Rheinwerk Neuss: An integrated, flexible metal source

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Welcome to Rheinwerk!

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An introduction to primary production

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Transforming the way we use energy

Energy efficient, low-emission electrolysis

Reduce energy consumption, improve cell efficiency, CO2 capture ready cells

Primary production

Lighter vehicles

Reduce fossil fuel consumption and GHG emissions by making cars lighter

Zero energy buildings

Reduce energy consumption and GHG emissions from buildings

Increase solar energy efficiency

Reduce fossil fuel emissions by contributing to making solar energy solutions lighter, simpler and cheaper

Packaging that reduces waste

Reduce GHG emissions from food production by conserving and protecting food better

Recycling and reuse

Reduce waste and energy consumption in a world of limited resources by recycling aluminium endlessly

Aluminium in use

Recycling

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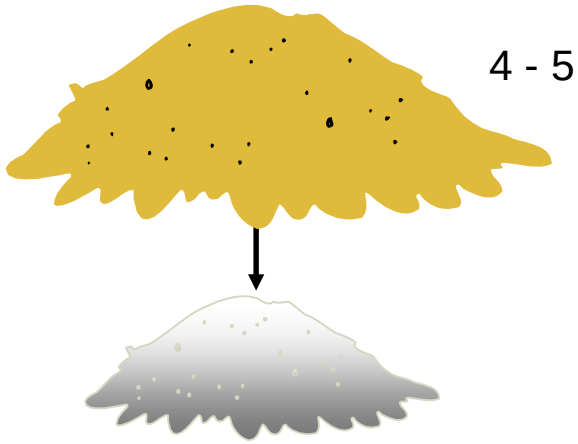
Raw materials to produce 1 kg aluminium



4 - 5 kg Bauxite

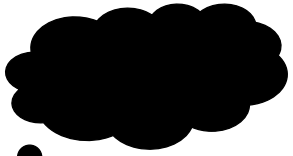
$Al_2O_{3,\ Electrolyte} + x\ C \longrightarrow 2\ Al + mCO_2 + nCO$

2 kg
Aluminium-oxide

+

0.5 kg
Carbon

+



1,5-2 kg

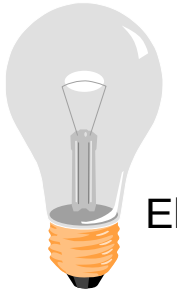
=

50 g
Aluminium fluoride

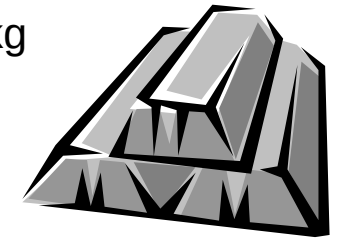
+

50 g
Cryolite

+



13 - 15 kWh
Electrical energy



1 kg
Aluminium

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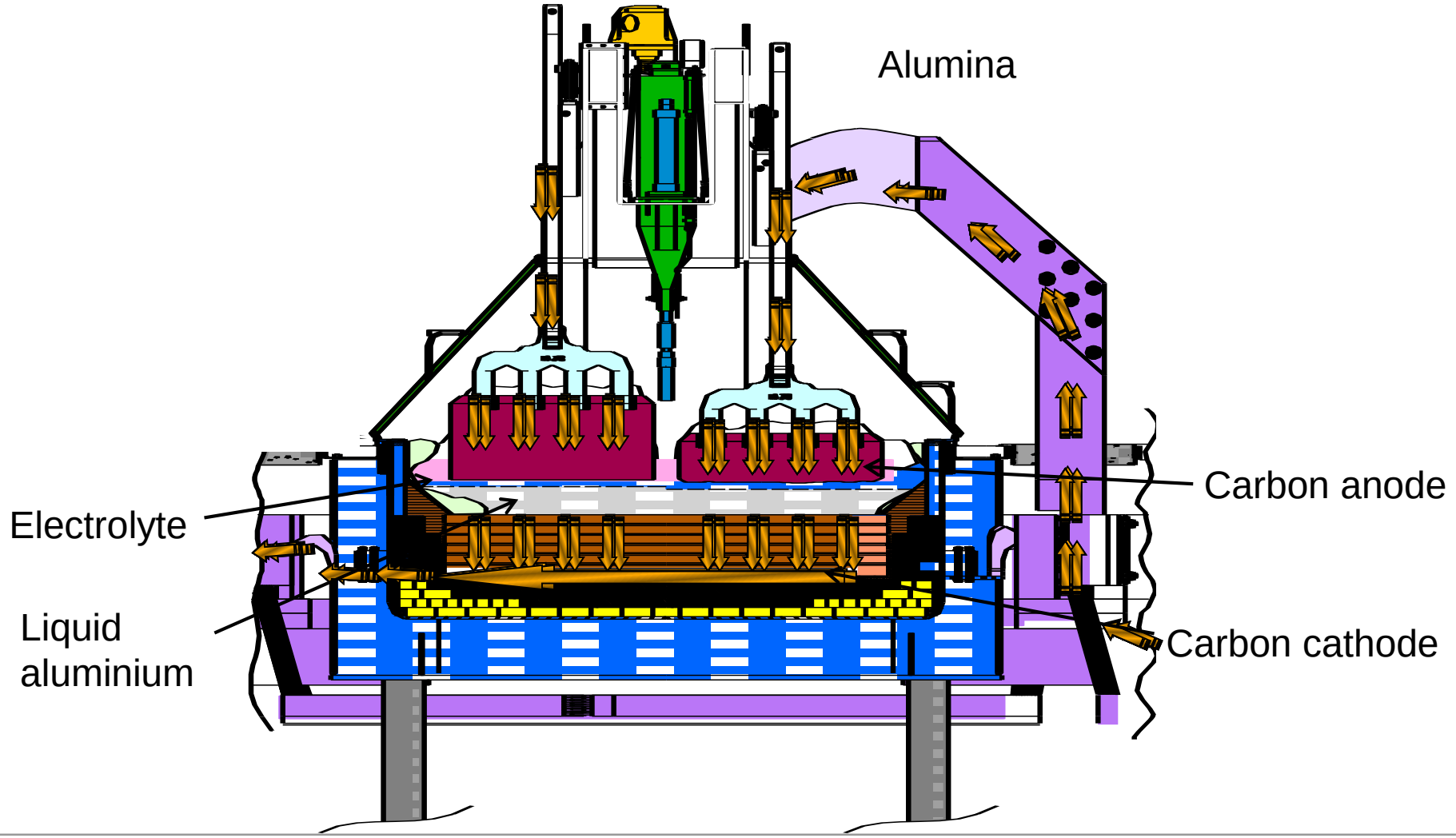
Aluminium cell



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Rheinwerk Neuss: An integrated, flexible metal source

Unique «Aluminium triangle» utilizing logistical, cost and process synergies

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Rheinwerk Neuss

The biggest aluminium smelter in Germany

- First green field smelter in BRD
  - Start-up in 1962
  - Expansions in 1970 and 1981
  - Continuous modernizations
- Part of Rolled Products
- Production capacities installed:
  - 190 kt baked anodes
  - 230 kt primary aluminium
  - 400 kt sheet ingots
- Energy demand of 400 MW at full production

