

COPPER

International Copper Association, Ltd.

Copper and the Environment

- **Copper: a Sustainable Resource?**
- **Copper and Human Health**
- **Copper and the Environment**
- ***CuproBraze* and the Environment**

Copper Resources

Is Copper a Sustainable Resource?

Annual Usage of Mined Copper (2000):

Primary Refined: ~ 13 Million Tonnes

Copper Reserves

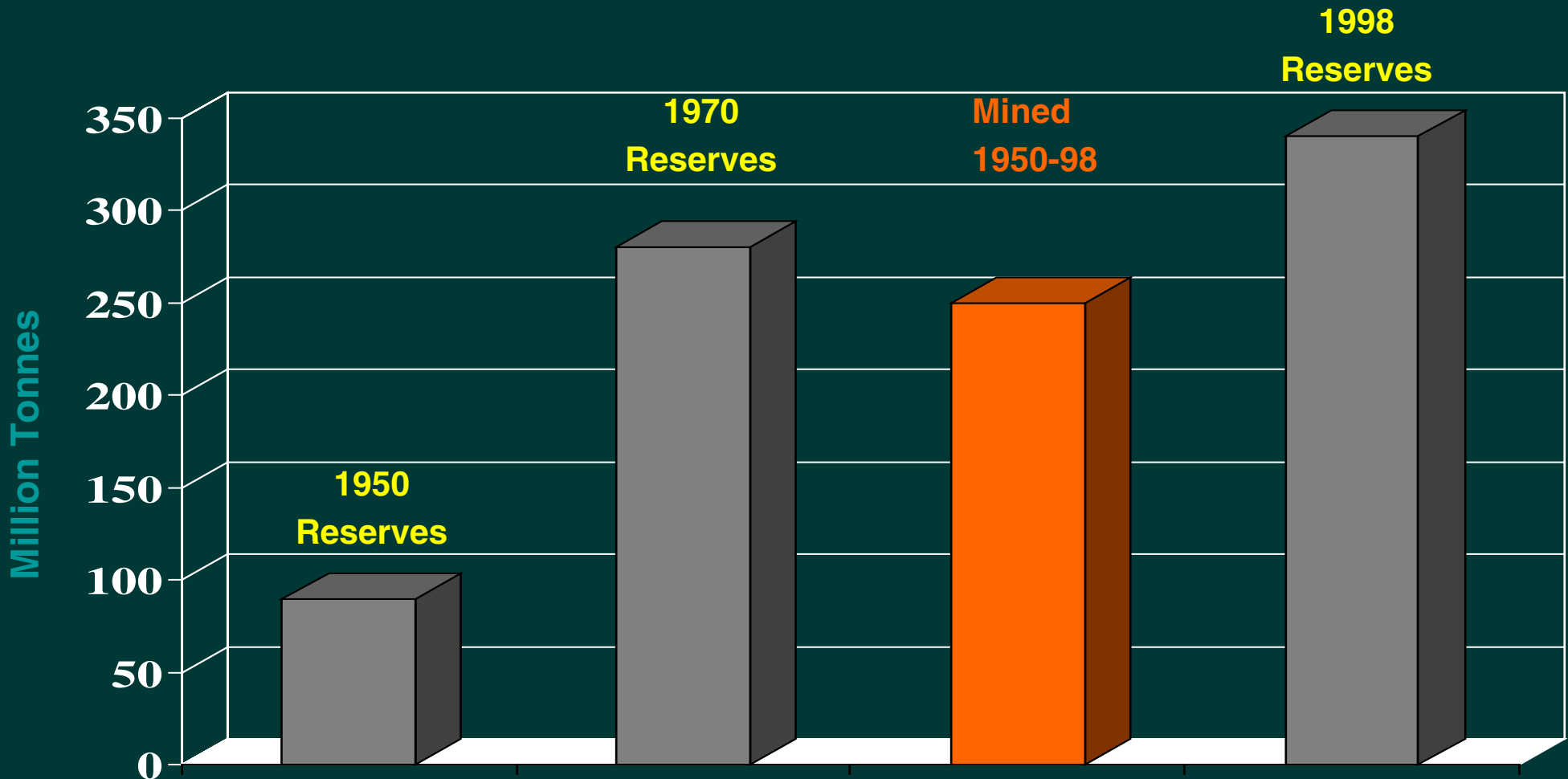
Economically Recoverable Volume*:

- 1950: 90 Million Tonnes
- 1970: 280 Million Tonnes
- 1998: 340 Million Tonnes

(1999: World Resources: 2300 Million Tonnes)

