Power4 Steel

# Transformation of the Saarland Steel Industry

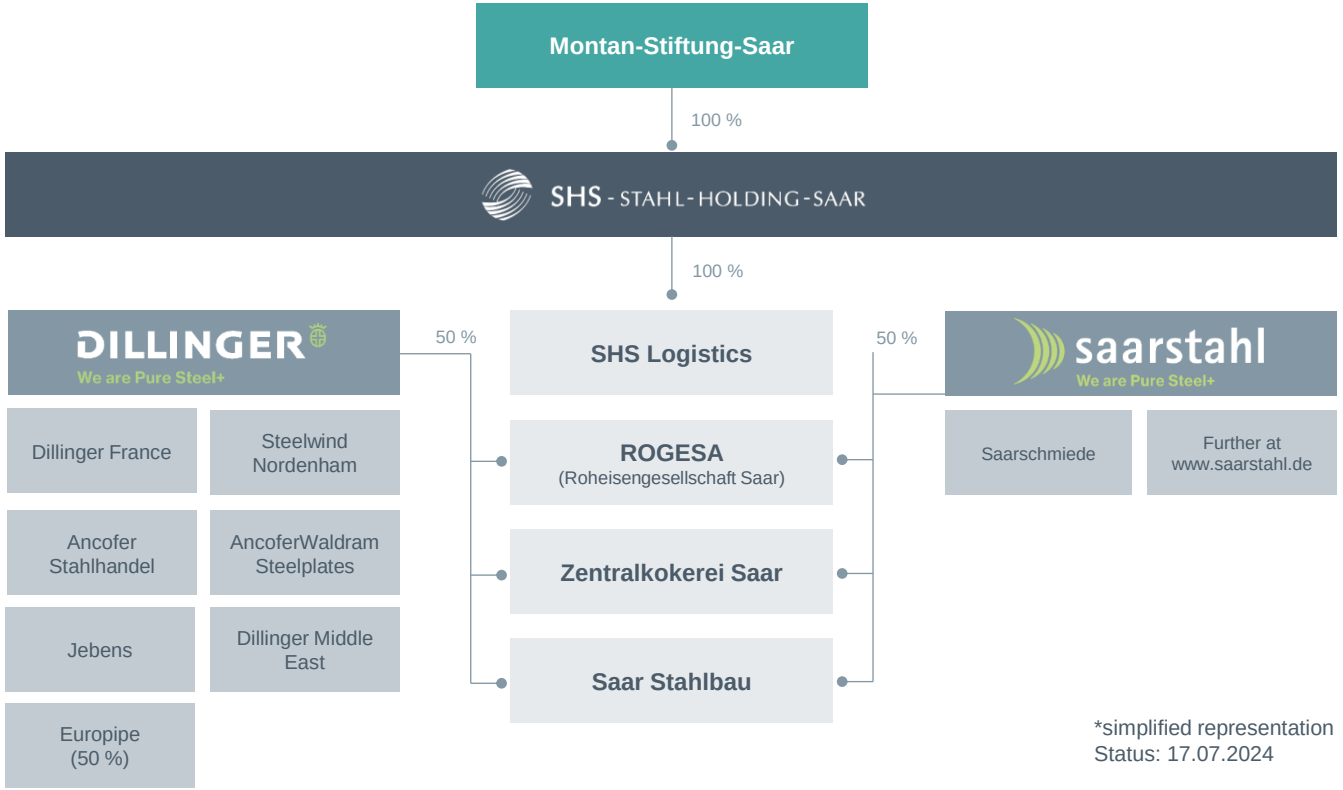
## Roadmap, Implementation and Challenges

DILLINGER SHS - STAHL - HOLDING - SAAR saarstahl

We are Pure Steel+

# Corporate structure: SHS with Dillinger and Saarstahl

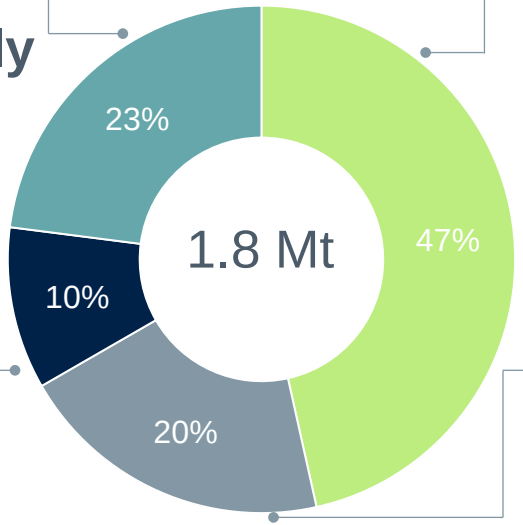
## International specialists for flat and long steel




