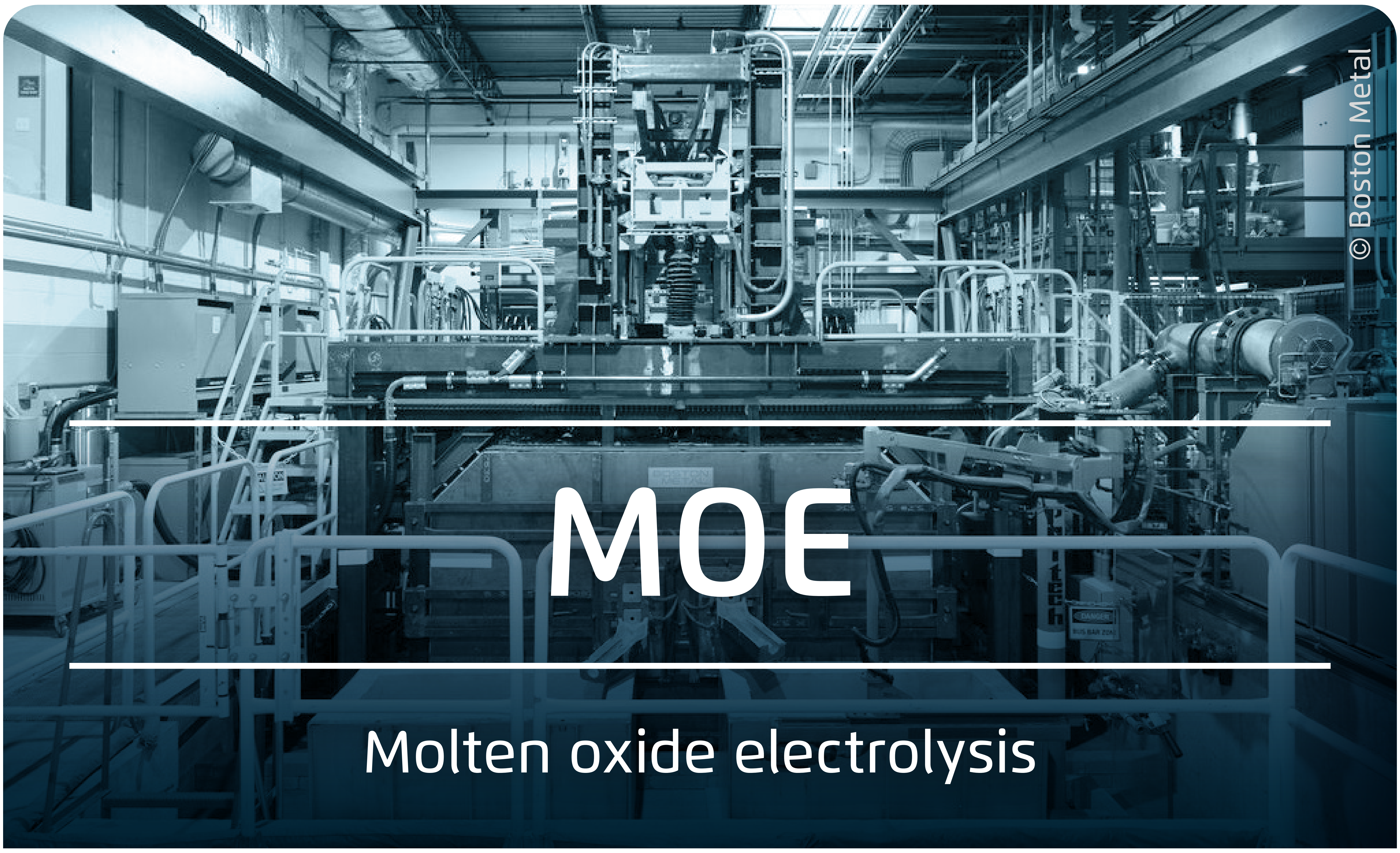

MOE

Molten oxide electrolysis

Emissions	Costs (2050)	Availability[2]
–100%[1]	+23–54%[1]	2035–2040
0 tCO_2/t steel	582–766 USD/t steel	