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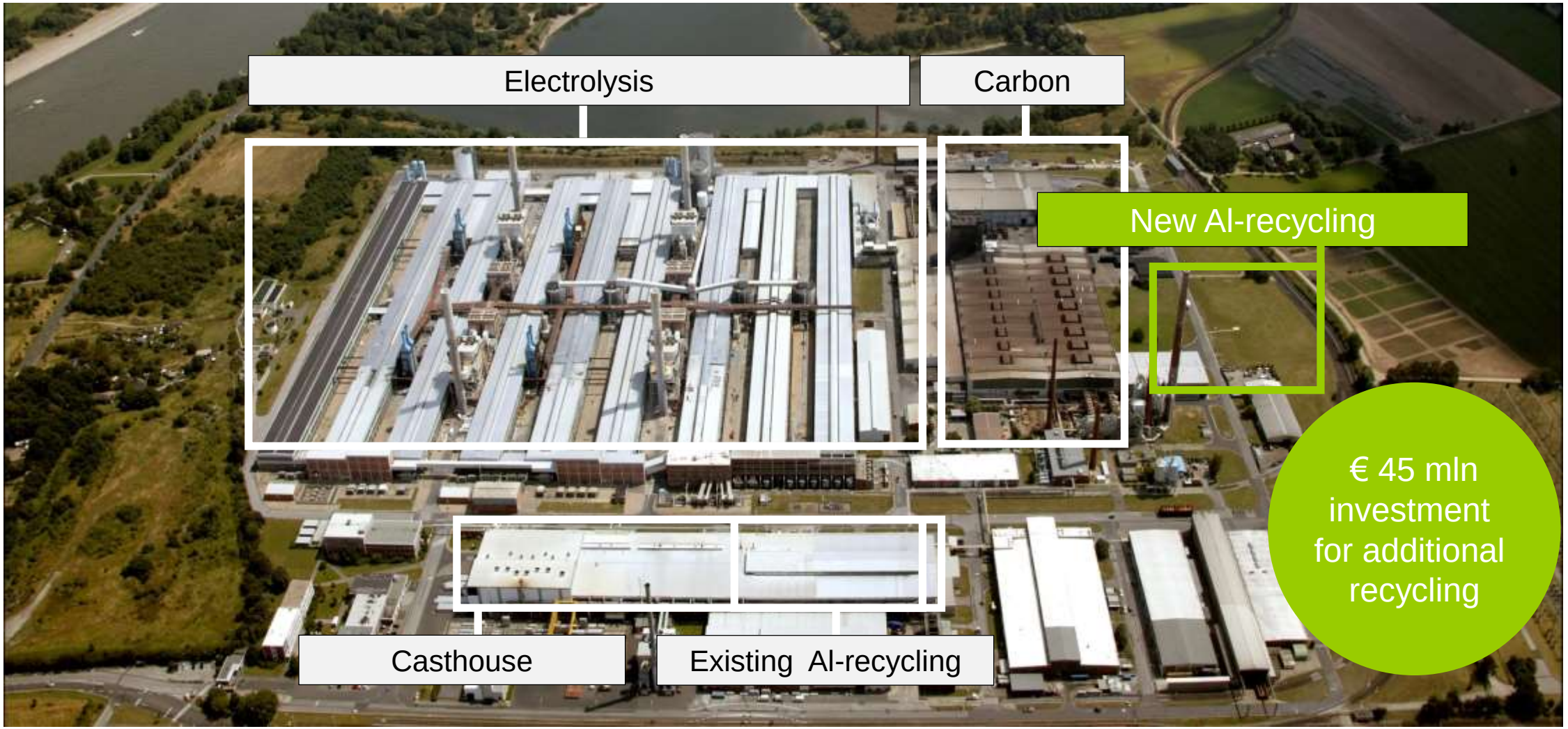
Electrolysis
Carbon
New Al-recycling
€ 45 mln investment for additional recycling
Casthouse
Existing Al-recycling

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Rheinwerk today

- 155 kt Primary Aluminium (of 230 kt)
- 230 kt Sheet Ingots
- 45 kt Liquid Metal from Recycling

During 2009 and 2012 mothballed down to 20%

Partly restarted as a result of:

- 2012 directive on CO2 cost in power
- Capturing synergies with Rolled Products
- Good operational efficiency

1962 – 2012
50 years Rheinwerk

Rheinwerk Carbon Plant

Efficient and sustainable supply of anodes to our electrolysis

Customers

Internal: Rheinwerk

External potential: 45.000 t/a surplus capacity installed

Capacity

200,000 mtpy green anodes	(production 120,000)
190,000 mtpy baked anodes	(production 95,000)
130,000 mtpy rodded anodes	(production 95,000)

Employees

approx. 95

Rheinwerk Electrolysis

155.000 t/a liquid aluminium delivered to our casthouse with clear value chain benefits

Capacity

- 230,000 kt (production 155,000)

Energy

- Amperage: 180 kA
- Current efficiency: 94 %
- Energy consumption: 13.8 kWh/kg Al

Set up

- Potlines: 3
- Pots: 474

Employees

- Approx. 200

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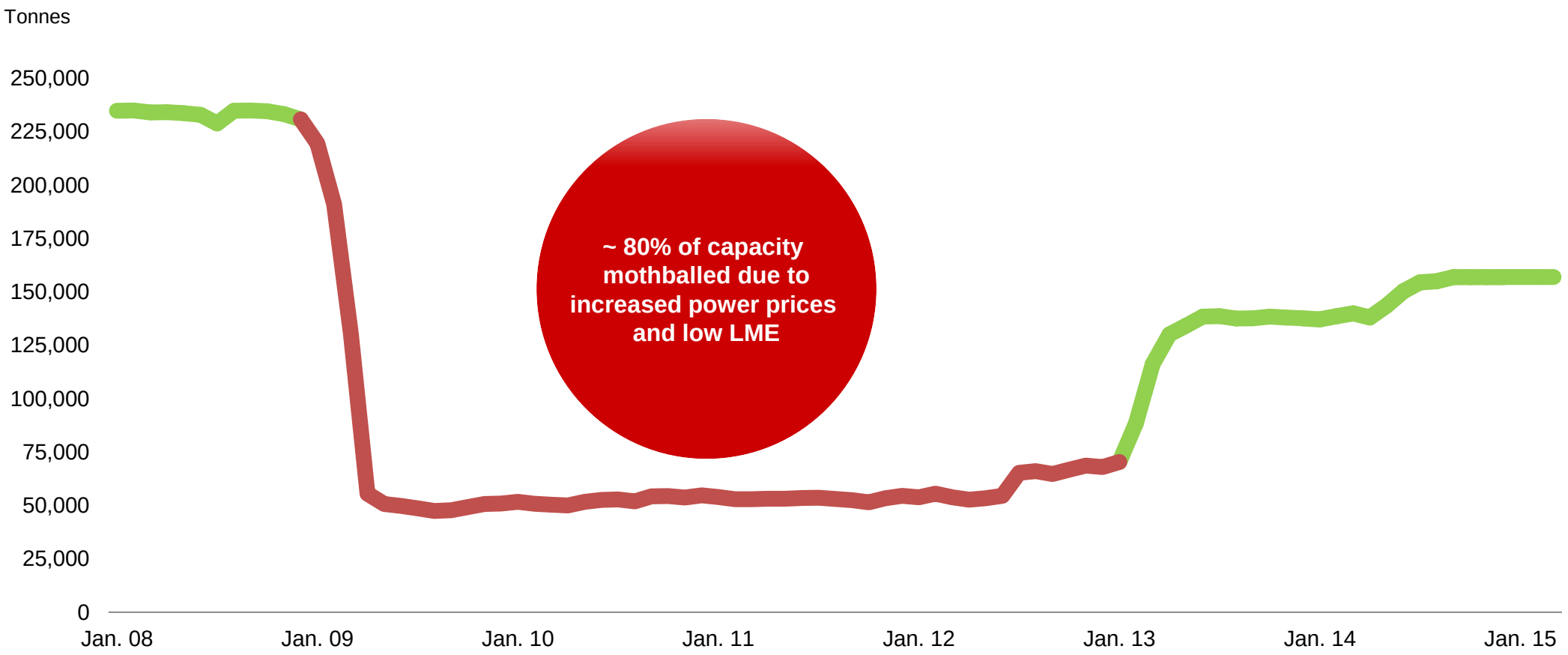
Electrolysis production 2008 – 2015

