

UC RUSAL

Aluminium Industry: Paving The Way To A Safer World

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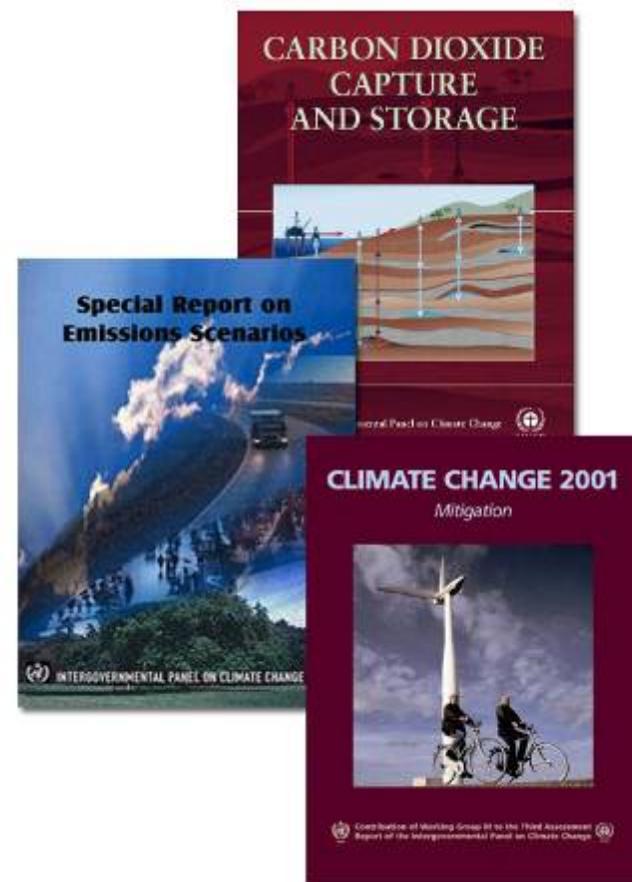
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RAISING GLOBAL AWARENESS

We have to literally “decarbonise” our global economy. It will require global effort of all over decades. Governments will have to create new legislations, industries will need to innovate changing to low-carbon energy production and efficient life cycles in manufacture and services, and consumers will have to change their lifestyles. **This process is already happening and may trigger a new economic revolution that will change the whole society, like the industrial revolution did 150 years ago.**

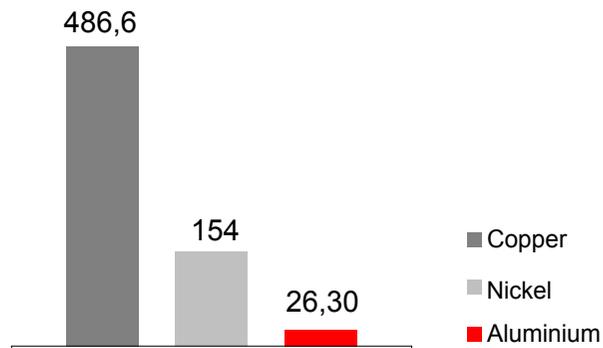
**Intergovernmental Panel on
Climate Change (IPCC)**



ALUMINIUM IS THE CHOICE OF THE FUTURE

- Aluminium is one of the most environmentally friendly metals

Air emissions (tonnes of CO2 per USD 1 mln worth production)



Source: The Russian Ministry of Education and Science

- Aluminium is easy to recycle and can be repeatedly reused
 - Recycling requires only 5% of the energy needed for primary aluminium production and emits only 5% of CO2
 - Recycling of iron scrap requires 7.0 GJ/t of energy
 - Recycling of aluminium scrap requires 4.0 GJ/t of energy

- Aluminium production process is one of the safest in the metals and mining industry

Loss Time Accident Frequency Rate (LTAFR)

Coal mining	0.8- 1.5
Iron ore mining	0.8- 1.5
Ferrous metal	0.3 – 0.5
Aluminium	0.4 (UC RUSAL 0.2)

