

# FUEL CELLS AND HYDROGEN IN THE ECONOMY

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Industry Perspectives

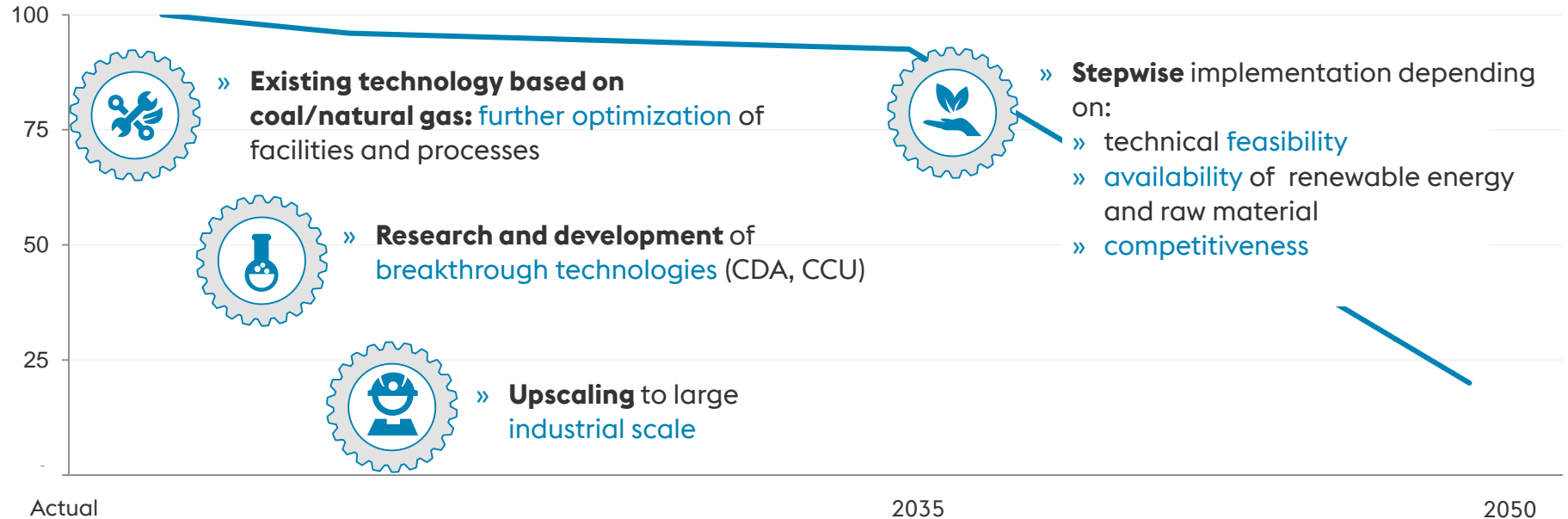
Johann Prammer, voestalpine AG

# LOW-CARBON STEELMAKING voestalpine SCENARIO

— CO<sub>2</sub> emissions (%)

Carbon steelmaking

Low-carbon steelmaking



# LOW-CARBON STEELMAKING

## voestalpine STEPS, PROJECTS AND ACTIVITIES

Technology development, R&D

Technology change

### H2FUTURE

(Hydrogen electrolysis and integration)

### Sustainable Steelmaking (SuSteel)

(Hydrogen Plasma Smelting Reduction)

### Raw material advancements

(Refinement, pre-treatment, ...)

### Metallurgy development

### CCU



### Upscaling

First application on industrial scale



### Implementation

Application of breakthrough technologies with new site and plant configurations



Aktuell

2035

2050

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ONE STEP AHEAD.