Successful restart of mothballed capacity to 67% of installed capacity finalized in 2014



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Current situation of Electrolysis

Up to 75.000 t/a capacity still mothballed

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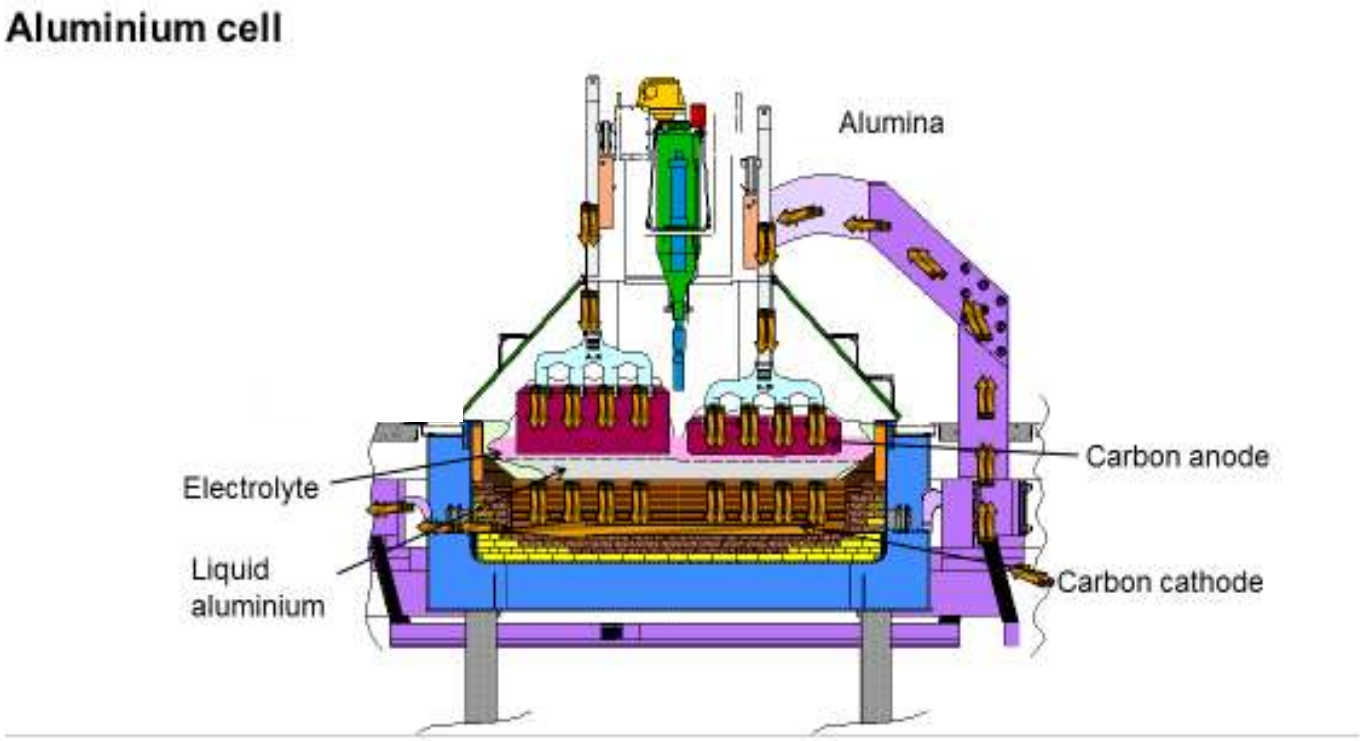
Benchmark Rheinwerk Electrolysis:

Operational parameters in comparison with peers demonstrate position and further potential

Current efficiency
Energy consumption
Net anode consumption
Gross anode consumption
Anode effect frequency
Anode effect duration
Anode effect minutes
Age of cells in operation
Age of shut down cells
Total production cost
Fixed cost



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Rheinwerk participates in regulation of interruptable load (AbLaV)

Our contribution to Germany’s energy turnaround: virtual “power plant capability”

Stabilization of public grid in times of huge variations

235 MW in up to 15 minutes

Further flexibility: Peak shaving, power modulation and secondary reserve

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Stabilization of German power grid during Solar eclipse March 20th 2015:

Rheinwerk demonstrated flexibility and was called to shut down and start four times

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Rheinwerk Casthouse

High quality products combined with short lead times and flexibility for optimized metal flow

Customers

- Hydro Rolling Mills (AluNorf & Grevenbroich)

Capacity

- 400,000 kt (production 230,000)

Sheet Ingot

- Max. l = 9,100 mm
- w = 2,200 mm
- h = 600 mm

Employees

- Approx. 120

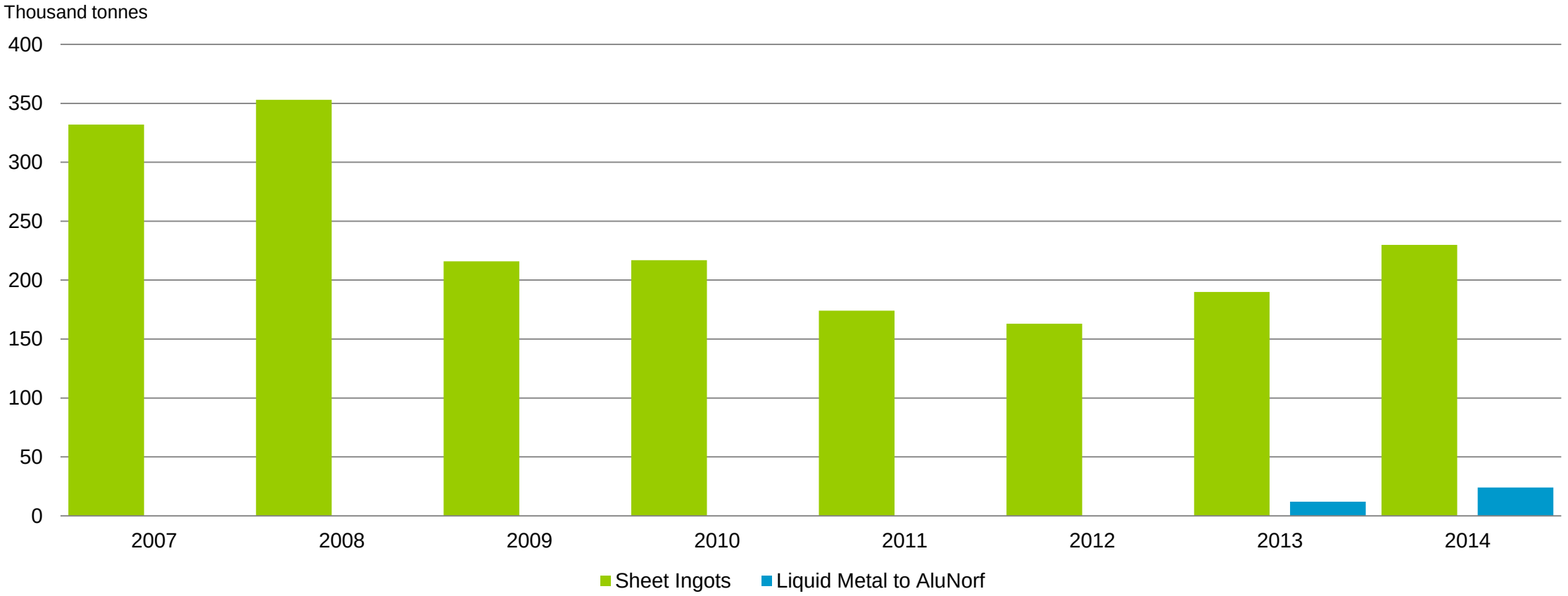
Low reject rate, high delivery performance

