

# Patterns of Energy Consumption and Greenhouse Gas Emission across primary Base Metals Production

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# Metalytics – who are we?

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Based in Sydney, Australia, Metalytics is a specialist consulting company primarily focussing on:

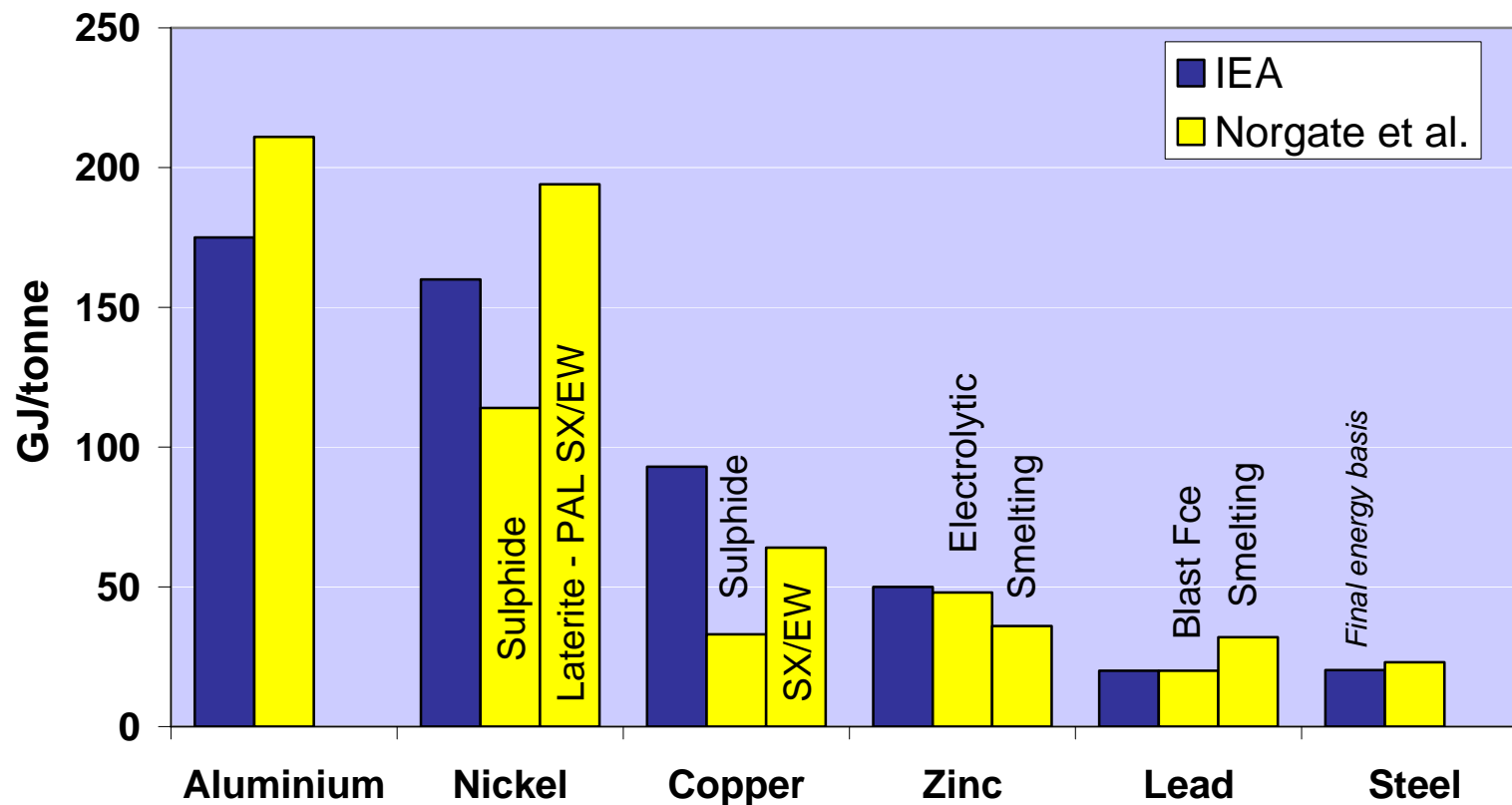
- ❖ Iron Ore and Steel Industries
- ❖ Nickel
- ❖ Aluminium and Alumina
- ❖ Energy and Infrastructure
- ❖ Other Base Metals
- ❖ Uranium and Nuclear Power

*Independently and with our sister company*



*We also work closely in association with [minecost.com](http://minecost.com) in modelling the energy consumption and GHG intensities of global base metals production*

