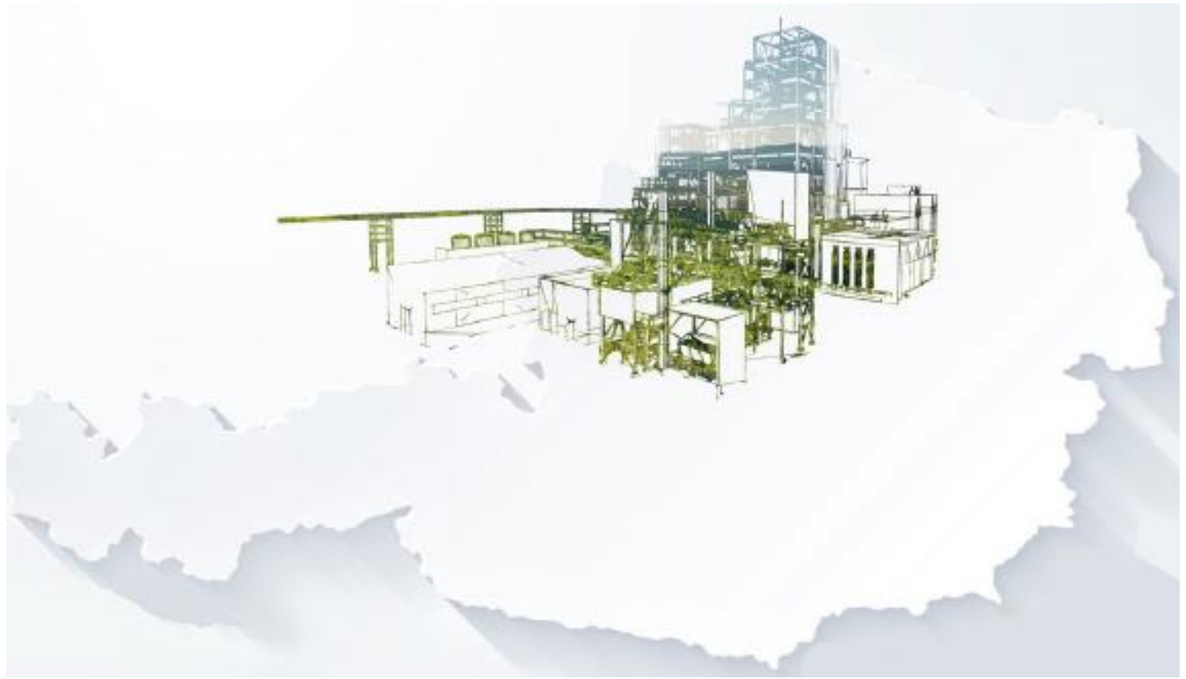
Demonstration plant

Austria‘s largest R&D-Project (for climate protection)