Our final product:

Sheet ingots ready for further processing: portfolio to be high-graded with auto and can alloys

Production in casthouse also impacted by electrolysis

Focus in the recent years on high flexibility regarding metal sources and balance downstream



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Casthouse: Today’s metal balance

in

+ 155,000 mt primary metal from electrolysis
+ 20,000 mt external used scrap
+ 45,000 mt process scrap from downstream
+ 30,000 mt ingots

out

- 230,000 mt sheet ingots
  Rheinwerk casthouse
- 20,000 mt liquid transport to AluNorf

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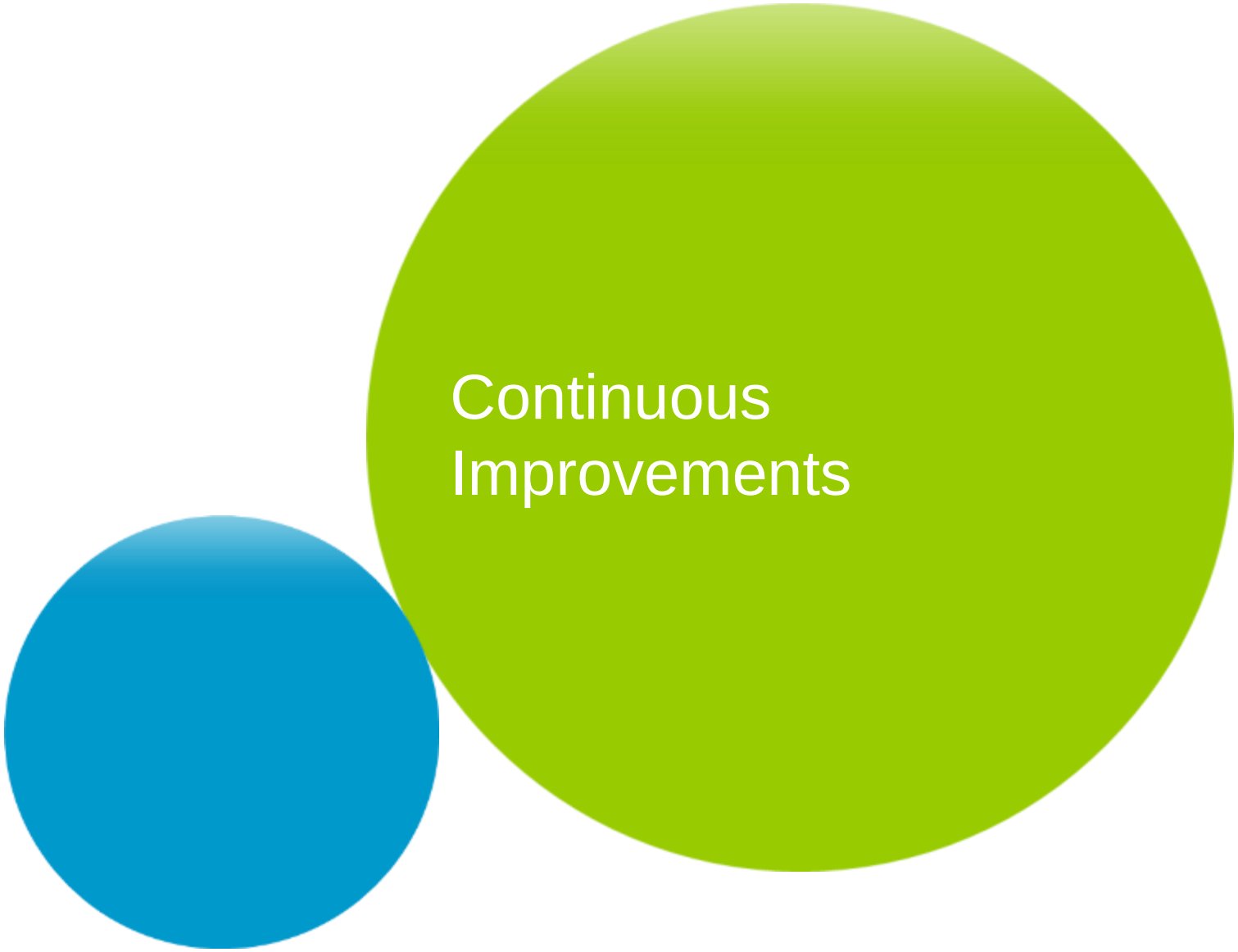

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Safety, our number one priority!

Equipment

- Reduce or remove underlying risks by updating and upgrading critical equipment and systems

Processes

- Reduce the operational risks through systematic analysis of risks, elimination of unnecessary processes and reduction of instability through the implementation of the Aluminium Metal Production System (AMPS) Principles.