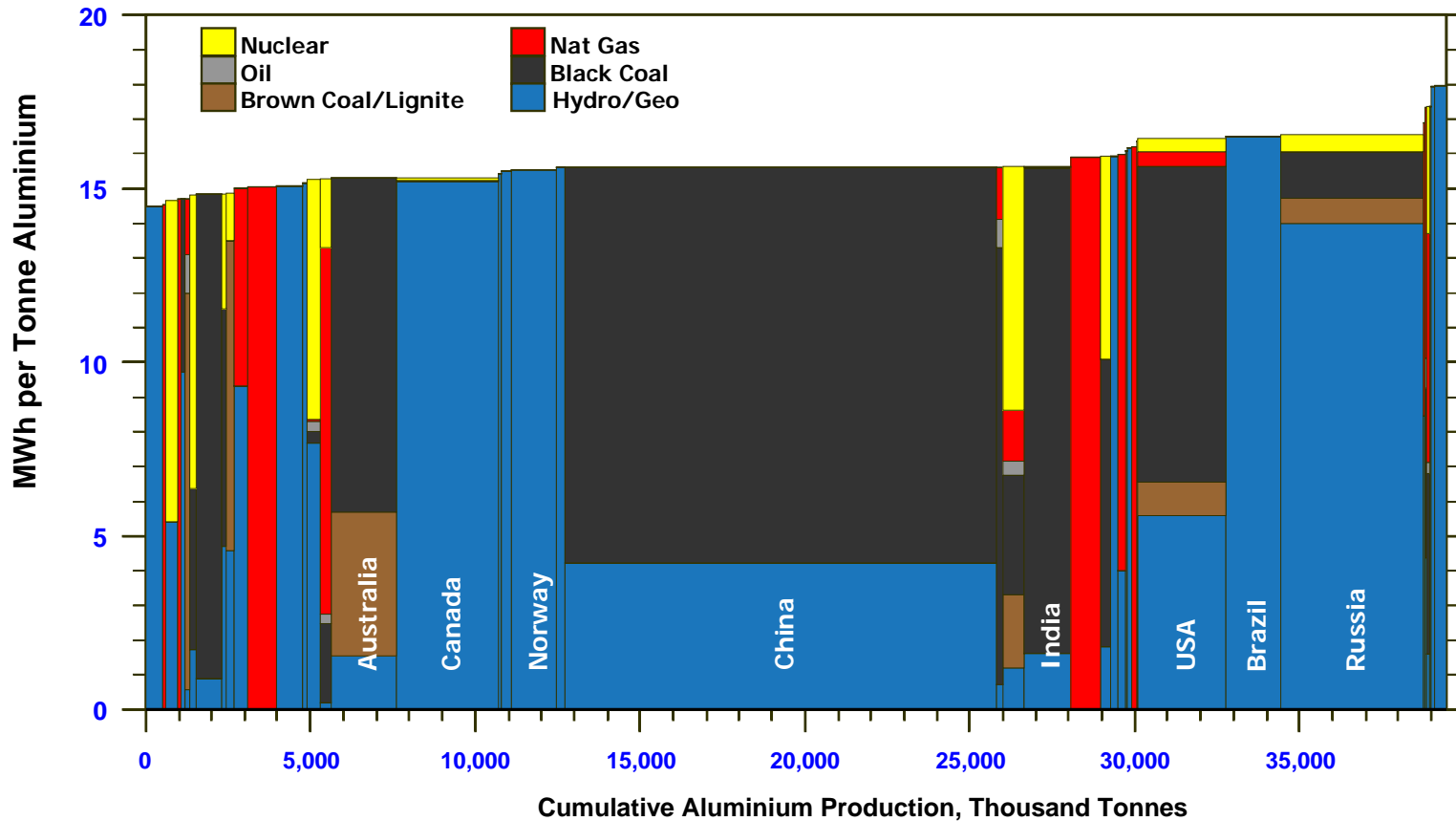
# Energy Intensity of Primary Metal Production



Primary Energy basis

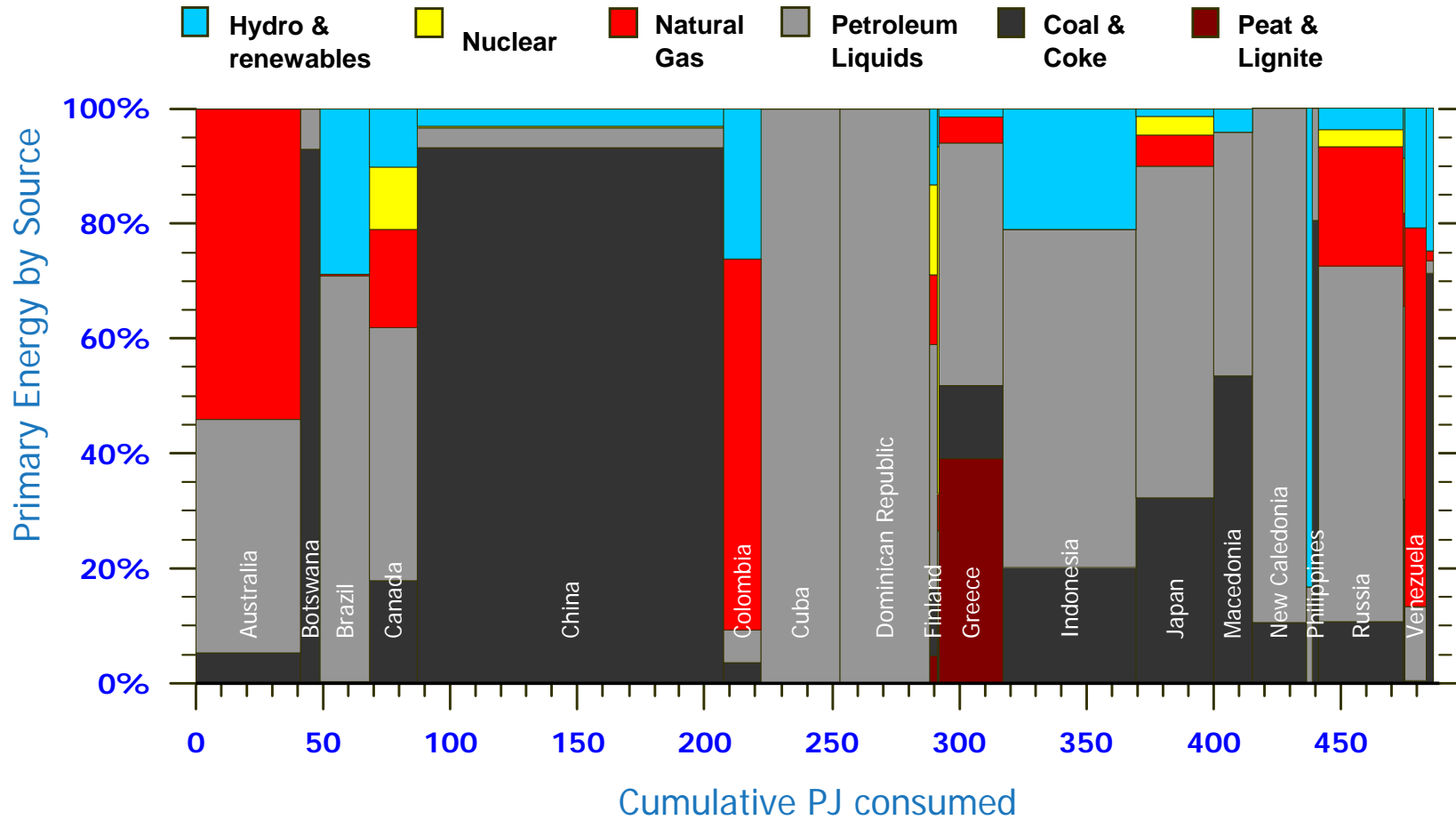
# Primary energy source mix varies around the world...

