Aluminum Industry and Climate Change :

Assessment and Responses

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Outline

- Impact of Aluminum Industry on Greenhouse Gases
- Industry Response

  # 1 Implement Process Improvements

  # 2 Promote Aluminum Uses in Transportation

  #3 Develop Recycle - Friendly Aluminum Alloys

  #4 Increase Recycling Rates

  #5 Qualify Carbon Trading / Offsets

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Impact of Global Aluminum Industry on Greenhouse Gases

- Aluminum is responsible for 1% of global human induced greenhouse gases (Carbon Dioxide and Perfluoro Carbons)
- 1 kg Perfluoro Carbons (PFC) is equivalent to 6500 kg CO_2
- About 32 million metric tonnes primary aluminum production worldwide
- Carbon Dioxide (CO_2)
  - 15.6 kg CO_2 per kg of aluminum production
    - Mining, refining, anode, electrolysis, and electric power generation
  - 453.8 billion metric tonnes CO_2 per year for worldwide production
- Perfluoro Carbons (PFC)
  - 1.0 kg PFC per tonne of aluminum production
  - 32 thousand metric tonnes PFC per year for worldwide production
  - Equivalent to 208 million metric tonnes of CO_2

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Industry Response #1
Implement Process Improvements

- Produce Electricity Efficiently
  - Use electricity from efficient coal/oil/natural gas power plants
  - Use renewable energy sources
    - Hydro (current world use ~50%), Geothermal, and Nuclear
- Enhance process efficiency in existing plants and develop new technology
  - Replace rotary with fluid bed calciners
  - Reduce electricity needed to make aluminum from 7 to 6 kWh /pound
  - Lower smelting energy consumption
    - Wettable / drained cathode
  - Lower carbon anode effect frequency (reduce PFC)
  - Lower carbon consumption
    - Inert anode
    - More efficient vertical electrode cell
  - Develop non-contact sensors

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Industry Response #2
Promote Aluminum Uses in Transportation

- Light weighting in aircraft, rail, shipping and especially cars and trucks saves fuel, and reduces CO_2 emissions
- Each pound of Al replacing iron or steel saves 20 pounds of CO_2 emissions over an average vehicle lifetime
- Fuel savings of 6-8% can be gained for every 10% weight reduction of a vehicle, resulting in less GHG emissions
- EPA estimates ~90% of automotive aluminum is recovered and recycled