Behavior

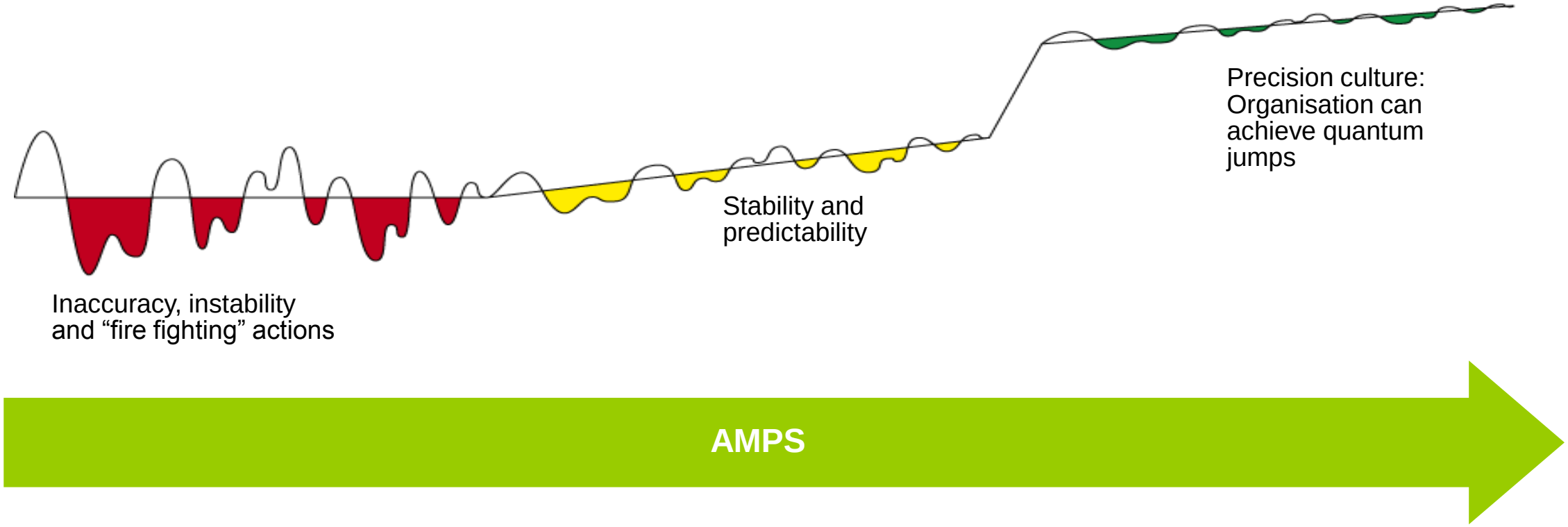
- Create ownership to safe behavior and safety culture through involvement, clear procedures, visible leadership and feedback.

Loyal, motivated and competent employees are the best guarantee to achieve our goals

Aluminium Metal Production System (AMPS):

A fundamental philosophy for continuous improvements

First class production requires stability



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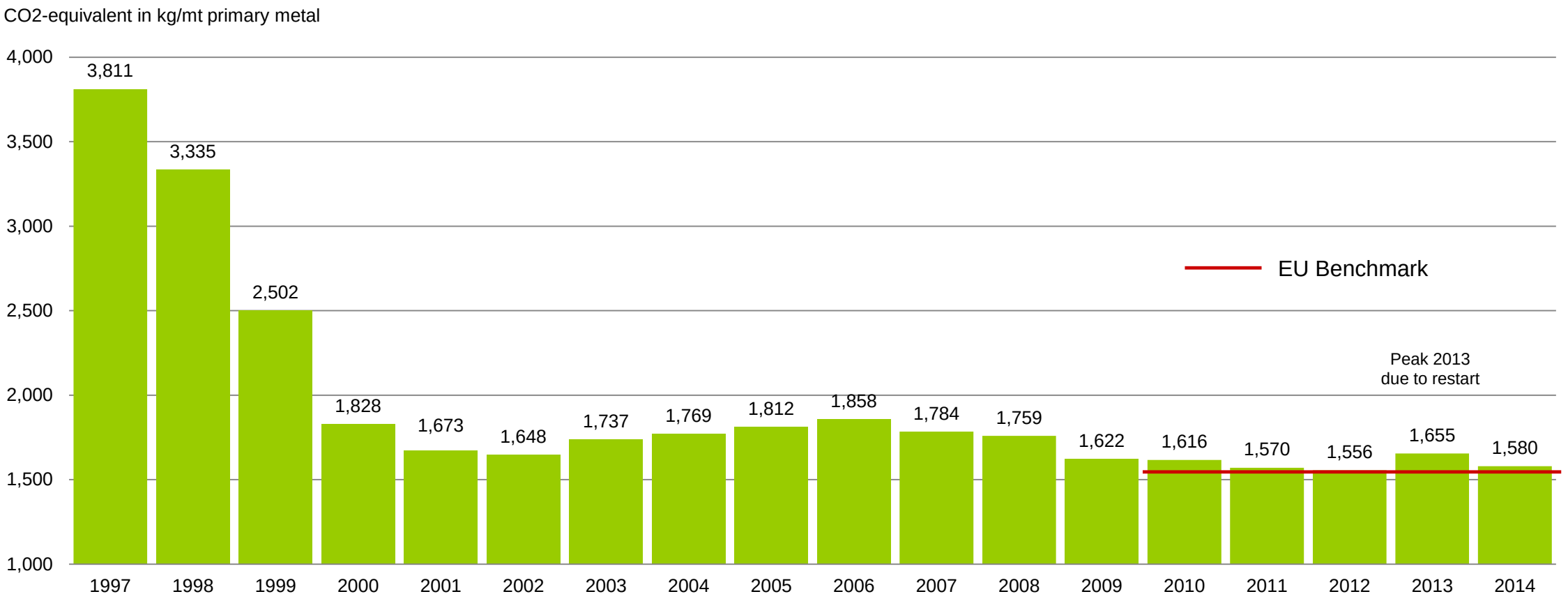
Utilization of Aluminium Metal Production System as a platform to continuously improve our processes through our people

Rheinwerk close to European CO_2 Benchmark

Further improvement potentials identified to meet or beat the benchmark in the future



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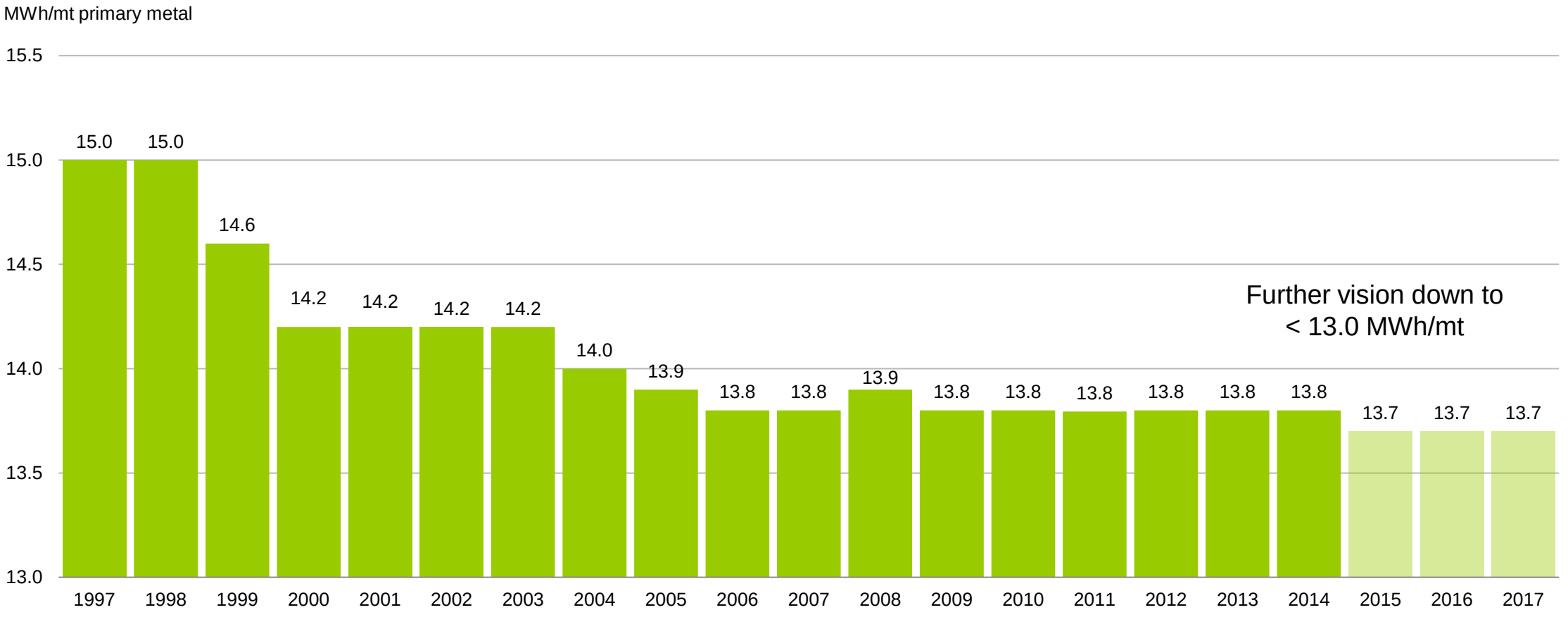
Concrete measures in place to further reduce energy consumption

