Alro – continuous compliance with highly evolving environmental legislation

ALRO - General Information

- ✓ **ALRO is a private-owned company, the largest primary aluminum smelter in the Eastern Europe.**
- ✓ **Its products: billets, slabs, wire rod, plates, sheets and strips.**
- ✓ **ALRO's shareholders:**
  - ✓**VIMETCO - 84.19%**
  - ✓**PROPRIETATEA Fund - 10.03%**
  - ✓**Others - 5.78%**
- ✓ **Since 1997 it has been listed in the Bucharest Stock Exchange**
- ✓ **ALRO is part of the VIMETCO Group which is listed in the London Stock Exchange**
- ✓ **ALRO is member of the European Aluminum Association and of the Aluminium REACH Consortium**
- ✓ **Alro holds the following certifications:**
  - ✓ **ISO 9001, ISO 14001, OHSAS 18001**
  - ✓ **EN 9100 and NADCAP (for aero), IATF 16949 (for auto)**
  - ✓ **ISO 50001, AD 2000 Merkblatt for pressure vessels**

VISION

Continuous improvement and efficient operation oriented towards high value added products in order to increase the customers satisfaction and protect the environment

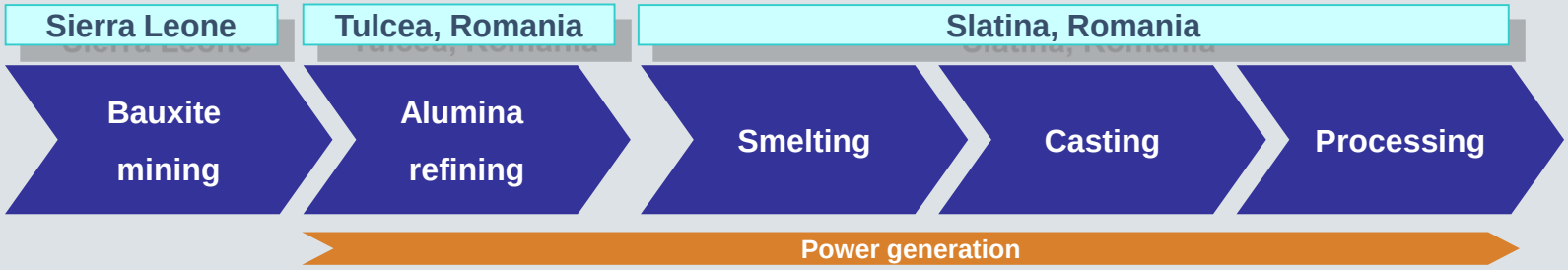
VALUES

Experience, team work, competence, highly qualified personnel.

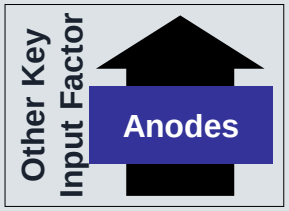
MAJOR OBJECTIVE

ALRO to consolidate its position as an aerospace and automotive products supplier

ALRO -Vertically integrated operations



- Acquired Sierra Minerals bauxite mine, sole supplier of bauxite to Alum, with roughly 30 mil. t resource base
- Tulcea production facility with capacity of 600kt
- 100% of the ALRO needs



Group activity

External supply

Location of facility

- <u>All carbon anodes required for the electrolysis cells are produced internally</u>
- Slatina production facility, which includes the smelter, anode plant and cast aluminium facility, has total capacity of 265kt of electrolytic aluminium and 340kt of cast aluminium
- Slatina processing facility capacity is 90kt of processed aluminium, depending on product mix; with capacity increase program is going up to 120,000 MT in 2020
- Vimetco extrusion with 25 kt capacity

ALRO STRATEGY FOR ENVIRONMENTAL PROTECTION

Main environmental directions developed by Alro

Energy efficiency increase

- ❑ Reduction of specific power consumption
- ❑ Audit performed by best in class technology provider and benchmarking
- ❑ Replace the classic light bulbs with LED lamps.
- ❑ Install variable speed drives to the electrical motors
- ❑ Introduce slotted anodes
- ❑ invest constantly in best available equipment

Increase recycling rates for waste/scrap

- ❑ Increase the capacity of the eco-recycling shop
- ❑ Cooperate with universities and other companies for waste recycling
- ❑ Active participation in the European Aluminium task force for waste