Aluminium Smelting - Avg Specific Energy and Primary Sources of Electric Power by Country - 2008



... and between metals.

## Energy consumed in primary nickel production - 2007

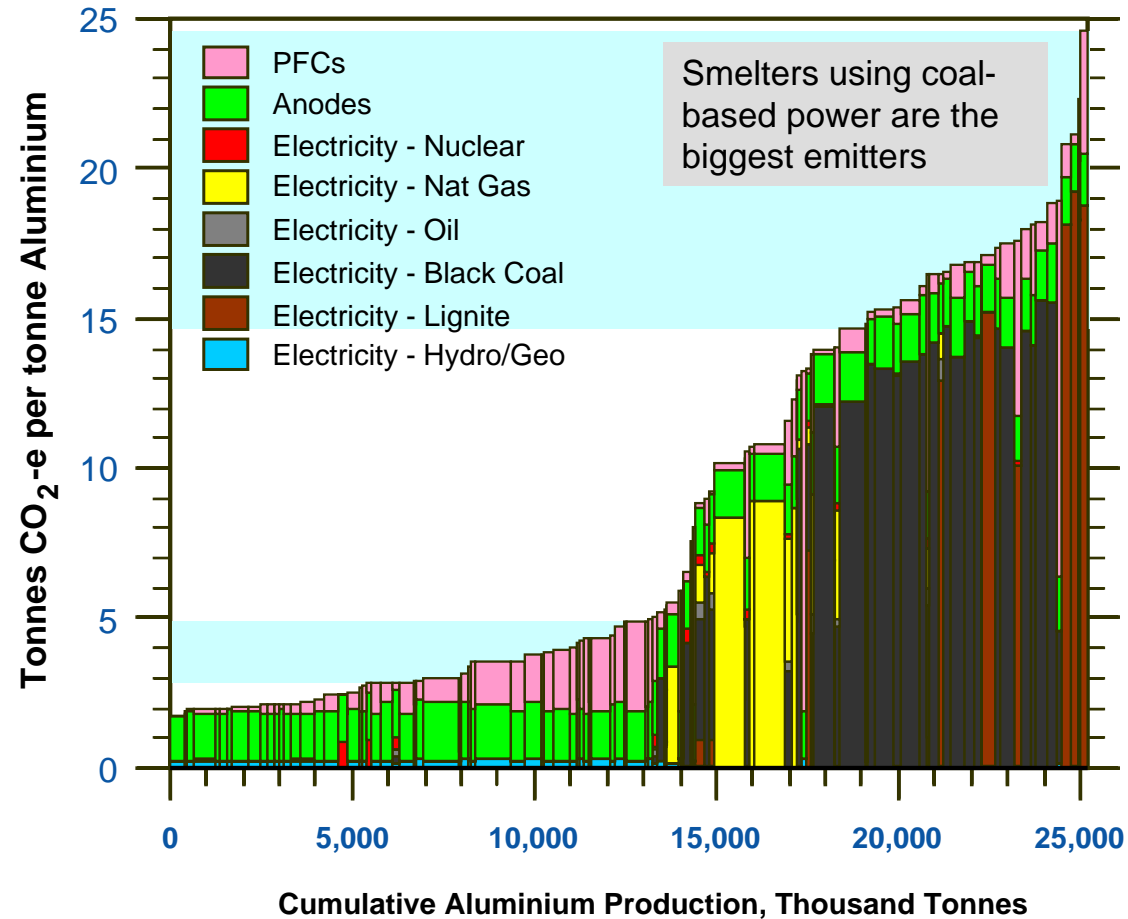


# Al smelter emissions curve, 2006 (world excl. China)

GHG Emissions by Aluminium Smelter - 2006

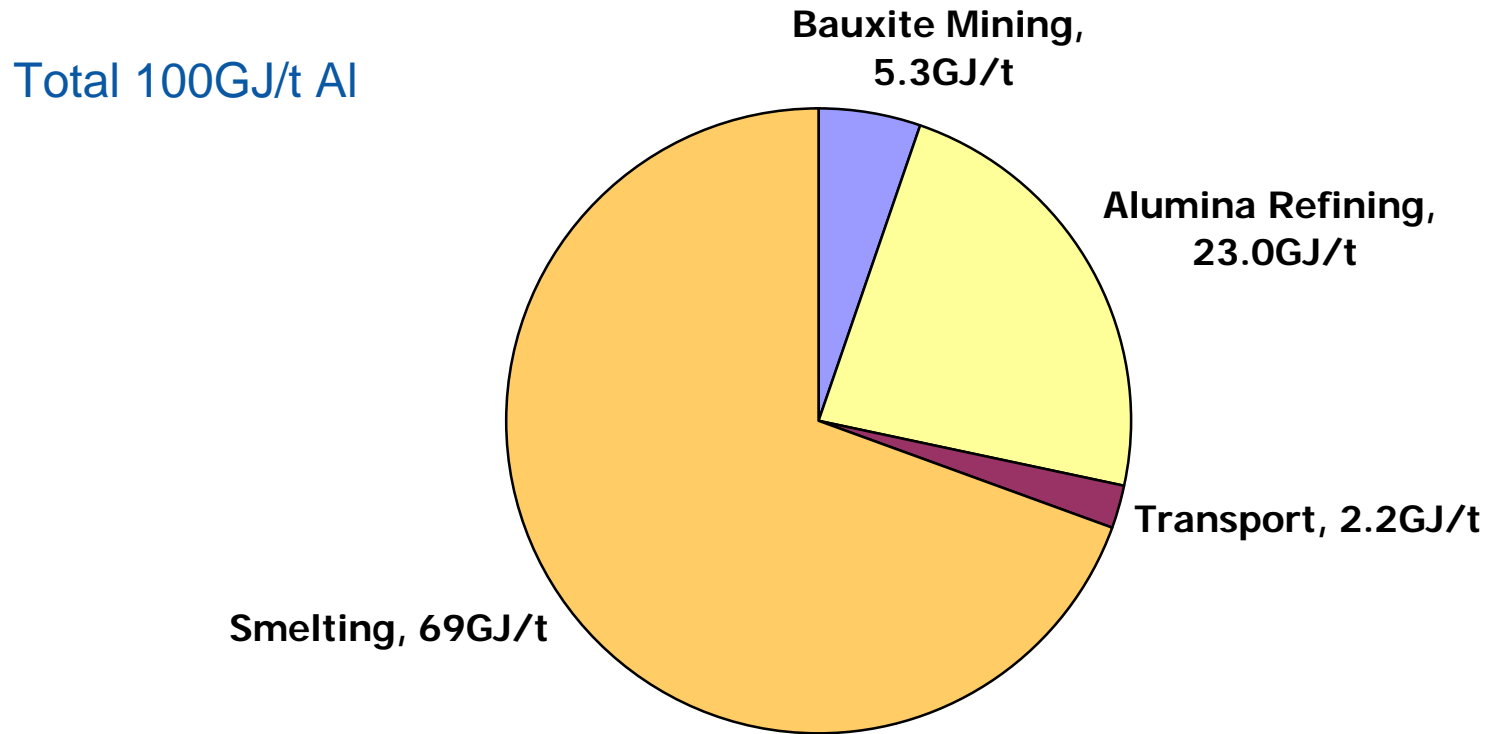
