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IKI International Climate Initiative

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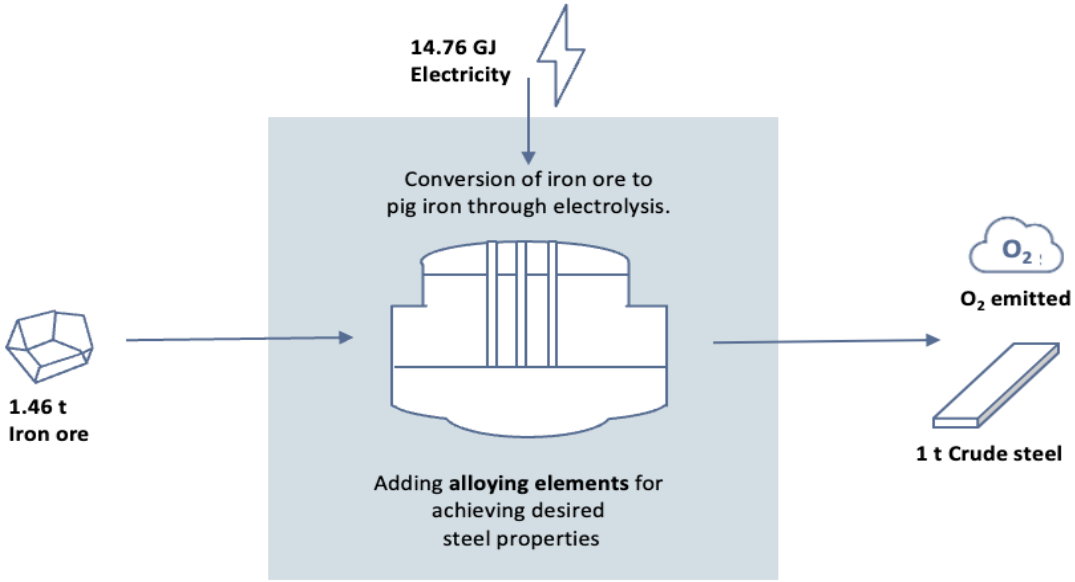
Steel

Iron ore Electrolysis: High temperature molten oxide electrolysis (MOE)

Description | The principle of electrolysis processes is reducing iron ore by putting it into a solution and passing an electric current through it. In the molten oxide electrolysis (MOE) route[1] the iron ore is dissolved in an electrolyte solution with a temperature above the melting point of iron and directly processed into a liquid metal. The process allows the production of various steel properties in the electrolytic process itself by adding alloying elements.



Process inputs and outputs per t of crude steel[2]

	Unit	Value
Electricity demand	GJ	14.76
Iron ore	t	1.46
CO_2 emissions (scope-1)	t CO_2	0
CO_2 emissions (scope-2)*	t CO_2	2.12
CO_2 captured	t CO_2	-

*Assumed emission intensity of electricity: 516 g CO_2/ kWh_{el}

Key characteristics:[3]

- Replacement of conventional plants
- Currently only proven on pilot plant level. Associated with uncertainties regarding its capabilities and market availability
- CO_2 emission reduction (scope-1) compared to conventional BF-BOF: 100%
- Cost increase of steel production compared to BF-BOF (w/o CO_2 costs): 47%-68%
- CO_2 avoidance costs: 104-150 $/t CO_2

Key requirements:

- Stable supply of large amounts of renewable electricity

Applicability to the Kazakh context:

- KZ has good conditions for renewable electricity
- If the assumed technological parameters are confirmed, MOE would allow near-zero emissions at low CO_2 avoidance costs

[1] Besides the MOE route the alkaline electrolysis (AEL-EAF) process is another route that uses iron ore electrolysis[2]

[2] The system boundary for the shown values is iron and steel production up to crude steel

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

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