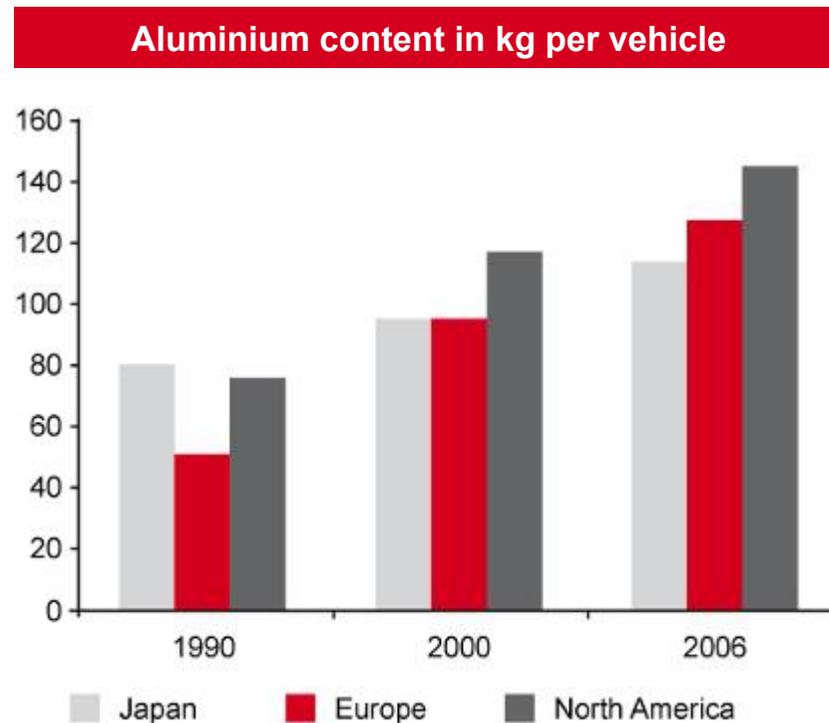
Safety index based on professional risk (10 grade scale)*

Coal mining	8.1- 8.5
Iron ore mining	5.5
Ferrous metals	1.7 – 1.9
Aluminium	1.1

* The Russian Federal Law 179 FZ (based on LTA, fatalities, safety statistics)