Developing the next generation electrolysis cell for Rheinwerk



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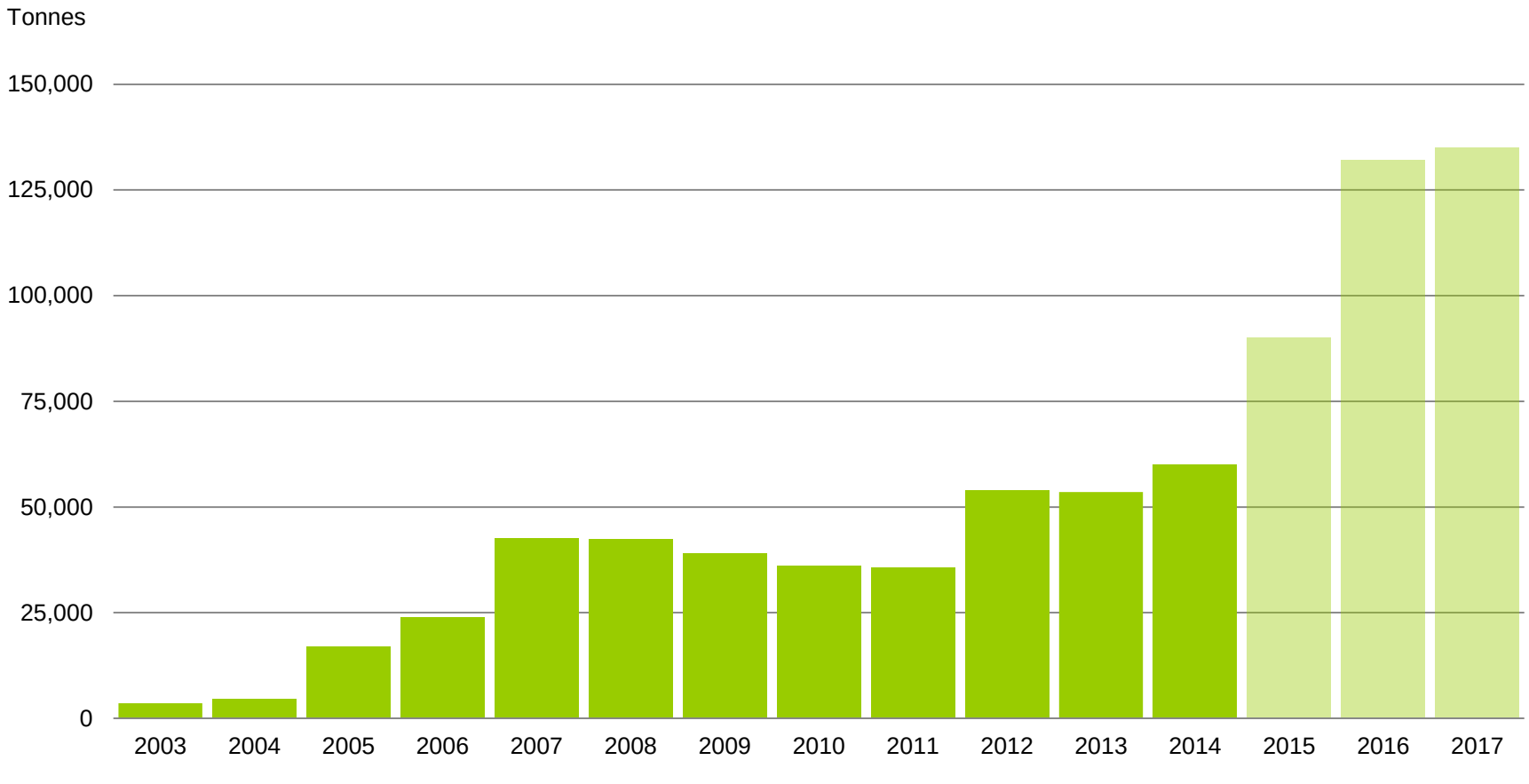
Increase recycling of aluminium through new investments and synergies

UBC line and remelt capability in existing assets will more than double recycling volume in 2016

2007: Recycling furnace S2

2012: Liquid metal to AluNorf

2016: Used beverage cans (UBC)



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UBC-Line Rheinwerk

Used Beverage Cans Recycling Plant

Strengthening of recycling position through UBC* recycling line

The new plant will replace ~50.000 t/a imported primary ingots through recycling of UBCs

Establishing strong recycling position

- Fulfilling customer needs and strengthening beverage can market position
- Improving metal cost position
- € 45 million investment
- Start of production end 2015
- Contribution towards 2020 carbon neutrality target