Top quartile generates 15-25t CO<sub>2</sub>-e per tonne

Half of world production generates less than 5t CO<sub>2</sub>-e per tonne of aluminium produced



# Final Energy Intensity of global primary Aluminium production

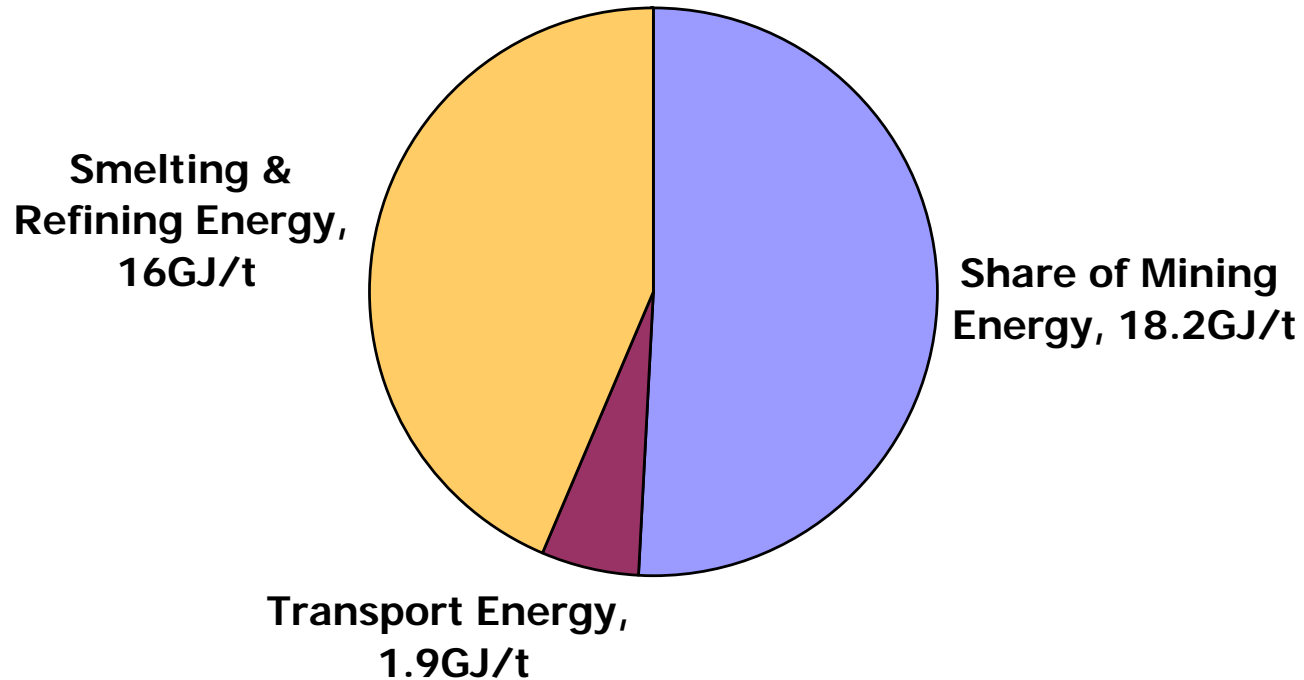
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# Final Energy Intensity of global primary Copper production

