

ESTEP 2025 Annual Event

28-30 October 2025
Udine (ITALY)

How decarbonisation, digitisation
and circular solutions forge the
sustainable European steel future?

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Advancing Decarbonization in Ironmaking

Progress and Future Directions of the Electrically Assisted Syngas Smelter



DIGIMET



DANIELI AUTOMATION



**UNIVERSITÀ
DEGLI STUDI
DI UDINE**
HIC SUNT FUTURA

Influencing factors of successful transition

Reduce risks – Act smart and flexible



A basket of solutions are required to be tailored based on the influencing factors.



The development of alternative steel routes is determined by the market constraints and the resources shortage

Production routes

Scrap-EAF

Additional ~238 Mtpa
by scrap and green electricity



DRI-EAF/ DRI-BOF

Additional ~153 Mtpa
by H2 & pellets



BF-BOF

More than 1100 Mtpa
to refurbish & decarbonize

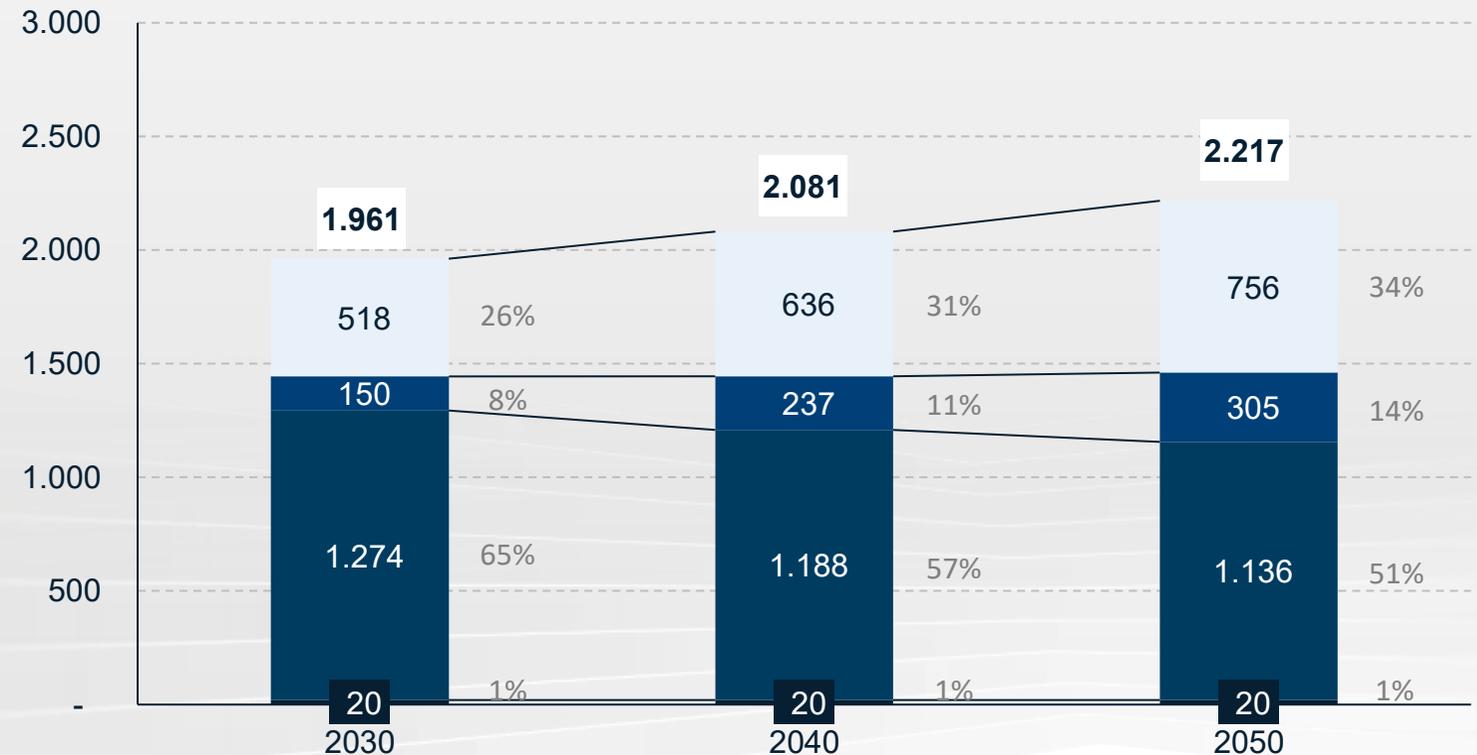


Others

Marginal increase of alternative technologies. Big room for improvement

Steel production

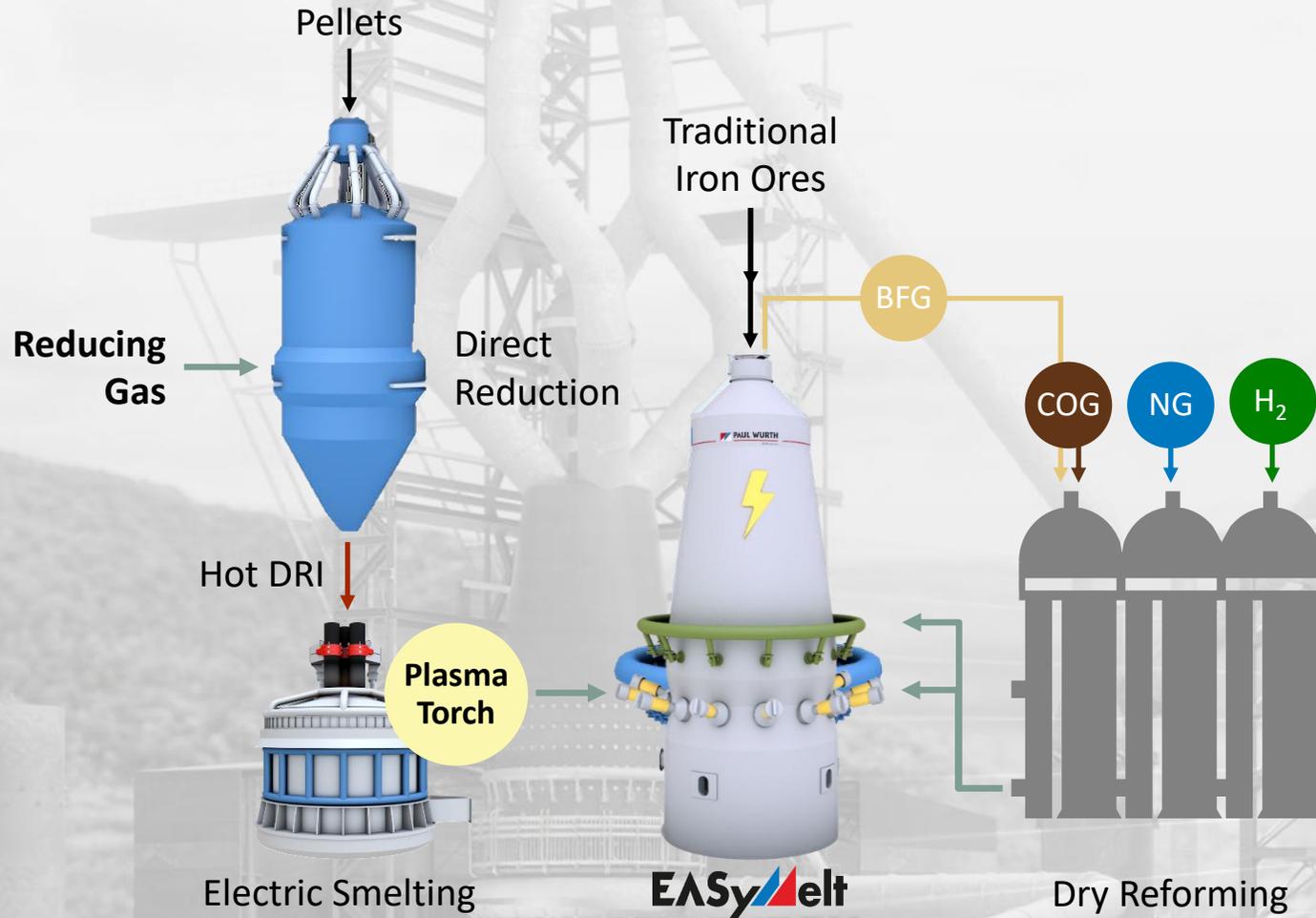
in Mt



Other (Fluidized bed, Siemens Martin, open hearth, etc.) & new direct electrification technologies

Paul Wurth EASyMelt – Technical concept

Electrically Assisted Syngas Smelter



How does the EASyMelt work?