Copper Reserves*

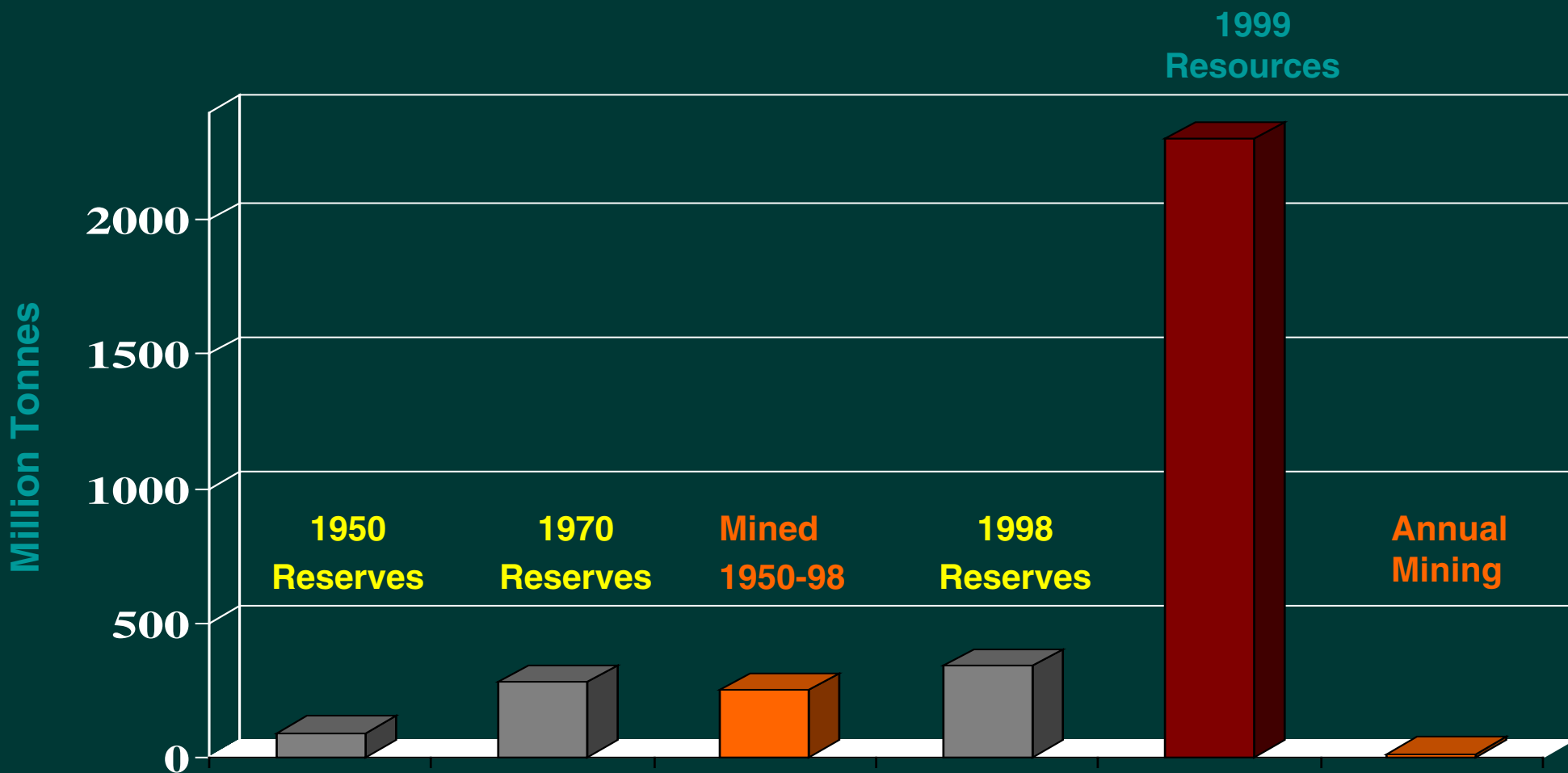
(Amount that is economically recoverable at the time of determination)



* Source: US Geological Survey

Copper Resources*

(Amount that is known to exist)



* Source: US Geological Survey

Copper Resources

Known Copper Resources: 2300 Million Tonnes

**At Current Mining Rate, known Copper Deposits will Last
~180 Years**

**Historically Mined Copper: 350 Million Tonnes
(- and Most of it is Still in Circulation)**

Copper Reserves

Is Copper a Sustainable Resource?

Primary Refined	13,0 Million Tonnes*
Secondary Refined	2,0 Million Tonnes*
Direct Scrap	<u>6,5</u> Million Tonnes
Total	21,5 Million Tonnes

~ 40% of All Copper Used Annually is Recycled Copper!*

Copper Resources

Is Copper a Sustainable Resource?

Copper Recycling Rate: ~ 40%*

(Aluminium Recycling Rate: ~ 25%)**

***Source: Int'l Copper Study Group**

****Source: World Bureau of Metal Statistics**

Copper Resources

Is Copper a Sustainable Resource?

Copper is not Consumed!

