

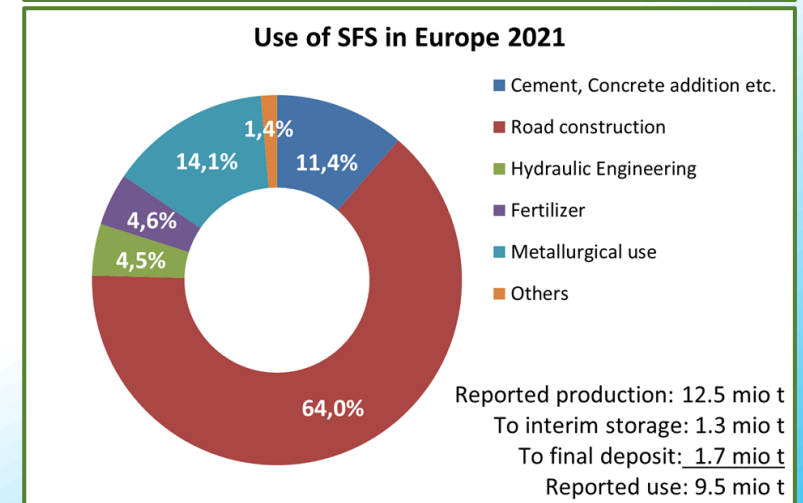
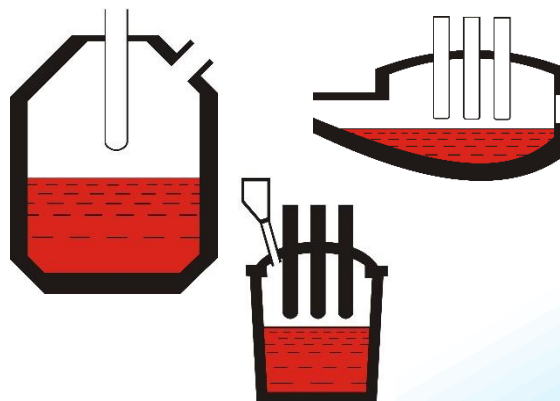
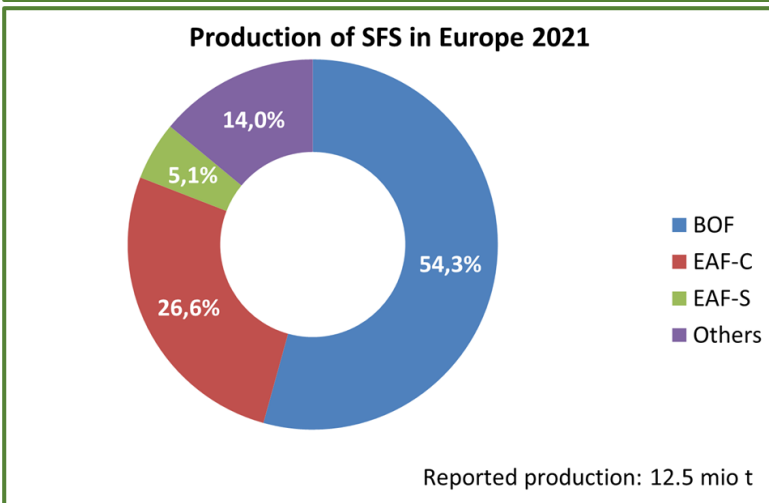
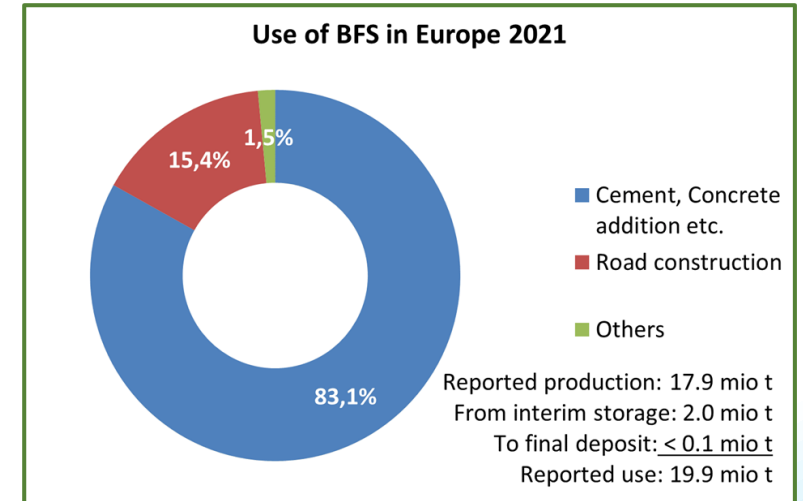
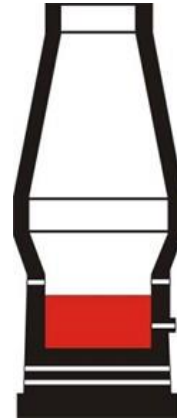
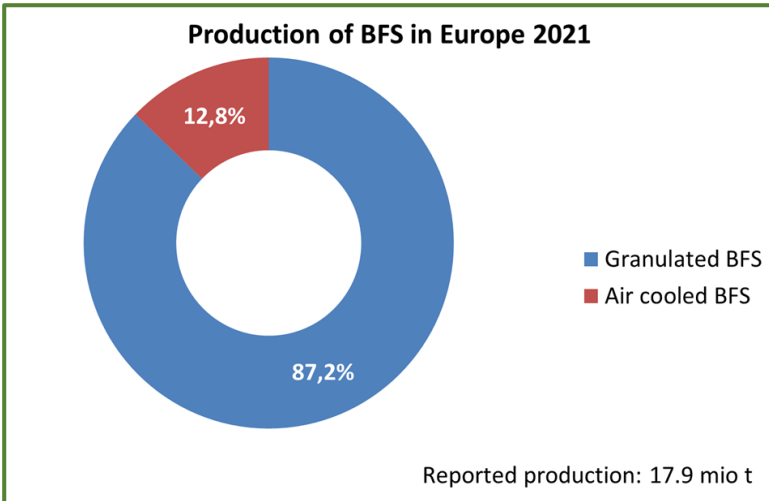
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FEHS

