SCRAP PREHEATING SYSTEM ISMELT®

***I**nteco **S**crap **MEL**ting **T**echnology*

and

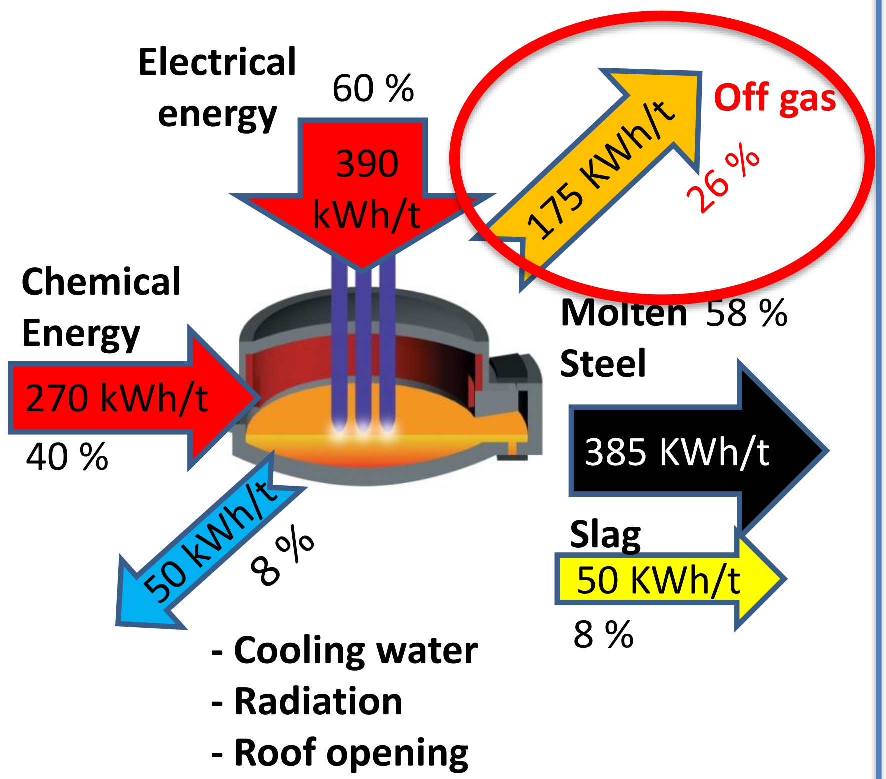
Telescopic EAF Evolution

EASES 2021

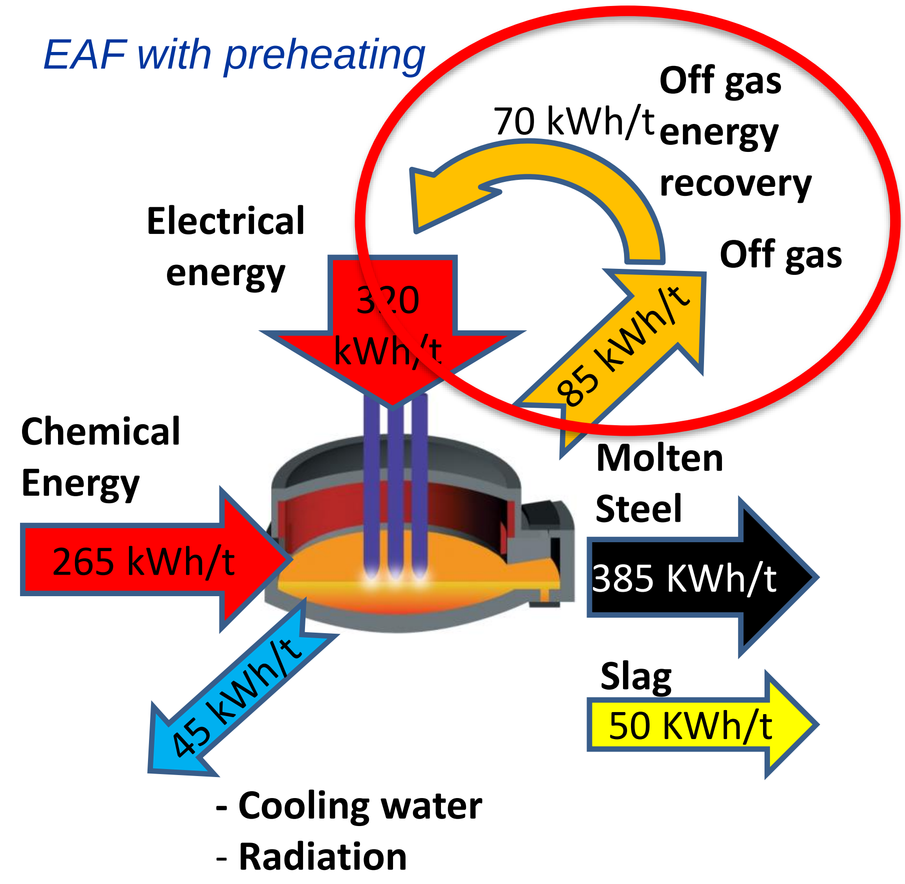
16 / 06 / 2021

Why preheat the scrap

EAF Conventional

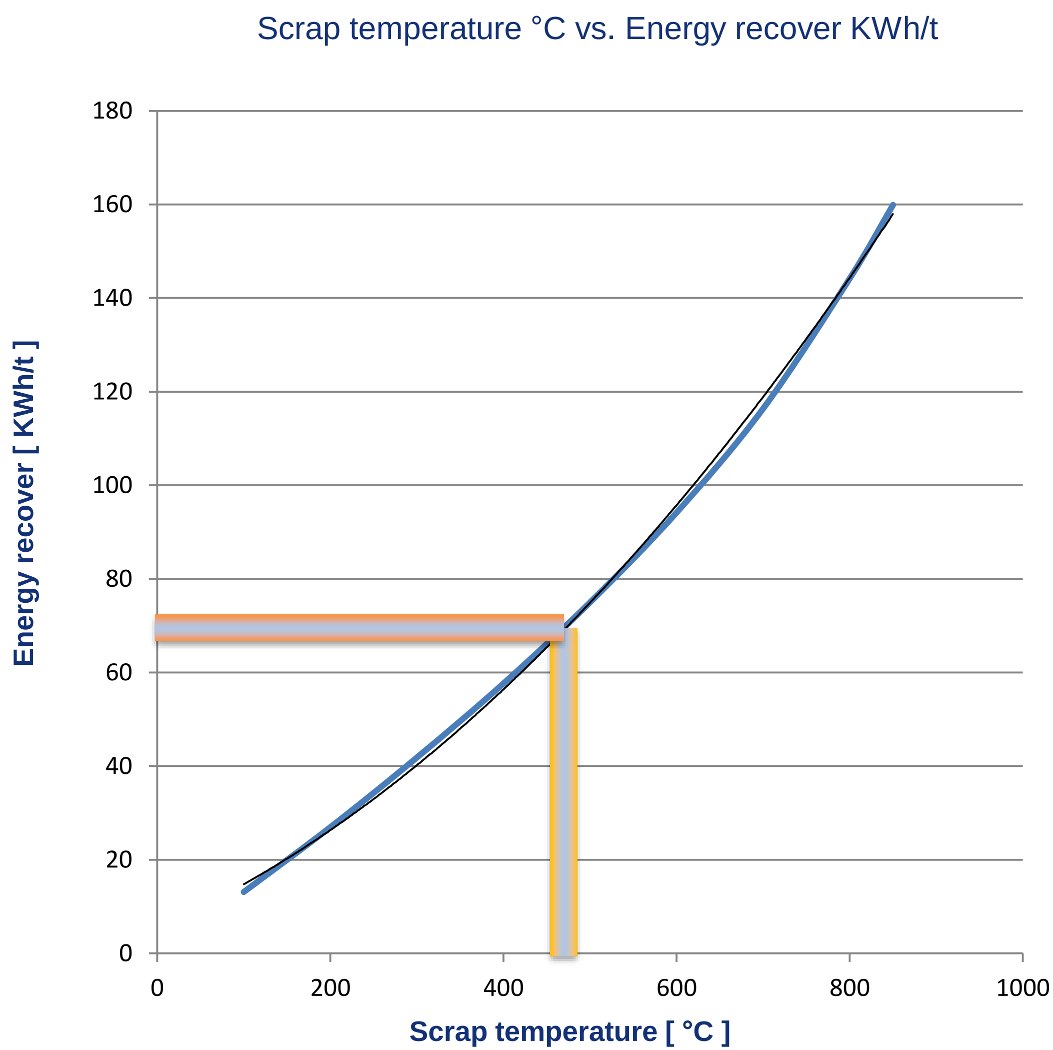


EAF with preheating



Energy recovery vs scrap temperature

INTECO

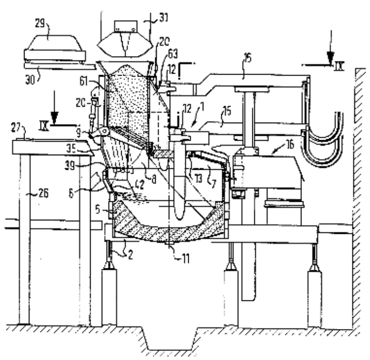


Preheated steel on the finger system

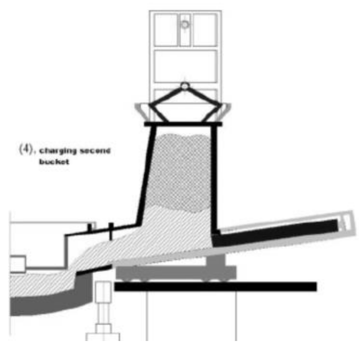
Evolution of preheating systems