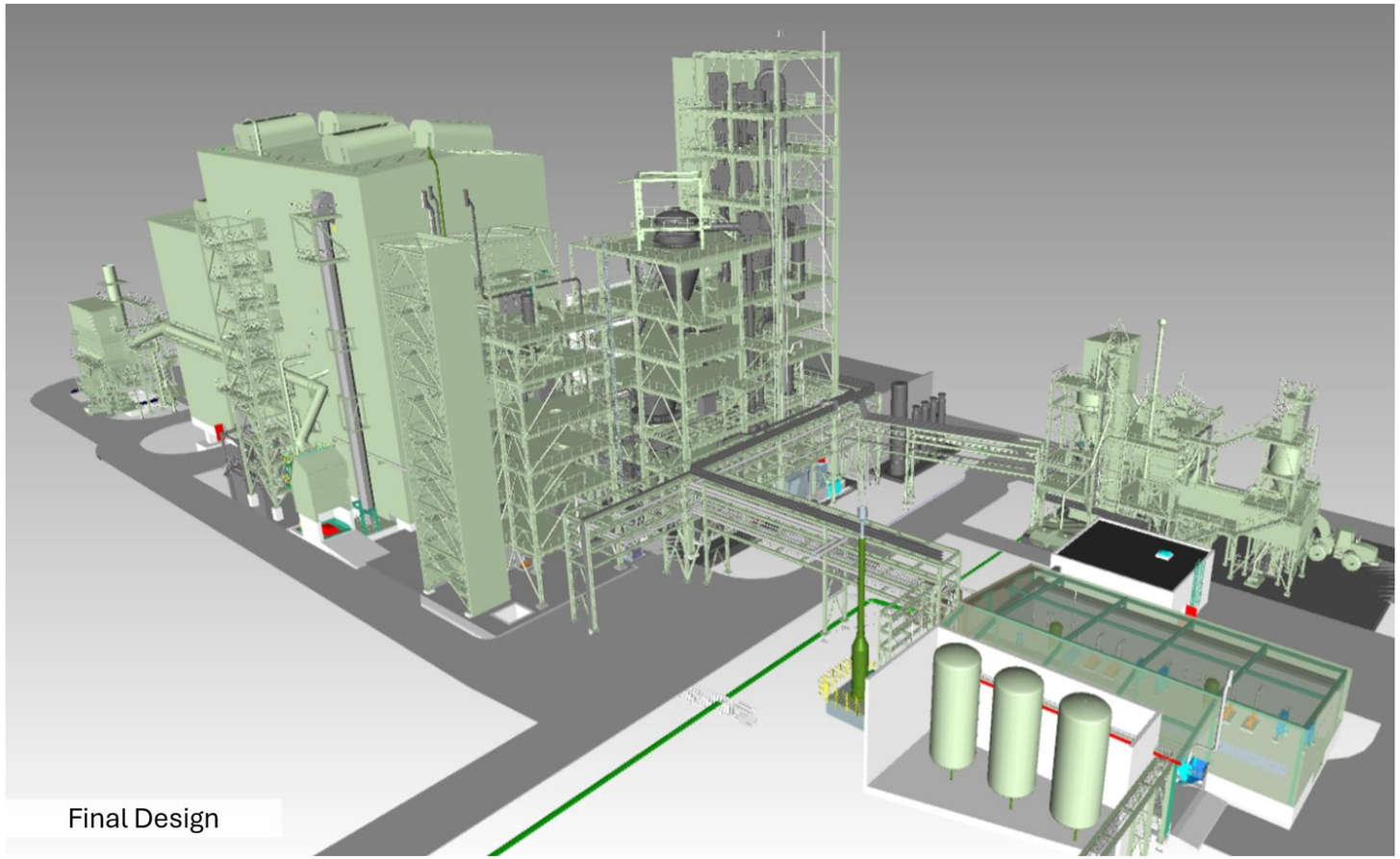


Construction Site Linz (AT)



Demonstration plant

Hydrogen-based fluidised bed direct reduction of ultra-fine iron ores and smelting to green hot metal