Progressive reduction of CO2 emissions

- ❑ Reduction of natural gas specific consumption
- ❑ Reduction of specific power consumption
- ❑ Reduction of anode consumption
- ❑ Reduction of specific fuel consumption

Air emissions reduction

- ❑ Installation of dry scrubbing units
- ❑ Installation of fume treatment centers
- ❑ Installation of volatile treatment center
- ❑ full compliance with NFM BREF
- ❑ cooperation with highly ranked providers

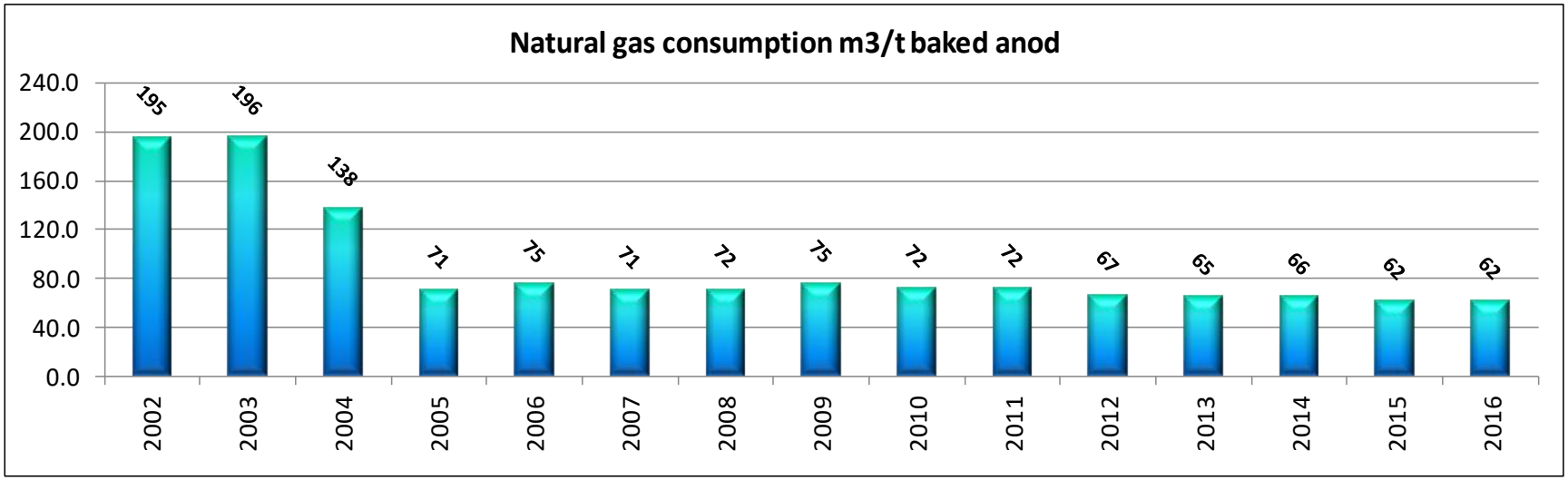
Reduction of industrial water consumption

- ❑ Installation and commissioning of forced cooling towers and water treatment equipment
- ❑ Active participation in the European Aluminium task force for water

FACTS

- Alro started a major retrofitting program for its smelter in 1997, program which ended in 2002.
- Since 2003 Alro invested more than $500 millions in modernization projects with direct or indirect impact over the environment protection
- In 2006 Alro was the first company in Oltenia region which obtained the environmental permit without any conformance program.
- Alro is among the top 3 aluminium smelter in Europe regarding CO2 emission from its primary aluminium smelting plant
- Alro is member of the European Aluminium which is the only industry that has its own sustainability roadmap: http://www.european-aluminium.eu/policy-areas/sustainability/
- Aluminium can be considered an energy bank as once produced is infinitely recyclable using much lower energy compared with the initial production.
- On 30.06.16 the Nonferrous Metals Best Available Techniques Reference Documents (NFM BREF) were published and although authorities have 4 years for implementation, Alro already started the implementation project.
- In the following slides we will present details about our achievements in environmental protection and energy efficiency in some of the Alro departments.