The integrated scrap preheating systems are based on a scrap batch within a preheating vessel, Shaft (vertical) concept or a transport tunnel, Consteel (horizontal) concept, crossed by the fumes.

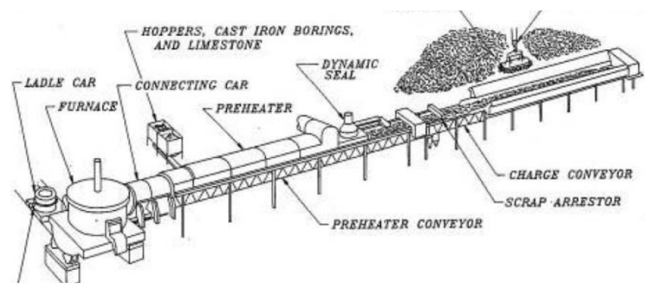
Various brand names used: Shaft, COSS, EPC, Quantum, Consteel, EcoArc, etc.



SHAFT

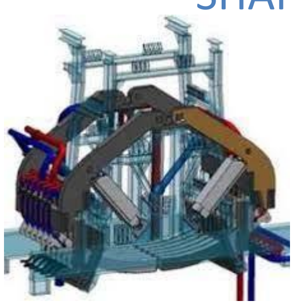


COSS



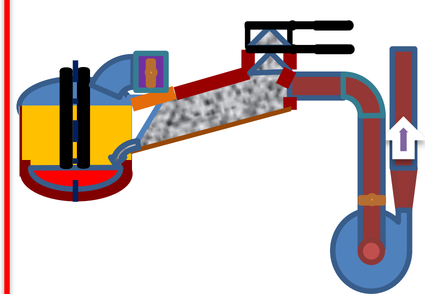
CONSTEEL

- Rotating drum BBS Brusa;
- System Endless Charging System (ESC) Danieli;
- Twin-shell EAF
- Bucket preheating