Technical features

- › No blast, only small amount of cold oxygen
- › No PCI, nor auxiliary fuel injection at tuyere
- › **Topgas recycling** = high efficiency ●
- › **Reducing gas production with dry reforming** ● →
- › **Reducing gas injection** at tuyere and/or shaft = decrease coke consumption →
- › Tuyere gas heated to ~2000°C with **plasma** ●
- › Flexible addition of **H₂** or **NH₃** when available ●

The EASyMelt Ecosystem

Stay flexible to succeed in every possible situation

Flexible technology configurations

- › Leverage existing assets
- › Adapt to your plant layout
- › Customizable investment timeline

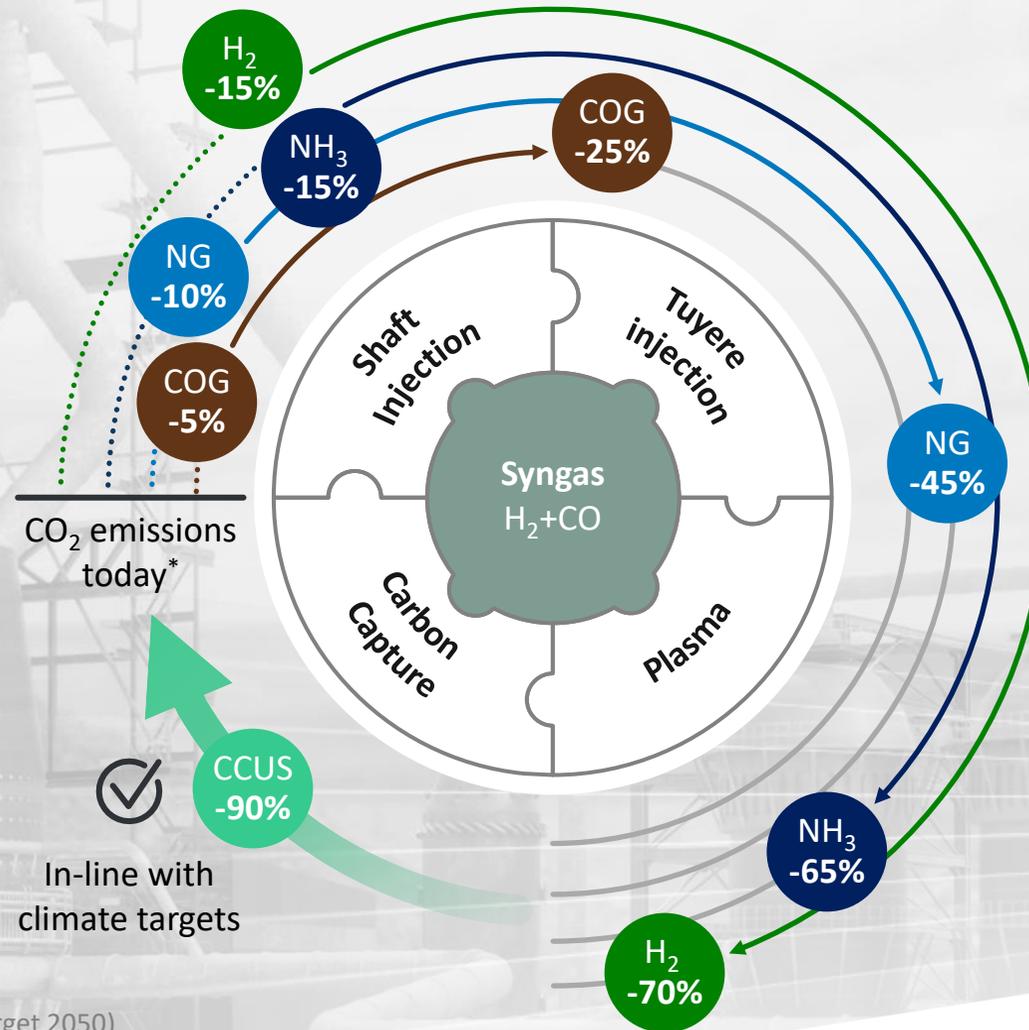
→ **Minimize CAPEX and risk**

Flexible production

- › High quality hot metal
- › Possibility to increase productivity
- › Fulfil orders efficiently

→ **Maximize income and reliability**

* Scope 1+2 assuming 80gCO₂/kWh_{electric} (OECD EU-28 target 2050)



Flexible energy inputs

- › Minimize your energy costs
- › Stay resilient against price volatility
- › Optimize decarbonization timeline

→ **Minimize OPEX and risk**

Flexible iron ore inputs

- › Minimize iron ore costs
- › Maintain existing ore supply chain
- › Adaptable to any other ore supply