Slags from Next Generation Steel Making Processes
Suitable for established Applications?

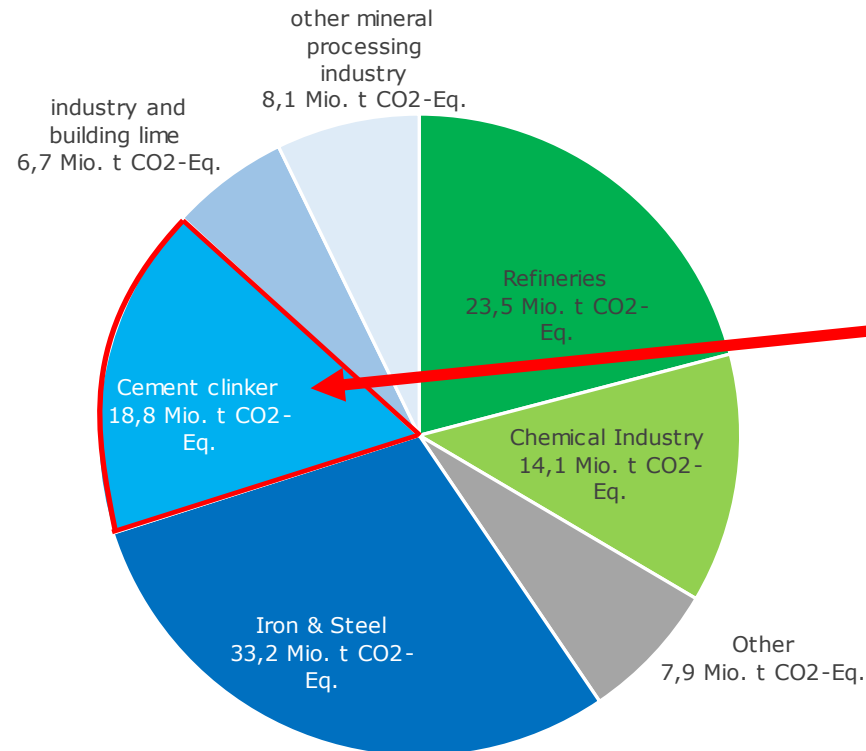
ESTEP Annual Event, Barcelona, 05.10.2023