ALUMINIUM IN TRANSPORT: SAFER WORLD

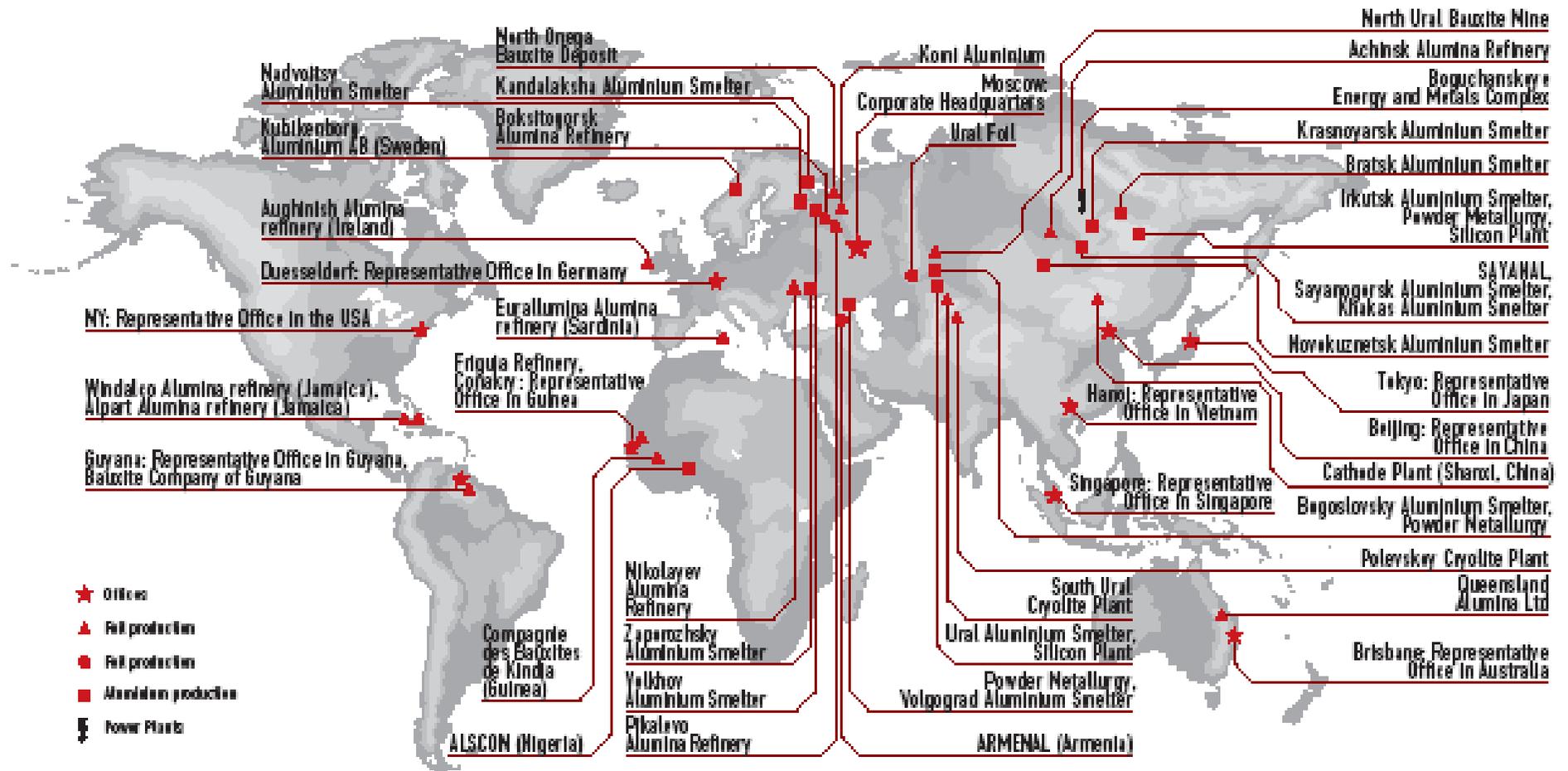
- 19% of man-made CO₂ emissions are generated by transport (7.6 bln tonnes of CO₂)
- Use of aluminium in transport contributes to reducing the weight of vehicles: for every 1kg of aluminium used to replace heavier metals, up to 20kg of CO₂ can be eliminated over the lifecycle of an average vehicle
- In 2006, about 65m cars and trucks were manufactured globally. Due to the weight savings from the use of aluminium, up to 140 mln tonnes of global CO₂ output will be saved
- The total primary energy saved due to the use of aluminium during the life-cycle of the vehicles produced in 2006 is equivalent to about 60bn litres of crude oil



The use of aluminium in transportation has increased over the years. In 1990, each automotive vehicle contained about 50 kg of aluminium. By 2006 this had increased between 120 - 145 kg