Final Design

Fine Ores 2 – 3 t/h
Hot Metal 2 – 3 t/h

Hydrogen 1,200 (1,500) m^3/h from on-site electrolyzing

Operating time 4,000 h/a

TRL 8
Location voestalpine Linz site

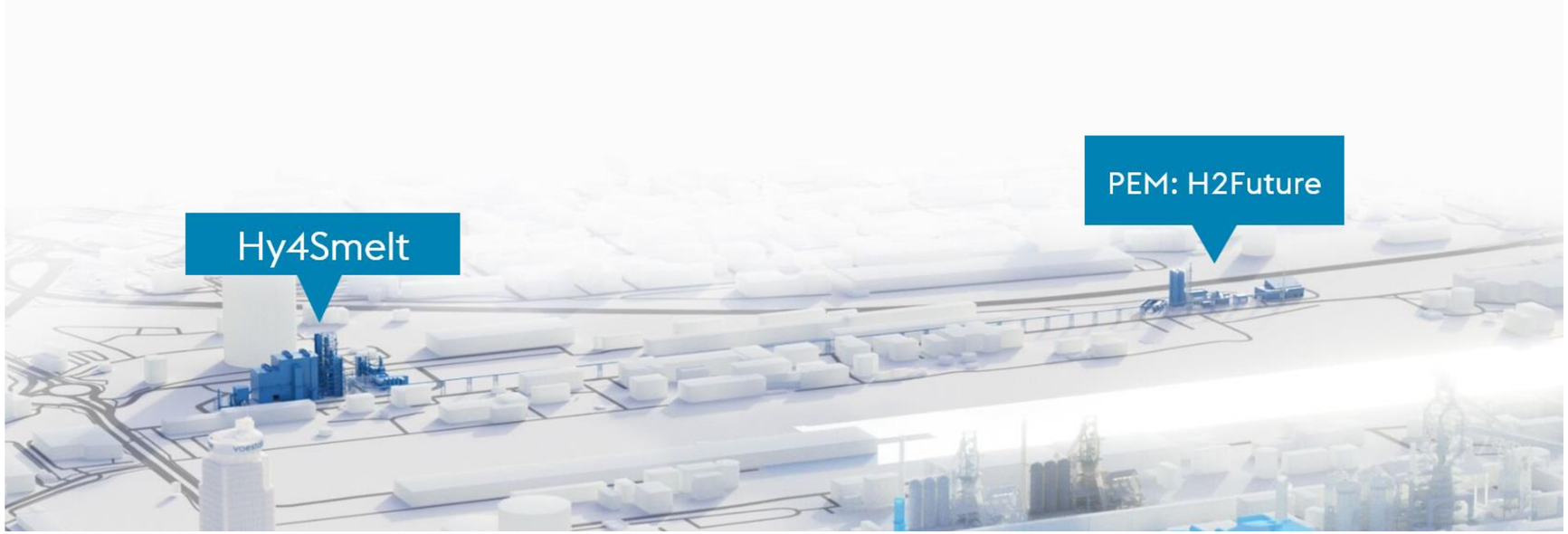
CAPEX MEUR 130
OPEX MEUR 40 (net)

Construction phase 2025 – 2027

Trial operation 2027 – 2030

Hydrogen supply & Project consortium RFCS

Hy4Smelt



voestalpine ONE STEP AHEAD. — Operation & Infrastructure, Trial operation

PRIMETALS TECHNOLOGIES, Mitsubishi Corporation — Engineering Hy4Smelt, Trial operation

K1 MET metallurgical competence center — Process evaluation, Trial operation

LOESCHE INNOVATIVE ENGINEERING — Slag treatment for cement and construction sector

CEMEX — Hy4Smelt slag for replacement of granulated BF slag in cement

UNIVERSITÀ DEL SALENTO — Reduction technology of iron ores

Bauhaus-Universität Weimar — Grinding parameters slag

Sant'Anna School of Advanced Studies – Pisa — LCA modelling Hy4Smelt

ESTEP European Steel Technology Platform — Dissemination

KOMMUNAL KREDIT PUBLIC CONSULTING
aws austria wirtschaftsservice
Co-funded by the European Union
Grant Agreement no. 101193416