Status quo of slag utilization



Cement Industry

- Emmitting approx. 800 kg CO₂ per ton of clinker (60 % of this is due to raw materials)
- Using granulated blast furnace slag decreases carbon footprint by more than 10 Mio. t/a and saves 25 Mio. t/a of natural ressources in Europe *



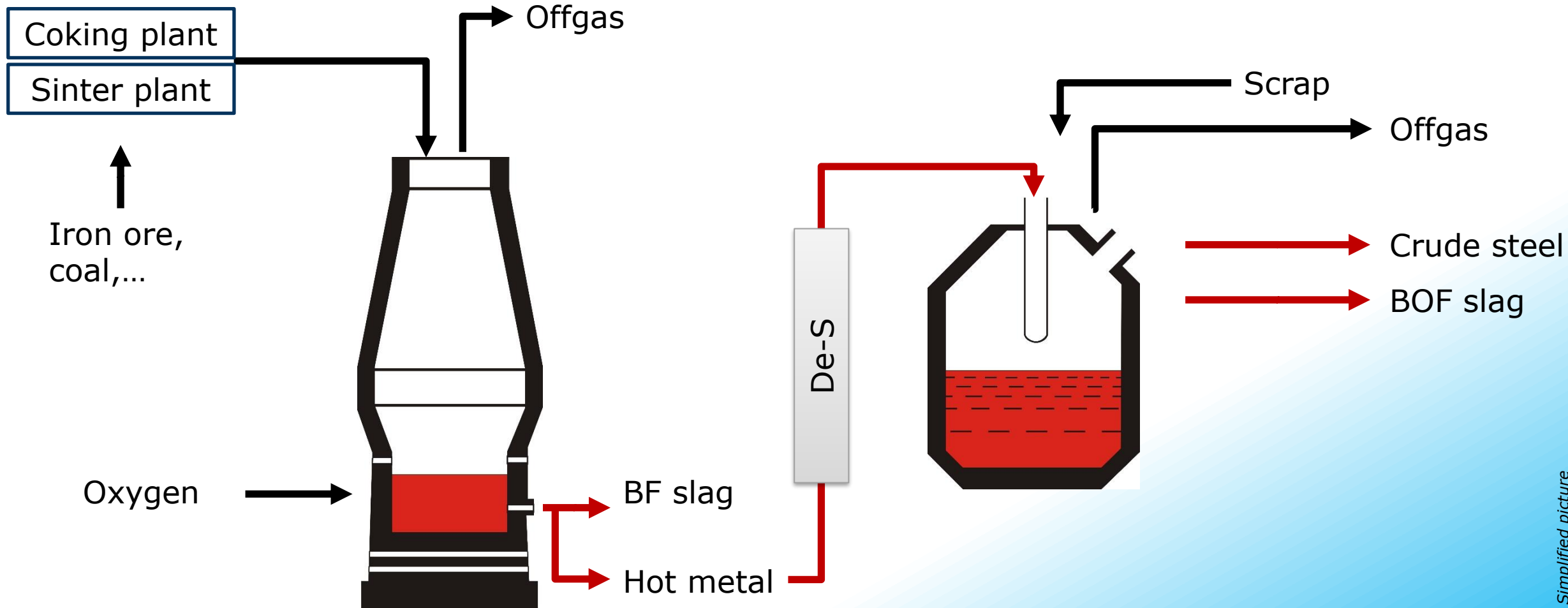
4.5 Mio. t/a CO₂

CO₂ emissions of german industry 2022
(wihout electrical energy producer)

