HILT CRC

HEAVY INDUSTRY LOW-CARBON TRANSITION COOPERATIVE RESEARCH CENTRE

OVERVIEW OF ALUMINA-RELATED RESEARCH AND TECHNOLOGY DEVELOPMENT AT HILT CRC

AlumiNEXT™:
Alumina Refineries' Next Generation & Transition

Woei Saw, The University of Adelaide

14th Oct 2025

Australian Government
Department of Industry, Science and Resources
Cooperative Research Centres Program

Alumina and Aluminium Emissions

Safeguard Facility emissions

- In Australia, Alumina refineries dominate Scope 1 emissions due to fossil-fuel use for process heat and calcination, with most of their product exported.
- Aluminium smelting has smaller Scope 1 emissions (carbon anodes), with most impacts from electricity (Scope 2).
- Default emissions intensity are:
  - Bauxite 0.00401 $tCO_{2\text{-}e}/t_{bauxite}$
  - Alumina 0.545 $tCO_{2\text{-}e}/t_{alumina}$
  - Aluminium 1.94 $tCO_{2\text{-}e}/t_{aluminium}$

Source: National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015, made under s 22XS(1) of the National Greenhouse and Energy Reporting Act 2007

- Brazil is the third largest alumina producer in the world.
- EGA has a different situation where aluminium production is supplemented by imported alumina.

De-risking and accelerating decarbonisation in the Alumina industry

DE-RISKING DECARBONISATION FOR HEAVY INDUSTRY

PROJECTS SUPPORTING ALUMINA

Program 1:

RP1.016
Thermal beneficiation

RP1.013
Alumina Refineries' Next Generation (AlumiNEXT™)

BAUXITE → BENEFICIATION → DIGESTION → CALCINATION → DECARBONISED ALUMINA PRODUCTS

RP2.011
High-temperature heat pumps

RP2.013
Mineral carbonation for CCUS

RP2.014
Low-cost reliable green electricity supply

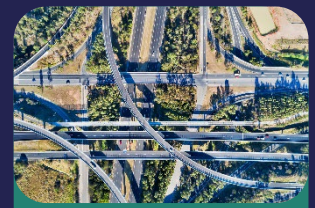
RP2.016
Thermophysical properties of ores

RP2.017
Thermal energy storage

RP2.018
Syngas from Biomass

Program 2:

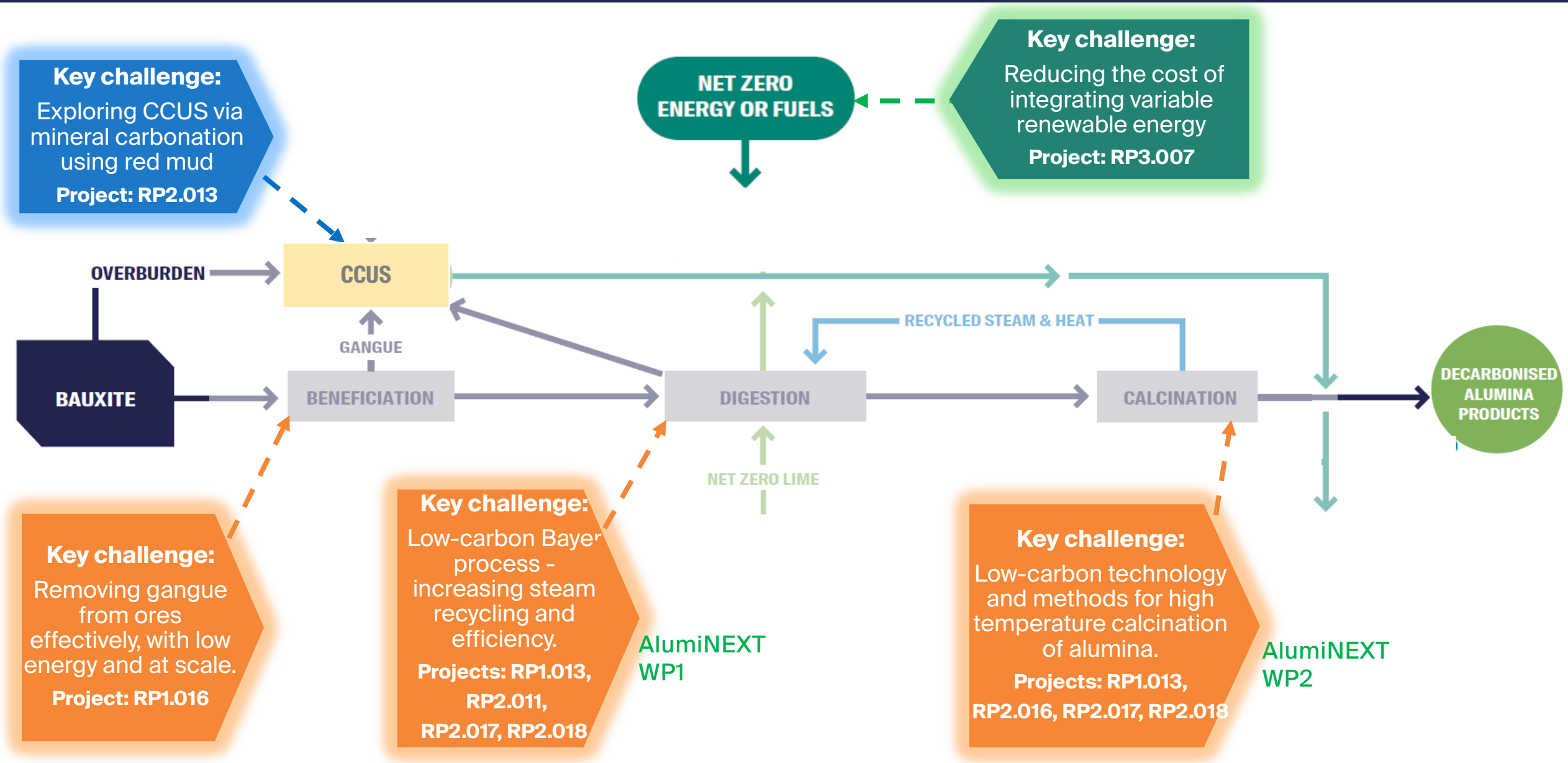
RP3.007
Energy infrastructure investment



RP3.008
Policy roadmap

Program 3:

Addressing Decarbonised Alumina Challenges



AlumiNEXT™: Low-carbon alumina processing

RP1.013 Alumina Refineries' Next Generation Transition, Woei Saw (University of Adelaide)

Aims:

Transition:
To de-risk retrofitting relatively high TRL emissions reduction technologies to existing alumina refineries

Transform:
To advance development of novel technologies that unlock a step-change in increased efficiency and reduce cost in next-generation net-zero refineries

Partners:

SOUTH32, Hydro, EGA Emirates Global Aluminium, Rio Tinto, cba, worley, SysCAD, calix, Energy Exemplar, 14, The University of Adelaide, CSIRO, Australian National University, Government of Western Australia, mriwa

Researchers/Industrial Collaborators:
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AlumiNEXT™: Low-carbon alumina processing

RP1.013 Alumina Refineries' Next Generation Transition, Woei Saw (University of Adelaide)

Approach:

Process/System modelling	Reactor redevelopment	Material
Topic 1.1: Steam generation	**Topics 2.1, 2.2, 2.8:** Electrification / hybridisation of existing calciner	**Topic 1.3:** Alternative heat transfer
Topics 1.2 & 2.10: Waste heat recovery	**Topics 2.3, 2.5:** Development & up-scaling net-zero alumina calciner	**Topic 2.6:** Particle behaviour
Topic 2.9: Transformation process design	**Topic 2.4:** Kinetic study of steam calcination	**Topic 2.7:** Material compatibility

Key Milestones:

2025

Low-carbon steam process design and evaluation: Development of optimised low carbon steam generation and recovery configurations based on reference refineries.

2026

Low-carbon calciner retrofit options: Evaluation of the potential for partial electrification and thermal energy storage integration in existing alumina refineries.

Development of novel calciner designs: Design and evaluation of innovative calciner configurations.

2027

Technology pathways to next generation refineries: Integration of innovative calcination and energy recovery designs.

Commercial pathways to next generation refineries: – Techno-economic evaluations customised for each reference refinery.

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DE-RISKING DECARBONISATION FOR HEAVY INDUSTRY

Thank you!

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