ANODE PLANT



- During 2003 – 2004 the baking furnaces were retrofitted with Pechiney and Setaram technology which resulted in 3 times reduction of natural gas consumption and similar reduction of CO2 emissions
- All 3 baking furnaces were connected to a fume treatment center in order to clean the exhaust fumes (Alstom technology)
- A volatile treatment center was installed in the paste plant to scrub the fumes from the anode paste
- In 2011 an additional system for complete burning of the volatiles inside the furnace and combustion optimization was installed, which resulted in an additional 14% reduction of natural gas consumption

PRIMARY ALUMINIUM SMELTER

- From 1997 to 2002 all the pots were converted to point feeding, computer control and were hooded.
- In the same period two dry scrubbing units were installed increasing the fluorinated gases retention from 60% to 99.5%.
- In 2007 an alumina hyper dense phase transport system, completely designed and implemented by Alro experts, was installed.
- A new 38,000 tons dome alumina silo was installed in 2009 and today alumina is transported in a close loop inside the plant and no spillage occurs.
- Most advanced technology provider (Aluminium Pechiney part of Rio Tinto Alcan) audited Alro in 2017 and made recommendation for additional power consumption reduction.

Pot after modernization

New dome silo

ECO RECYCLING SHOP

At the end of 2013 we started the aluminum scrap melting facility of an overall capacity of 35,000 tons/year, with the following advantages:

- recycles scraps;
- reduces the fabrication cycle of aluminum products;
- reduces ALRO's dependency on high electricity price, considering that the energy for recycling is only 5-7% from the energy necessary to produce electrolytic aluminium.

We plan to increase the capacity of this eco recycling shop to 100,000 tpa until 2020.

Overview photo of eco recycling shop

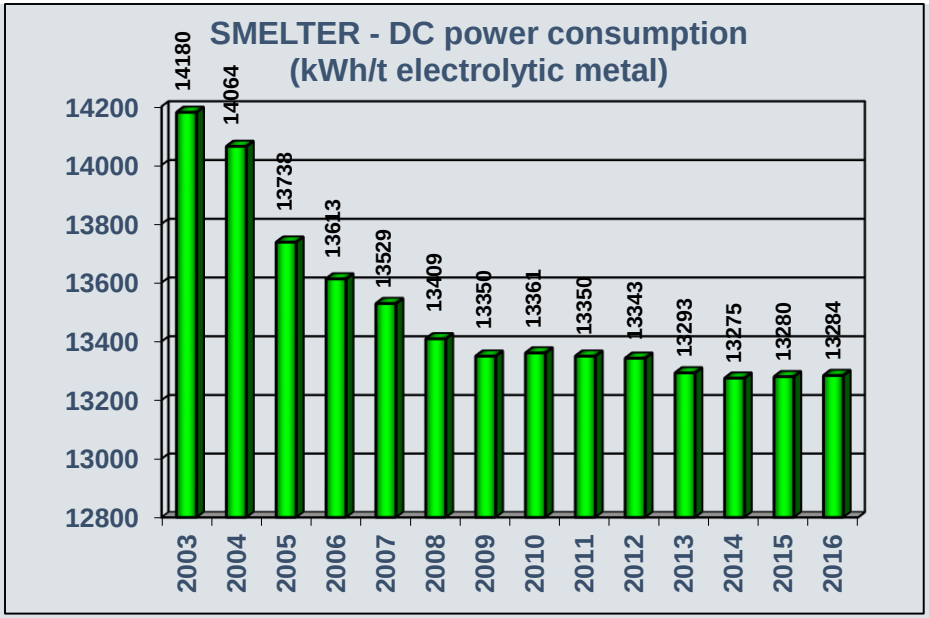
We are using state-of-the-art equipment:

- Double chamber furnace with high efficiency oxygen burners (these burners use less natural gas compared with standard burners)
- Induction furnace.
- Fume treatment center