# HYDROGEN STEELMAKING

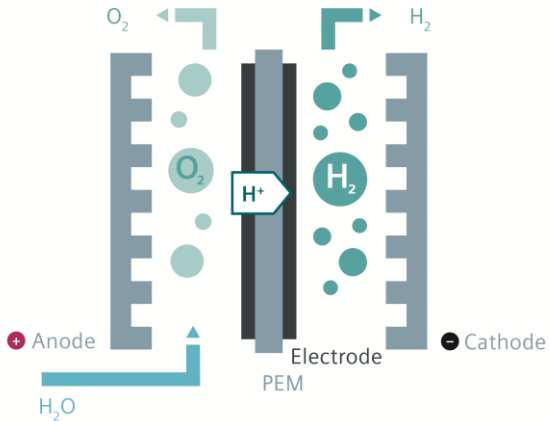
## voestalpine CONCEPT

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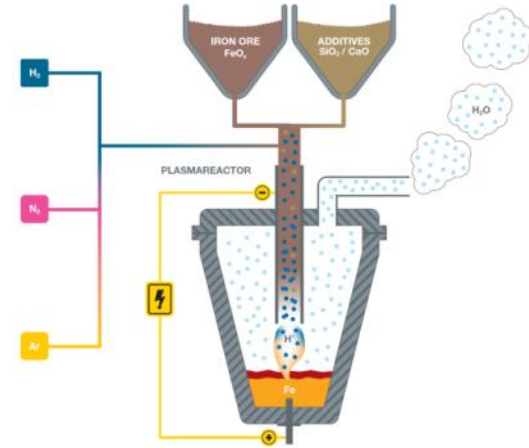
- » **Bridge technology:** Direct reduction plant in Texas (USA); using natural gas as reducing agent in direct reduction plants; potential for gradual introduction of green hydrogen generated using renewables.
- » **Renewable hydrogen generation:** H2FUTURE project at Linz site (Austria); investigating hydrogen electrolysis technology on an industrial scale.
- » **Breakthrough technology:** SuSteel (“Sustainable Steelmaking”); smelting reduction of iron ore using hydrogen plasma, ongoing research with pilot plant at the Donawitz site (Austria).

# HYDROGEN STEELMAKING

## CDA PROJECTS: H2FUTURE AND SuSteel



PEM electrolyser unit with 6 MW power and 1.200 m<sup>3</sup>/h H<sub>2</sub> production at voestalpine Linz site for full scale demonstration of H<sub>2</sub> production and demand-side-management balancing funded by FCH JU.



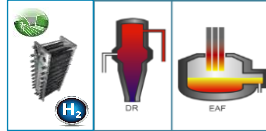
Fundamental research project for plasma smelting reduction with H<sub>2</sub> at voestalpine Donawitz site. This project for the upscaling from lab scale (< 500 g) to batch operation with 50 kg is funded by FFG.

# LOW-CARBON STEELMAKING BASED ON H<sub>2</sub> OPTIONS AND PRECONDITIONS

## CDA (Carbon Direct Avoidance)

## Preconditions

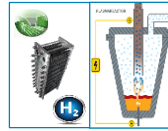
Production route: **DRI – EAF**



- » Raw material management
- » Energy management (gas/H<sub>2</sub>)



Production route: **SuSteel**



- » Technical feasibility
- » Raw material management
- » Energy management (H<sub>2</sub>)



## CCU (Carbon Capture and Usage)

## Preconditions

„**Carbon-2-X**“: Conversion of CO<sub>2</sub> from process gases and utilization as raw material in chemical industries

- » Technical feasibility, efficiency
- » Project partners (Chemicals)
- » Energy management (H<sub>2</sub>)



... etc.

# KEY FACTORS INNOVATION

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## » **Development of breakthrough technologies requires**

- » Public support in funding → large scale innovation programs for R&D and industrial upscaling to reduce OPEX of CO<sub>2</sub>-lean production
- » Refunding of ETS costs with the purpose of low-carbon reinvestment



## » **Implementation of breakthrough technologies requires**

- » Establishment of an integrated European energy system based on least-cost renewables incl. hydrogen infrastructure – innovative generation, supply, storage, and transmission of energy
- » Any residual excessive OPEX to be balanced by cost-pass-through mechanisms to the final consumer, e.g. a globally applied CO<sub>2</sub> price, willingness-to-pay systems, state aid, ...

# PUBLIC SUPPORT IN FUNDING OPTIONS

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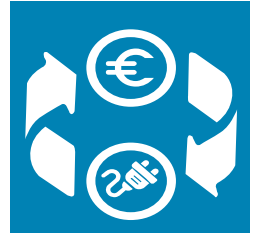
## » **Development & deployment of breakthrough technologies**

- » **Horizon Europe** – anchoring sufficient allocation of funds, establishment of dedicated PPPs
- » **IPCEIs** – Import Projects of Common European Interest
  - » SVCs<sup>\*)</sup> - “low-carbon-industry”, “hydrogen technologies and systems”
  - » IPCEI for sector-specific research and innovation (transnational projects – national cofinancing)
- » **EU-ETS-Innovation Fund** – secure access
- » Implementation of **national Innovation Funds** for low-carbon-innovation

<sup>\*)</sup> SVC ... Strategic Value Chains

## » **Compensation of electricity price**

- » National **implementation of EU-ETS-compensation** mechanism
- » **Extension for H<sub>2</sub>**-utilization – review of state aid law / EU-ETS
- » **Exemption** from political costs (e.g. renewable cost allocation)





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