Construction Progress

Smelter building

HYFOR® tower





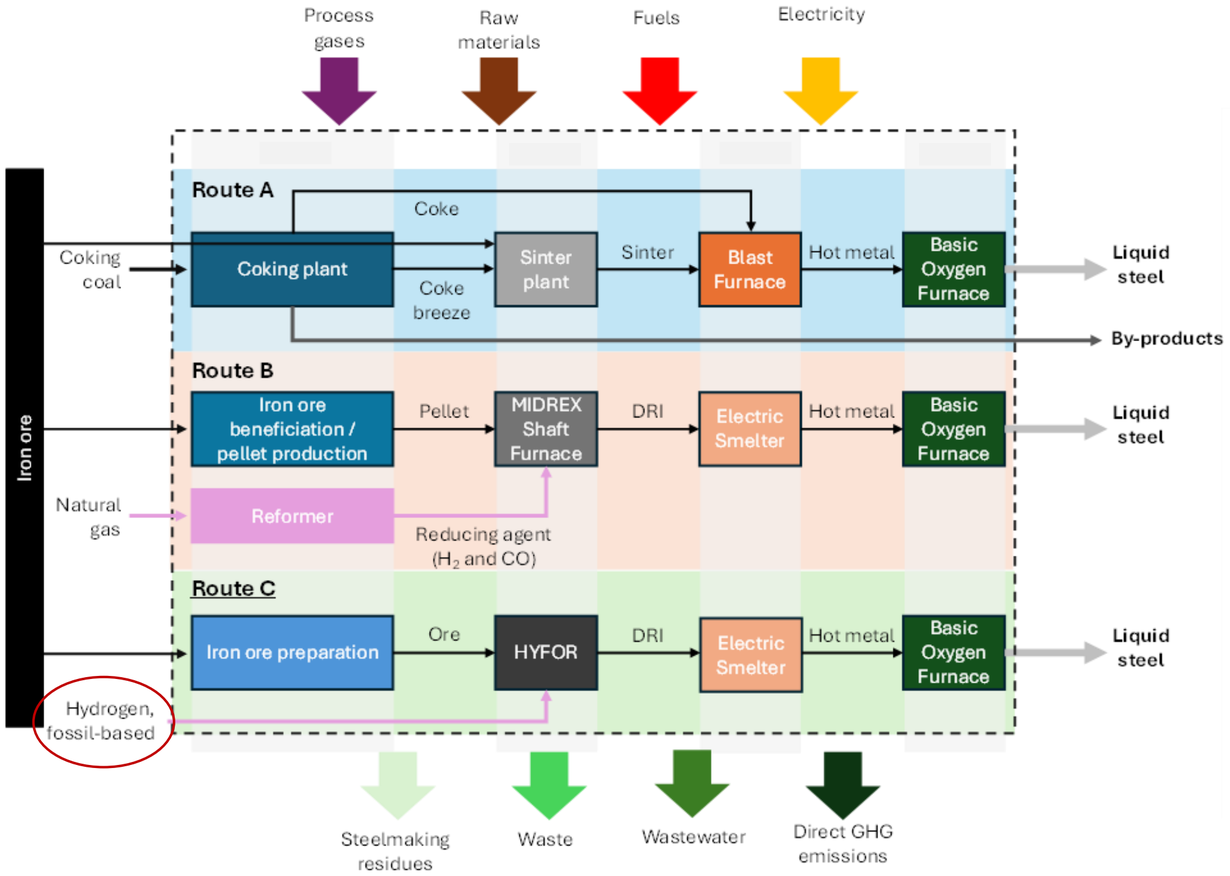
Drying and grinding plant