*simplified representation
Status: 17.07.2024

# Dillinger
## Deliveries to the key industries

**Power supply**




**Renewable energy production**

**Mechanical engineering and security**

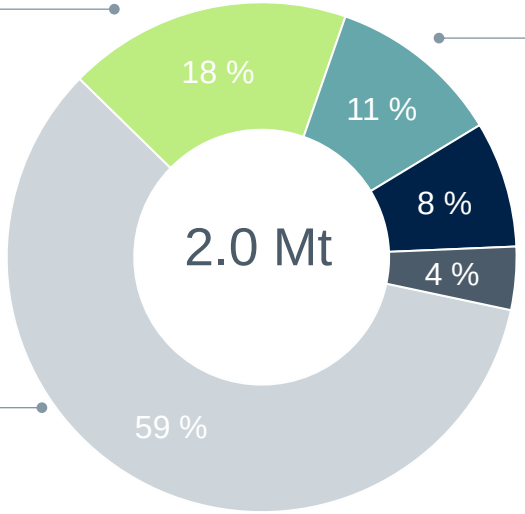
**Infrastructure and earthmoving machinery**

# Saarstahl

## Deliveries to the key industries

**Mechanical engineering**

**Automotive**




**Rail infra-structure**

**Con-struction**

**Other**



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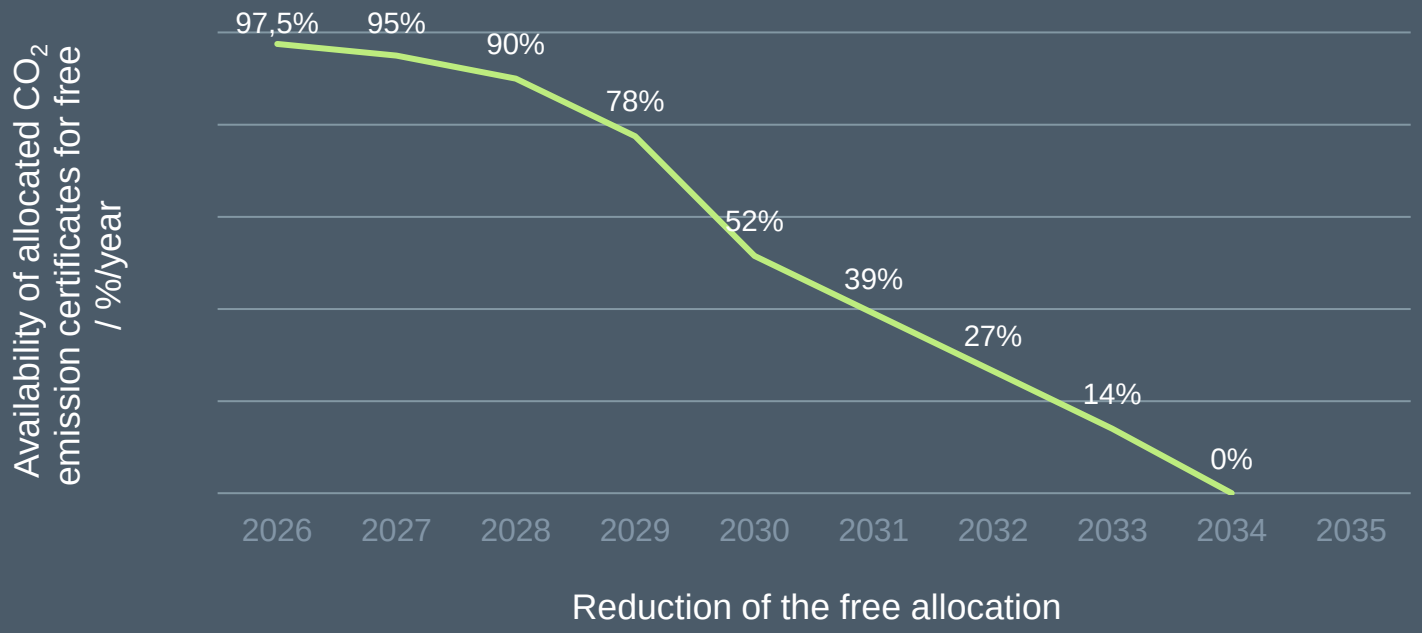
# A look at the Power4Steel project of Saarland’s steel industry