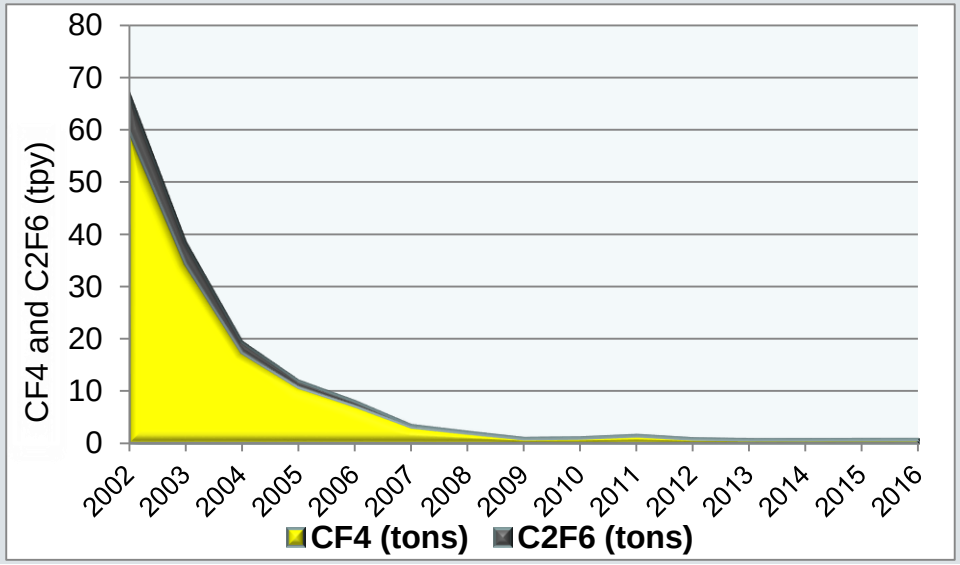
Induction furnace

Double chamber furnace

POWER CONSUMPTION / GHG EMISSIONS



From 2003 until now the DC power in the smelting plant decreased by 6%. In 2014 ALRO reached the highest potlife age (100 months of operation compared with the time before '90 years 40 months) and the lowest energy consumption per electrolytic metal ton ever recorded in its 50 years of history.



As a result of constant concern for environmental protection, the 2016 perfluorocarbons (CF4 and C2F6 are gases which very high warming potential) emissions were **85 times lower** than in 2002.

European benchmarking (1)

JRC-Institute for Energy and Transport in 2015 issued a report to European Commission: "*Energy Efficiency and GHG Emissions: Prospective Scenarios for the Aluminium Industry*"