- Copper is Used

- and Reused

Copper in Perspective

Noble Metals:

Au Pt Ag Cu

Copper in Perspective

	Ag	Cu	(Al)
Electric Conductivity	106	100	(59)
Thermal Conductivity	106	100	(59)

Copper, Health and the Environment

Heavy Metals $> 4,5 \text{ g/cm}^3 >$ Light Metals

E.g. W, Hg, Pb, Cd, Mo, Co, Ni, Cr,
Fe, Zn, Cu, Mn, Sn, Au, Ag

Li, Be, Na, Mg, Al, K, Ca,
Rb, Sr, Cs, Ba, Sc, Y, Ti

Copper, Health and the Environment

Toxicity of Metals:

Toxicity Depends on Chemical State, Type of Compound, Dose, Bioavailability

Light Metals can be as Toxic as Heavy Metals!

Copper, Health and the Environment

Metals Essential for Life:

Essential Minerals

Fe, Zn, **Cu**, Mn, Cr

Trace Elements

Na, K, Ca, Mg

Copper and Health

**Copper is an Essential Nutrient
Required by the Human Body!**

Copper and Health

The World Health Organization (WHO) has Concluded that Copper Deficiency is much more of a Risk in Humans than is Copper Toxicity.

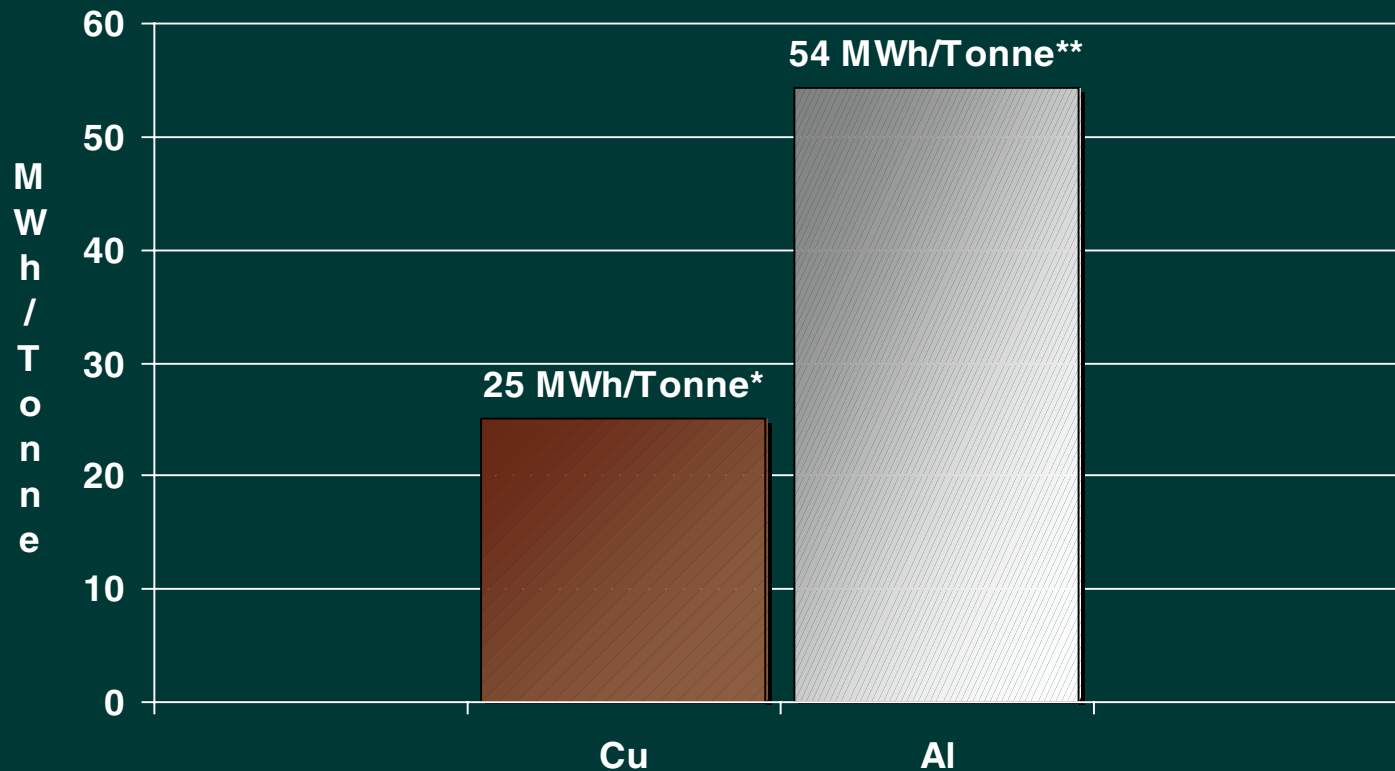
Eat Chocolate!

