Caridad

Sabinas

San Martin

St Barbara

Tizapa

Peru

Antamina

Atacocha

Cerro Verde

Cuajone

El Porvenir

Huaron

Quiruvilca

Raura

Tintaya

Toquepala

Toquepala/Cuajone

PNG

Ok Tedi

Poland

KGHM Mines

Portugal

Neves Corvo

Russia

Norilsk Polar & Kola

South Africa

Black Mountain

Nkomati

Palabora

Spain

Aguablanca

Las Cruces

Sweden

Aitik

Boliden

Garpenberg

Turkey

Çayeli

USA

Bagdad

Bingham Canyon

Carlota

Chino

Continental

Doe Run

Miami

Mission

Morenci

Pinto Valley

Ray

Robinson

Safford

Sierrita

Tyrone

Zambia

Bwana/Lonshi

Kansanshi

Konkola

Lumwana

Mufulira

Nchanga

Nkana

The Report comes with interactive spreadsheet models.

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