

Embracing Net Zero: A Step Towards a Sustainable Future

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Abstract

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As a major emitter of CO₂, the alumina industry takes initiatives to decrease its environmental footprint. In the process of alumina refining, alumina calcination contributes to the overall CO₂ emissions, accounting for approximately 31 % of an alumina refinery footprint. Therefore, reducing emissions from this specific process directly reduces the refinery's carbon footprint. FLSmidth after considerable research & development have implemented the latest generation alumina calciners which are presently in operation with fuel consumption below 2650 kJ/kg. FLSmidth has actively participated in change from high carbon intensive fuels like heavy fuel oil to low carbon dioxide emitting fuels like natural gas & hydrogen. The use of hydrogen in alumina refineries is under progress as industry seeks to reduce further their carbon emissions and FLSmidth is an active participant in this initiative.

Keywords: CO₂, Sustainability, Fuel efficiency, Emission reduction, Aluminium hydroxide calciner.

1. Introduction

1.1 Hindalco

Hindalco Industries Limited (Hindalco) is the metals flagship company of the Aditya Birla Group. A 26 billion USD metals powerhouse, Hindalco is the world's largest aluminium company by revenues, and the world's second largest copper rods manufacturer (outside China). Hindalco operates across the value chain, from bauxite mining, alumina refining, coal mining, captive power plants and aluminium smelting to downstream rolling, extrusion and foils. Along with its subsidiary Novelis, Hindalco is the global leader in flat rolled products and the world's largest recycler of aluminium.

Hindalco's global footprint spans across 52 manufacturing units over 10 countries. Hindalco has been ranked the world's most sustainable aluminium company in the Dow Jones Sustainability Indices (DJSI) for four consecutive years – 2020, 2021, 2022 and 2023. Hindalco has developed a well-defined decarbonisation plan and is committed to achieving Net Carbon Neutrality by 2050. In addition, Hindalco has set a target to reduce specific Greenhouse gas (GHG) emissions by 25 % by the fiscal year 2024-2025, measured against the base fiscal year 2011-2012.

1.2 FLSmidth

FLSmidth, now known as FLS, is a global supplier of engineering, equipment, and service solutions to the mining industries. They focus on enhancing productivity, reducing operating costs, and minimizing environmental impact for their customers. As a pioneer of decarbonization and digitalization, FLSmidth is always one innovation ahead, thanks to its ability to anticipate customer needs. FLSmidth is able to provide both environmental and economic performance globally, responding to the specific needs of each local market.

1.3 Collaboration and Government Policies

In India, as part of their global plan to reduce the SO₂ emissions, the government imposed stringent regulation on alumina refineries, which were using heavy fuel oil (HFO). New fuel such as Low Sulphur Heavy Stock (LSHS) and Natural Gas have been promoted. A pipeline from the states of Uttar Pradesh to Odisha was constructed by the government where the alumina refineries and smelters are located.

Utkal Alumina Ltd. & Aditya Alumina, a flagship companies of Hindalco Industries having its operations at Tikiri & Kansariguda, Odisha, partnered with FLSmidth to be the first refinery in India to use natural Gas (NG) instead of HFO in their 3 existing Alumina Calciners. This strategic project was decided and approved by the Hindalco Management team to comply with the state fuel policy guidelines as well as to support the carbon neutrality target by 2050.

2. Fuel Conversion – From Heavy Fuel Oil to Natural Gas

Natural gas, primarily composed of methane, produces less CO₂ upon combustion compared to other fossil fuels like fuel oil or coal. This direct reduction in emissions contributes to climate change mitigation. While natural gas is still a fossil fuel, it is a step towards a cleaner energy matrix for alumina refineries. It paves the way for integrating more sustainable energy sources like electrification, hydrogen or biomass in the future.

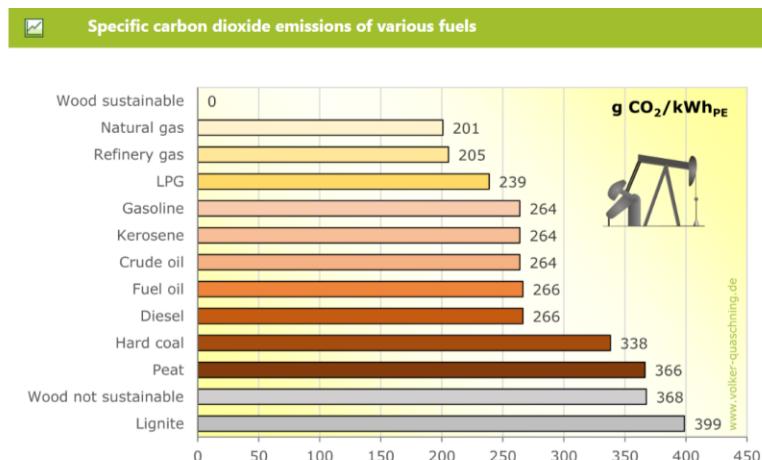


Figure 1. Specific carbon dioxide emissions of various fuels.

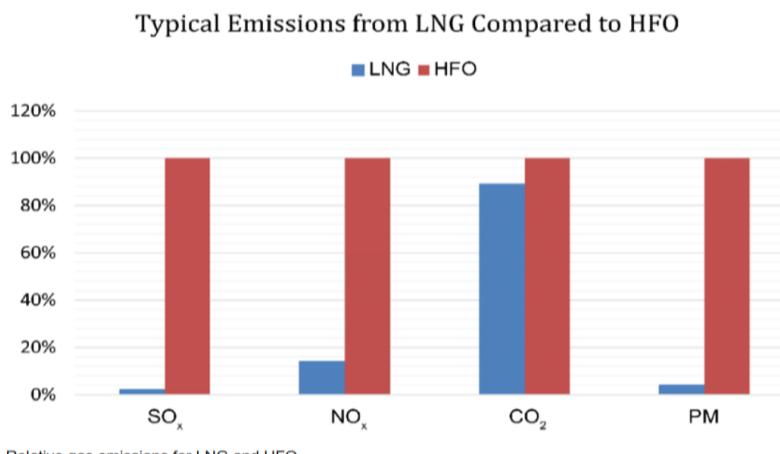


Figure 2. The reduction of CO₂, NO_x, SO_x & particulate matter emissions of NG vs HFO.

Advantages:

- Low alpha in alumina
- Improved Quality
- Lower Calciner temperature :
- Smaller Vessel-Lower CAPEX
- Lower thermal load on refractory
- Longer lining life-Lower OPEX
- Lower heat consumption
- Improved economy

4.1 Improved Refractory Design

A multi-layer lining with optimized performance of layers in the specific operating environment, and proper installation, improves the energy efficiency of a furnace and can contribute to saving specific fuel energy as stated by Pungkuntran [6].

The specific energy consumption of the latest generation calciners operates with fuel consumption in the range of 2650 kJ/kg as stated by Pungkuntran [6].

5. Summary and Conclusions

In conclusion, switching from HFO to natural gas in alumina production is a significant step towards reducing emissions and improving the environmental sustainability of the industry. Safety considerations and compliance measures need to be addressed.

The new refineries can work with the latest generation FLS Calciners which have the lowest fuel consumption calciners and its ability to operate on natural gas and potentially on hydrogen is proof of environmental sustainability of the industry.

The older generation FLSmidth calciners can be retrofitted by adding holding vessel to reduce fuel consumption.

Alumina Hydrate Flash Calcination using a Hydrogen Fired Flash Calciner is under implementation and will be commissioned shortly.

6. References

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