→ **Minimize OPEX and risk**

Exemplary adoption

Tailoring the steps to local assets

Scope 1+2*

EASyMelt Shaft

Shaft injection
of syngas



-15% CO₂

- › Easy implementation
- › lowest CAPEX

EASyMelt Tuyere

Tuyere injection
of syngas with O₂



-40% CO₂

- › Increased CO₂ reduction
- › No additional electricity

EASyMelt Plasma

Tuyere injection
of syngas with plasma



-70% CO₂

- › Further CO₂ reduction
- › additional elec. & CAPEX requirement

Carbon capture



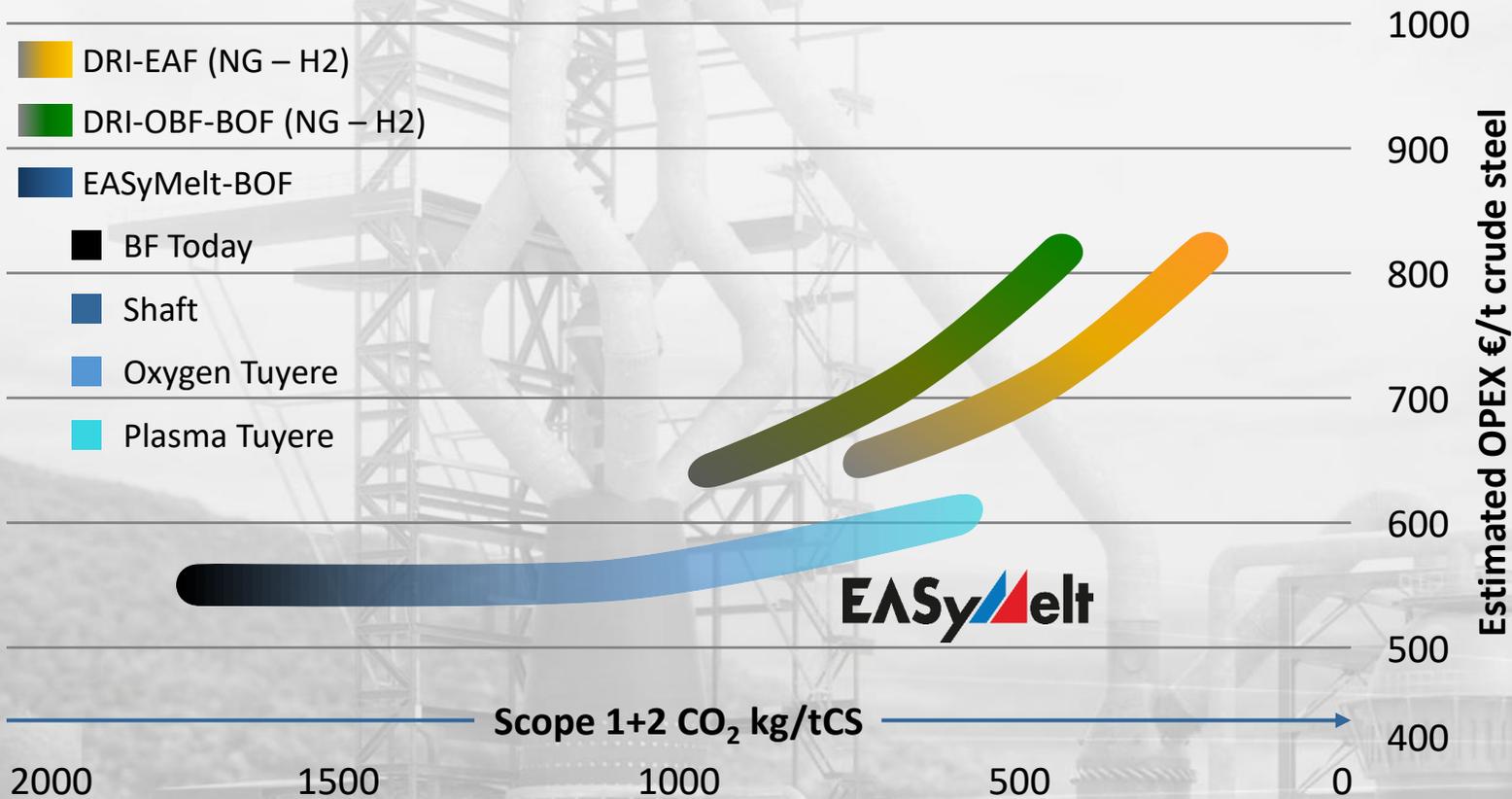
-90% CO₂

- › Last mile towards net zero
- › Dependent on political agendas

* Typical scope 1+2 assuming 80gCO₂/kWh_{electric}
Exact values may vary depending on site & chosen steps