# Transition from conventional steel production to the DRI-EAF route

| | Iron reduction | | Steelmaking | | $CO_2$ emissions |
|---|---|---|---|---|---|
| **Blast furnace converter route** (ø EU28, 2015) | **Ore** + Coke/coal |  Blast Furnace | **Hot metal** + Scrap + $O_2$ |  Basic Oxygen Furnace | 1,921 kg $CO_2$/t |
| **Step 1 DRI-EAF route** (Natural gas) | **Ore Pellets** + Natural Gas |  Direct Reduced Iron | **Direct Reduced I.** + Scrap + Electricity |  Electric Arc Furnace | 1,098 kg $CO_2$/t<br>709 kg $CO_2$/t (with green electricity) |
| **Step 2 DRI-EAF route** (Green $H_2$) | **Ore Pellets** + $H_2$ |  DRI | **DRI** + Scrap + Green electricity |  EAF | 339 kg $CO_2$/t |

# Allocated free $CO_2$ certificates for steel production

## Future cost increase for Carbon based steel production



# Power4Steel
## Our new Core Units

### DRI Plant Dillingen

**Procedure**: Innovative Midrex Flex Technology

**Annual Capacity:** 2 Mio. t DRI

**Construction:** Primetals Technologies, Midrex Technologies Inc., DSD Steel Group.

**Commissioning:** Q3/2029

### Dillinger EAF

**Weight of heat:** 195 t

**Construction:** Primetals Technologies, DSD Steel Group