Copper and the Environment

In most of its Forms,
Copper is not Bioavailable

Copper and the Environment

Energy Consumption to Produce 1 Tonne of Primary Metal



* Source: Outokumpu Copper

**Source: International Aluminium Institute, LCI, May 2000

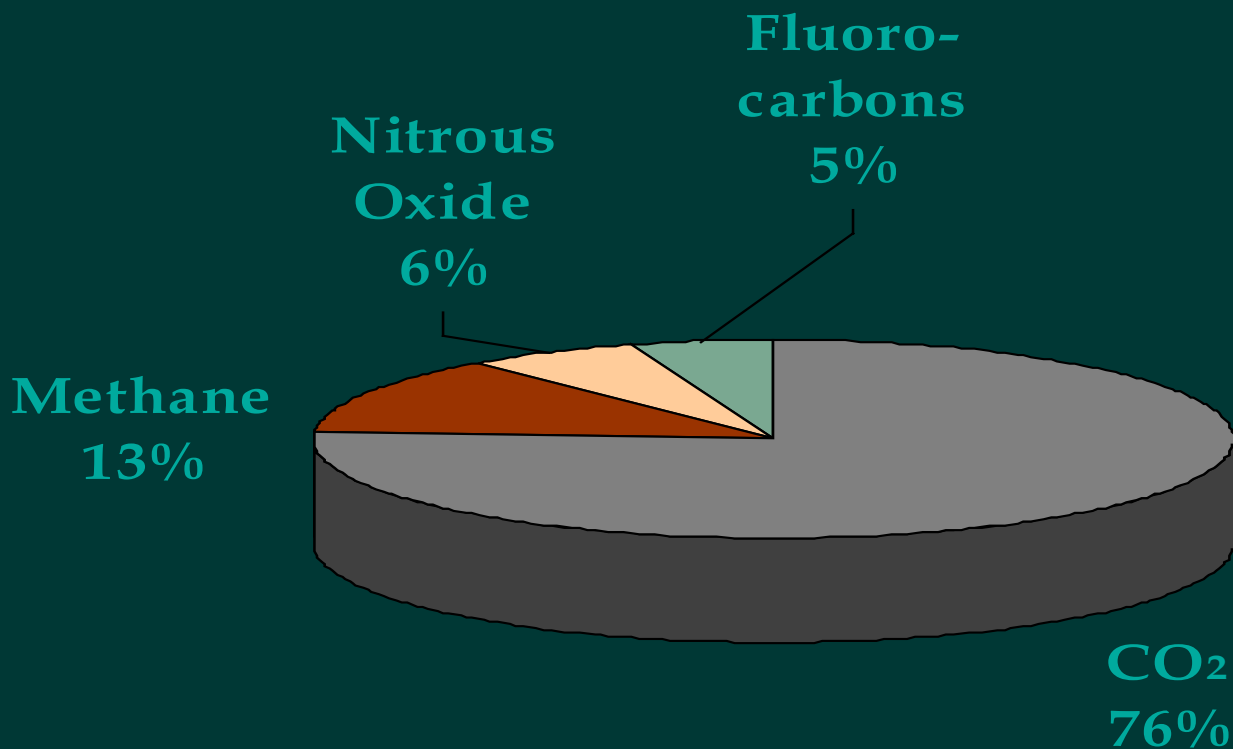
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Greenhouse Gases