* UBC: Used beverage can

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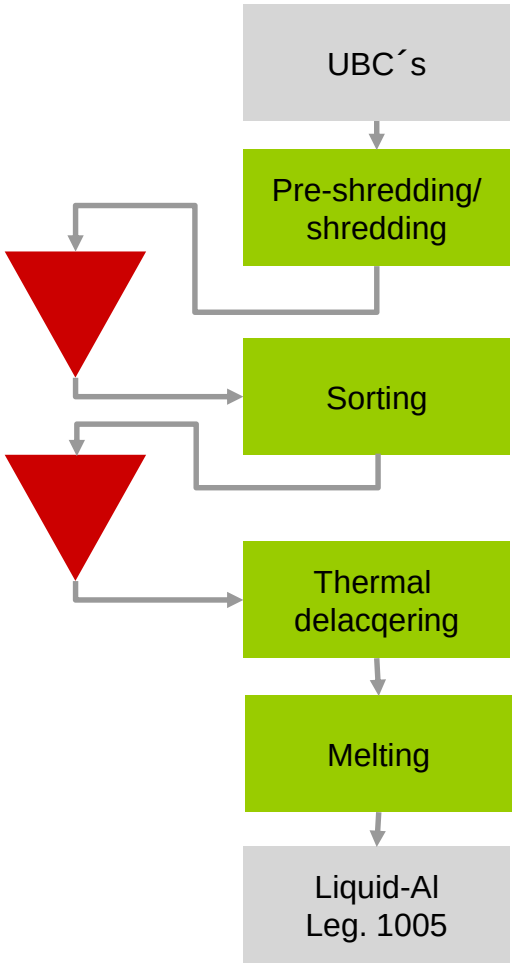
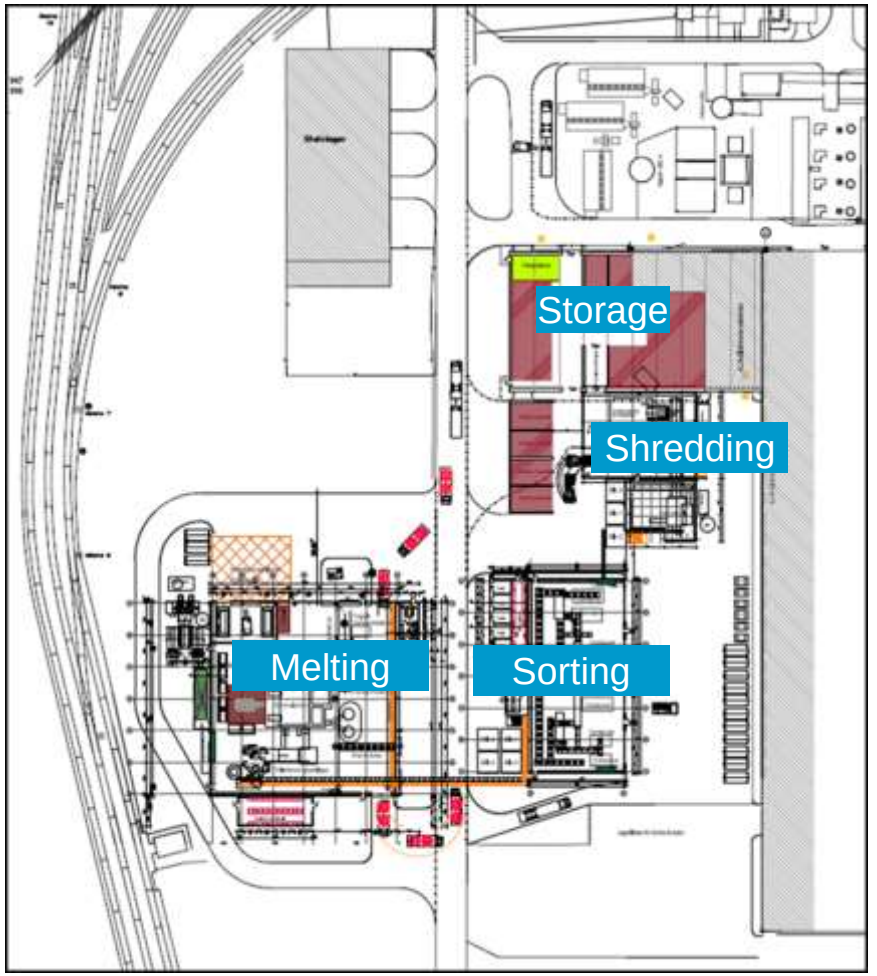
Process Layout UBC-Line





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UBC shredder unit

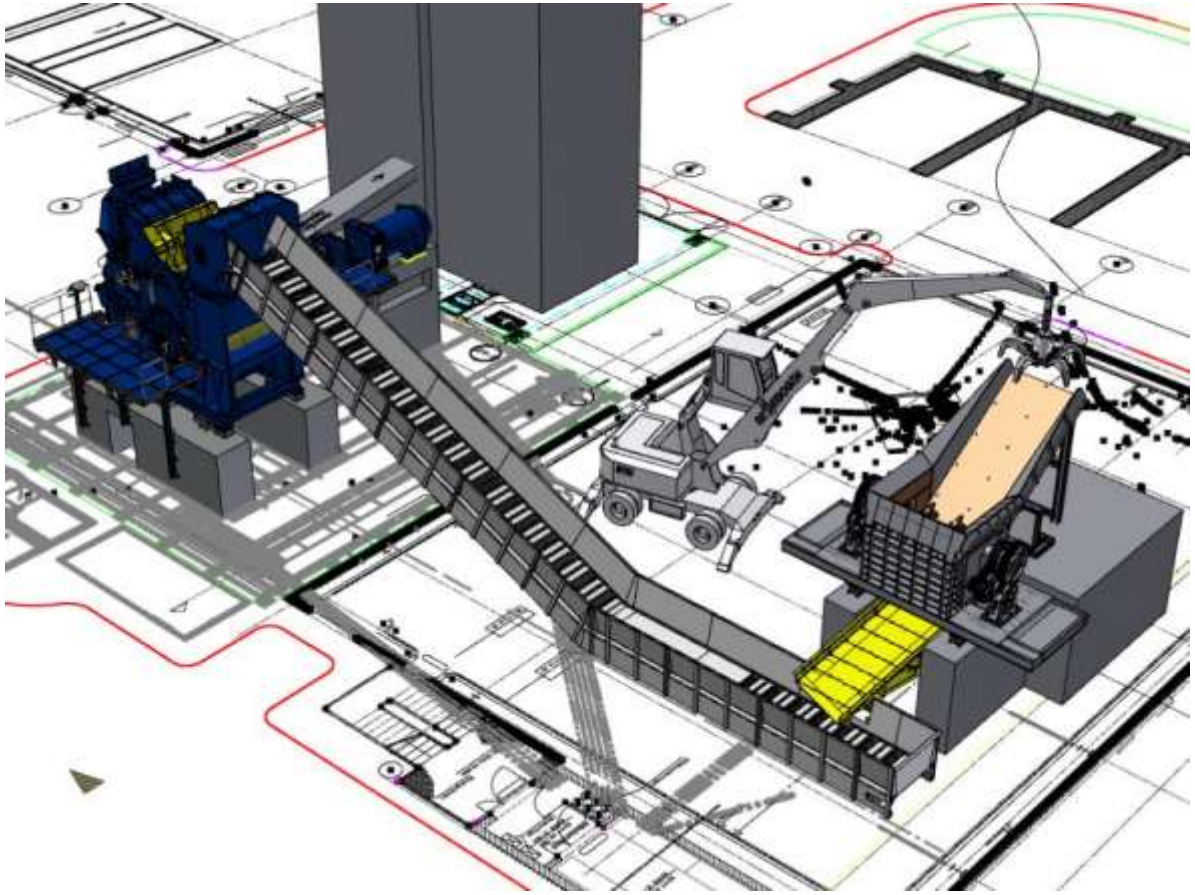
Overview

a. Shredding the cans for optimal sorting
   i. contamination such as "plastic widgets" in special beer cans must be exposed by the shredding (Guinness / bitter beer)

b. Shredding the cans for optimal delacquering
   i. both sides of the aluminium can (inside / outside) must be open
   ii. target grain size: 50mm