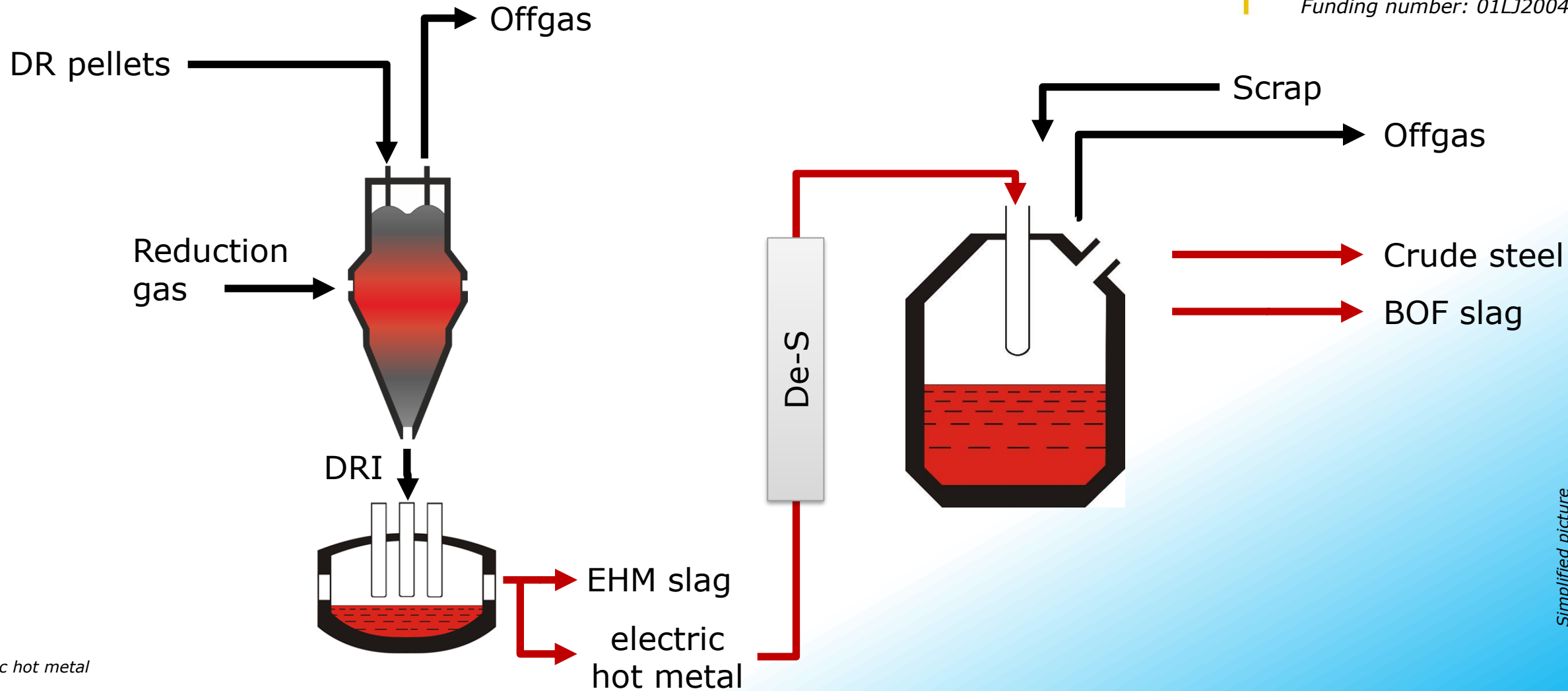
Ref.: based on German Federal Environmental Agency, DEHSt, 2022