- CO₂
- Methane
- Nitrous Oxide ("NO_x")
- Fluorocarbons

Copper and the Environment

Projected Global Warming Effect by Greenhouse Gases



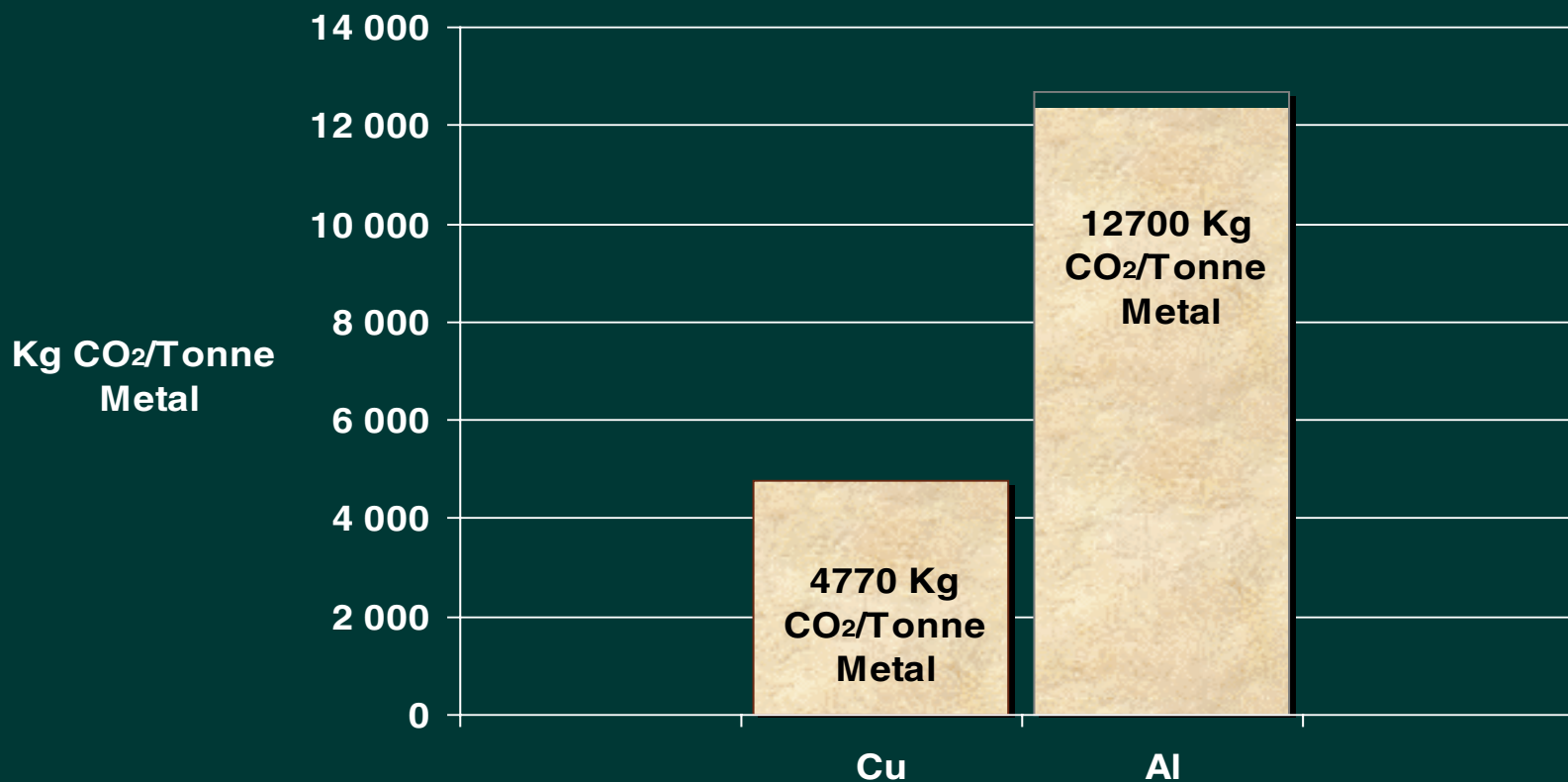
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Greenhouse Gases

Greenhouse Gas Amounts are often Recalculated to
"CO₂ Equivalents" in Accordance with their
Individual
Global Warming Potential

Copper and the Environment

CO₂ Equivalent Emission to Produce 1 Tonne of Primary Metal*



*Source: International Aluminium Institute, LCI, May 2000

CuproBraze® and the Environment

Mobile Heatexchanger Lifetime Energy Consumption and Greenhouse Gas Emissions:

Two Factors - both Heatexchanger Weight Related:

- ✓ Materials Mining and Manufacturing
- ✓ Heatexchanger Weight Contribution to Fuel Consumption