Technical challenge

1. scrap composition
2. shape and density of scrap bales and packages



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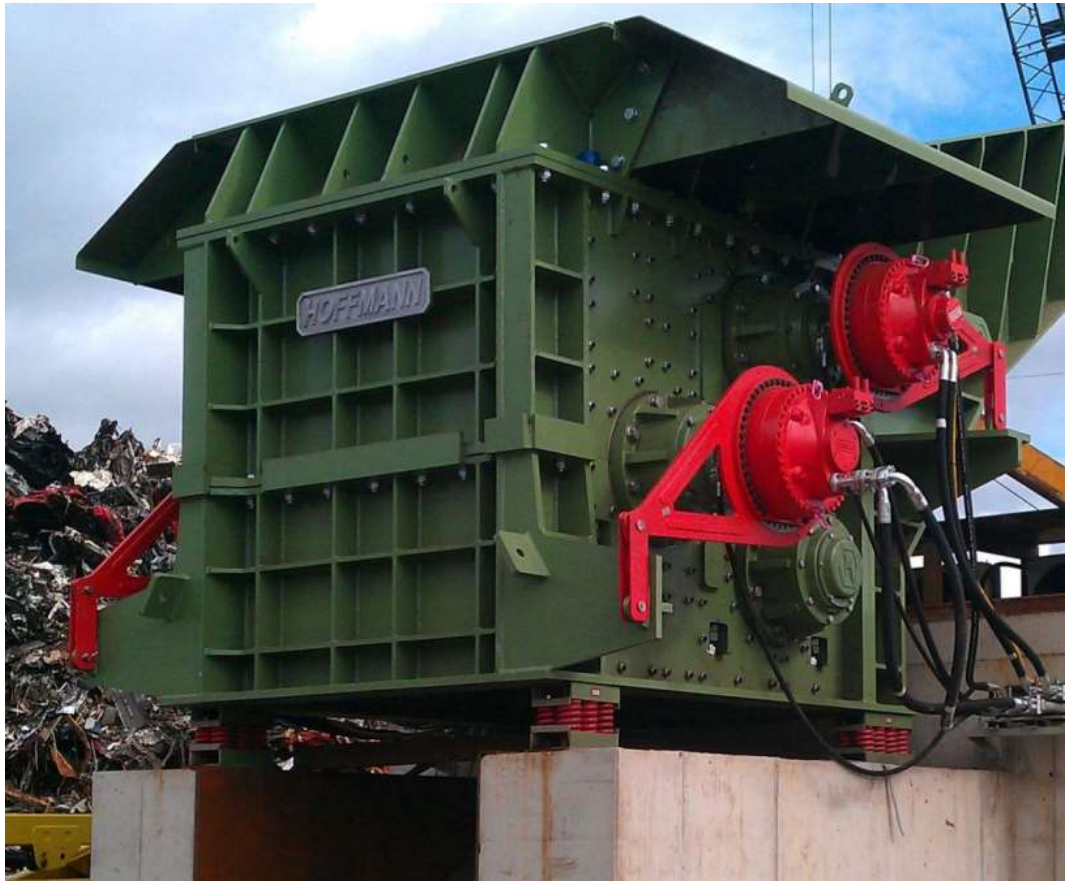
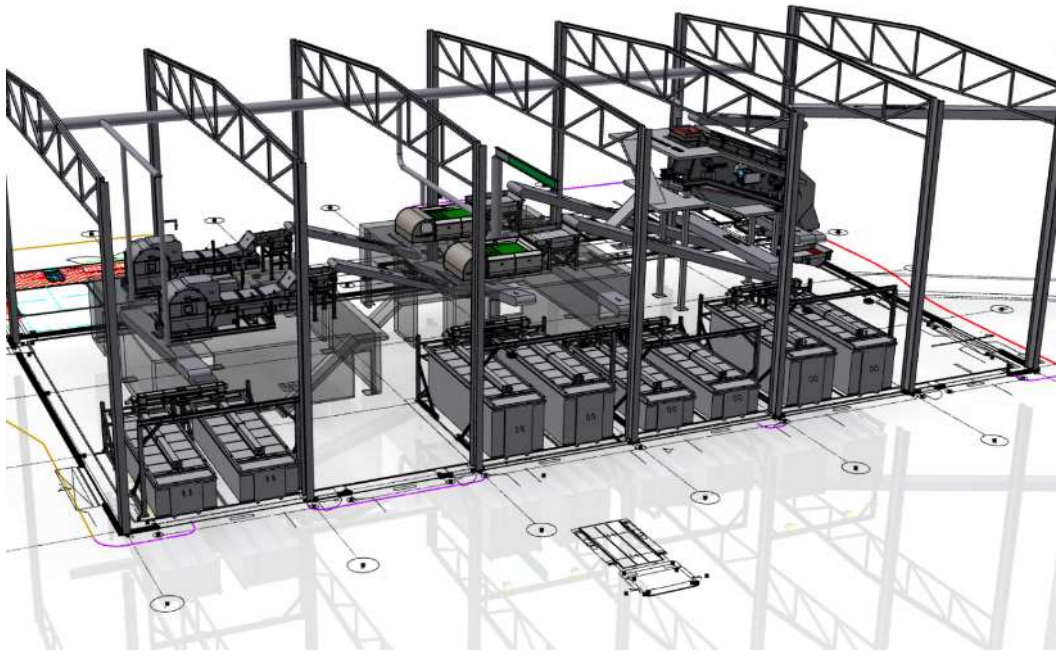
Bale braker and hammer mill



Sorting line, furnace and delaquering



UBC-Centre: Laying of the foundation stone (April 27th. 2015)

Strategy and aspiration Rheinwerk

Rheinwerk strategic goals until 2016

1. Safety as culture
2. Further develop synergies with rolling operations
3. Continuously develop human capital
4. Fit for automotive
5. Successful commissioning of UBC
6. Process & system stabilization
7. Cost stabilization
8. Developing „Next Generation Rheinwerk Smelter“

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Our vision 2020

With competent and engaged staff, we are the sustainable, most flexible metal source in Rolled Products, contributing to become the No. 1 in Europe.

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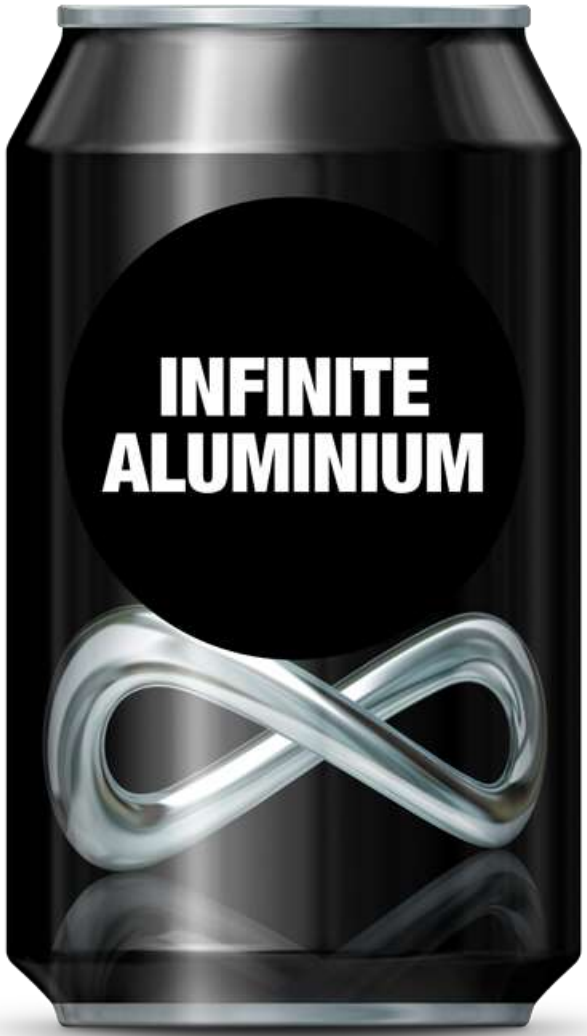

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