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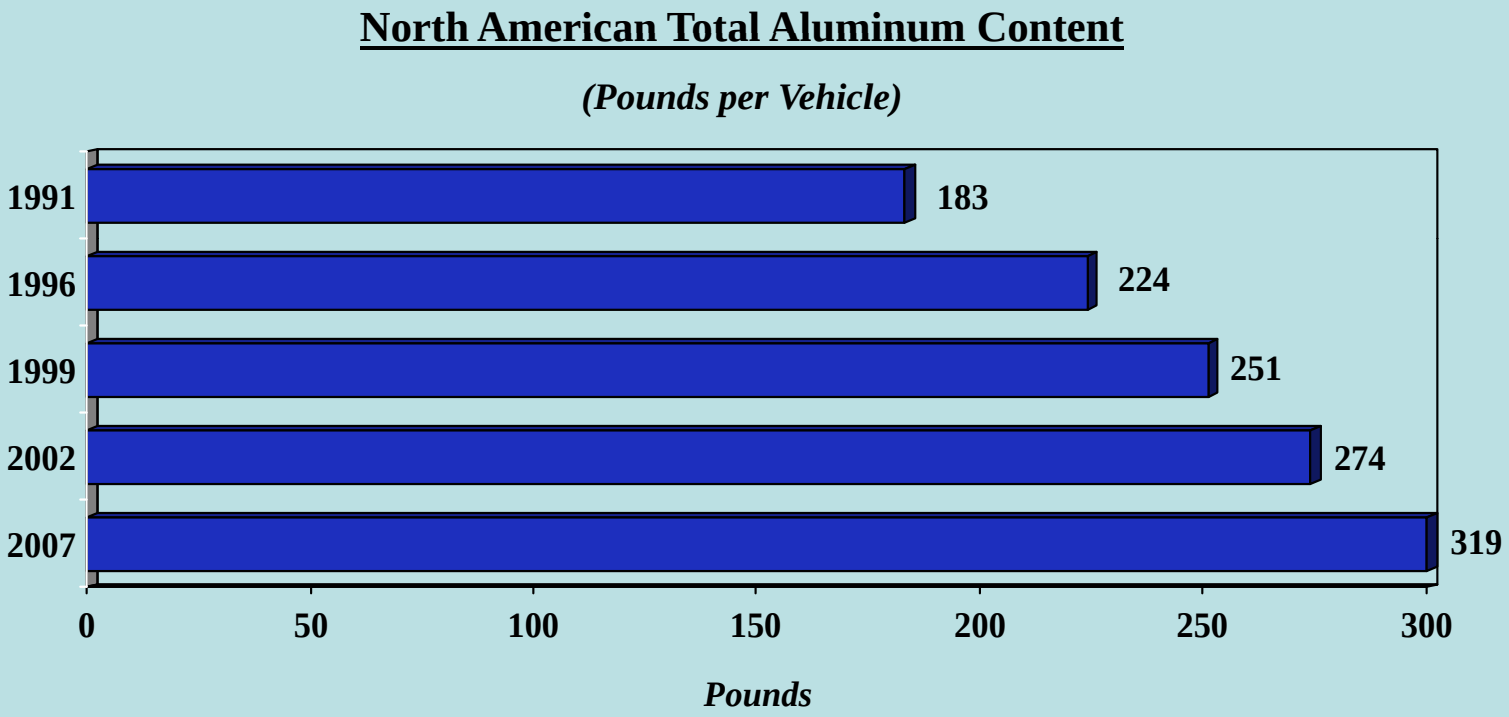
North American Light Vehicle Aluminum Content Changes



Industry Response #3

Develop Recycle Friendly Aluminum Alloys

Existing Model

"Primary World"

New Model

"Recycling World"

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Recycling Driving Changes in Alloy Development

- Previous approach to alloy development
  - Driven solely by desired performance
  - Limited considerations of end-of-product-life
  - Less considerations for cost, carbon footprint and availability of alloying elements
- Beginning to recognize impact of recycling
  - How will product be recovered for recycling ?
  - How will composition impact cost & recyclability?
  - What will be it's carbon footprint?

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New Paradigm for Evaluation of Existing and Designing of New Alloys

- For both existing and new alloys --- Recycle to same product
- For existing alloys:
  - Recognize relative value when recycled
    - How big are energy source and carbon footprint?
  - Consider how best to group alloys for remelting to maximize value of remelt composition?
- For designing new alloys
  - Consider how useful composition will be when remelted
    - Avoid adding elements that become contaminants
  - Consider direct production from recycle remelts
    - Avoid tight impurity limits
    - Consider alloys from automotive, B&C, packaging or aircraft recycling scrap streams

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Aluminium Recycle Index (ARI)

- **Concept Introduction and Definition:**
  - **ARI is a measure of the relative ease, value, and desirability of recycling & remelting alloys in end-of-life products**
    - **Includes potential for recycling back to the same product or to another high-value product with minimal primary additions**
  - **ARI is a measure of the energy content and carbon footprint**

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Industry Response # 4
Increase Recycling Rates

- Enhance aluminum melting efficiency (average 25 %)
- Implement new recycling/sorting technologies
- Increase UBC recycling rate to new industry goal of 75 % by 2015
- Consider consumer behavior, convenience and economic incentives
- Consider urban mining of Used Beverage Cans (UBCs)
  - US recycling rate ~ 50% (Brazil, Norway ~ 96%)
  - Accumulated landfill totals 20 million tons in the US
  - Total value of “urban mine” is $50 billion in the US
  - New landfill equals outputs of 3 aluminum smelters (~900,000 tonnes per year in the US)

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- **Recycling lowers energy & carbon footprint**
  - **Requires 5% of energy : 2.3 vs. 45 kWh/kg Al**
  - **Emits 5% of carbon dioxide : 0.6 vs. 12 kg/kg Al**
  - **Alloying Elements Conservation (Mg, Mn , Cu , Zn, Si)**
    - **Have high energy and carbon footprints**