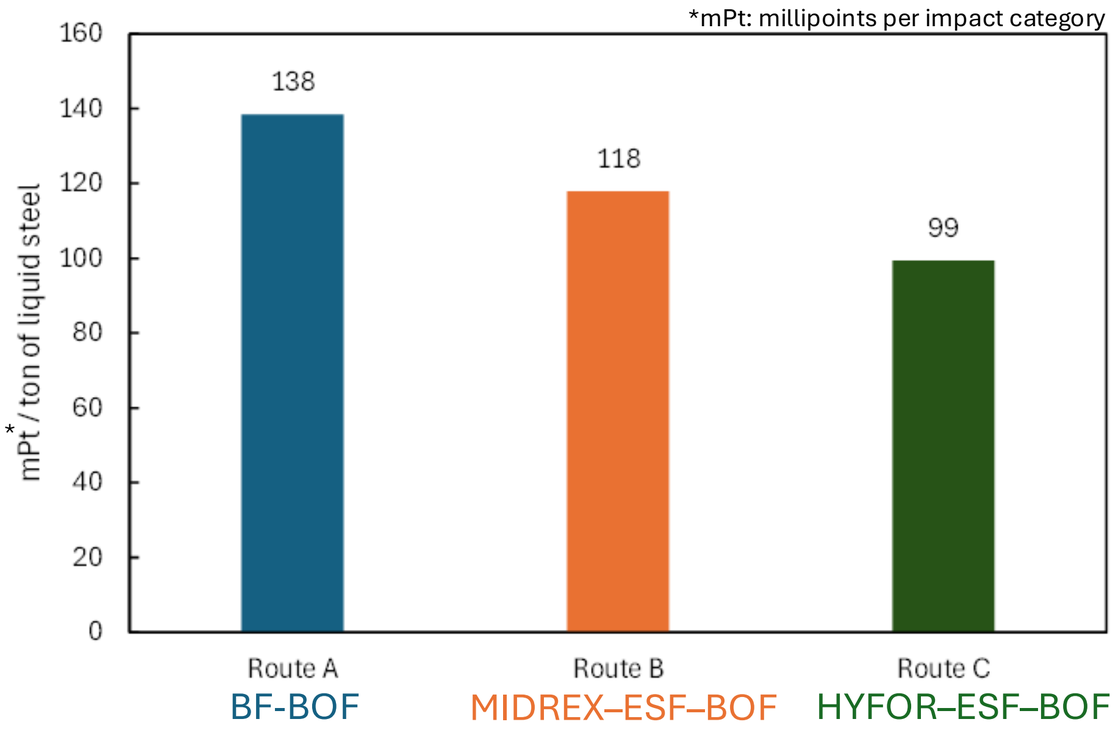


Media Supply

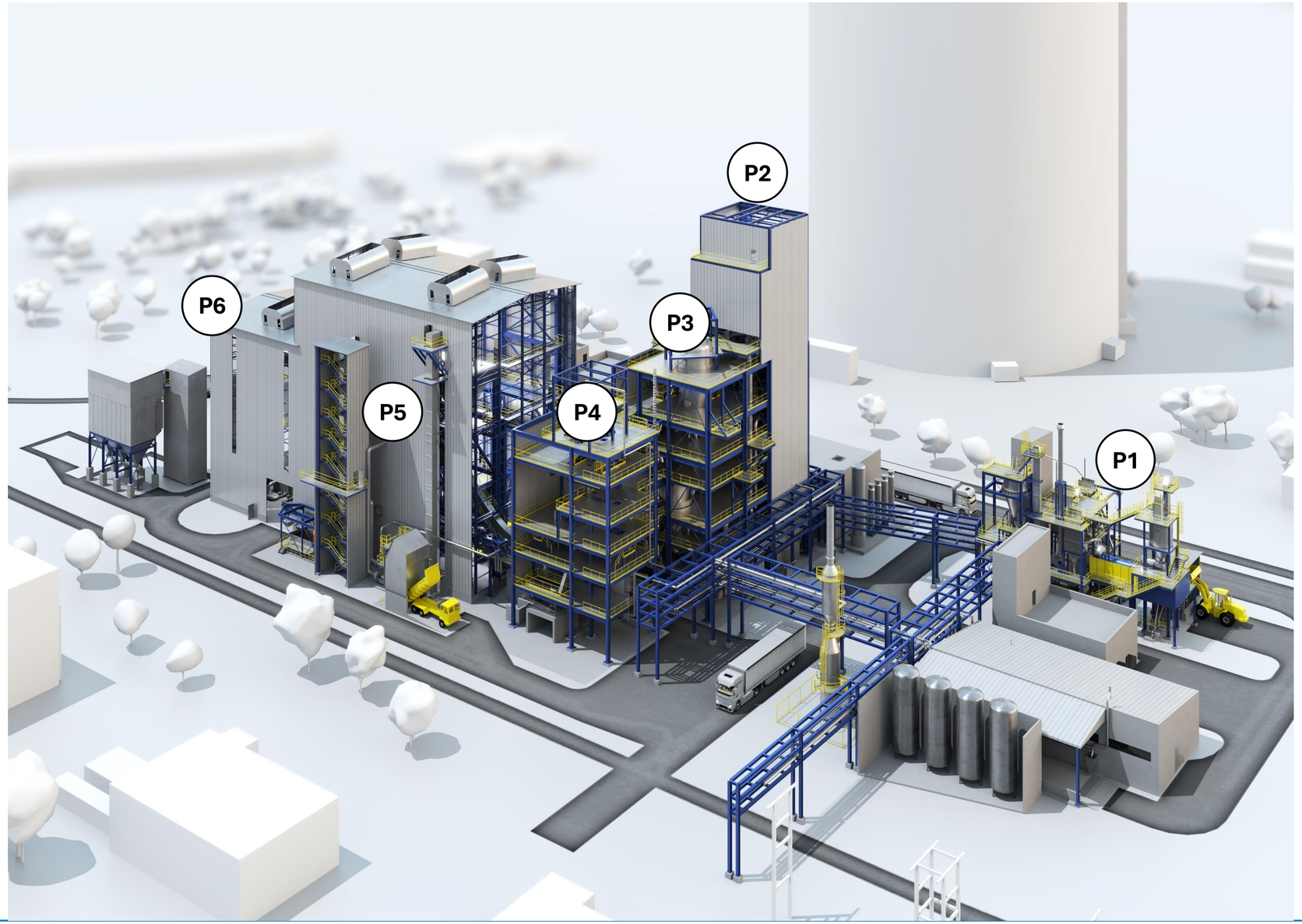
Progress R&D-Project and topics – Impact & Exploitation