Challenges:

- → Large continuous renewable electricity demand needed
- → Futher TRL[3] develop-ment needed

Technology potential:

- → Use of lower-quality iron ores possible
- → Potential lower cost and modular scale-up of capacity possible

Note: [1]Versus current BF-BOF route; [2]Estimate; [3]Technology Readiness Level

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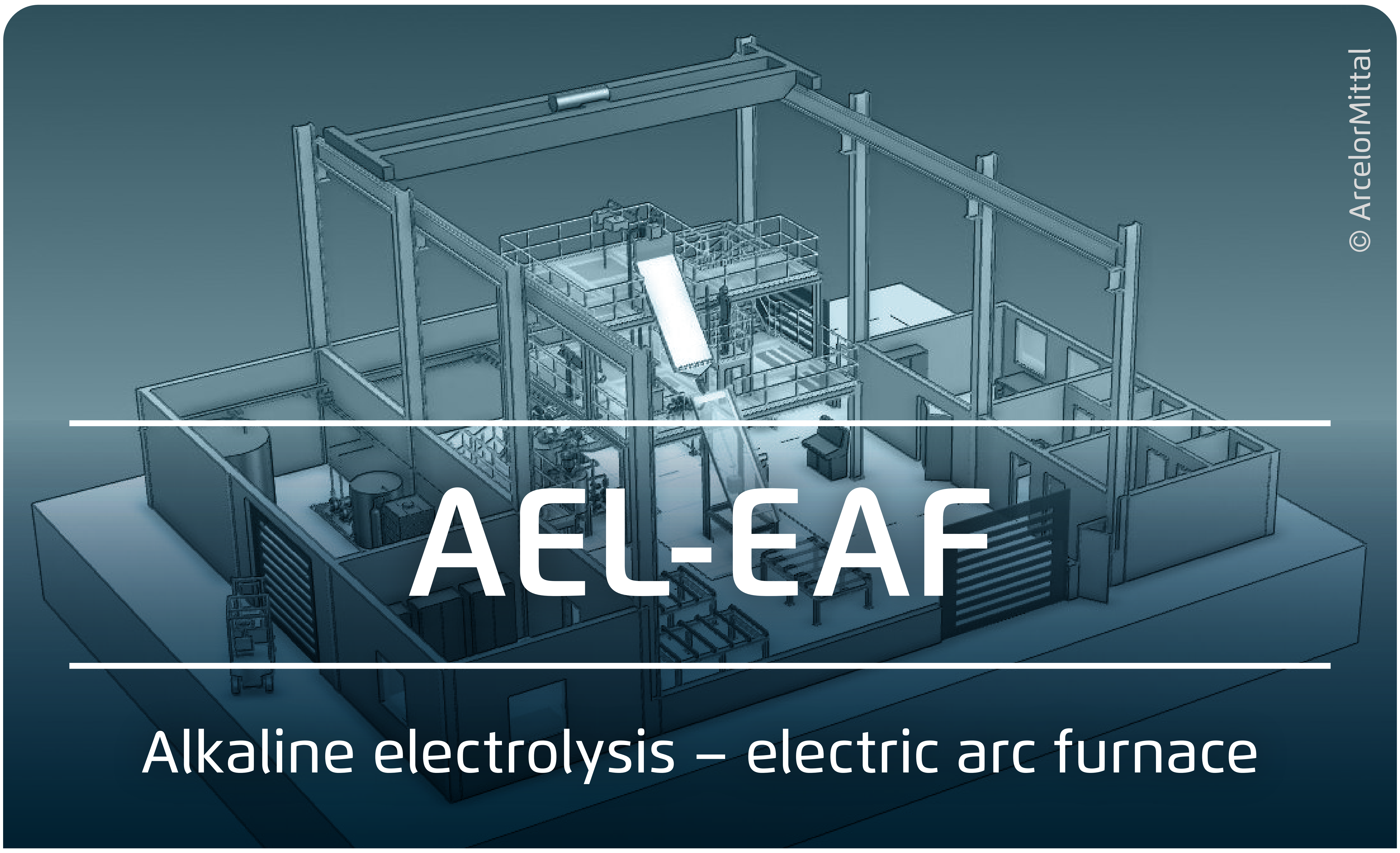

