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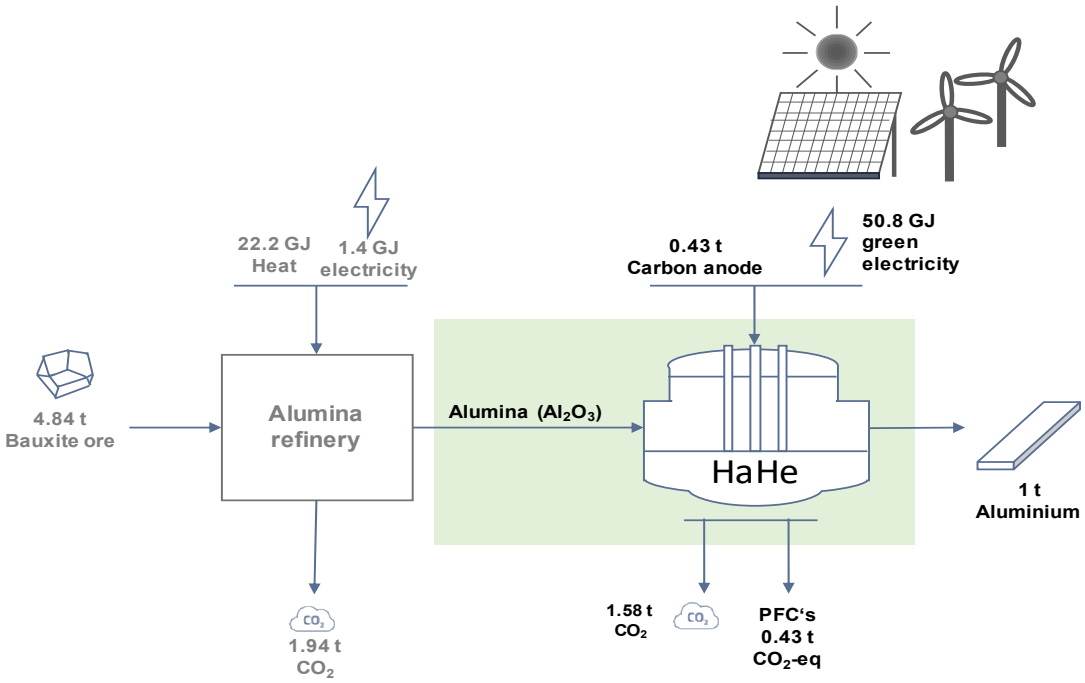
Aluminium smelting with use of low-carbon electricity

Description | The aluminium smelting process (Hall–Héroult process; HaHe) requires large amounts of electricity – 14.1 MWh_{el}/t of aluminium, in the global average – which can be associated with significant scope-2 emissions from electricity production, depending on the CO_2-intensity of the used electricity. Using renewables-based electricity instead of fossil based electricity avoids these scope-2 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
CO_2 emissions (scope-1)[1]	t CO_2-eq	2.01
CO_2 emissions (scope-2)	t CO_2	0
CO_2 captured	t CO_2	-

Key characteristics:[2]

- Avoids scope-2 emissions
- Greenhouse Gas (GHG) emission reduction compared to conventional[3] aluminium smelting: 78% (scope-1 + scope-2)

Key requirements:

- Supply of large amounts of green electricity
- Stable electricity supply to smelting process (electricity balancing)

Applicability to the Kazakh context:

- KZ has good conditions for renewable electricity
- Without policy support, green electricity becomes competitive only in the long term

[1] of the aluminium smelter (HaHe process) including PFC emissions in CO_2-eq, excluding alumina refinery

[2] More information and assumptions are provided in the final report of the *DeKaMe* project (https://epub.wupperinst.org/frontdoor/index/index/docId/8779)

[3] Assumed emission intensity of electricity: 516 g CO_2/ kWh_{el}

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