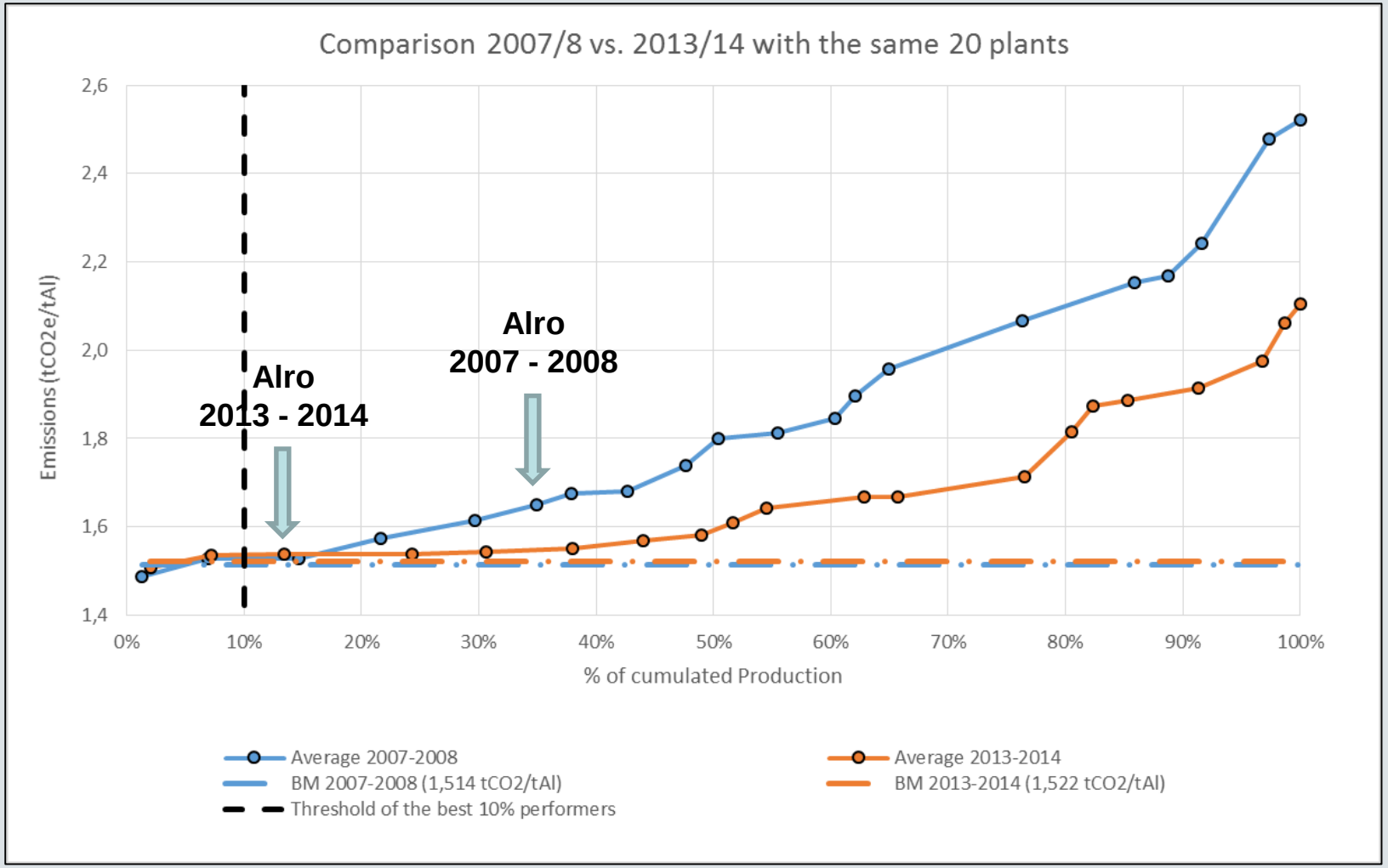
Company	City	Technology	Max brownfield efficiency (MWh/t)	Distance-to-target (%)
Aluminium Dunkerque S.A.	Graveline-sur-Loon-Plage	AP30	12.8	95 %
Trimet Aluminium AG	St.-Jean-de-Maurienne	AP18 AP30	13.2	99 %
Hydro Aluminium Deutschland GmbH	Neuss	VAW CA-165	13.2	93 %
Trimet Aluminium AG	Essen	Alusuisse EPT-14	13.5	92 %
Trimet Aluminium AG	Hamburg	Reynolds P19	13.8	98 %
Voerdal GmbH	Voerde	Kaiser P69	13.6	91 %
Aluminium de Grece S.A. (ADG)	St. Nicolas (Distomon)	AP07 AP09	13.2	100 %
Atlantic Aluminium Co.	Keilisnes	-	13.2	100 %
Alcoa Fjardaal	Reydarfjordur	AP30	12.8	97 %
Nordic Aluminium Company	Grundartangi	VAW CA-180	13.2	96 %
Nordural Helguvik	Helguvik	AP36	12.8	100 %
Rio Tinto Alcan Iceland Co. Ltd.	Straumsvik	Alusuisse EPT-10	13.2	88 %
Vimetco Arlo SA	Slatina	AP09	13.2	99 %
SLOVALCO	Ziar nad Hronom	Hydro HAL-230	13.2	98 %
Talum, d.d. Kidricevo	Kidricevo	AP18	13.2	94 %
Alcoa Inespal SA Aviles	Aviles	PF-VSS	13.8	98 %
Alcoa Inespal SA La Coruna	La Coruna	PF-VSS	13.8	91 %
Alcoa Inespal San Ciprian	San Ciprian	AP-14	13.2	95 %
Rusal Kubikenborg Aluminium AB	Sundsvall	Kaiser P86	13.5	100 %
Alcan Smelting & Power UK	Fort William	AP18	13.2	99 %

Maximum attainable efficiencies and distance-to-target (energy efficiency) per plant

Alro uses an old cell design as compared to other plants, but the energy efficiency performance is 99%, due the continuous technical improvements.
In a couple of months Alro will install an equipment to cut slots in the anodes which is the last step mentioned in the JRC report. This will result in an additio-nal 100 kWh/t reduction of energy consumption. Therefore in a short time Alro will reach 100%.