Variable OPEX comparison

Typical European scenario



Cost assumptions

Sinter 57%Fe Low Grade	142 €/t
Pellet 62%Fe Low Grade	153 €/t
Pellet 68%Fe High Grade	204 €/t
Scraps 96%Fe	400 €/t
Coke	352 €/t
PCI	144 €/t
Natural gas	11 €/GJ
COG	9,6 €/GJ
BFG	8,3 €/GJ
H ₂	45 €/GJ
NH ₃	30 €/GJ
Electricity	25 €/GJ
CO ₂ intensity	80 Kg CO ₂ /MWh
CO ₂ tax	100 €/tCO ₂
BOF scrap rate	20 %
	5,4 €/kg
	0,56 €/kg

Around -250 M€/y OPEX savings

compared to alternatives for 2,5MTPA production
(around -100€ savings per ton crude steel)

EASyMelt Ecosystem

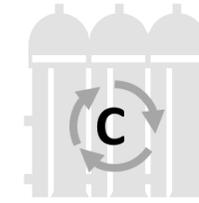
Technology components

EASyShaftGas



EASyMelt

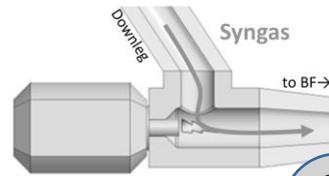
EASyLooper



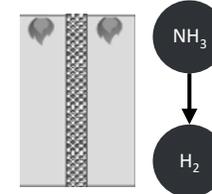
EASyTuyere



EASyPlasma



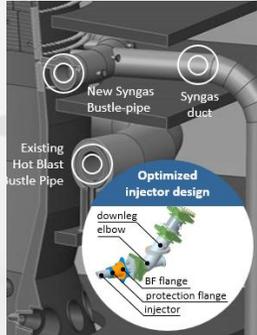
EASyCracker



EASyMelt Ecosystem Status

Current TRL and next step

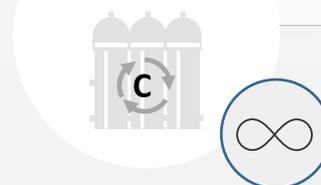
TRL 7: Full-scale engineering done



EASyShaftGas



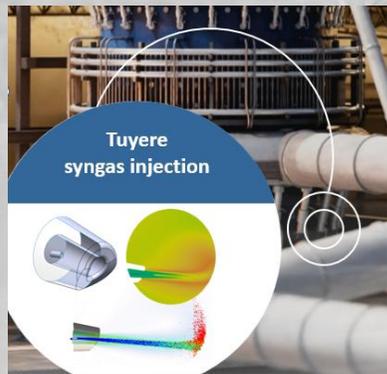
EASyLooper



TRL 7: Pilot plant validated since 2021



TRL 5: Full-scale engineering ongoing



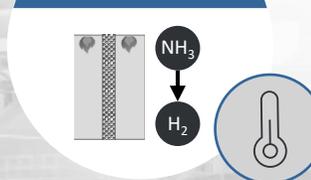
EASyTuyere



EASyMelt



EASyCracker

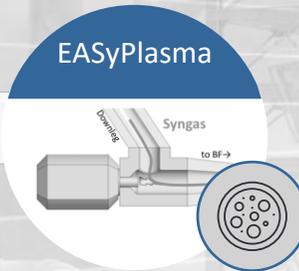


TRL 3: Concept demonstrated
Requested European Funding for pilot plant

TRL 7: Pilot plant ongoing (~1MW)