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Total 35.7GJ/t Cu

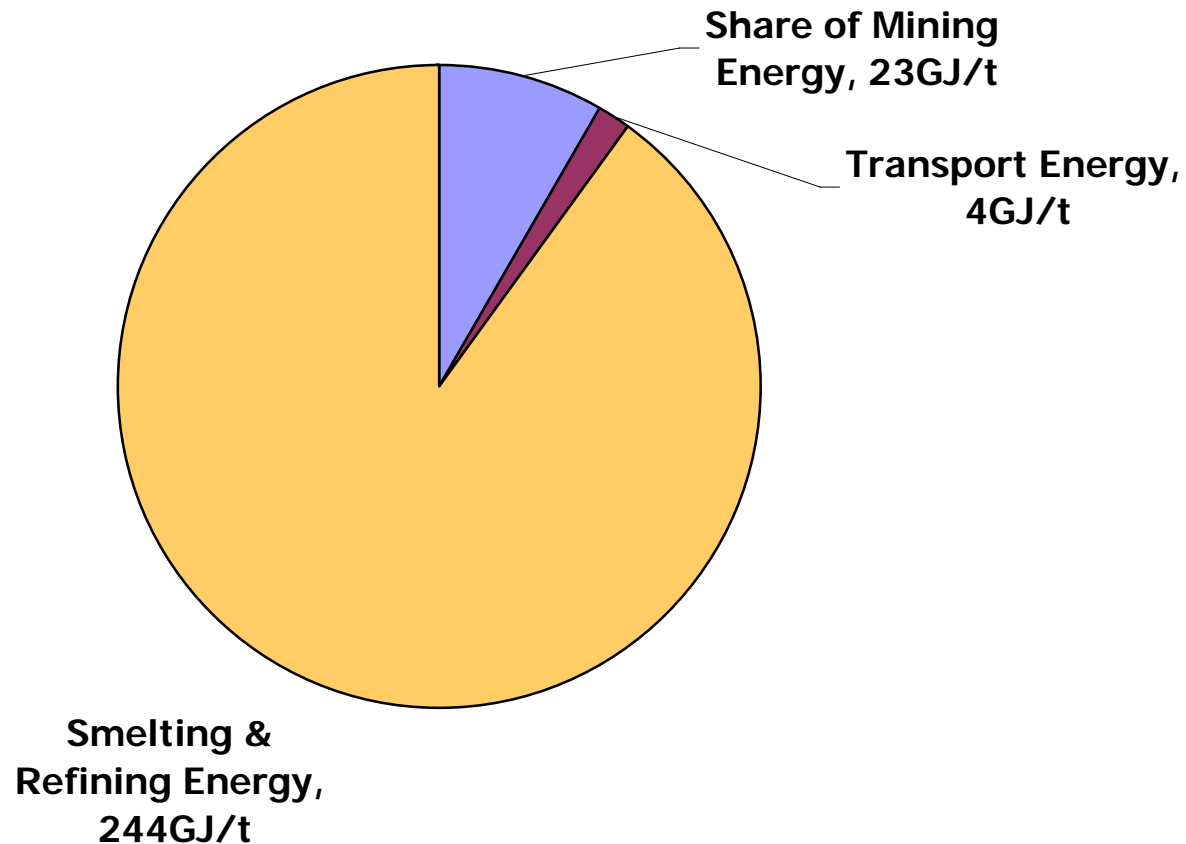




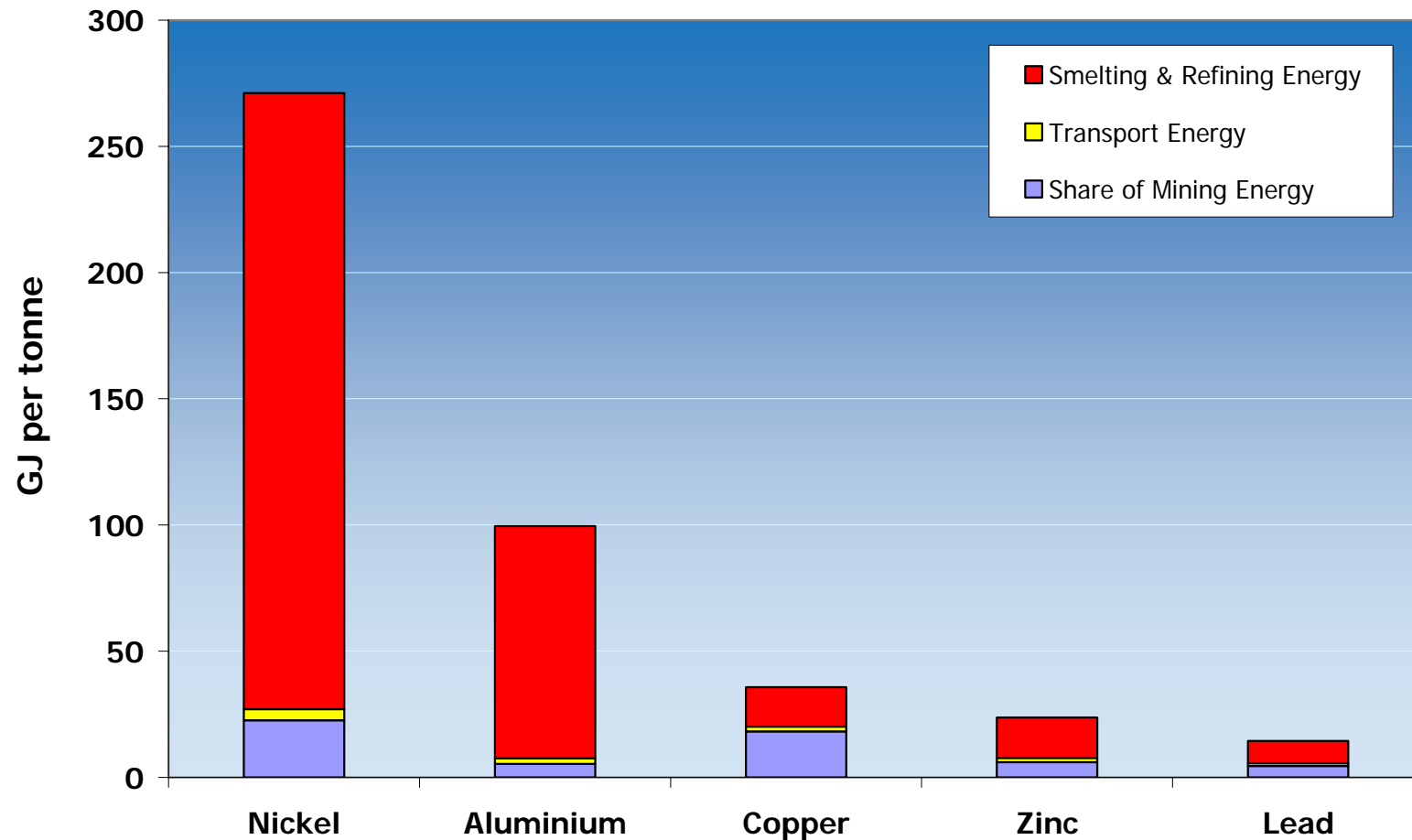
