

ARENA INSIGHTS SPOTLIGHT: MECHANICAL VAPOUR RECOMPRESSION FOR LOW CARBON ALUMINA REFINING

AN INTERVIEW WITH
ALCOA OF AUSTRALIA

OCTOBER 2021



Australian Government
Australian Renewable
Energy Agency

ARENA

INTRODUCTION

In the first project of its type in Australia, Alcoa will trial a new way of generating steam required for the refining of naturally occurring bauxite material into alumina that can be smelted into aluminium. Known as Mechanical Vapour Recompression (MVR), this process uses renewable energy to recycle waste steam that would otherwise be exhausted to the atmosphere.

MVR represents an opportunity to electrify a refining process that is currently powered by fossil fuels using a renewable solution - addressing ARENA's investment priority of helping industry to reduce emissions as well as the Government's Technology Investment Roadmap. This is an important step on the pathway towards green aluminium in Australia.

INTERVIEW WITH:

RAY CHATFIELD

ALCOA OF AUSTRALIA - GLOBAL TECHNICAL MANAGER REFINING ENERGY

ARENA: WHAT ARE ALCOA'S GLOBAL DECARBONISATION TARGETS AND INITIATIVES TO REDUCE CARBON EMISSIONS?

At the beginning of October, we announced an ambition to achieve net-zero greenhouse gas (GHG) emissions across our global operations by 2050.

This aligns with our strategic priority to advance sustainably and complements our existing targets, which include reducing direct and indirect GHG emissions from aluminium smelting and alumina refining operations by 30 per cent by 2025 and 50 per cent by 2030 from 2015 baselines.

We plan to reach this ambition by:

- › Increasing use of renewable energy.
- › Growing our low-carbon portfolio.
- › Bringing breakthrough innovations to the market.

This includes a joint venture to develop a zero-carbon smelting process known as ELYSIS. This technology emits pure oxygen and eliminates greenhouse gas emissions associated with the traditional aluminium smelting process. Batches of carbon-free aluminium produced by ELYSIS have been sold for use by such companies as Apple and Audi as the ELYSIS joint venture continues working toward an industrial scale.

The ambition to achieve net-zero greenhouse gas emission is part of our broader focus on sustainability and sustainability-related innovations in bauxite, alumina and aluminium.

We are working to reduce water consumption, minimise waste generation, improve biodiversity conservation and decrease energy consumption across our operations.

ARENA: HOW IS ALCOA PLANNING TO HELP ACHIEVE THESE TARGETS IN ITS ALUMINA REFINING OPERATIONS?

In May we announced a project with the potential to significantly reduce carbon emissions in the alumina refining process, supported by a grant from ARENA, to test the potential use of renewable energy through Mechanical Vapor Recompression (MVR).

If the feasibility studies are successful, by the end of 2023 we plan to install a three megawatt MVR module with renewable energy at our Wagerup refinery in Western Australia to test the technology at scale.

The application of MVR, if proven successful, would be an important step forward in further reducing greenhouse gas emissions.

ARENA: WHAT IS THE KEY INNOVATION OF THE LOW CARBON ALUMINA REFINING PROJECT AT THE WAGERUP REFINERY AND WHAT ROLE DOES IT PLAY IN ACHIEVING THESE TARGETS?

We are currently conducting technical and commercial studies to adapt MVR technology to refining.

Electricity sourced from renewable energy would power compressors to turn waste vapor into steam, which would then be used to provide refinery process heat.

The MVR technology powered by renewable energy could reduce an alumina refinery's carbon footprint by up to 70 per cent.

The technology also has the potential to significantly reduce water use in the refining process by capturing water vapor that would otherwise be lost to the atmosphere.

ARENA: IF THE FEASIBILITY STUDY PROVES THE PROJECT TO BE VIABLE, THEN WHAT PROPORTION OF ENERGY CONSUMPTION AT THE WAGERUP REFINERY COULD POTENTIALLY BE POWERED BY RENEWABLE ENERGY?

Our boilers are fired by natural gas so the fossil fuel consumption is similar to the potential CO₂e emission reduction. Between 65 and 70 per cent of the fossil fuel energy would be displaced by renewables, however MVR recovers waste energy, therefore the renewable energy required is far less than the fossil fuel energy it is displacing.

ARENA: WHAT ARE SOME OF THE OTHER INITIATIVES ALCOA IS UNDERTAKING TO REDUCE EMISSIONS AND OTHER WASTE?

Water scarcity is a growing threat. Fortunately, MVR saves substantial quantities of water as we are capturing waste heat in the form of water vapour that would have previously been lost to the atmosphere.

Late last year we joined the four-year ReActiv project. Alcoa, in cooperation with 20 partners across 12 European countries, will establish links between bauxite residue (the by-product of the alumina refining process) and the cement production industry.

In ReActiv, modification will be made to both alumina and cement production technology, transforming bauxite residue into a reactive material suitable for new, low CO₂ footprint cement products.

ReActiv proposes a win-win scenario for both industrial sectors by reducing wastes and CO₂ emissions.

ARENA: HOW IS ALCOA COLLABORATING WITH OTHER BUSINESSES AND STAKEHOLDERS TO ACHIEVE LOW OR ZERO CARBON ALUMINA PRODUCTION IN AUSTRALIA?

Alcoa is a founding member of the Heavy Industry Low Carbon Transition - Cooperative Research Centre here in Australia. Its membership includes other Australian alumina producers.

Supported by ARENA and started in 2016, we are partners in a University of Adelaide study on integrating concentrated solar thermal energy into the Bayer process.

We also collaborate through local and global aluminium industry forums.

Further information is available at
arena.gov.au

Australian Renewable Energy Agency

Phone +61 1800 804 847

Postal Address

GPO Box 643
Canberra ACT 2601

Location

2 Phillip Law Street
New Acton ACT 2601

Engage with us

ARENAWIRE



This work is copyright, the copyright being owned by the Australian Renewable Energy Agency (ARENA). With the exception of the Commonwealth Coat of Arms, the logo of ARENA and other third-party material protected by intellectual property law, this copyright work is licensed under the Creative Commons Attribution 3.0 Australia Licence.

Wherever a third party holds copyright in material presented in this work, the copyright remains with that party. Their permission may be required to use the material.

With the exception of the Commonwealth Coat of Arms, ARENA has made all reasonable efforts to:

- clearly label material where the copyright is owned by a third party; and
- ensure that the copyright owner has consented to this material being presented in this work.

Under this licence you are free to copy, communicate and adapt the work, so long as you attribute the work to the Commonwealth of Australia (Australian Renewable Energy Agency) and abide by the other licence terms. A copy of the licence is available at <http://creativecommons.org/licenses/by/3.0/au/legalcode>

This work should be attributed in the following way:
© Commonwealth of Australia (Australian Renewable Energy Agency) 2021

Requests and enquiries concerning reproduction and rights should be submitted on the ARENA website at www.arena.gov.au.



Australian Government
Australian Renewable
Energy Agency

ARENA