Source: The International Aluminium Institute

UC RUSAL: GLOBAL SCALE OF BUSINESS

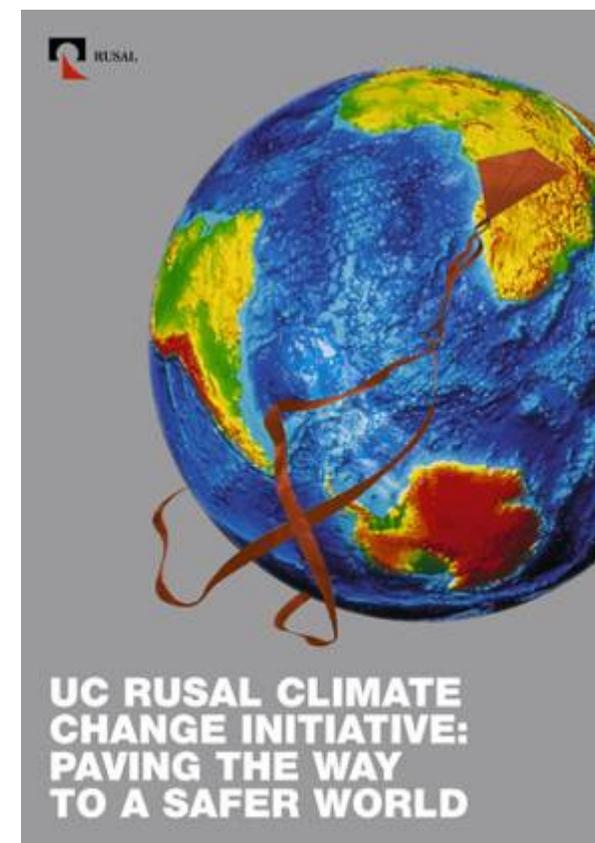


- 48 production sites located in 19 countries and 5 continents
- Over 100,000 people

- 4.2 mln tonnes of aluminium annually
- 11.3 mln tonnes of alumina annually

UC RUSAL CLIMATE CHANGE INITIATIVE

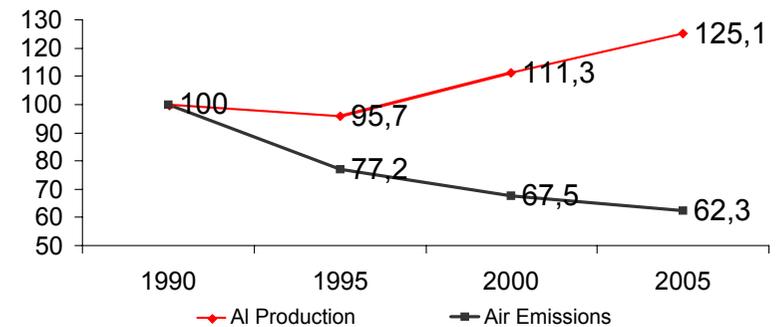
- UC RUSAL was the first company in Russia to join the **UNDP initiative** to accelerate the reduction of greenhouse gas emissions.
 - Reduce direct greenhouse gas emissions from the company's existing smelters by 50% by 2015
- Involve public organisations in the assessment of capacity increasing projects, and encourage local communities to participate in environmental initiatives
- Commit to improve the environmental situation in the regions of UC RUSAL's presence
- Participate in developing the legislation related to greenhouse gases, energy and fuel efficiency and environmental protection
- UC RUSAL abides by and implements the provisions of
 - The Kyoto protocol (emissions of greenhouse gases)
 - The Stockholm convention on persistent organic pollutants
 - IAI's 'Sustainable Development of Global Aluminium Industry' Initiative



UC RUSAL: ACHIEVEMENTS TO DATE

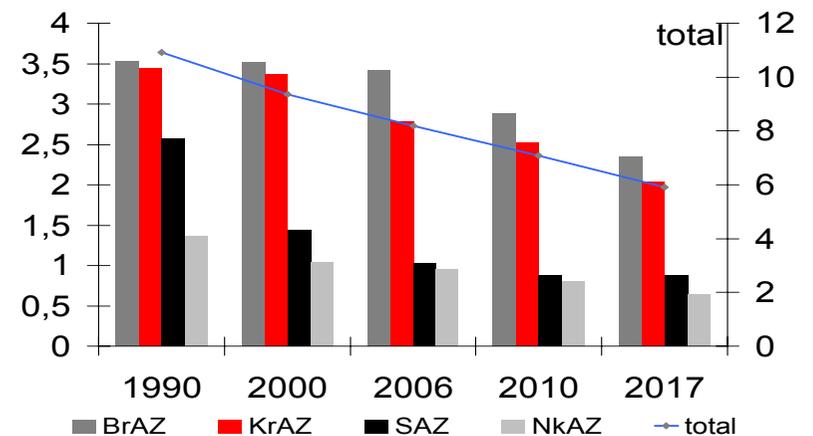
- Since 2000, **over USD 1 bln** invested in environmental programmes
- 80% of UC RUSAL's production sites, including the Krasnoyarsk, Bratsk and Sayanogorsk aluminium smelters are certified (**ISO 14001**)
- Greenhouse gas emissions have been reduced by over 30% at UC RUSAL's aluminium production sites compared to 1990 (Krasnoyarsk smelter lowered these emissions by 37% in 2006)
- UC RUSAL is the first company in Russia to introduce direct measurement of perfluorocarbons emissions
- The modernisation programme at Krasnoyarsk aluminium smelter and installation of alumina point feeders led to a **40%** reduction of perfluorocarbons emissions
- **80%** of aluminium is produced by UC RUSAL with hydropower, which is the safest and most renewable form of energy. When hydropower is used in the smelting process there are **NO** greenhouse emissions