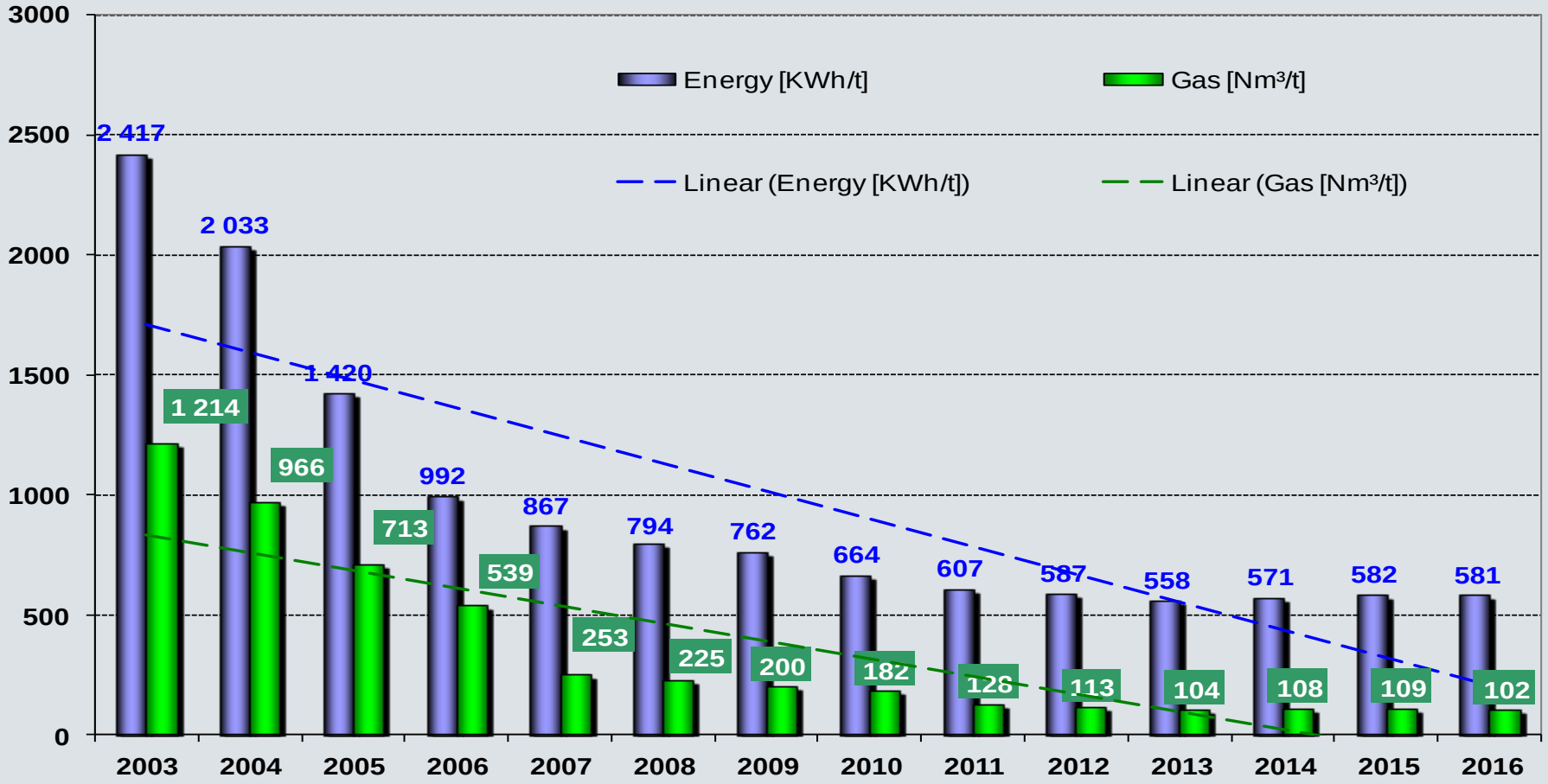
European benchmarking (2)

