

**Metal Bulletin**  
Events



# International Aluminium

Conference

## CAN THE GLOBAL ALUMINIUM INDUSTRY ACHIEVE CARBON NEUTRALITY?

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## GLOBAL METAL INDUSTRY CARBON FOOT PRINT (2008)

Metals	World Production	CO <sub>2</sub> eq (MT/MT)	% Global GHG
Iron & Steel	1,330	1.0	>4
Aluminium	38	12	>1
Copper	17	5.5	<1
Zinc	10	3	<<1
Magnesium	1	>18	<<1
Titanium	0.1	>20	<<1





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## CARBON FOOTPRINT OF THE GLOBAL ALUMINIUM INDUSTRY ( 2008 )

Items	Production (MMT)	Unit Emission CO <sub>2</sub> eq (MT/MT)	Total Emission MT CO <sub>2</sub> eq	Comments
Smelting	38	10	380	World Average
Anode Effect (PFC)	38	2	75	0.3 kg/MT GWP = 6,500
Recycling	40	0.5	20	5 % of Primary
Total Emission			475	1 % of Global 44,130 MM CO <sub>2</sub> eq



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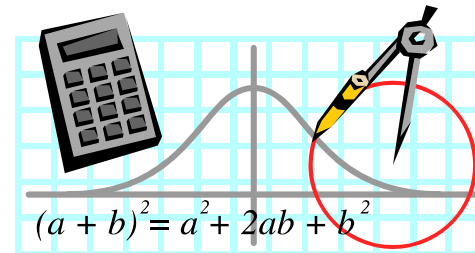
## HISTORICAL TRENDS IN ALUMINIUM INDUSTRY

- **Safety** – 1950s (Zero Lost Time Accident)  
✓ Industry Standard Now



- **Environmental** – 1970s (Zero Discharge)  
✓ Industry Standard Now

- **Quality** – 1980s (Zero Defects)  
✓ Industry Standard Now



- **Carbon Neutrality** – 2000s (Zero Carbon Impact)  
☐ New Industry Paradigm



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## CARBON FOOTPRINT REDUCTION STRATEGIES

1. Use “Greener” Sources of Electrical Energy for Smelting
2. Reduce Process Energy Requirements and Eliminate Anode Effect (PFC)
3. Employ In-Use Energy Saving Products (Transportation / Renewal Energy)
4. Prevent Aluminium Products Going into Landfills
5. Recover Aluminium from Landfills (Urban Mining)





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## HOW TO ACHIEVE CARBON NEUTRALITY ( MILLIONS OF TONNES CO<sub>2</sub>EQ PER YEAR )

World Carbon Footprint (2007)	<b>+44,130</b>
Aluminium Carbon Footprint ( >1% of Global )	<b>+475</b>
Increase Use of “Greener Energy Grid ” by 10%	
Reduce by Process & Electrical Energy Needs by 15 % Eliminate Anode Effects/ Process Improvements/ New Technologies	
Deploy 35 % of Products for In-Use Energy Savings Transportation & Renewal Energy Sectors Applications	
Divert 4 million tonnes/year from landfills/incinerators	
Mine 2 million tonnes from Urban Landfill / year	
Global Carbon Impact	<b>+425</b>





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## ELECTRICITY GENERATION ON GHG EMISSIONS

Smelting electricity Source	Total GHG Emissions kg CO <sub>2eq</sub> /kg Al	Base Change	Location
Hydro	6	-50%	Canada, Norway
Average grid	12	0%	World
Natural gas	13	+8%	Middle East
Heavy oil or coal	16	+33%	China

Increase Use of “Greener Energy Grid” by 10%





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## HALL- HERAULT CO<sub>2</sub>EQ EMISSIONS

Emissions	kg CO <sub>2</sub> eq / tonne Al					
	Mining	Refining	Anode	Smelting	Casting	Total
Process			388	1,626		2,014
Electricity		58	63	5,801	77	5,999
Fossil Fuel	16	789	135	133	155	1,228
Transport	32	61	8	4	136	241
Auxiliary		84	255			339
Fluoro-carbons				2,226		2,226
Total	48	992	849	9,790	368	12,047