Aluminium production and air emissions, % increase/decrease from 1990



Source: NP "Aluminium"

Gross emissions, CO₂, mln tonnes



R&D IS THE BASIS FOR SUSTAINABLE GROWTH

UC RUSAL invests **over USD 100 mln** in R&D activities every year

Key developments and technologies developed by UC RUSAL include:

- RA-300, a powerful electrolytic cell
- RA-400 and RA-500, 'superpowerful' electrolytic cells
- Upgraded Soederberg technology (dry anode)
- 'Clean' Soederberg technology
- Cells with vertical inert anodes
- High-efficiency alumina production

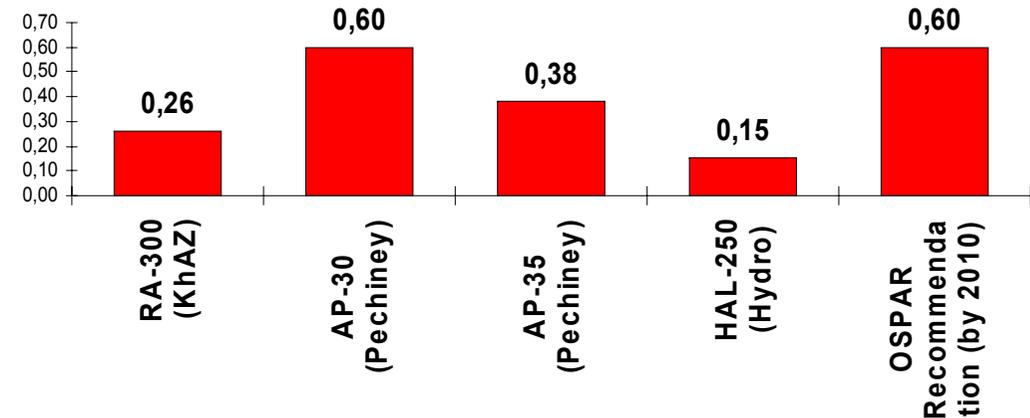


RA-300: TECHNOLOGY OF ENVIRONMENTAL TRANSFORMATION

RA-300 at Khakas aluminium smelter



RA-300 performance parameters: HF emissions, kg/t of Al



- Amperage – 320 kA
- Current efficiency – 95 %
- Fluorides consumption – 16 kg/t of Al
- Frequency of anode effects – 0,15

Parameter	Planned	Actual
Gas treatment rate per one cell, m ³ /hour	9 500	9 300-10 100
Cell hooding efficiency, F total %	98,00	98,75
Gas treatment efficiency, HF %	99,60	99,82
Gas treatment efficiency F _{ТВ} , %	99,60	99,40
Scrubbers efficiency, dust, %	99,60	99,20
Aggregate emissions, fluorides, kg/t of Al	0,60	0,26

RA-400: WORLD'S ADVANCED TECHNOLOGIES



- Amperage - 415 kA
- Frequency of anode effects < 0.05
- Net consumption of anodes – 425 kg/t
- AlF_3 consumption < 16 kg/t

Emission of pollutants:

- Gaseous fluoride **0.04 kg/t**
- Poorly soluble fluorides **0.18 kg/t**

RA-400 is a unique, environmentally friendly technology with low capex and opex

NEW APPROACH: ENVIRONMENTALLY FRIENDLY SOEDERBERG

Environmentally safe Soederberg technology is currently under development

Current outcomes:

Harmful emissions (kg/t Al)	Initial status	Achieved results
HF	0.7	0.18
F solid	0.92	0.37
F total	1.62	0.55