* estimated, based on German data and EUROSILAG statistic

Crude steel production by BF + BOF



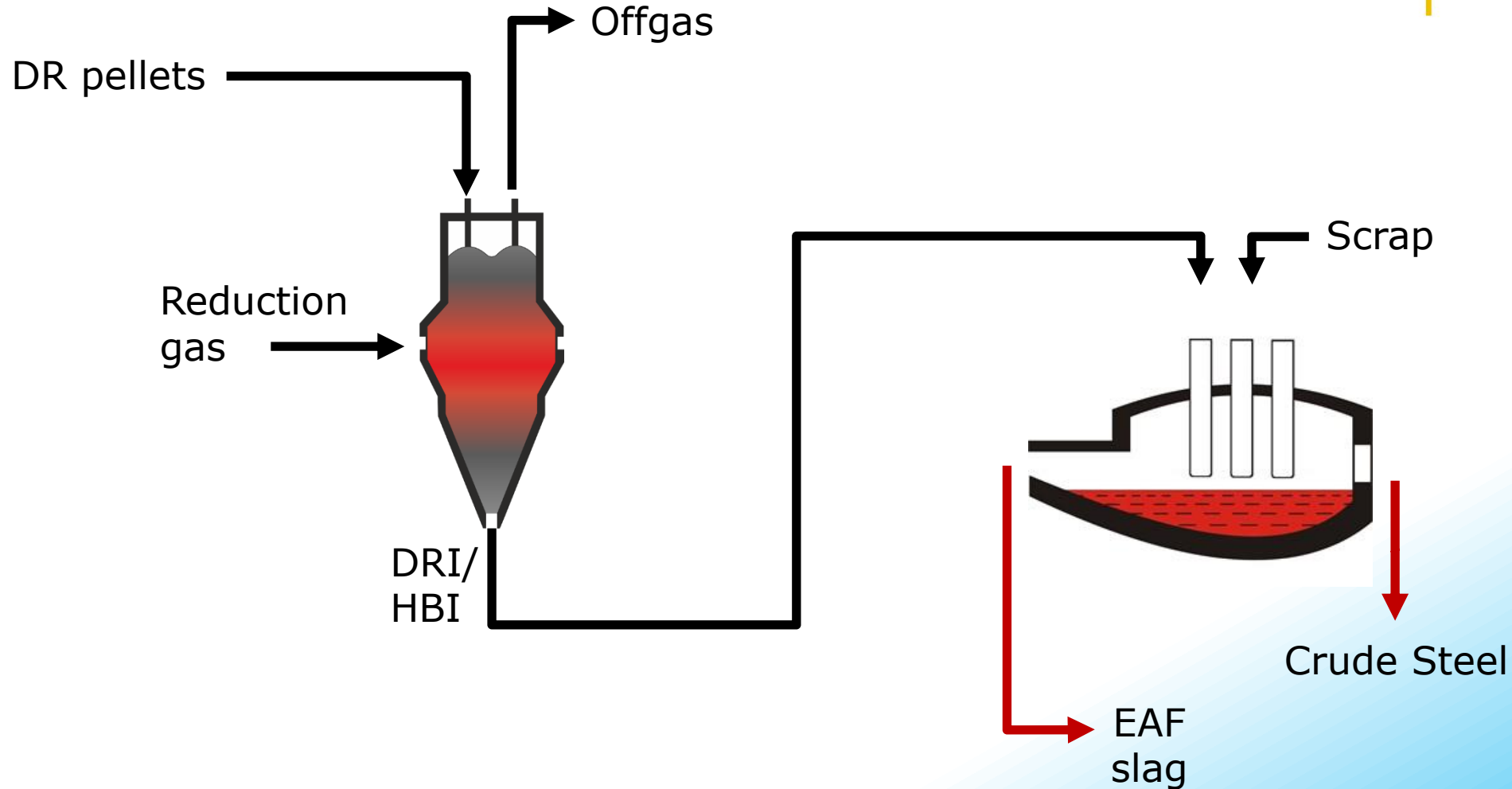
Crude steel production by BF + BOF



EHM: electric hot metal

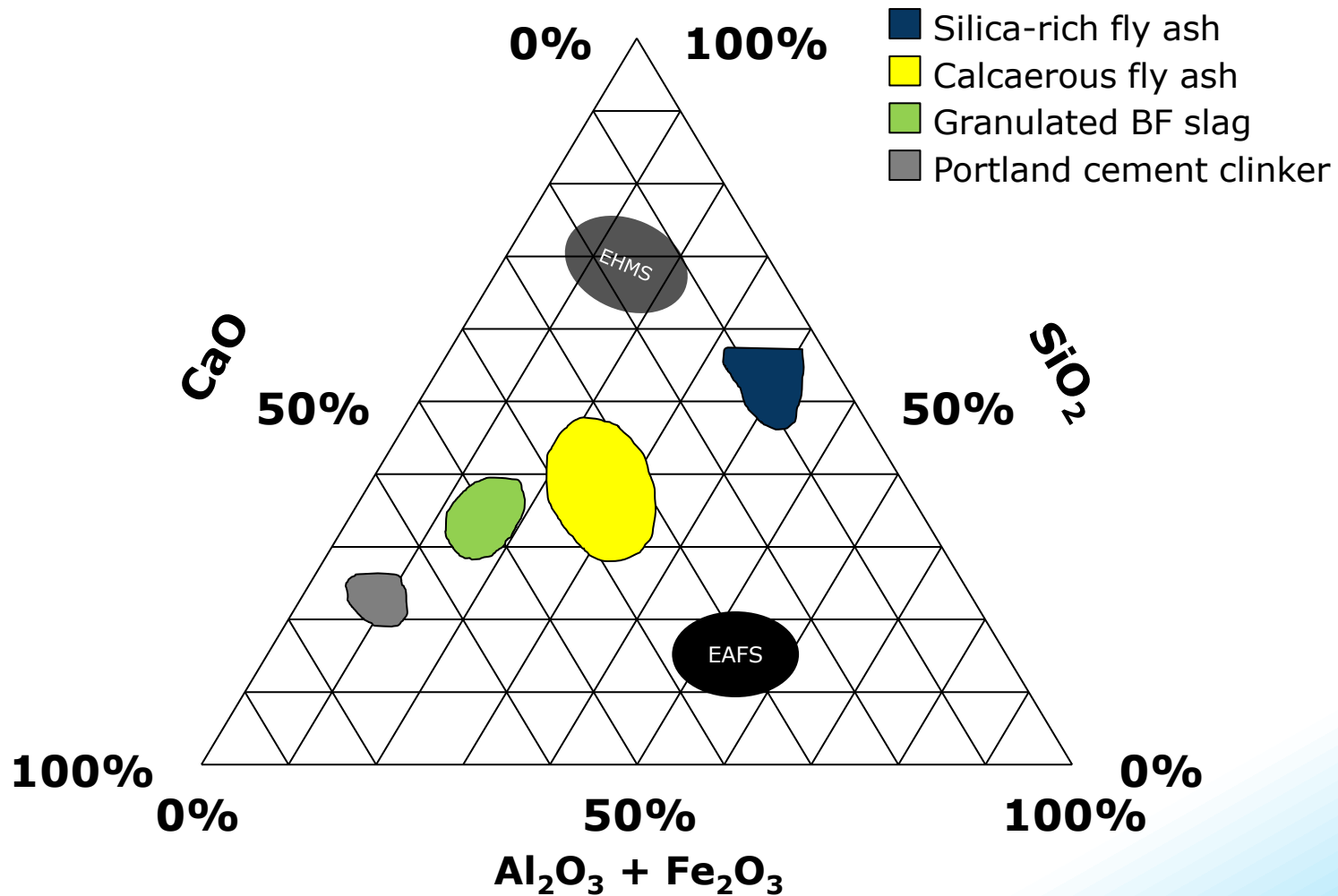


Crude steel production by BF + BOF



Simplified picture