AEL-EAF

Alkaline electrolysis – electric arc furnace

Emissions	Costs (2050)	Availability[2]
–99.6%[1]	+29–71%[1]	2040–2045
0.01 tCO_2/t steel	611–855 USD/t steel	

Challenges:

→ Large renewable electricity demand needed

→ Futher TRL[3] development needed

Technology potential:

→ Use of lower-quality iron ores possible

→ Potential lower cost and modular scale-up of capacity possible

Note: [1]Versus current BF-BOF route; [2]Estimate; [3]Technology Readiness Level

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H_2-DRI-EAF

H_2-based direct reduction – electric arc furnace

Emissions	Costs (2030)	Availability[2]
–99.6%[1]	+54–72%[1]	2025–2030
0.01 tCO$_2$/t steel	727–857 USD/t steel	

Challenges:

- → Large H_2 and renewable electricity demand
- → Availability of high grade iron ore

Technology potential:

- → Allows for flexible H_2 uptake and scrap usage
- → Production of green iron in locations with cheap H_2 possible

Note: [1]Versus current BF-BOF route; [2]Estimate

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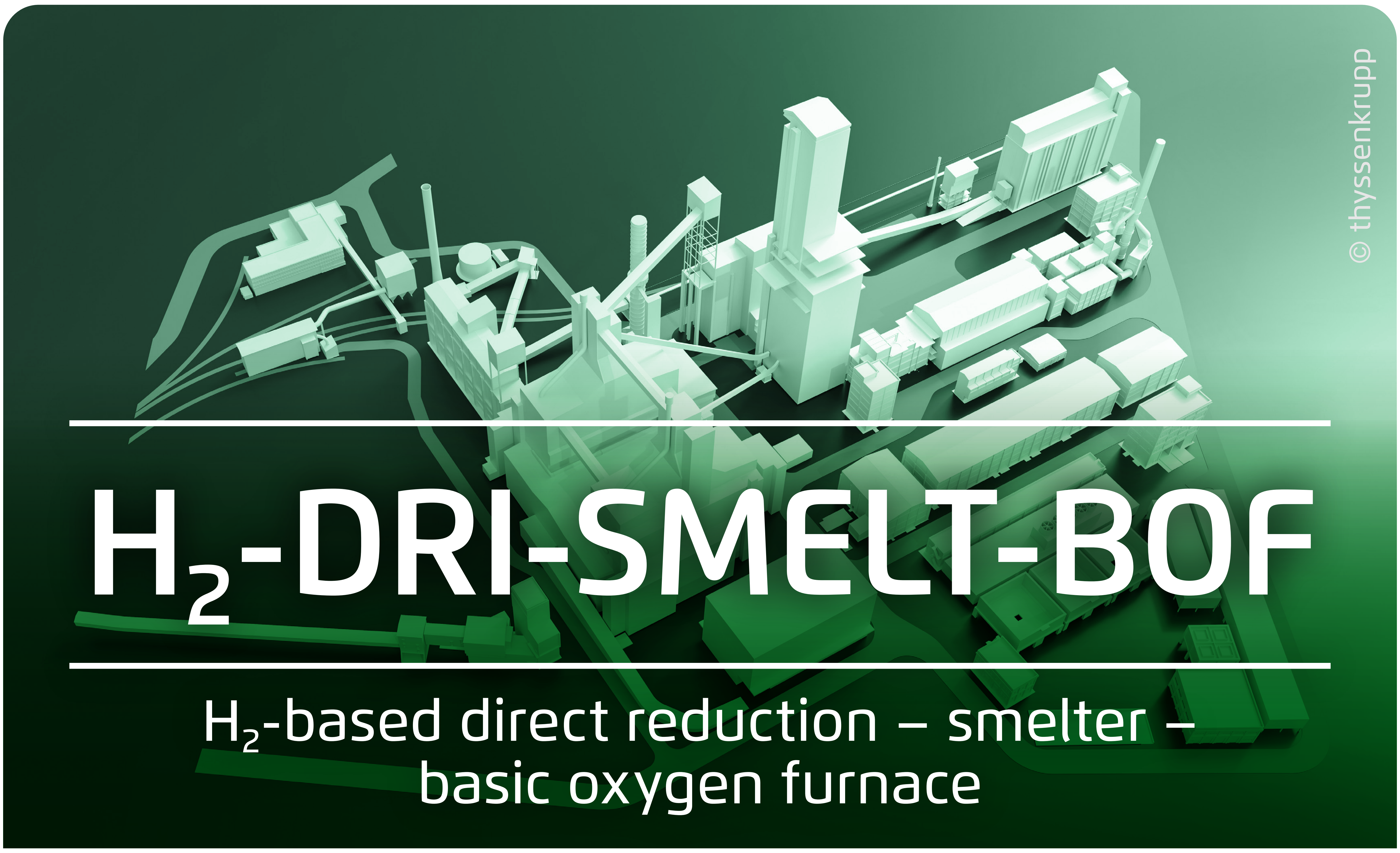