Reduce by Process & Electrical Energy Needs by 15%







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## PROCESS IMPROVEMENTS

- Replace rotary with fluid bed calciners
- Reduce electricity needed for smelting
- Implement wettable / drained cathode
- Lower anode effect frequency (reduce PFC / adopt modern cells)
- Lower carbon anode consumption

**Reduce by Process & Electrical Energy Needs by 15%**





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## ALTERNATIVE ALUMINIUM PRODUCTION ROUTES









	t CO <sub>2eq</sub> /t Al	Change
Hall-Herault ( H-H ) @ 4.5 cm ACD	12	0%
H-H Center Break Pre-Bake @4.5 cm ACD ( no anode effect )	10	-20%
Wetted drained cathode @ 2 cm ACD	9	-25%
Wetted cathode and inert anode @ 2 cm ACD	8	-33%
Carbothermic electric furnace	8	-33%
Clay carbochlorination & chloride electrolysis	8	-33%

Reduce by Process & Electrical Energy Needs by 15%



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## RECYCLABILITY AND IN-USE ENERGY SAVINGS MATRIX

	Recyclability		
In-Use Energy Savings		High	Low
	High	 	 
	Low		  

Develop Carbon Credit Protocols for In-Use Energy Savings

Deploy 35 % of Products for In-Use Energy Savings Applications



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## PRODUCTS WITH MULTIPLE ATTRIBUTES AND RECYCLABILITY

May Not Have Enough Primary Aluminium for ALL PRODUCTS for >> 7 Billion People

<b>Great</b>	Transportation :	Lightweight (++) , Safety ( ++ ) , Recyclability (++)
<b>Good</b>	Aerospace :	Lightweight (++) , Recyclability (-)
<b>Good</b>	Electrical :	Conductivity (+) , Cost ( + ) , Recyclability (++)
<b>Marginal</b>	B&C :	Lightweight ( + ) , Recyclability (-)
<b>Questionable</b>	Packaging :	Convenience (+) , Recyclability ( - - )

\*Replacing steel with aluminium saves 20 t/t of CO<sub>2eq</sub> over 10 years of lifetime of vehicle

Deploy 35 % of Products for In-Use Energy Savings Applications



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## LOWER CARBON IMPACT AND RENEWABLE ENERGY PRODUCTS

	Existing Products	New Products
Aluminium Industry		
Renewable Energy Industry		

Develop Protocols for Energy In-Use Savings & Recycling as Carbon Credits

Develop Aluminium Products for Renewal Energy Applications



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## DIVERT ALUMINIUM FROM LANDFILLS / URBAN MINING

Recycled Aluminium has 5% of the Carbon Footprint of the Primary Aluminium  
Global Can Recycling Rate ~ 65 % ( ~ 2 MMT Land filled/yr , 6 Smelters / Year )

**Divert 4 MMT / year from Landfills ( 12 Smelters / Year )**

Global Urban Aluminium Can Mine Reserve > 50 MMT & Growing (>2MMT/year)