The aim is a latent hydraulic material



EHMS

- Smelter slightly reducing
- Lime addition necessary
- High amounts of TiO_2 , V_2O_5 , Alkalines can remain
- Negative or unknown impact as latent hydraulic material

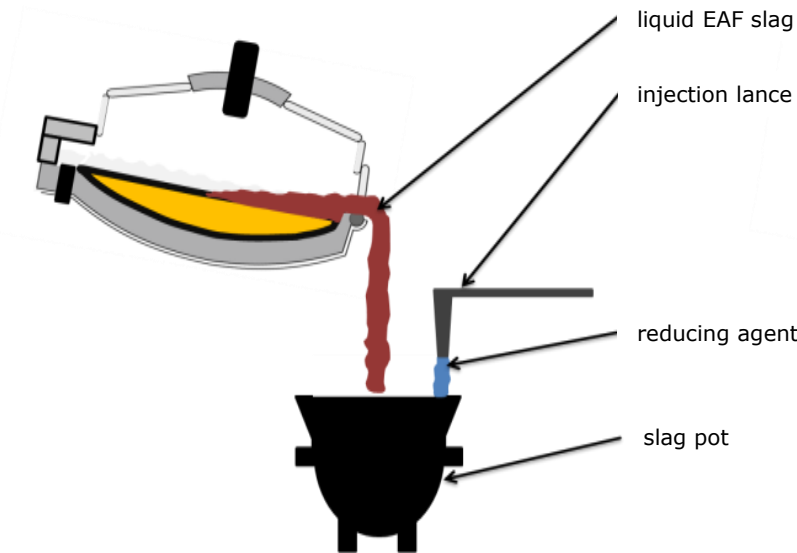
EAFS

- SiO_2 addition necessary
- Reduction desired??