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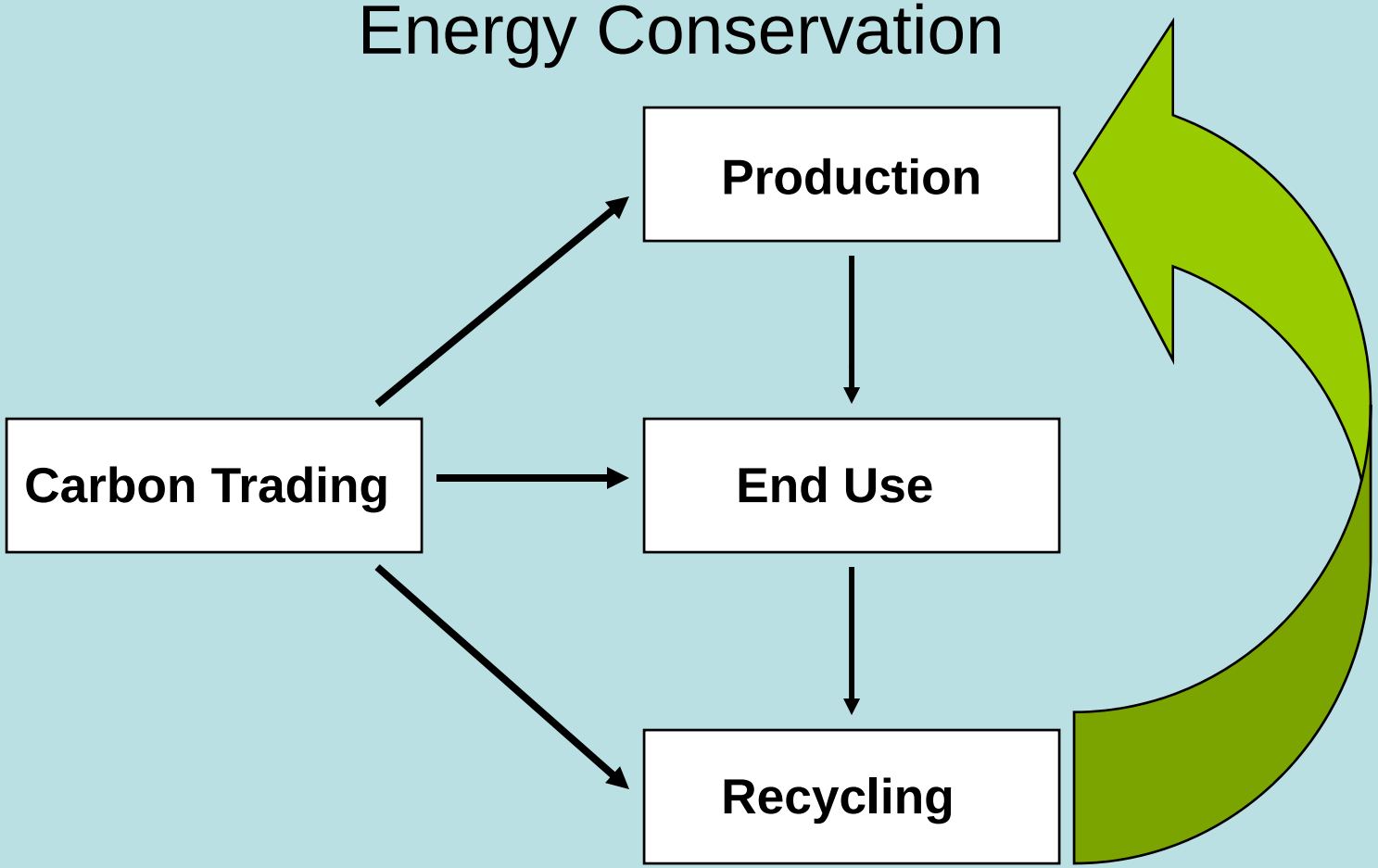
Industry Response # 5
Qualify Carbon Trading / Offsets for Recycling and Energy Conservation



Thank You

For further discussion, please contact

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