source: European Aluminium



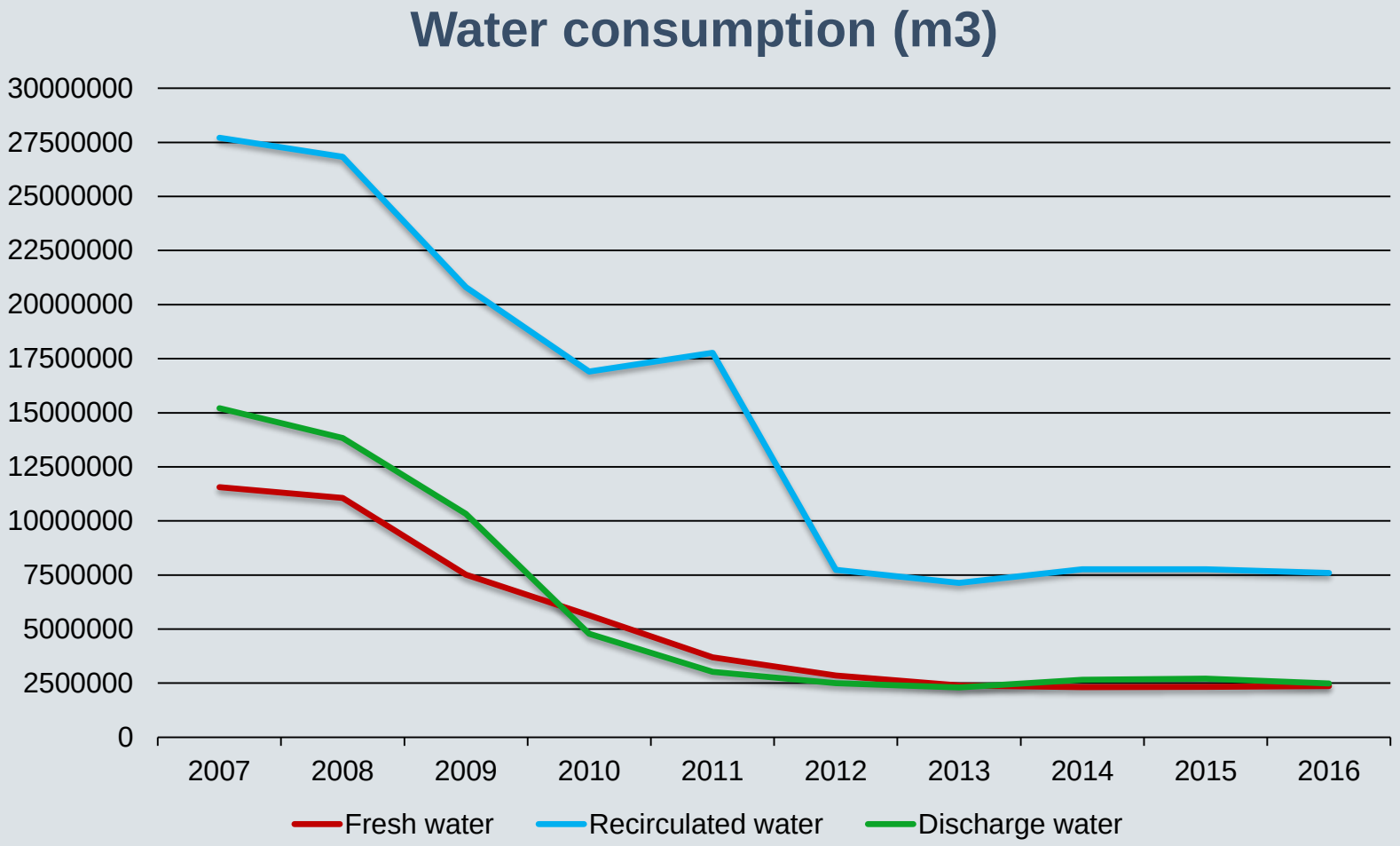
Alro improved its position for CO2 emissions in the primary Al smelter from 6th place to 3rd place from 2007-2008 to 2013-2014.

Processed division power and natural gas specific consumption evolution 2003 - 2016



Specific consumptions of natural gas decreased 10 times since 2003 and the energy consumption decreased more than 4 times in the same period.

WATER CONSUMPTION



Massive investment in water treatment and recycling equipment resulted in a reduction of fresh water used by 5 times and in the discharged water by 6 time in the last 10 years. Today water recycling rate is more than 80%.

Medium term goals

In the coming future 2017 – 2020, ALRO SA will continue to be concerned with achieving investments and developing technologies in areas such as:

- **Energy efficiency: decrease the electricity specific consumption with 10% by 2025;**
- **Research & Development- development of products portfolio & technologies; The R & D activity financing will be made from both own and attracted sources (UE funding).**
- **Implement the European Aluminium sustainability principles;**
- **Waste reduction, emissions reduction, recycling: increase the aluminium scrap recycling capacity from 35,000 tpa to 100 000 tpa and full compliance with the requirements of the new NFM BREF**
- **Improve the management of accidents prevention;**
- **Improve implementation of TPM and 5S methodologies;**
- **Continue the cooperation with highly ranked equipment/technologies providers.**


Thank you !