Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH



Federal Ministry for Economic Affairs

and Climate Action

on the basis of a decision by the German Bundestag In cooperation with

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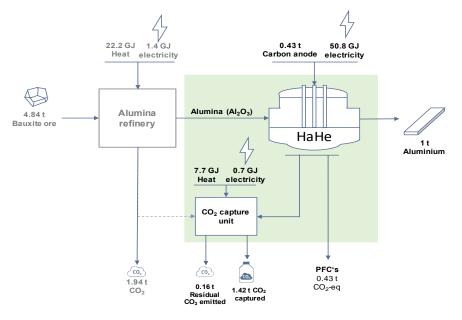
INITIATIVE



Alu

Aluminium Smelter equipped with carbon capture and Storage (HaHe-CCS)

Description | Carbon Capture and Storage (CCS) includes the capture of CO_2 at the plant and its subsequent transport to an underground storage site such as exploited oil and gas fields or saline aquifers in which the captured CO_2 will be permanently stored underground. For this the aluminium smelter (Hall–Héroult process; HaHe) is retrofitted with post-combustion CO_2 capture technology with a capture rate of 90%. However CCS technology can only capture CO_2 emissions but no PFC¹ emissions.



Process inputs and outputs per t of aluminium

	Unit	Value
Electricity demand	GJ	52.2
Heat demand	GJ	29.9
Bauxite ore	t	4.84
Carbon anode	t	0.43
GHG emissions (scope-1) ²	${\rm t~CO}_{_2}\text{-}{\rm eq}$	0.59
GHG emissions (scope-2) [*]	$t CO_2$	7.28
$\rm CO_2$ captured	t CO ₂	1.42

*Assumed emission intensity of electricity: 516 g CO2/

in CO2-eq, excluding alumina refinery

¹ PFC (perfluorocarbons) emissions are mainly CF₄ and C₂F₆, whose

² of the aluminium smelter (HaHe process) including PFC emissions

global warming potentials (GWP) are a multi-fold of that of CO₂

kWh_{el}

Key characteristics:3

- Retrofit to existing plants possible
 - Low concentration of CO_2 in off-gases (~ 1%)
- Low Technology Readiness Level (TRL)
- Does not capture PFC emissions
- Green house gas (GHG) emission reduction compared to conventional aluminium smelting: ~70% (scope-1)⁴

Key requirements:

Access to CO₂ infrastructure

Applicability to the Kazakh context:

- Promising CO₂ storage sites have distance of several hundred up to two thousand km from current aluminium smelters. Currently no transport infrastructure exists
- Application of CCS must be assessed in the context of a broader CCS-strategy

 3 More information and assumptions are provided in the final report of the DeKaMe project

(https://epub.wupperinst.org/frontdoor/index/index/docId/8779) ⁴ The system boundary for the calculations is the aluminium smelter (HaHe process), not including the alumina refinery

This fact sheet is the result of the project "Providing a knowledge base for decarbonizing the Kazakh metals industries (DeKaMe)" which was granted to Wuppertal Institut by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in the context of the GIZ project "Capacity Development for climate policy in the countries of South East, Eastern Europe, the South Caucasus and Central Asia, Phase III' (CDCPIII) as part of the International Climate Initiative (IKI).