From aluminium to bauxite residue (red mud)
- When circularity works and when it's more of a struggle
Ambitious goals
Recycling & $\text{CO}_2$

Greener:
Lead the transition towards sustainable solutions

Aluminium
One of the most recyclable of all materials

5% to recycle
75% still in use

Bauxite Residue
Our big challenge

Waste versus $\text{CO}_2$ - emissions
Hydro – An integrated aluminium company

• Global provider of alumina, aluminium and aluminium products and solutions.
• 35,000 employees at 150 locations in 40 countries
• Annual revenues NOK 109 billion (2017)
• Included in Dow Jones Sustainability Indices, Global Compact 100, FTSE4Good.
1/3 density of steel means lighter vehicles, lower energy consumption and reduced emissions.

The superior food preservation properties of aluminium packaging reduces food waste meaning reduced emissions.
Ambitious goals: recycling and CO$_2$ emissions

- Recover 1 million tonnes of contaminated and post-consumer scrap aluminium annually by 2020.

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https://www.aluminum.org/industries/production/recycling
Growing in recycling

**Investments:**
- Ex.1: Dormagen, Germany: scrap shredding and sorting plant
- Ex. 2: Neuss, Germany: UBC recycling line.

**R&D:**
- Ex.1: Alloy sorting (LIBS)
- Ex.2: Development of recycling friendly alloys.
- Ex.3: Circular aluminium packaging (Alpakka)

**Certification:**
- Development of traceability and quality principles (DNV GL)

- Increasing post-consumer scrap usage
- Increasing RFA sales

Product with minimum 75% post-consumer recycled aluminium
Recycling - making circular economy a reality

Advanced recycling plants for scrap shredding, sorting and recycling

- Dormagen, Germany: Scrap shredding and sorting plant
- Neuss, Germany: UBC recycling line
- Clervaux, Luxembourg: Recycling plant upgrade
Sorting technology

Source TiTech
Low-carbon products
Unique advantages through integrated value chain, renewable energy and post-consumer recycling

Hydro 4.0

- All-in approach
- Maximum 4.0 kg CO2e/kg Al
- Verified by ISO 14064 by DNV GL

Hydro 75R

- Minimum 75% post-consumer Recycled aluminium
- Verified by DNV GL based on traceability and quality principles developed by Hydro
Recycling of aluminium food packaging

Aluminium food packaging:

- Most of the aluminium lost to waste incineration and landfill comes from aluminium packaging.
- The short loop time of aluminium packaging, as compared to e.g. building materials with a loop time of approximately 40 years, makes this waste volume comparatively large.
- Recycling challenges: food residues, multi-materials (e.g. aluminium + plastics), multi-alloys.

Circular aluminium packaging in Norway:

- Aims to establish a Norwegian flagship demonstrator for circular economy in practice which will increase the aluminium packaging circularity, by value-chain cooperation between collectors, packaging designers (food producers) and recyclers.
Bauxite Residue (red mud) - Our big challenge

- Key issues:
  - Mineralogically and chemically complex.
  - High pH
  - Fine particle size
  - Moist
  - Large volumes typically in remote locations (= cost and CO₂ footprint of transport).
  - Use options typically competes with low-cost virgin raw materials that are less energy demanding to process (waste versus CO₂-emissions).

DSP (de-silication product) is a sodium aluminium silicate: Na₆[Al₆Si₆O₂₄]Na₂X.

<table>
<thead>
<tr>
<th>Mineralogical components</th>
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<tbody>
<tr>
<td>Hematite</td>
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<td>Goethite</td>
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<td>Gibbsite</td>
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<td>Rutile</td>
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<td>Quartz</td>
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<td>DSP*</td>
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How to approach the bauxite residue challenge

Bauxite → Alumina + Energy = Primary → Casting → Recycling

Products

Bauxite residue
How to approach the bauxite residue challenge
How to approach the bauxite residue challenge

• Solve the problem as early as possible in the value chain:
  • Prevent the waste
  • Modify the properties of the waste

• Use as feedstock for another industry.
  • E.g. cement (collaboration project with Norcem and Heidelberg Cement).

• (Alternative alumina / aluminium production processes)
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We are aluminium