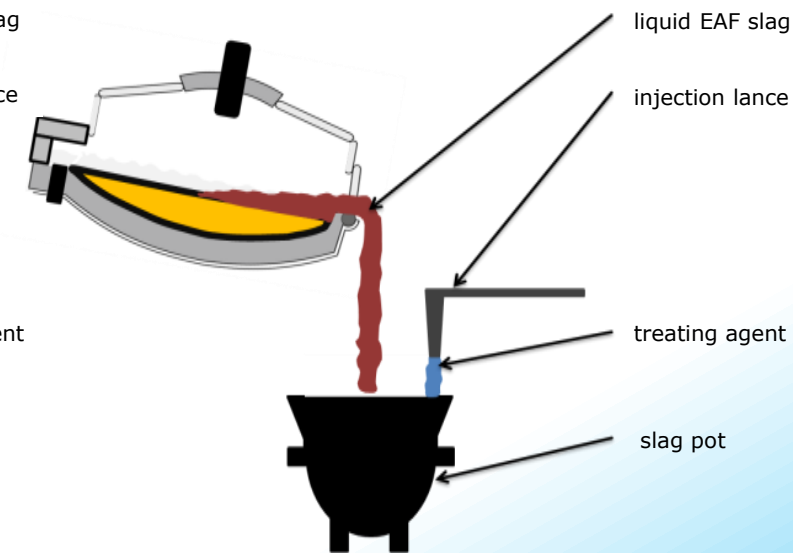
Possibilities...



Secondary Slag Metallurgy



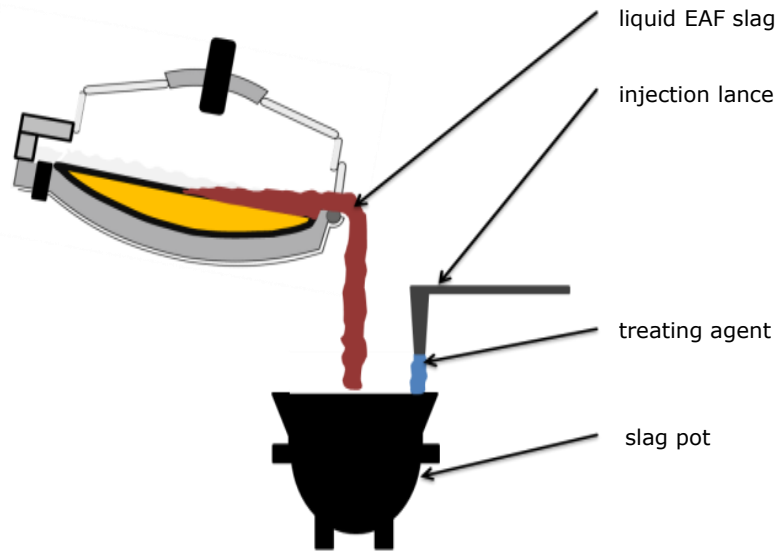
Reduction + treating during tapping



Treating during tapping

Flexibility	+	-	o
Chemical change	+	o	-
Hot metal recovery	+	o	-
Space requirement	-	+	+
Experience	-	o	+

Possibilities...