Preliminary Life Cycle Assessment (LCA) according EF 3.1 LCIA method with 16 midpoint impact categories





Process Description



P1 **Drying & Grinding**
2-3 t/h Iron ore feed 10mm -> 500 µm

P2 **Oxidation/ Pre-Heating**
4 cyclones in series, up to 900°C

P3 **Reduction**
2 reactors in series, up to 700°C
HDRI metal-grade 85%, 1.5-2 t/h

P4 **Compacting**
HDRI < 500 µm -> HBI/HCI < 40 mm

P5 **Smelting**
Endreduction up to 1480°C

Hot metal 2-3 t/h, slag 1 t/h

P6 **Granulation**
Water graulation (Granshot)

GPI appr. 10mm, 2-3 t/h

Key Development Areas for Hyfor

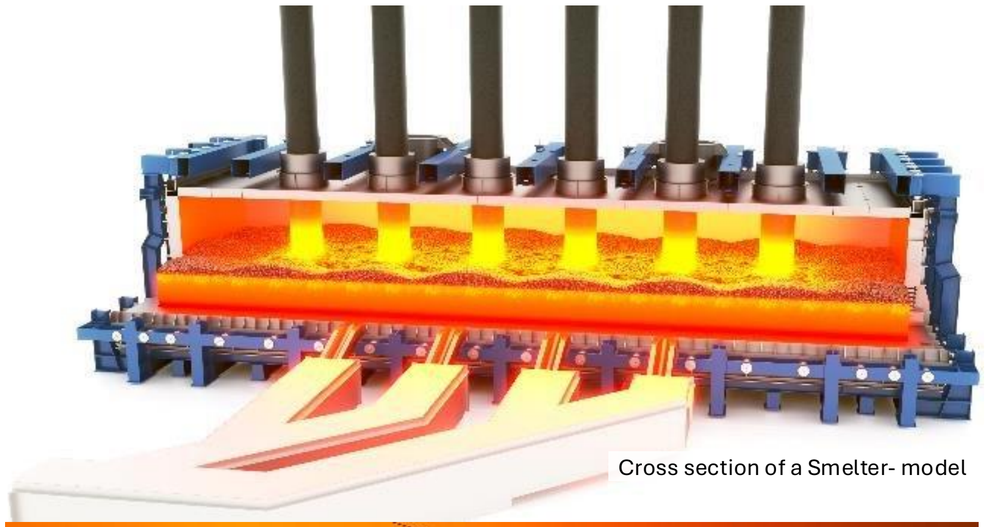


HYFOR Pilot Plant

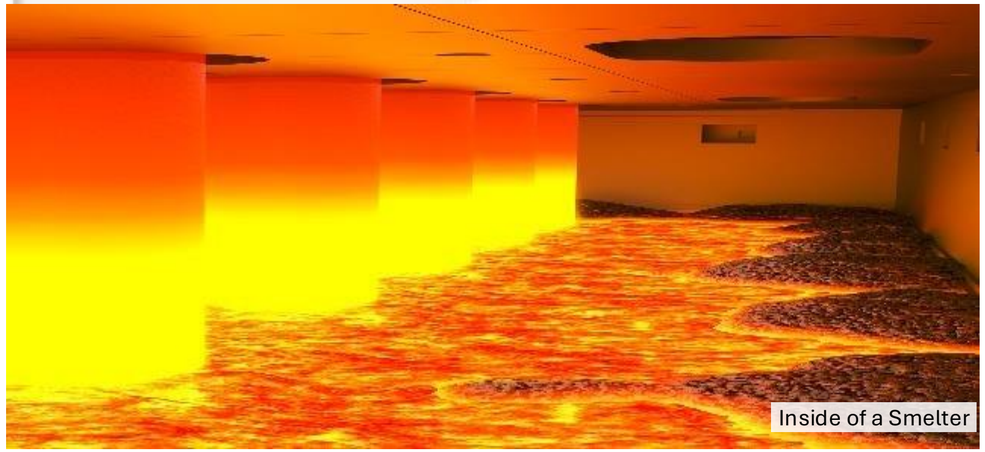
Key development topics

- Fine ore material handling
- Hydrogen
- Sparger grid- gas distribution
- Dedusting at high temperatures/ hydrogen
- E-Heater (direct vs. Indirect heating)
- Capacity (acc. to H2-availability from electrolysis
- Briquetting- higher load