# Final Energy Intensity of global primary Nickel production

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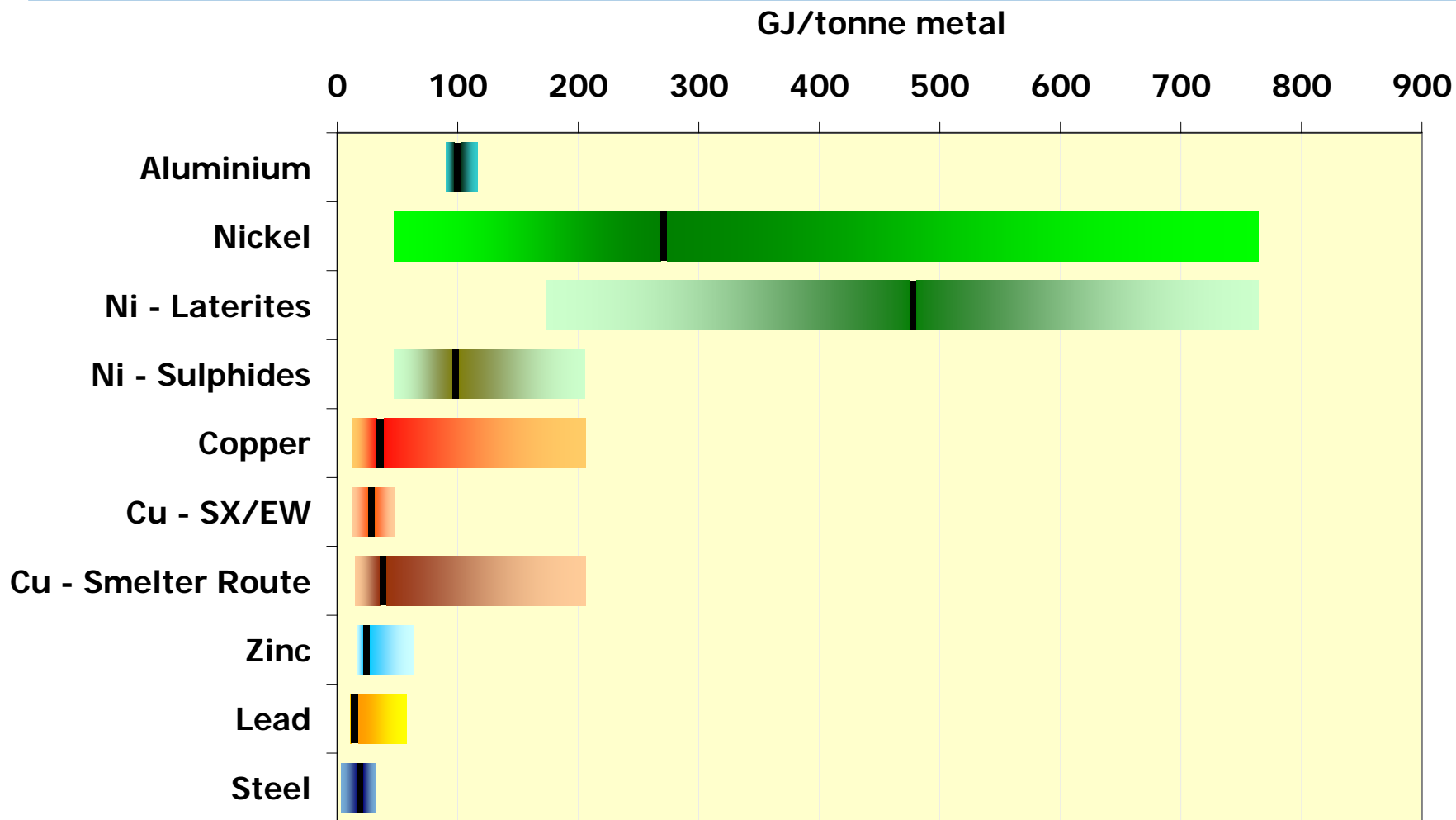
Total 271GJ/t Ni