H_2-DRI-SMELT-BOF

H_2-based direct reduction – smelter – basic oxygen furnace

Emissions	Costs (2030)	Availability[2]
–98%[1]	+54–75%[1]	2027–2030
0.04 tCO_2/t steel	725–871 USD/t steel	

Challenges:

→ Large H_2 and renewable electricity demand

→ Availability of renewable carbon input

Technology potential:

→ Use of lower-quality iron ores and flexible H_2 uptake

→ Production of green iron in locations with cheap H_2 possible

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Note: [1]Versus current BF-BOF route; [2]Estimate

NZE-SCRAP-EAF

Near-zero emissions scrap electric arc furnace

Emissions	Costs (2030)	Availability[2]
–99.6%[1]	+35–68%[1]	Today
0.01 tCO_2/t steel	639–837 USD/t steel	

Challenges:

→ Availability of high-quality scrap supply

→ Requires decarbonised electricity supply

Technology potential:

→ Most energy-efficient technology

→ Presents no-regret option for countries with high or growing scrap supply

Note: [1]Versus current BF-BOF route; [2]Estimate

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NG-DRI-CCS

Natural gas-based direct reduction with CCS

Emissions	Costs (2030)	Availability[2]
−89%[1]	+31–48%[1]	2025–2030
0.2 tCO_2/t steel	618–739 USD/t steel	

Challenges:

→ Requires CO_2 transport and storage infrastructure

→ Availability of high grade iron ore

Technology potential:

→ Potential retrofit option

→ Precondition: high CO_2-capture rates and low upstream methane emissions

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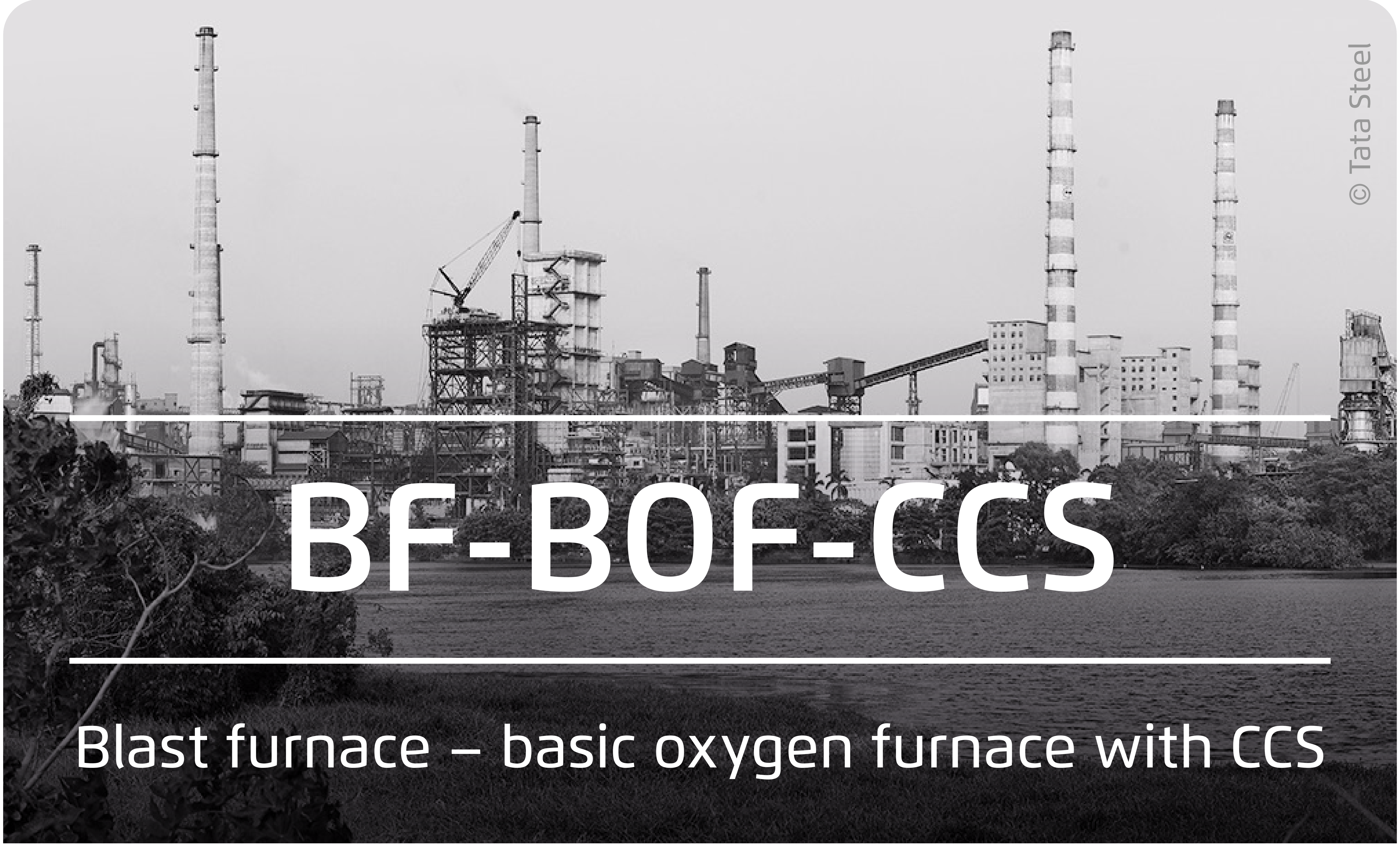
Note: [1]Versus current BF-BOF route; [2]Estimate



BF-BOF-CCS

Blast furnace – basic oxygen furnace with CCS

Emissions	Costs (2030)	Availability[2]
–73%[1]	+27–45%[1]	2030–2035
0.51 tCO_2/t steel	599–721 USD/t steel	

Challenges:

→ Requires extensive CO_2 transport and storage infrastructure

→ Risk of high residual emissions and upstream methane emissions

Technology potential:

→ Potential retrofit option

→ Low technology development activity

Note: [1]Versus current BF-BOF route; [2]Estimate

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HISARNA-BOF-CCS

Hisarna – basic oxygen furnace process with CCS

Emissions	Costs (2030)	Availability[2]
–93%[1]	+23–41%[1]	2030–2035
0.13 tCO_2/t steel	581–704 USD/t steel	

Challenges:

→ Requires extensive CO_2 transport and storage infrastructure

→ Further TRL[3] development needed

Technology potential:

→ Potential low cost option

→ Stalled technology development activity

Note: [1]Versus current BF-BOF route; [2]Estimate; [3]Technology Readiness Level

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