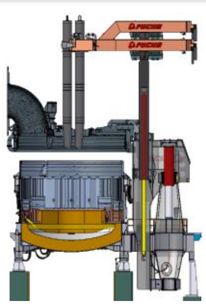


QUANTUM

SHARK



ISMELT

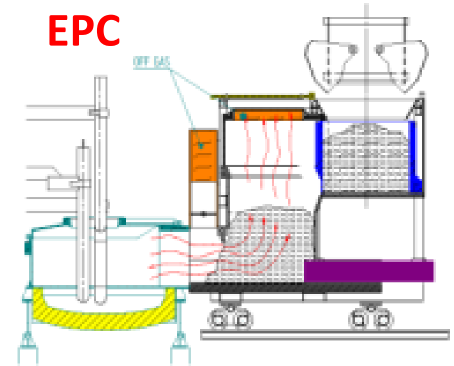


Telescopic

Inteco background

FUCHS Technologies

- One of the first EAF supplier active in inventing and utilization of scrap preheating systems
- EAF with Finger Shaft
- EPC EAF - Environmental Friendly Preheating & Charging System
- COSS EAF - Integrated Scrap Preheating Continuous Optimized Single Shaft



INTECO

- 2015 – acquisition of Fuchs Technology AG and Fuchs Engineering GmbH
- Transfer of EAF and LF technology, including patents and other intellectual property rights
- **TELESCOPIC® EAF** – example of highly efficient EAF with charge pre-heating during melting
- **ISMELT®** – intense R&D work and concept that focuses on elimination of existing shaft preheater bottle-necks with simultaneous efficiency improvement combined with continuous charge feeding

INTECO FUCHS

ISMELT INTECO Scrap Melting Technologies

Evolution of Scrap preheating

The **ISMELT (INTECO Scrap Melting Technology)** solution is an innovative technological design to overcome the problems, which became evident over the years in connection to scrap preheating technologies.

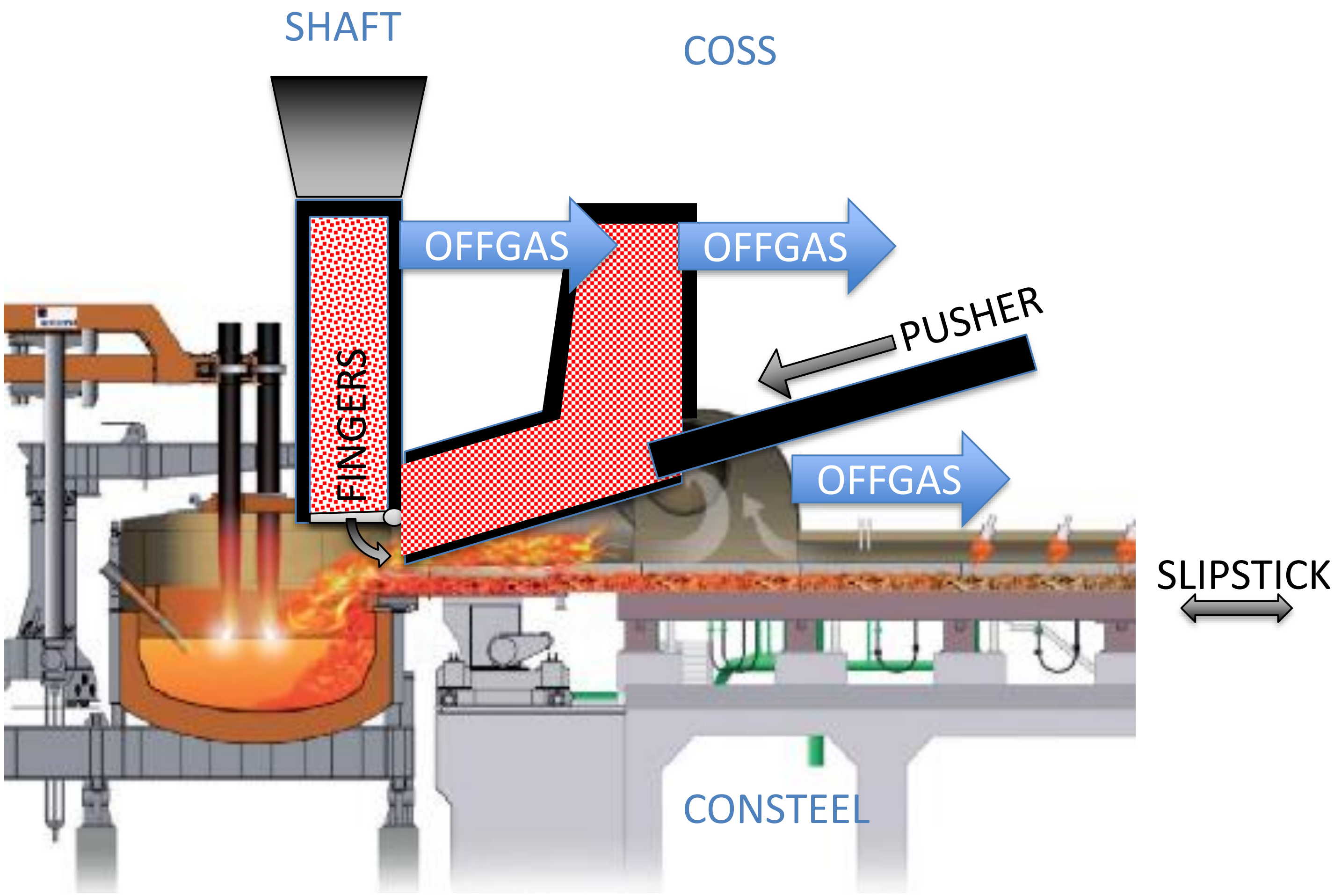
Drawbacks vertical (Shaft type) systems:

- With vertical systems the scrap is charged discontinuously in batches leading to negative consequences in the melting process and off-gas treatment and unbalancing of electric power load.