Treating
during tapping



Ref.: BMBF - KONDEOS



Ref.: AiF - PROEOS 2

Overview about *Next Generation Slags*



Grant agreement: 101112665

Duration: 48 months

1st July 2023 to 30th June 2027

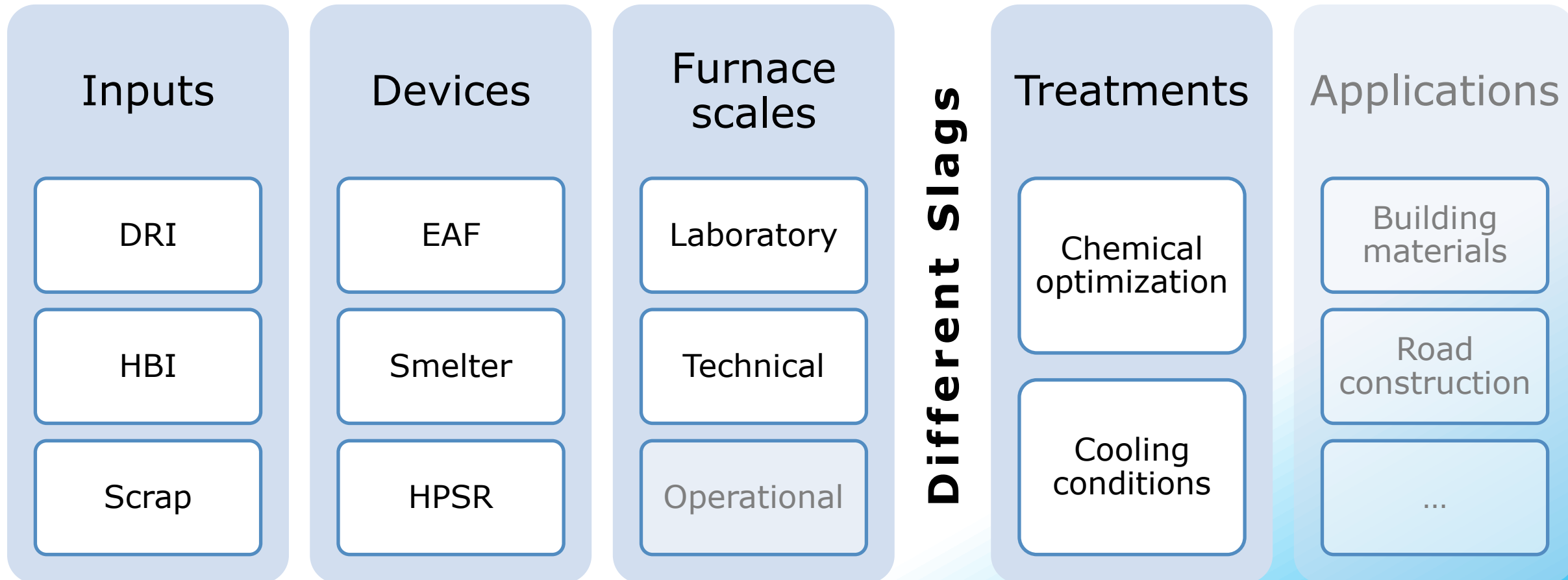
Web page: www.insgep.eu

LinkedIn: [InSGeP](https://www.linkedin.com/company/insgep)



The research leading to these results has received funding from the European Union's Research Fund for Coal and Steel research programme under grant agreement number: 101112665

Slag investigations



The research leading to these results has received funding from the European Union's Research Fund for Coal and Steel research programme under grant agreement number: 101112665

Outlook



~~Sufficient~~ Time for R&D is running out!

ArcelorMittal, Bremen (XCarb)

- 2025-2027: 1st Blast furnace will be shut down, DRP + EAF start operation

Thyssenkrupp (tkH2Steel)

- 2026: 1st Blast furnace will be shut down, DRP + SAF start operation

Salzgitter AG (SALCOS)

- 2025: 1st Blast furnace will be shut down, DRP + EAF start operation

Beside research of slag development, engineering and plant manufacturing, one more (time intensive) point is required!



Summary and Outlook

- Transformation of steel industry will lead to no well-known granulated blast furnace slag!
- Specific slag amounts will decrease, compared to the blast furnace
- Direct avoidance of CO₂ in cement production is only possible through use of (latent) hydraulic products such as granulated blast furnace slags
- A few steel works will use a SAF with similar slag chemistry, but unavoidable trace elements
- Most steel works will use an EAF with a completely different slag chemistry compared to BFS
- Several technological and regulatory efforts must be made to continue the decades of cooperation between steel and cement industry

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...and the InSGeP consortium