**Commissioning:** Q2/2029

**Final product:** Heavy plate

### Saarstahl EAF

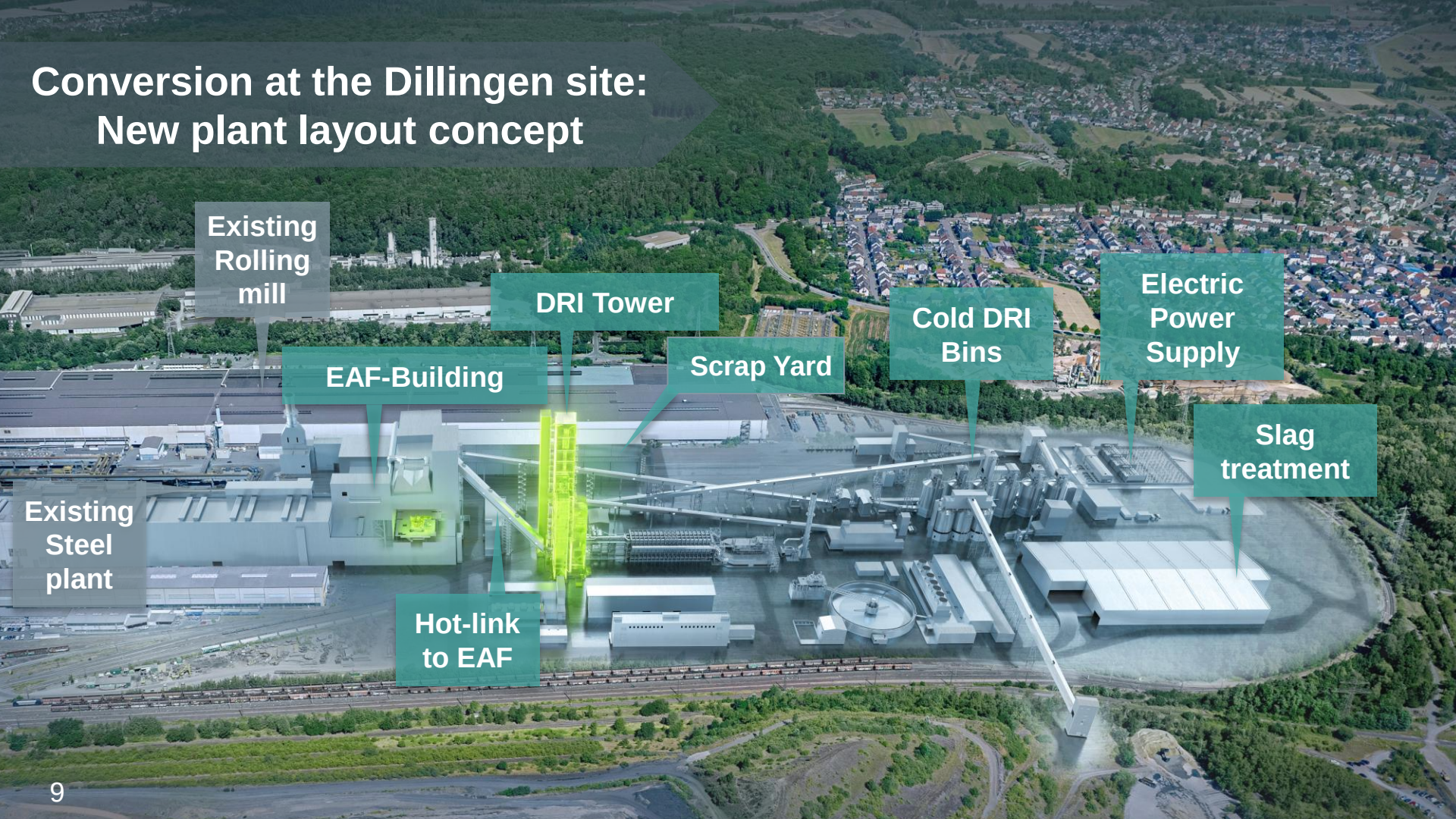
**Weight of heat :** 190 t

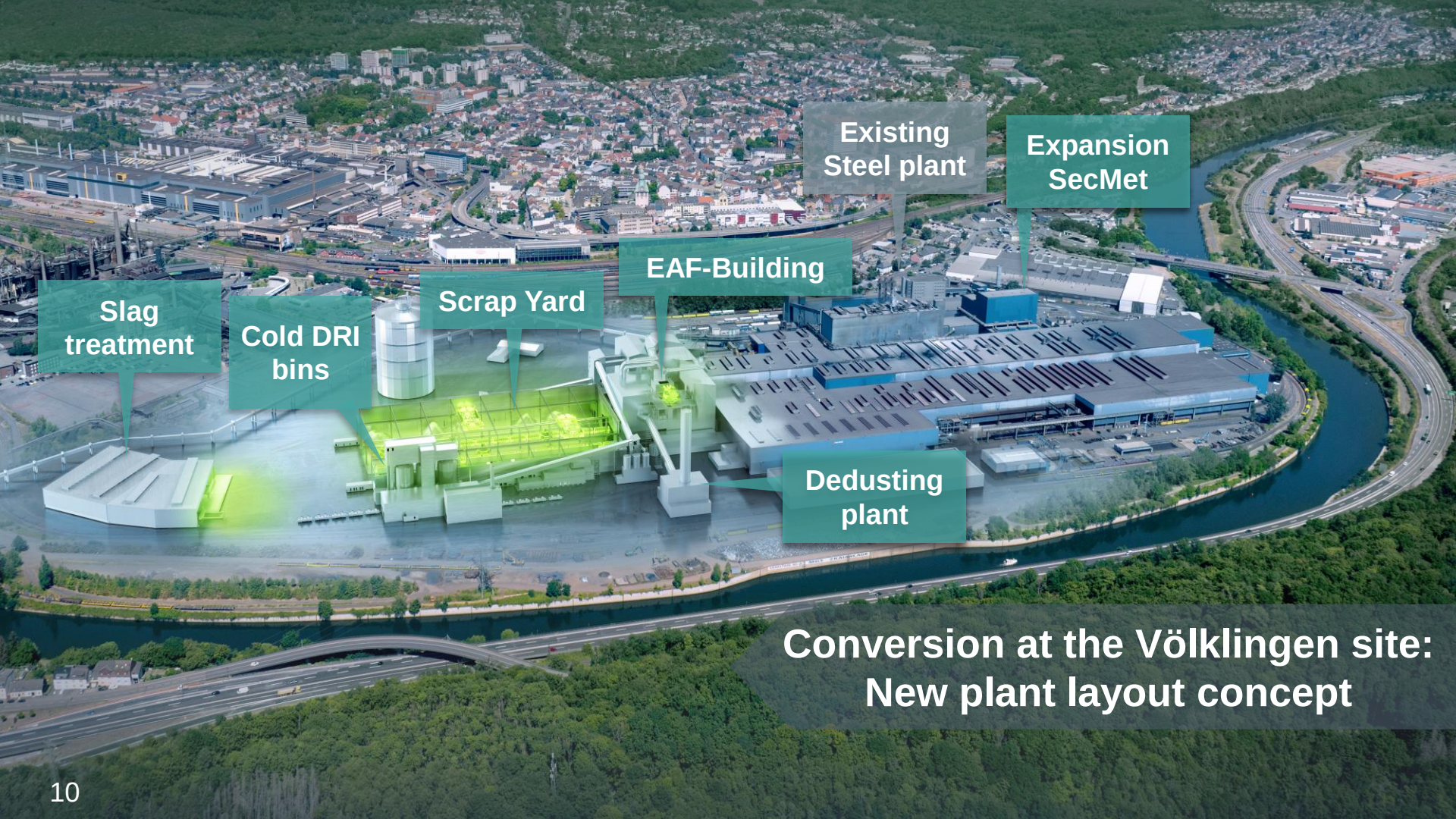
**Construction:** SMS

**Commissioning:** Q3/2028

**Final product:** Long steel

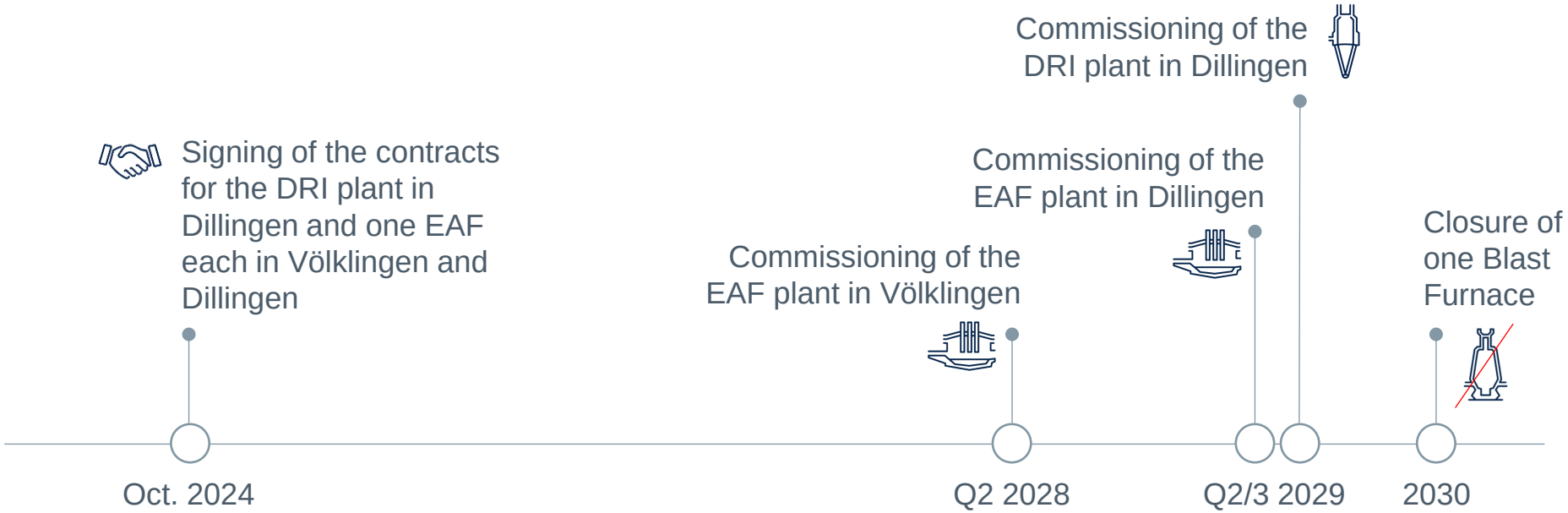
# Conversion at the Dillingen site: New plant layout concept






# Conversion at the Völklingen site: New plant layout concept

# SHS Milestones
## Transformation timeline



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# Effects on other emissions by closing one Blast Furnace