CuproBraz® and the Environment

Heatexchanger Weight's Contribution to Fuel Consumption

Ford Motor Co: 0,000027 l/kg/km

Others range from 0,000033 l/kg/km

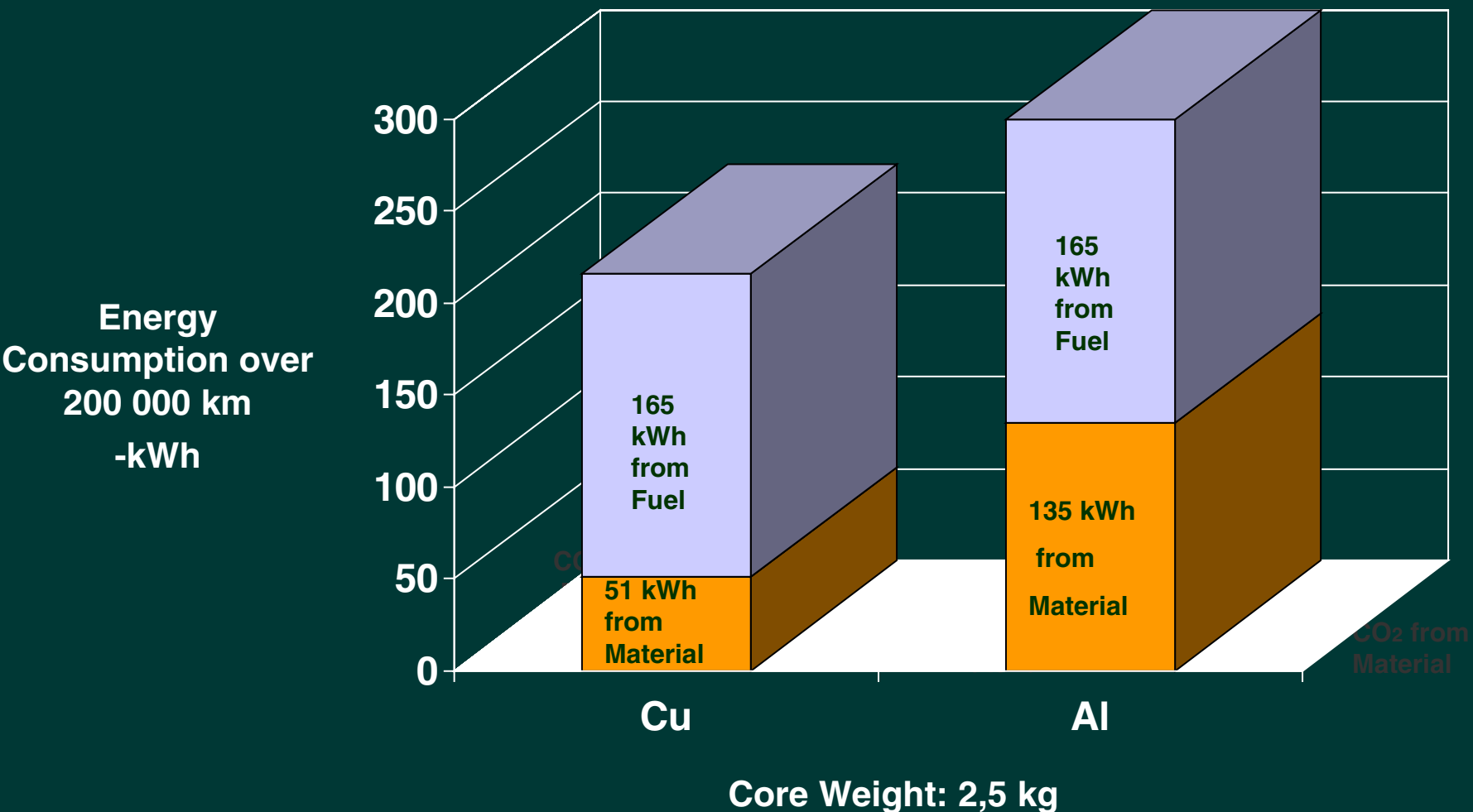
to 0,000066 l/kg/km

Aluminum Industry uses 0,000046 l/kg/km

We use 0,000033 l/kg/km

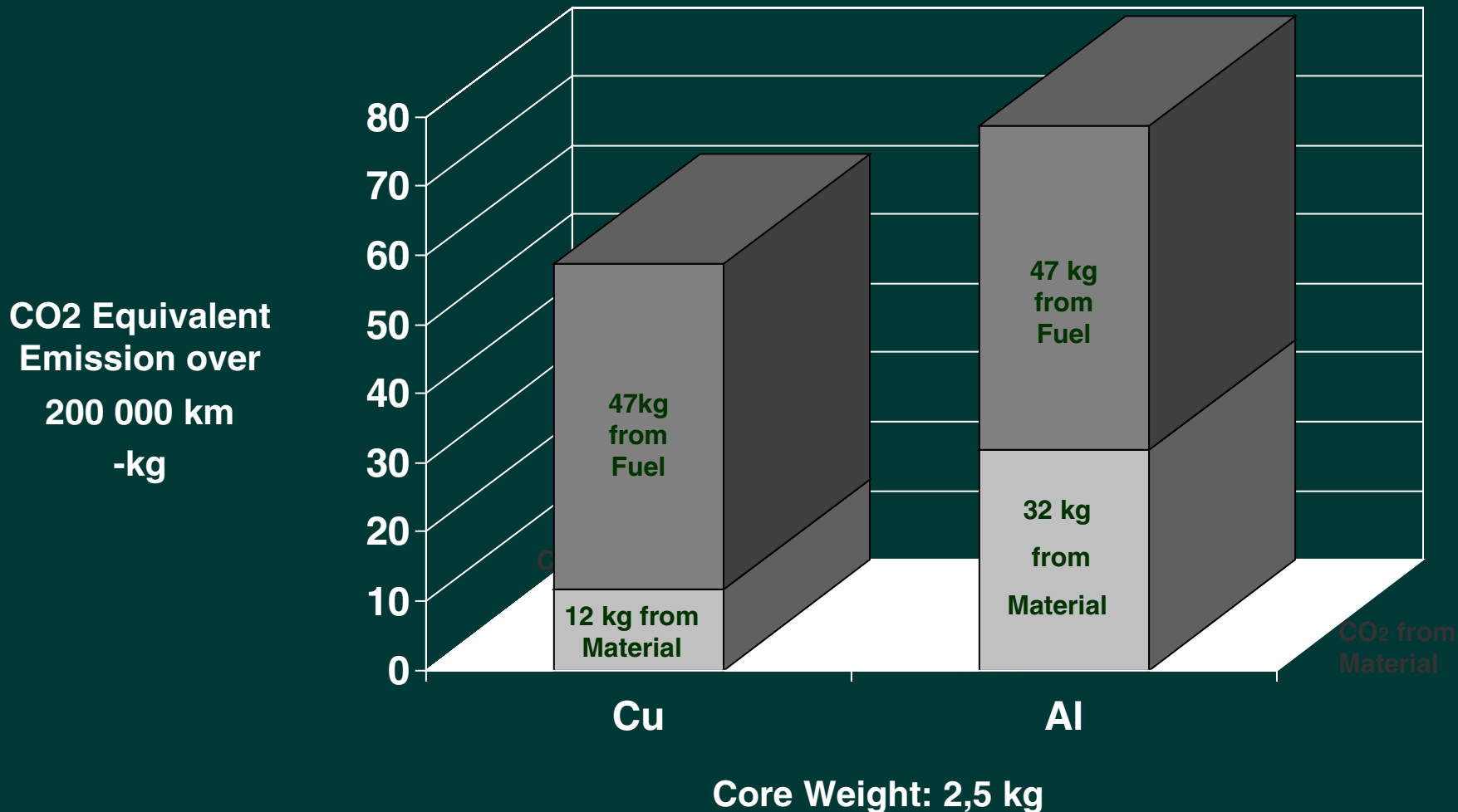
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Heatexchanger Lifetime **Energy Consumption** - Cu vs. Al