Urban Mining ( Richest “ Bauxite Deposit “ in the World ! ) is Worth Exploring

**Mine 2 MMT per year ( 6 Smelters/ Year )**

One aluminum can saved or recovered ~ 200 g CO<sub>2</sub>eq





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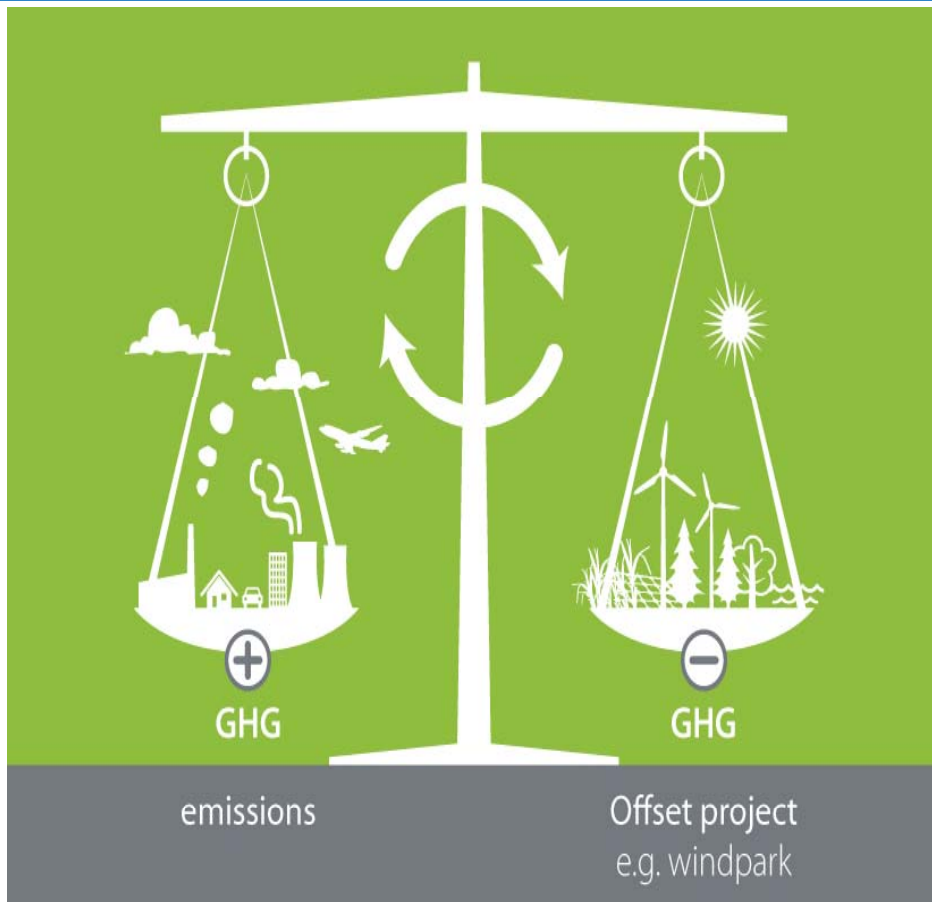
## HOW TO ACHIEVE CARBON NEUTRALITY ( MILLIONS OF TONNES CO<sub>2</sub>EQ PER YEAR )

World Carbon Footprint (2007)	<b>+44,130</b>
Aluminium Carbon Footprint ( > 1% of Global )	<b>+475</b>
Increase Use of “Greener Energy Grid ” by 10 %	<b>-50</b>
Reduce by Process & Electrical Energy Needs by 15 % Eliminate Anode Effects/ Process Improvements/ New Technologies	<b>-75</b>
Deploy 35 % of Products for In-Use Energy Savings Transportation & Renewal Energy Sectors Applications	<b>-270</b>
Divert 4 million tonnes/year from landfills/incinerators	<b>-55</b>
Mine 2 million tonnes from Urban Landfill / year	<b>-25</b>
Global Carbon Impact ( Carbon Neutrality Achieved !!! )	<b>ZERO</b>



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## DEVELOP PROTOCOLS FOR CARBON CREDITS



- In-Use Energy Savings
- Renewal Energy Products
- Recycling
  - ✓ Diverting from Landfills
  - ✓ Urban Mining



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## COPENHAGEN, DENMARK TAXI - EXAMPLE OF CARBON MANAGEMENT



Less Idling

Better Fuel Mix

Less Dead Weight

Less “Scenic” Routes

Better Driving Habits

Local Offsets



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## CAN THE GLOBAL ALUMINIUM INDUSTRY ACHIEVE CARBON NEUTRALITY?



“ We didn’t inherit aluminium from our parents.

We are borrowing aluminium from our children.”



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Group Discussion: Global Aluminium Industry Executives



ALL DATA OBTAINED FROM PUBLICLY AVAILABLE SOURCES