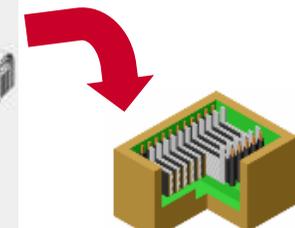
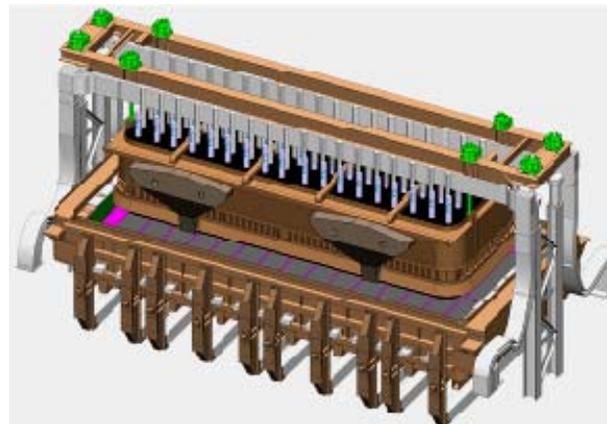
- This technology will ensure the reduction of emissions down to OSPAR levels and environmental performance close to that of pre-bake technology
- Environmental improvements are achieved through unique solutions in anode technology and pot design

Harmful emissions (kg/t Al)	Dry anode Soderberg	Colloidal anode Soderberg	Pre-bake anode technology
HF	0.7	0.2	0.2
F solid	0.92	0.4	0.4
F total	1.62	0.6	0.6
CO	78.9	53.5	27.2
Benzo(a)pyrene	0.002	0.001	0



VERTICAL INERT ANODE AS A NEW ERA IN ALUMINIUM PRODUCTION

- Produces environmentally safe products - Al and O₂
- Has no carbon usage
- Eliminates harmful emissions in the process of aluminium smelting
- Uses energy to achieve environmental improvements through the extraction of O₂ during aluminium smelting
- Minimises impacts on the natural landscape during construction (60% reduction in the size of the smelter while maintaining its production capacity)



200 kA cell with carbon anodes 200 kA cell with vertical inert anodes

KHAKAS ALUMINIUM SMELTER: STATE-OF-THE-ART TECHNOLOGY



Technology	RA-300
Production capacity	300,000 tpa
Investments	USD 750 mln

RA-300 certified as compliant with environmental standards by BECHTEL Engineering Company

Efficiency of 'dry' gas scrubbers:

- In the potrooms: for hydrogen fluoride and pot dust 99.5-99.6%
- In the baking furnaces: for hydrogen fluoride 99%, for tarry substances and benzo(a)pyrene 98.5%

Emissions of the main pollutants (as of 2007):

- Hydrogen fluoride – 0.05 kg/t Al
- Poorly soluble fluorides – 0.21 kg/t Al



BEMO: GREEN POWERED ALUMINIUM PRODUCTION

- Unique combination of green power and an advanced reduction technology
- Renewable energy source (a 3,000 MW hydropower plant)
- Use of hydro energy as an alternative to thermal energy will save **6.5 mln tonnes** of CO₂ emissions annually
- A 600,000 tpa aluminium smelter using a leading RA-300 technology
- Investments – USD 3.6 bln
- Project completion – 2012



TAISHET: UNIQUE TECHNICAL CAPACITY & ENVIRONMENTAL STANDARDS

- RA-400 cells operate at **415 kA**
- Process-related technical solutions enable the smelter to be one of the most environmentally friendly facilities per tonne of aluminium produced
- Design capacity – 750,000 tpa
- Investments – over USD 2 bln
- Project completion – 2011