Drawbacks horizontal systems :

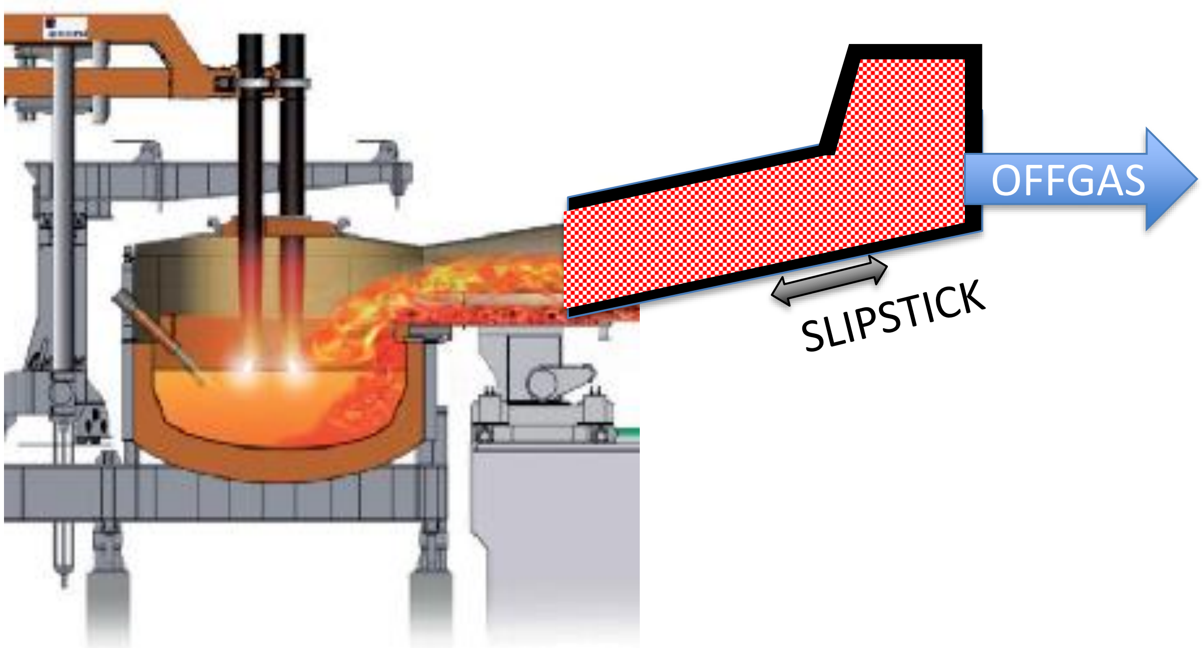
- With horizontal systems a belt conveyor or conveying device continuously transport the scrap through a channel towards the furnace and the hot exhaust fumes of the arc furnace are guided in the counter-current on the tunnel to the dedusting system. Since the area above the scrap is relatively large in the conveyor, **only the top layer of the scrap is slightly preheated**, while the underlying scrap portion remains cold.