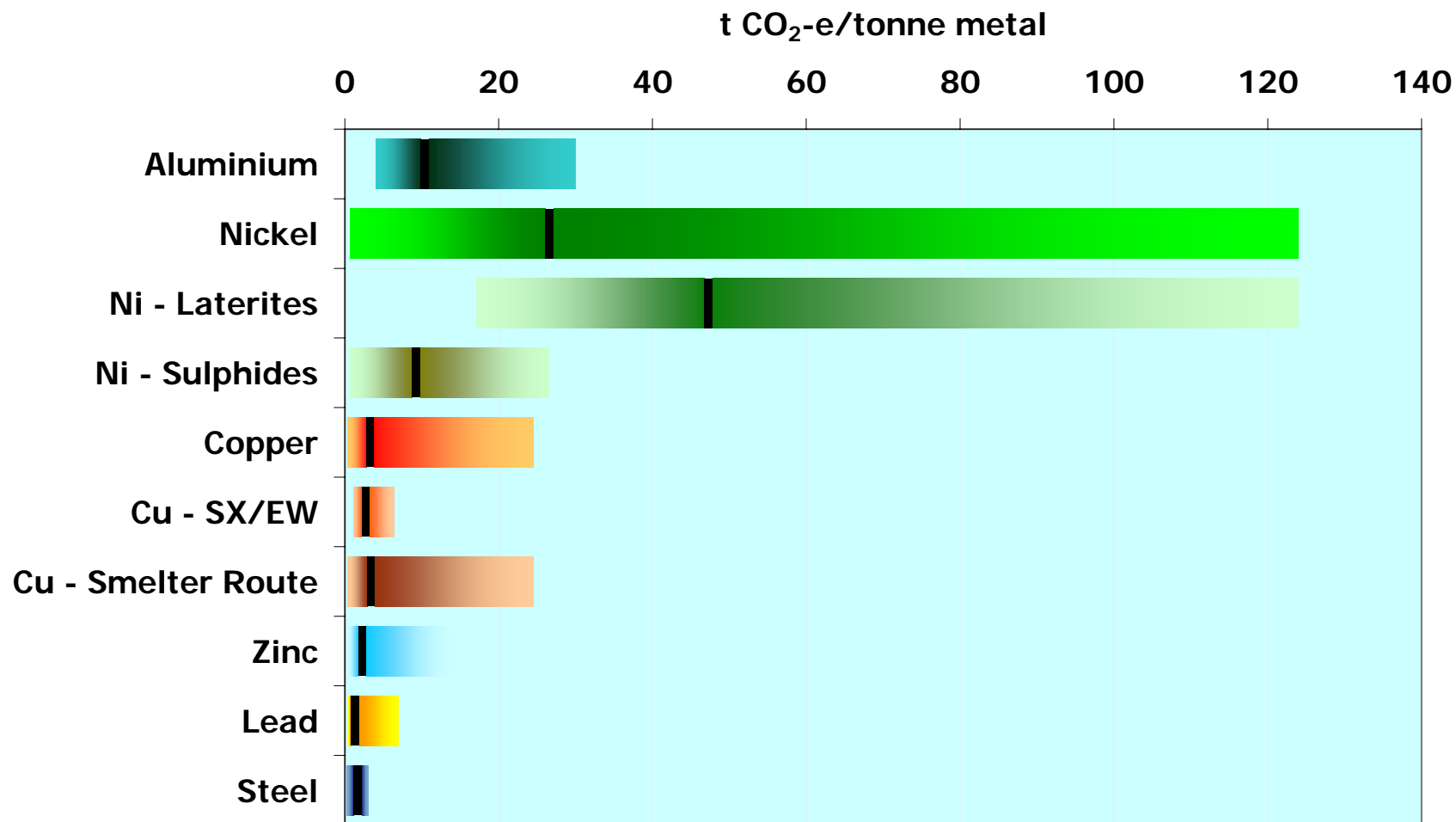
# Average Final Energy Intensities of Primary Base Metal production