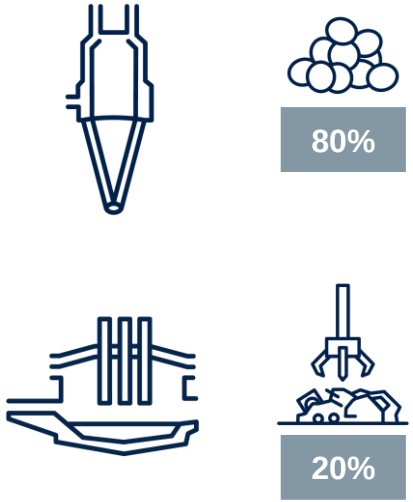
## Based on Pollutant Release and Transfer Register (PRTR) values 2023

| Air pollutants | Total annual load in 2023 of ROGESA in t/a | Estimated reduction of annual load by closing one BF in t/a |
|---|---|---|
| Chlorine and inorganic compounds (as HCl) | 28.6 | - 14.3 |
| Carbon monoxide (CO) | 2412.7 | - 1206.3 |
| Fine Dust (PM10) | 170.0 | - 85.0 |
| Sulphur oxides ($SO_x/SO_2$) | 2648.9 | - 1324.4 |
| Nitrogen oxide ($NO_x/NO_2$) | 1649.9 | - 824.9 |

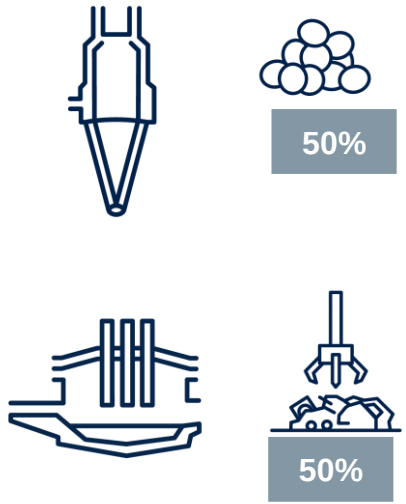
- The estimated reduction of Hg, Pb and Cd and their compounds is 0.045, 0.32 and 0.008, respectively.

# CAPEX optimization due to reduced DRI and increased scrap share in raw materials. More production flexibility due to adjustable scrap share.

**Green route with similar DRI : Scrap as BOF**




**Capex optimized green route**

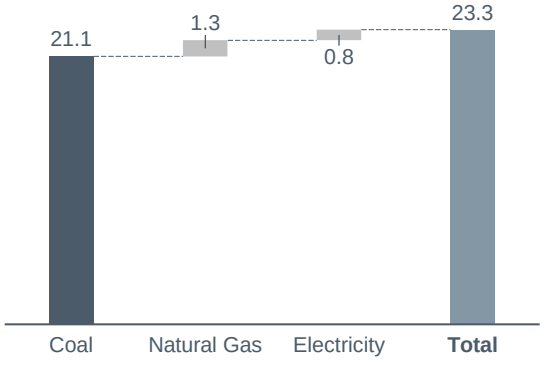



- Due to increased scrap in the input mix, the amount of highly expensive DRI can be reduced resulting in lower CAPEX and OPEX costs.
- Varying amount of scrap also provides a more flexible pathway compared to conventional steel making using the BF-BOF route.

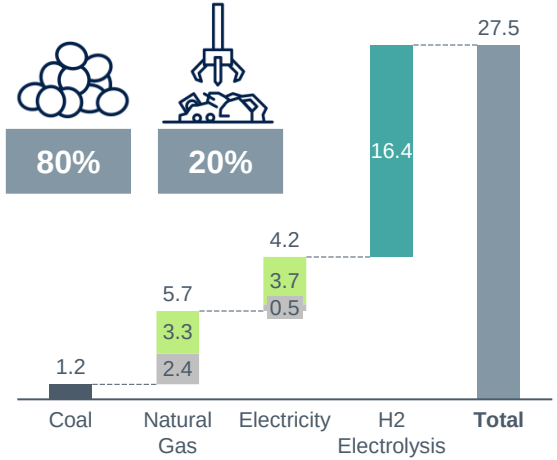
# Energy Balance in TWh/a (input 80 % $H_2$)