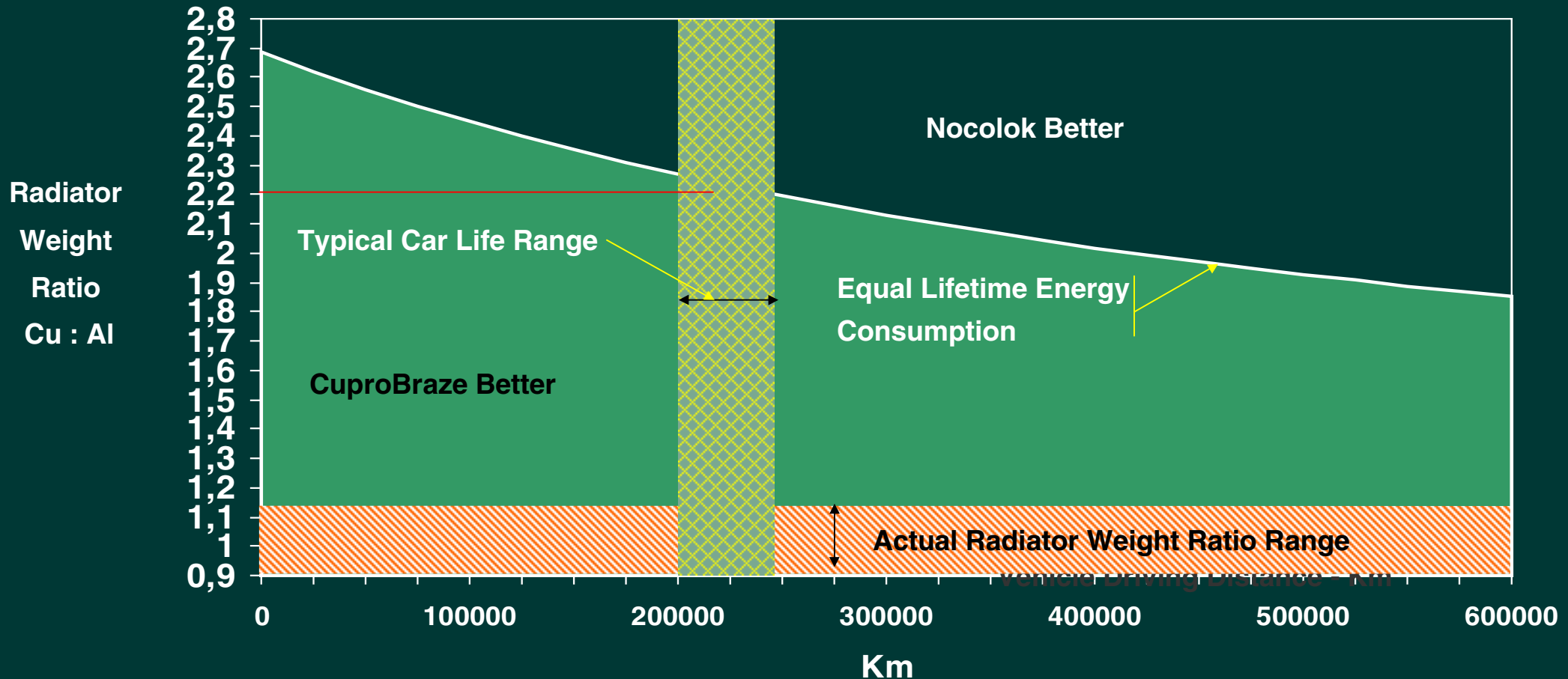
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Heatexchanger Lifetime **CO2 Equivalent Emission** - Cu vs. Al