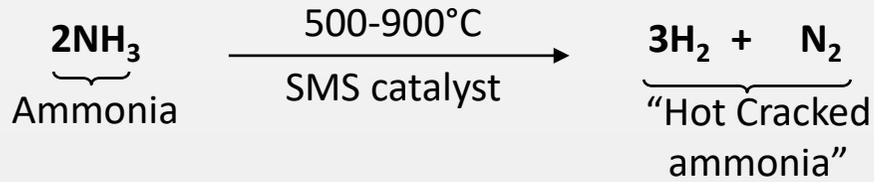
EASyPlasma



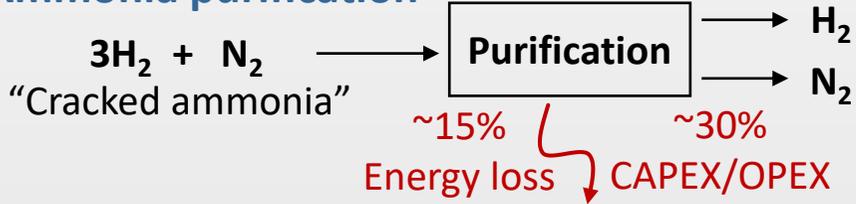
EASyCracker – Ammonia use

Transportable & Storable H₂ of the future

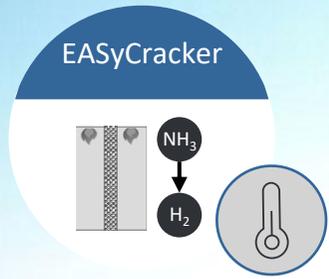
Ammonia cracking



Ammonia purification



- ✓ Use cracked ammonia directly in EASyMelt to avoid energy loss & **-30% of costs**
- ✓ Buy H₂ reliably at best price from global market !
Estimated **2-5 €/kgH₂** (source: IEA, Bloomberg, SMS)
- ✓ Store H₂ reliably for **24/7 availability**
1x NH₃ tank = 160x world's biggest battery*



 **Neom, Saudi Arabia**
Green NH₃ from 2027
Source: Air Products Inc.

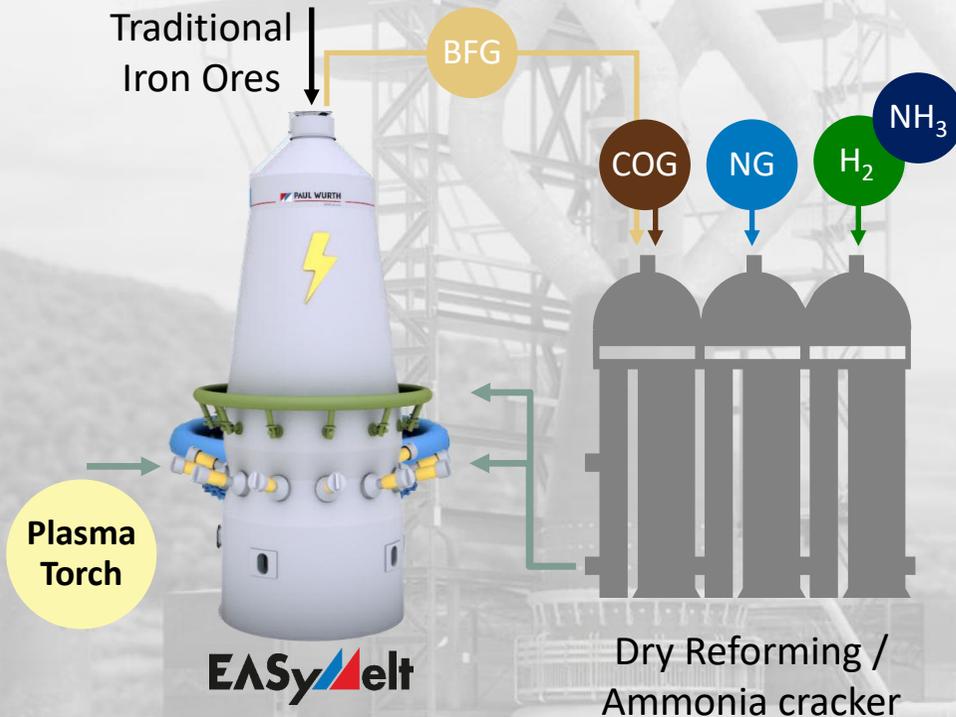


EASyCracker enables **cost-effective & resilient** H₂ supply for iron making

*50 000 t NH₃ tank = 260 GWh = 160 x 1,6GWh (Moss Landing BESS, USA)
10/22/2025

Future development steps

European industrial demonstration Plant



Development barriers

Big investment requirements...

Requirement for industrial environment

Risks associated with new developments

Green molecule and energy supply issues

How the EU can drive green steel breakthrough

Funding support: EU funds, National funds

Policy support: CBAM, Green Steel Taxonomy

Public support to kick-off positive feedback loop for green (NH₃) economy?

Risk reduction: Sharing the development with partners



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Green Steel Team