Key Development Areas for Smelter



Cross section of a Smelter- model



Inside of a Smelter

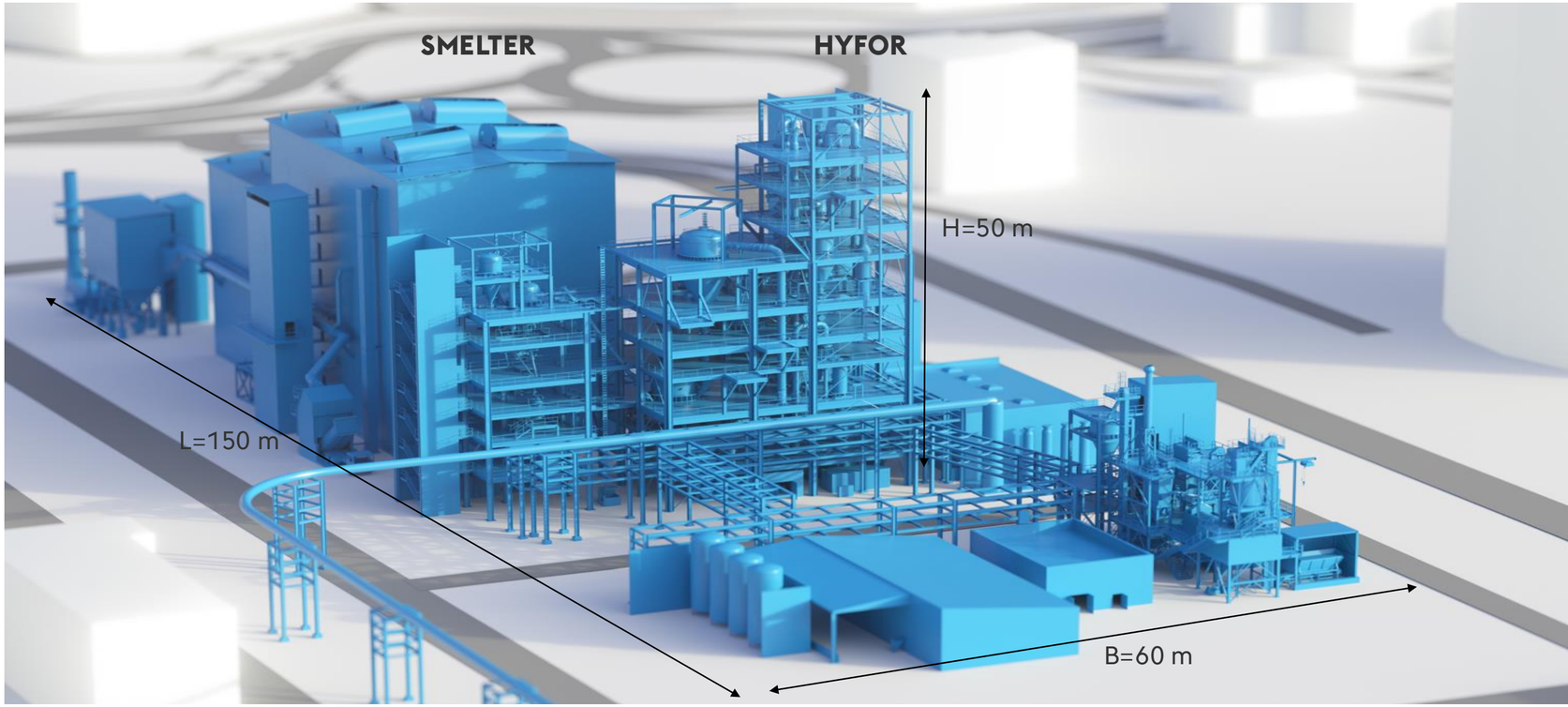
Key development topics

- Refractory material (suitable for slag basicity)
- Level measurement in bath (Fe, Slag)
- Max. Output of Fe (<1% Fe in slag)
- Continuous material intake
- Renewable biocarbon (biochar): fossil coal for carburization replaced- research on reactivity, chemistry, density