## BF / BOF – DRI / EAF (simulation with 5 Mt crude steel)

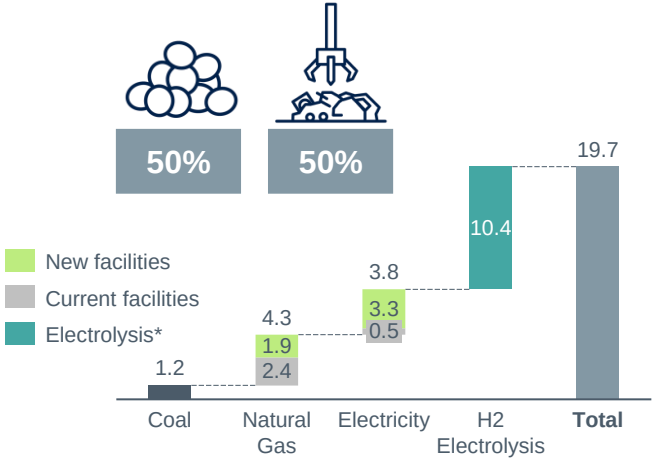
**Present Status**




**Green route with similar DRI : Scrap as BOF**




**Capex optimized green route**

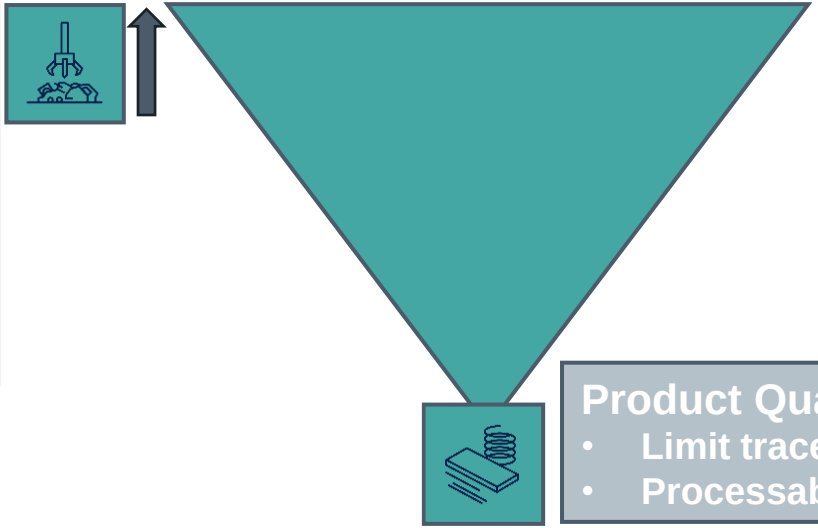



New facilities
Current facilities
Electrolysis*

*65% Electrolysis efficiency, Source: Deutscher Wasserstoff- und Brennstoffzellen-Verband e.V., 2022

# Competing Challenges in the Realisation of Power4Steel

**Costs / Increase Scrap rate**
- CAPEX
- OPEX
- Scrap availabilty (high quality)
- Scrap preparation



**Environment**
- Energy
- Sustainability
- Circular Economy

**Product Quality**
- Limit trace element levels by DRI
- Processability (internal and external)

**R&D Projects to investigate the influence of trace elements (Cu, As, Sn, etc.)**
- MariSteel - Welding joint (WJ); MOWSES – Material Properties (MP) + WJ; Groeien met Groen Staal - Hot forming + MP + WJ; Spring Steel - AVIF A332 (MP, fatigue life of springs)
- Several internal Investigation projects
- Synergy with SAARSTAHL ASCOVAL and SAARSCHMIEDE


- “Power4Steel” is the decarbonization project with the greatest amount of green steel and the highest carbon reduction in the German steel industry. The “fit-for-55” targets will already be achieved by 2030.
- As a result, Saarland’s steel industry offers an ambitious transformation project.
- “Power4Steel” is a historic step for Saarland’s steel industry and a foundation for the positive economic future of the Greater Region.
- The preliminary environmental permits are in place, the orders for the core facilities have been placed and preparations for the construction sites are in full swing

Ministerium für Wirtschaft, Innovation, Digitales und Energie
SAARLAND

Gefördert durch:
Bundesministerium für Wirtschaft und Klimaschutz
aufgrund eines Beschlusses des Deutschen Bundestages