ISMELT CONCEPT



ISMELT CONCEPT

ISMELT



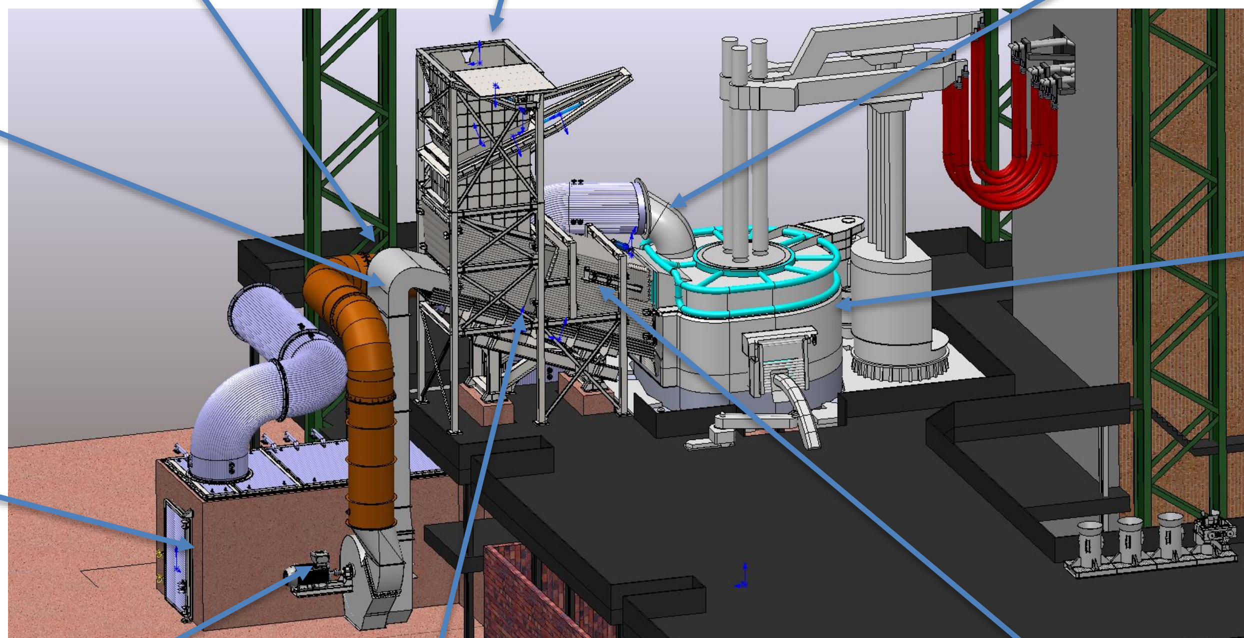
ISMELT INTECO

Scrap Melting Technologies

PATENTED

ISMELT INTECO Scrap Melting Technologies

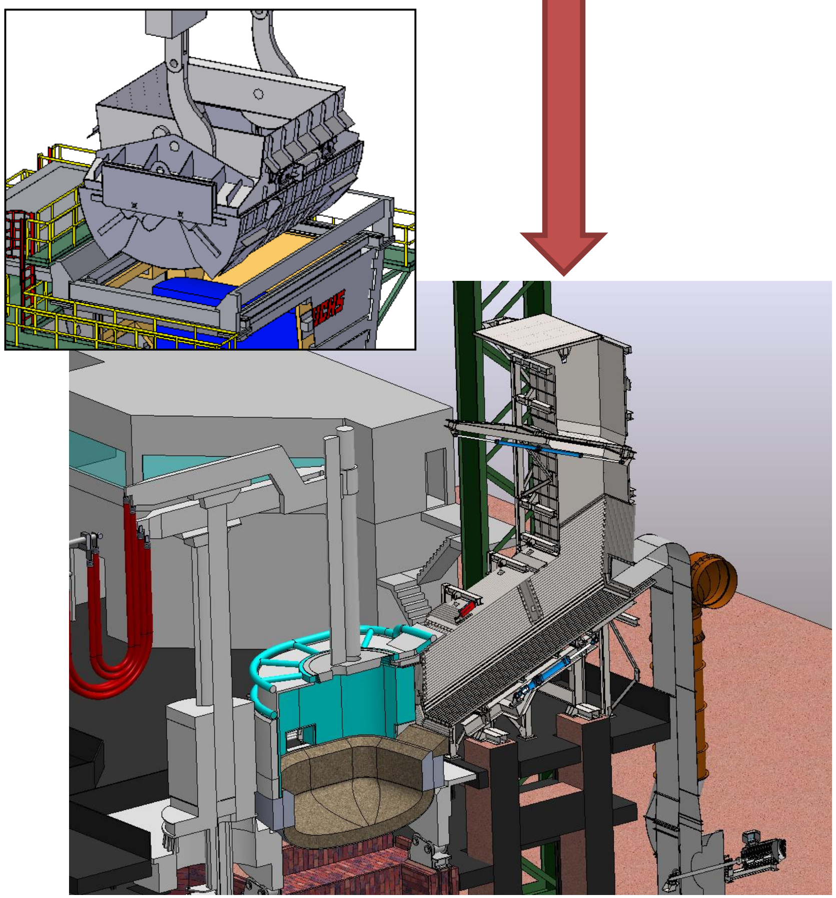
—INTECO—

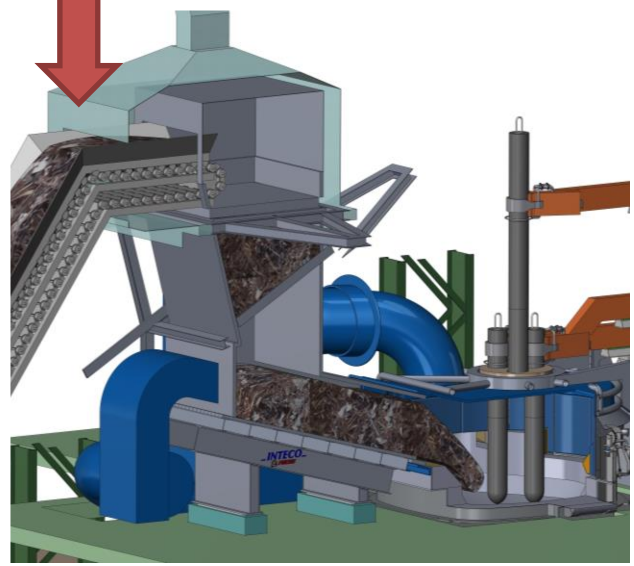


CONCEPTUAL DESIGN

The scrap is charged into the pressure insulation chamber by means of:

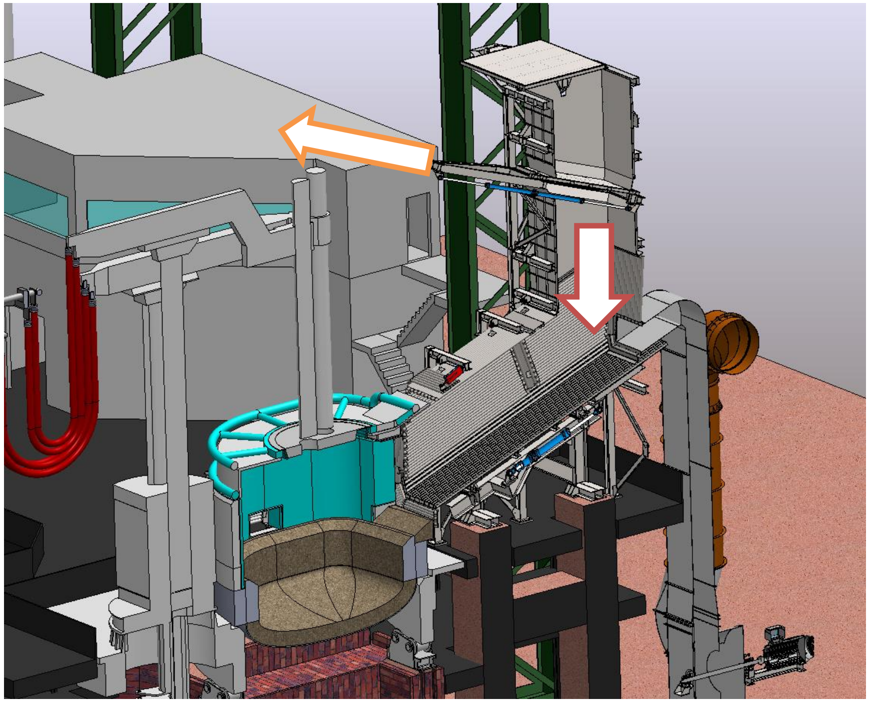
scrap bucket **conveyor belt**





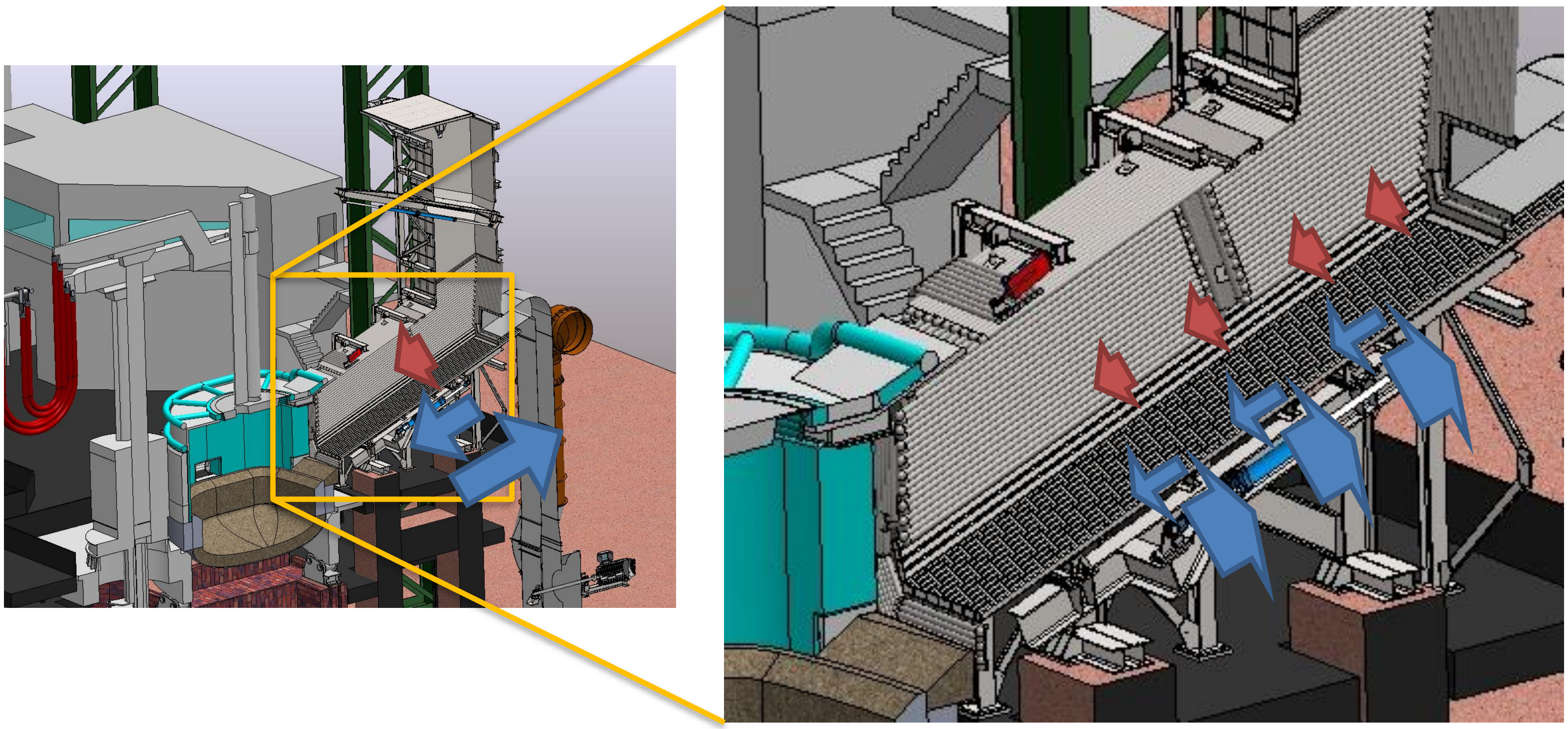
CONCEPTUAL DESIGN

When the lower sliding gate opens the scrap fall into the preheating chamber



CONCEPTUAL DESIGN

The bottom of the ISMELT sliding alternatively upwards slowly and backward faster, combined with the bottom slope feed the material into the EAF shell

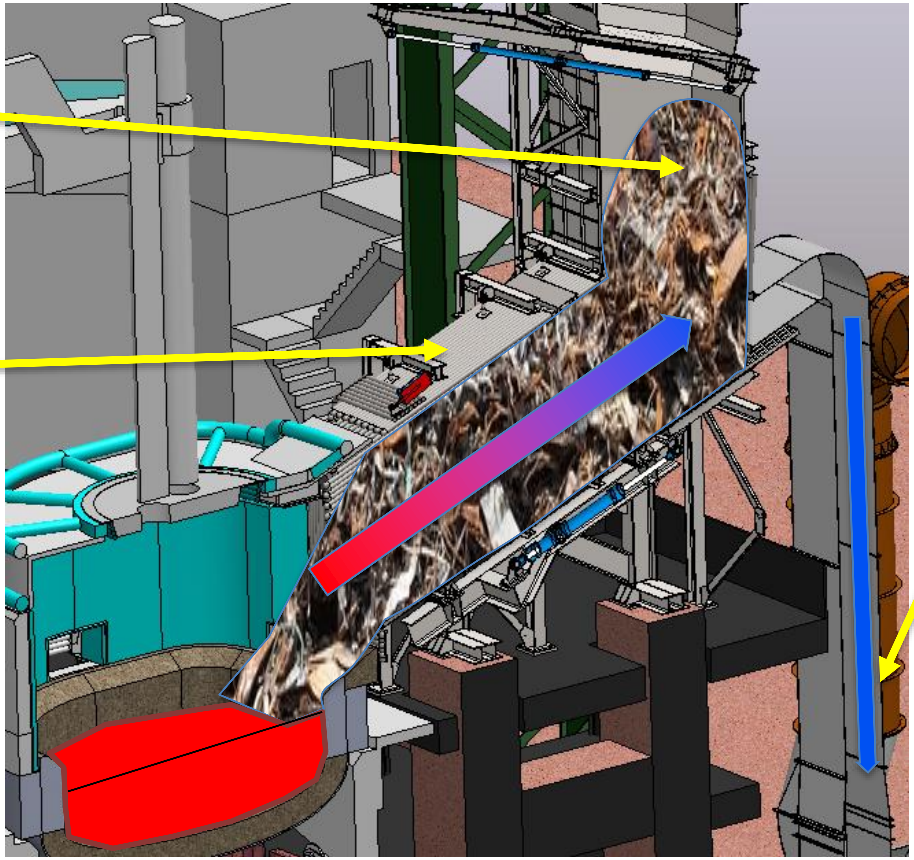


Controlled scrap input speed adjustable according to feeding bed oscillation frequency

CONCEPTUAL DESIGN

The charging scrap column is maintained to fill the tunnel section.

The hot gas is passing through the bulk, creating an intimate contact of the gas with the charged material.



The pressure drop of the scrap mesh is recovered by a booster fan driven by a frequency converter.