Upscaling to Industrial scale plant

Upscaling

- **Material handling:** due to flow regime of material- no enlargement necessary
- **Reactor design:** enhanced pressure may allow higher throughput (volume/ton metal produced
- **Dedusting:** large filter surface area necessary
- **Smelter:** similar design- more electrodes (vessel layout)

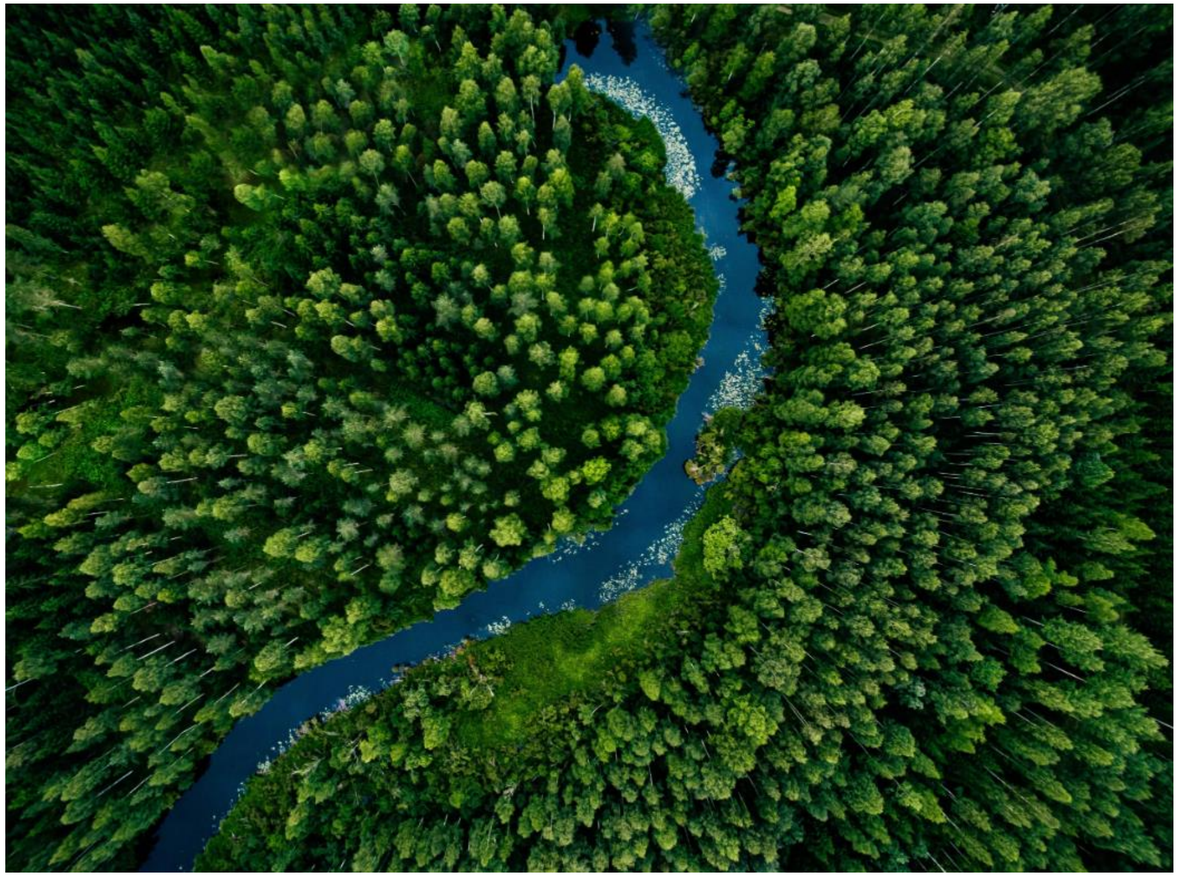


Model of Hy4Smelt at voestalpine Linz site

Environmental impact

Key decarbonization measures

- **Hydrogen:** Green hydrogen from water electrolysis used as the reducing agent
- **E-heater:** Electrically generated process heat replaces fossil fuel combustion
- **Biochar:** Fossil coal for carburization replaced by renewable biocarbon (biochar)



Towards a Net-Zero-CO2 Ironmaking Process

- **No direct CO_2 emissions** from the Hyfor reduction and smelting processes
- Carbon emissions avoided when supplied with renewable electricity, green hydrogen, and sustainable biochar