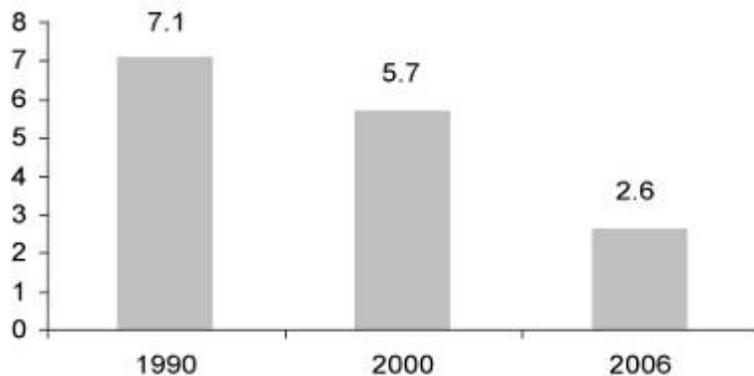


KRASNOYARSK: 'CLEAN SOEDERBERG'

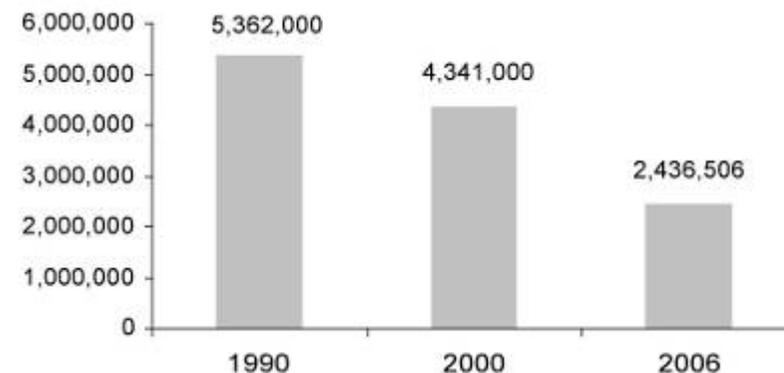
- Advanced technologies applied at Stage 1 of the modernisation programme (dry anode, point-feeders, dry scrubbers) to reduce emissions **by 30%**
- Investments – approx. USD 300 mln
- Implementation period – 2004-2008



Average GHG emissions per tonne of aluminium produced at the Krasnoyarsk smelter



CO₂ emissions at the Krasnoyarsk smelter, tonnes



BRATSK: ENVIRONMENTAL TRANSFORMATION OF THE SMELTING GIANT



- Prior to acquisition by RUSAL in 2000, the Bratsk aluminium smelter was one of the most environmentally hazardous facilities in the non-ferrous metals industry in Russia
- A decision was made to make environment protection a top priority. **Over 3 years**, the level of emissions was reduced by **26%**
- The smelter has spent **USD 49 mln** on environment protection projects over the past **6** years
- In 2007, a large-scale modernisation continuation project was launched. The **USD 350 mln** project provides for:
 - Improvement of the dry anode technology
 - Installation of alumina point-feeders
 - Installation and modernisation of gas treatment plants

Bratsk Aluminium Smelter



RUSAL R&D: ACHIEVEMENTS AND PLANS FOR THE FUTURE



- Introduction of energy saving technologies, RA-300 and RA-400, at new aluminium smelters **reduces emissions by 50%**
- Modernisation of the current Soederberg technology aimed to improve energy efficiency by 20% and **reduce emissions by 70%**
- A full-scale transition to an environmentally acceptable Soederberg technology will start from 2010 with the purpose of reducing emissions by more than 3 times
- An objective to develop a reduction technology using vertical inert anodes by 2012 that will reduce energy consumption and **eliminate emissions**
- Introduction of a cutting-edge technology (high temperature bauxite digestion) at UC RUSAL's alumina refineries allowing for a 40% reduction in energy consumption



A PROCESS TO MAINTAIN AND DEVELOP

- **Generation of cleaner energy:**
Creation of an environmentally friendly in-house energy base including development of additional hydroenergy resources
- **R&D activities:**
An intense R&D programme worth over USD 50 mln aimed at increasing the aluminium production efficiency and reduce specific CO₂ emissions per tonne of aluminium
- **Modernisation:**
A plan to invest USD 1.4 bln in environmental modernisation programmes in 2007-2013
- **Recycling of secondary materials:**
A leading position to consolidate the secondary aluminium industry. By 2013, UC RUSAL plans to increase its share in the secondary aluminium market by 50% with investments totalling USD 190 mln



Thank you

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