CONCEPTUAL DESIGN

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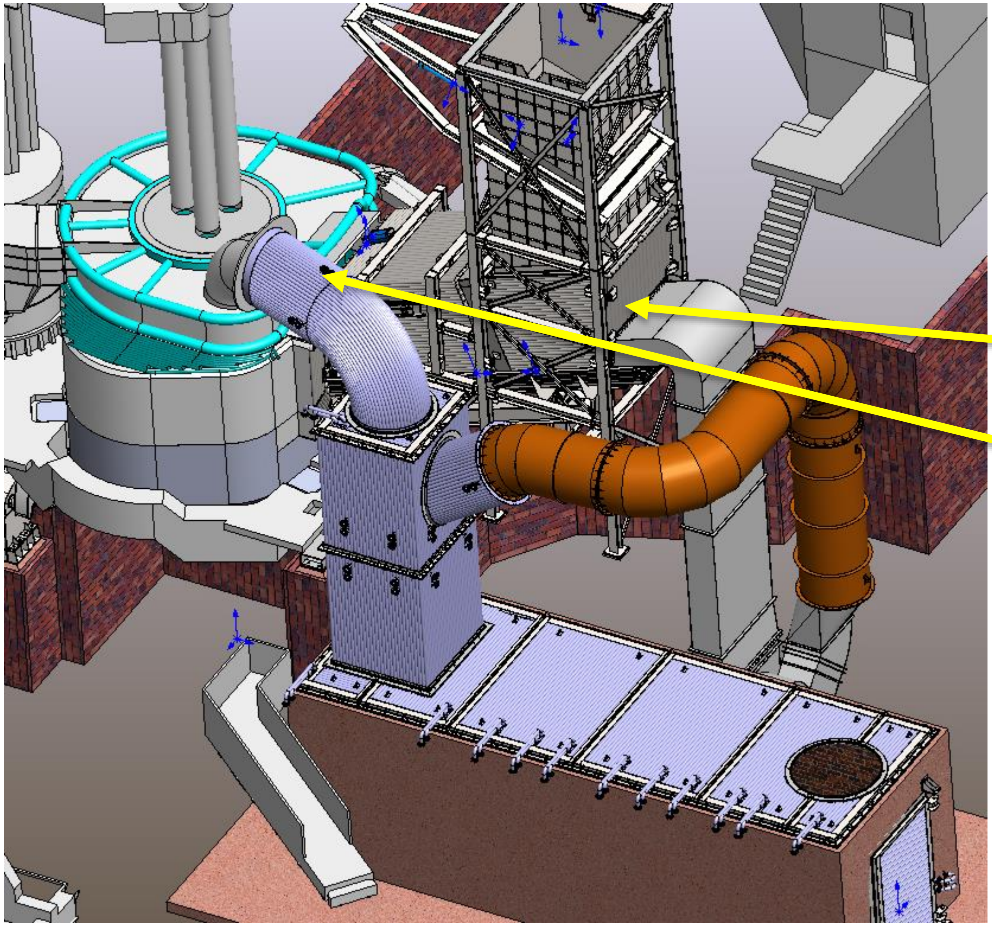


The primary flow in split in 2 streams to modulate the preheating grade

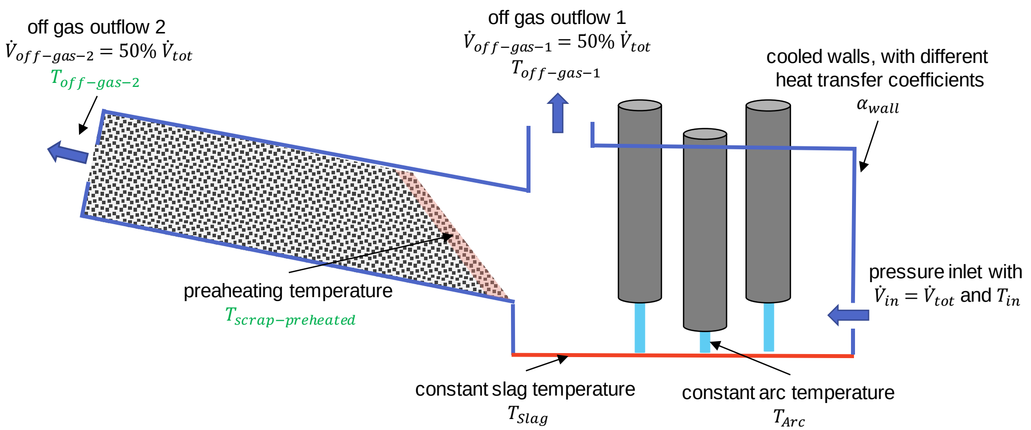
- trough ISMELT chamber
- trough 4th hole on the EAF roof

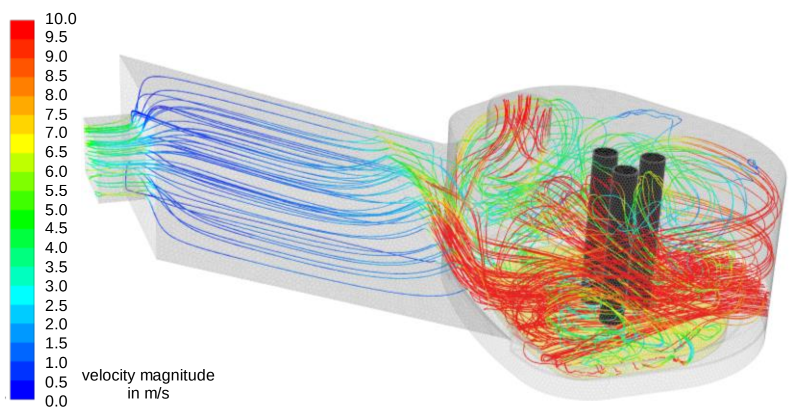
The streams are mixed in the combustion chamber.

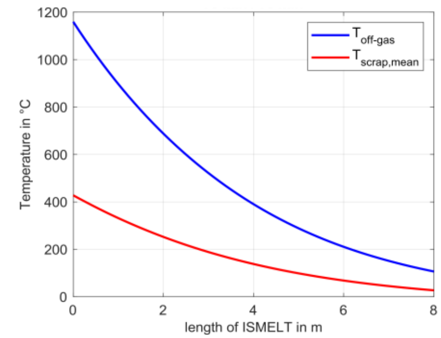
The temperature is controlled to crack all pollutants compounds.