# Final Energy Intensities of Primary Metal Production



# Range of GHG Intensities in primary metal production



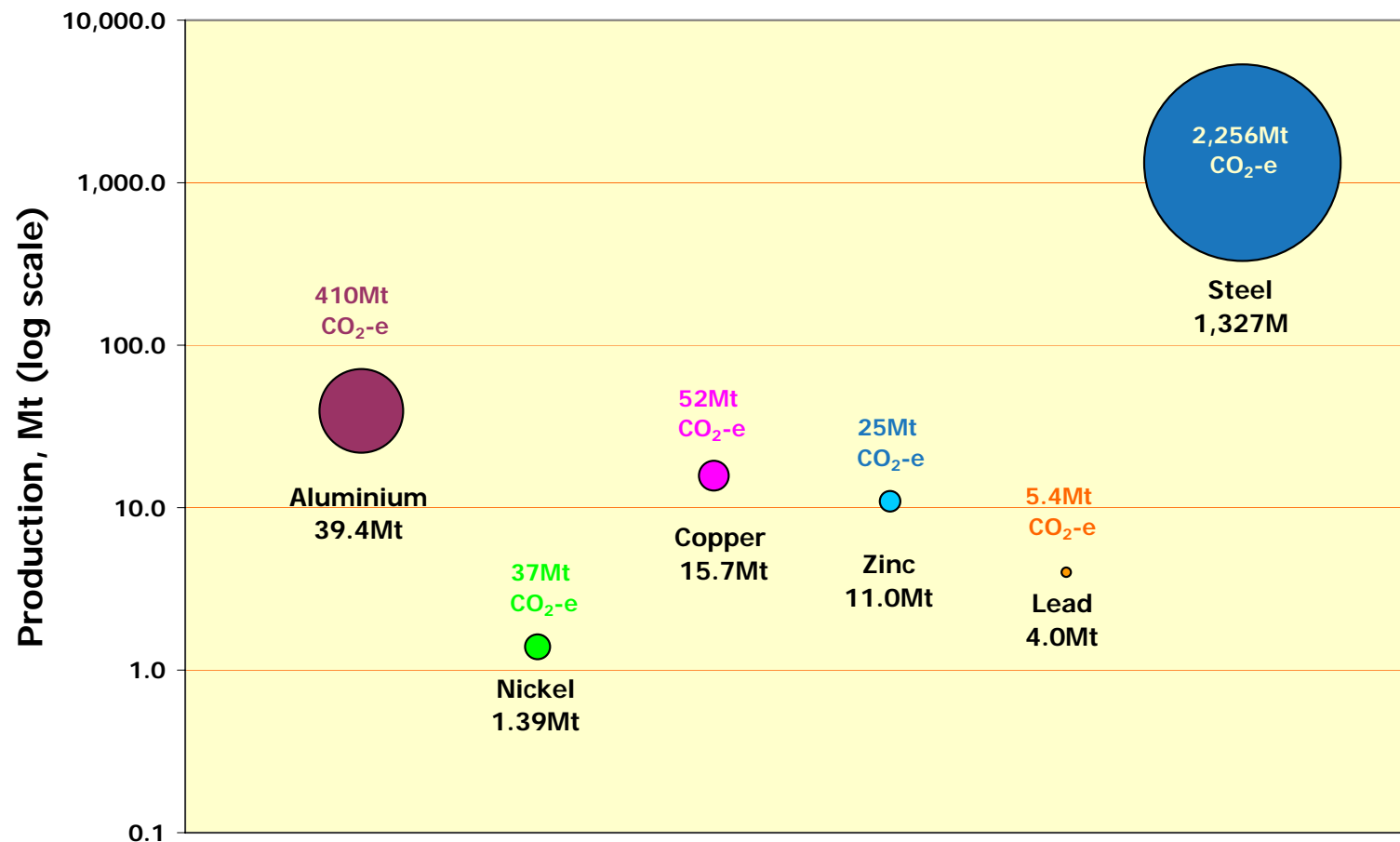
# Metals Industries GHG in Perspective

- ❖ World GHG emissions in 2007 estimated at 52Gt CO<sub>2</sub>-e
- ❖ Fossil fuels share estimated at 35Gt CO<sub>2</sub>-e

Primary Metal	Production (Mt)	GJ/t <i>(final energy basis)</i>	GHG t CO <sub>2</sub> -e per t metal	GHG Mt CO <sub>2</sub> -e	World GHG Share
Aluminium	38.1	100	10.4	396	0.76%
Nickel	1.43	271	26.6	38	0.07%
Copper	15.5	36	3.3	52	0.10%
Zinc	10.8	25	2.3	25	0.05%
Lead	3.9	14	1.4	5	0.01%
Steel	1,349	19	1.7	2,290	4.41%

Based on 2007 production and average estimated emissions

# Contributions of Primary Metal Production to Global GHG Emissions: 2008 estimates



# Calculated impact of a US\$50/t carbon price on 2007 base metal production costs

Base Metal	Average Cash Cost in 2007 US\$ / tonne	Average increase in cash cost from carbon tax at US\$50/t CO <sub>2</sub> -e	Average cash cost increase
Aluminium	\$1,714	\$520/t Al	30.3%
Nickel	\$6,040	\$1,330/t Ni	22.0%
Copper	\$1,604	\$157/t Cu	9.8%
Zinc	\$1,151	\$116/t Zn	10.1%
Lead	\$1,150	\$67/t Pb	5.8%

# Thank You

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