



INITIATIVE  
**EnergieEffizienz**<sup>+</sup>  
Industry & Production

## Recognition Prize: Energy Efficiency Award 2010.

**Alunorte – Alumina do Norte do Brasil S.A. – energy efficiency in aluminium production.**

As part of the Initiative EnergieEffizienz, the Deutsche Energie-Agentur GmbH (dena) – the German Energy Agency – in cooperation with Deutsche Messe AG and DZ Bank AG, presents the international “Energy Efficiency Award”. It is funded by the German Federal Ministry of Economics and Technology (BMWi). A recognition prize goes to Alunorte S.A.

### Project description.

Aluminium oxide, also known as alumina, is the primary material for aluminium production. In the upstream calcination step, alumina hydrate  $\text{Al}(\text{OH})_3$  is dehydrated to form alumina ( $\text{Al}_2\text{O}_3$ ). Alunorte has installed an optimised, energy-efficient method for calcining aluminium hydroxide.

The alumina hydrate is mixed in two preheating stages with the hot waste gas from the calcining stage, predried and partially already calcined. The mixture between gas and solid is carried out in a venturi dryer, followed downstream by a cyclone where gas and solid are separated. The final calcination is achieved at 970 °C in a fluid bed reactor (CFB). The hot alumina is discharged from the CFB and cooled in a fluid bed cooler by preheating the combustion air used for the calcination. In front of the fluid bed cooler are two cooling stages. In each cooling stage the alumina is mixed with the combustion air and then separated in a cyclone stage. However, separation in cyclones is never complete, which means that fine dust is transported with waste air from the one stage to the next within the installation. This leads to a reduction in heat recovery and increases pressure losses in the installation.

Using simulations, technology company Outotec has developed a procedure which makes the separation of particles and gaseous medium in the cyclones significantly more efficient. Thanks to this optimised process, considerably fewer solid particles now remain in the gaseous medium than in the past. In this way, heat transfer is improved and pressure losses in the process are reduced. This results in an appreciable energy saving and in more stable operation, meaning that a relatively large temperature fluctuation is prevented and the quality of the end product is improved.

By using this procedure, Alunorte has been able to reduce specific energy consumption for calcination from 3,000 kJ/kg to 2,790 kJ/kg. In annual production terms, this means a considerable energy saving of around 56 million kWh.

### Energy efficiency measures.

- Reducing the fine dust circulation through cyclone optimization thus reducing pressure losses and improving heat utilisation.
- Optimization of process operation.

### Figures that speak for themselves.

Reduction in electricity consumption	2,565,000 kWh/year
Reduction in heavy oil consumption	53,530,000 kWh/year
Percentage energy saving	6%
CO <sub>2</sub> -reduction <sup>1</sup>	18,000 tonnes/year
Additional investment	€ 100,000
Cost reduction	€ 1,360,000/year
Return on Investment	>100%

<sup>1</sup> GEMIS 4.5 values are used in calculations: electricity 633 g CO<sub>2</sub>/kWh and heating oil 302 g/kWh. Since no equivalent value is available for heavy heating oil according to GEMIS 4.5, the value for heating oil was used. It is assumed that the value for heavy heating oil will be even higher. The equivalent value for electricity relates to the German power mix.

### Assessment.

The energy-intensive industrial company Alunorte – Alumina do Norte do Brasil S.A. – has been very active in optimising processes with regard to energy consumption. The technology used has been further developed, tested and improved over a long period on the basis of empirical values and new system approaches. The innovative calcination process has made it possible to thus reduce highly absolute energy consumption per year. The key figures speak for them-

selves: a cost reduction of € 1.36 million was achieved over the year along with a reduction in CO<sub>2</sub> emissions of around 18,000 tonnes. The process optimization was developed by Outotec and jointly implemented with Alunorte. This project is an example of energy efficiency technology being successfully exported and applied to elsewhere in the globe. This is an impressive example of the potential savings to be made even in processes which have already been highly optimised with regard to energy use, such as aluminium production.



*Figs. (from left to right):  
External views of calcination, holding tank with aluminium hydroxide*

### Profile of the award winner.

Alunorte S.A. was founded in 1978. The Brazilian company with its registered office in Barcarena employs 2,500 staff. The company is part of the aluminium production chain in Pará state. The company produces around 6.3 million tonnes of aluminium per year. The project partner is Finnish company Outotec's German subsidiary, which specialises in services and technological solutions for the metals industry.

*“For an energy-intensive business sector such as ours, every kilowatt hour that we can save helps to make us more competitive. This is why innovations such as the new calcination process are very important to us.”*

*Joaquim Ribeiro Alves Filho, White Site Manager*

### The international “Energy Efficiency Award”.

Since 2007, dena has presented the international “Energy Efficiency Award” to companies for outstanding projects that help to increase energy efficiency. The award-winning projects demonstrate the economic viability of energy efficiency measures in industry and production.

Why not emulate them? Details of all previous winners of the “Energy Efficiency Award” and further information about efficient energy use, in your company too, can be found at [www.industrie-energieeffizienz.de](http://www.industrie-energieeffizienz.de).

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### Energy efficiency pays off.

The *Initiative EnergieEffizienz* stands for the efficient use of electricity in all consumer sectors: Campaigns aimed at specific target groups provide consumers in private households, industry and production and the services sector with information on ways of using electricity efficiently and encourage them to act accordingly.  
[www.initiative-energieeffizienz.de](http://www.initiative-energieeffizienz.de)

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