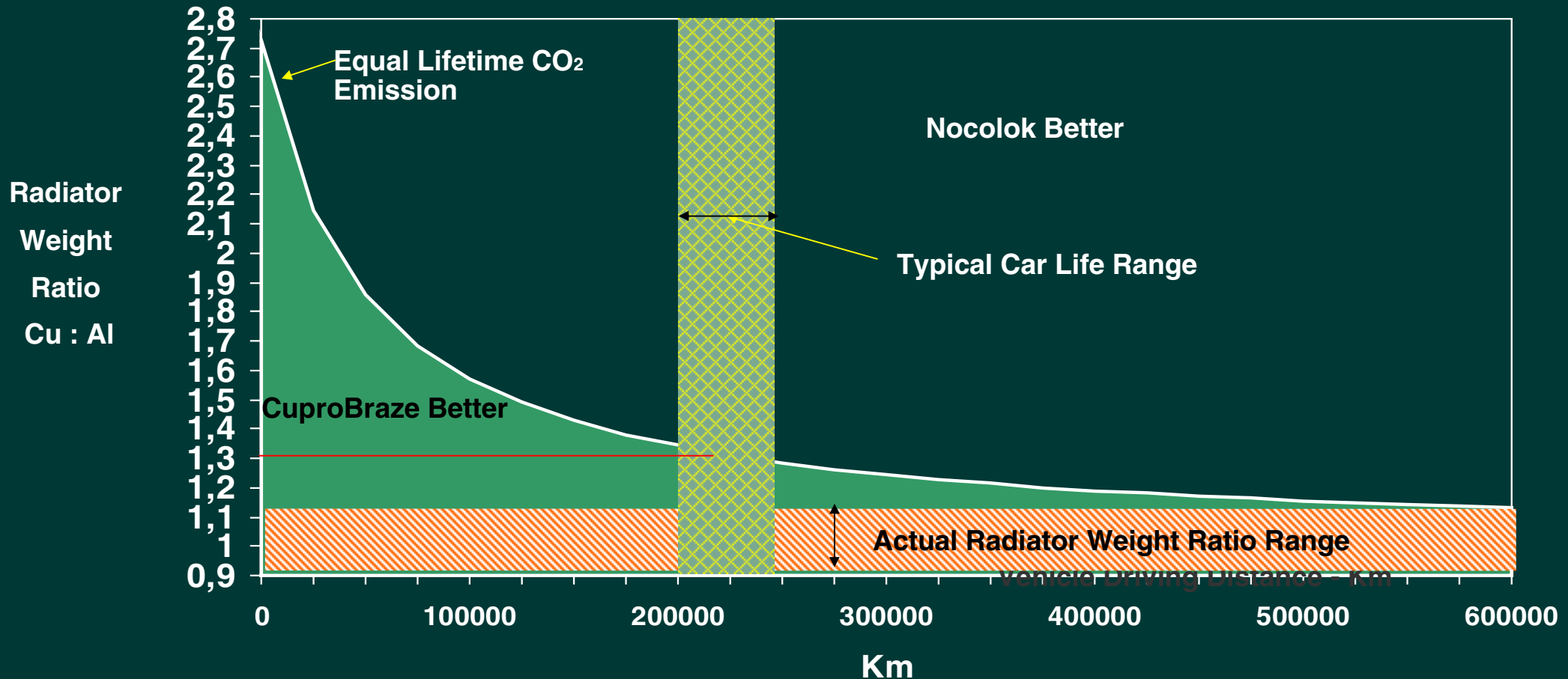
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Heatexchanger Lifetime **Energy Consumption** - Cu vs. Al



CuproBraze® and the Environment

Heatexchanger Lifetime **CO₂ Equivalent Emission** - Cu vs. Al



CuproBraze[®] and the Environment

Nocolok and *CuproBraze* Furnace Energy Consumption

Specific Heat:

Al 0.230 cal/g/°C

Cu/Br 0.090 cal/g/°C

CuproBraze[®] and the Environment

Nocolok and CuproBraze Furnace Energy Consumption

Examples:

Core Weight: 2,5 kg

Energy Savings for CuproBraze over Nocolok:

0,364 kWh/Core

Core Weight: 4,0 kg

Energy Savings for CuproBraze over Nocolok:

0,563 kWh/Core

CuproBraze[®] and the Environment

Estimated World Production of Mobile Heatexchangers 2001

- Cars: 115 million
- Commercial Vehicles: 24 million
- Aftermarket: 36 million
- Total: 175 million

CuproBraze[®] and the Environment

CuproBraze Energy Savings

Total Annual Energy Savings Potential in

Metal Production:

175 000 000 Nocolok Heat Exchangers with an
Assumed Average Weight of 2 kg Converted to
CuproBraze:

29 400 000 MWh

CuproBraze[®] and the Environment

CuproBraze Energy Savings

Total Annual Energy Savings Potential in

Manufacturing:

175 000 000 Nocolok Heat Exchangers with an
Assumed Average Weight of 2 kg Converted to
CuproBraze:

50 000 MWh

CuproBraze[®] and the Environment

CuproBraze Energy and CO₂ Equivalent Savings

Energy Savings Potential:

29 450 000 MWh

Corresponding to a Reduction of

5,9 Million Tonnes CO₂ Equivalent per Year

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