SIMULATIONS STUDY

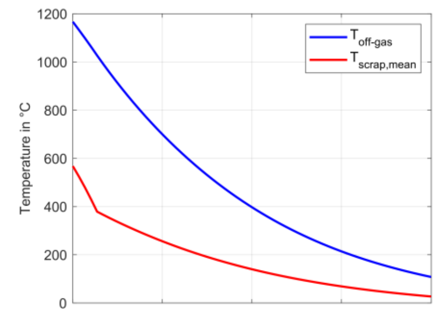
Aachen university simulation the ISMELT process



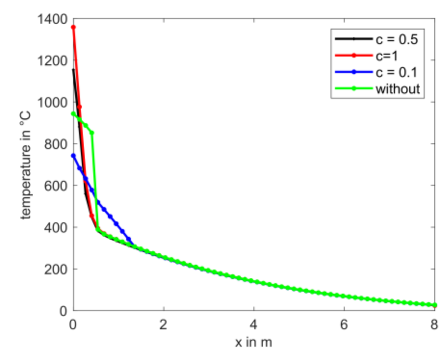




Simple transmission



Transmission and radiation



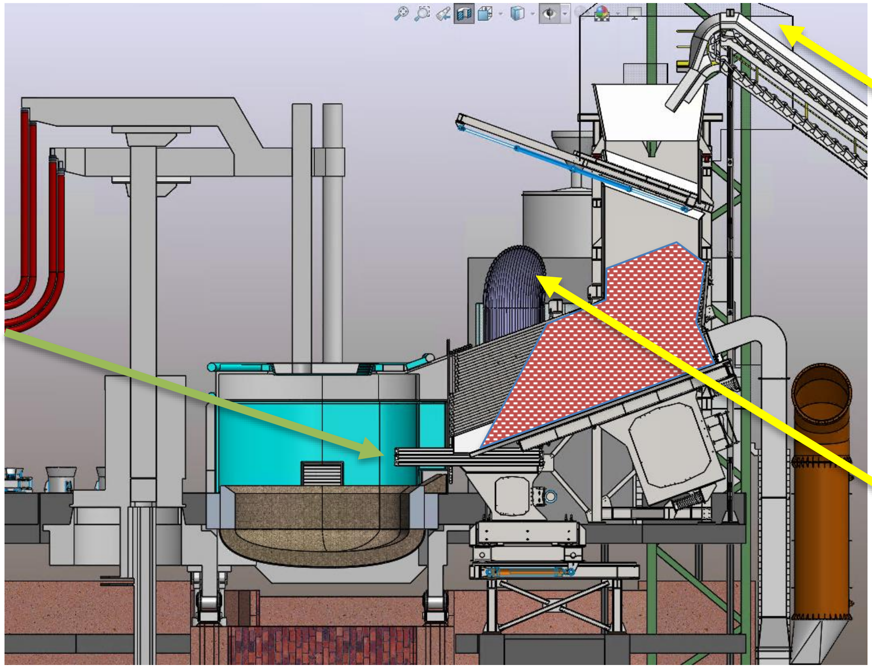
5’ after stop of the feeding

LAST IMPROVEMENT

Added retractable car to connect the preheating tunnel to the furnace.

To allow the tilting during tapping and deslagging phase.

Keep the scrap far for the bath when the feeding system is not operating



Additional suction of the off-gas during scrap charging to minimize dust losses

Gas bypass suction on the tunnel to reduce the roof weight and design complexity

MAIN FEATURES

- ✓ Controlled preheating temperature through bypass off gas regulation system
- ✓ Controlled scrap input related to the transformer capacity through regulation of feeding bed speed
- ✓ Flat Bath Operation: Constant high energy input, lowest flicker generation and less noise generation

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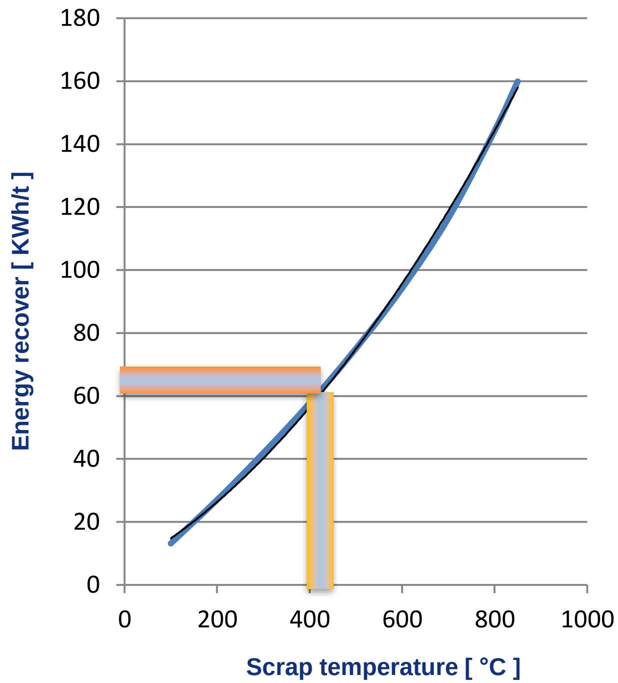
ADVANTAGES

- ✓ Temperature of the scrap at EAF inlet window 400-500 °C with an **energy recover of 60-70 KWh/t**
- ✓ Flat bath operation:
  - ➢ Flickering reduced of 60% compared to a standard EAF
  - ➢ Harmonics reduced of 60% compared to a standard EAF
  - ➢ Noise below 95 dB at 10 m from slag door
  - ➢ Refractory consumption reduced of 40% compared to a standard EAF

Scrap temperature °C vs. Energy recover KWh/t



ADVANTAGES

- ✓ Reduced electrode consumption
- ✓ Good access for maintenance
- ✓ Safe system condition at any time
- ✓ Independence of bucket charging from melting process: no power-off time, no reactions & explosions caused by charging
- ✓ Reduction of dust amount
- ✓ Improved temperature control of off-gas-temperature
- ✓ Less dust on EAF working platform → better working conditions

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RESULT KEY FIGURES

✓ Electric consumption	320	Kwh/t
✓ Scrap yield	92	%
✓ Natural gas consumption	9.0	Nm3/t
✓ Electrode consumption	<0,95	kg/t
✓ Carbon consumption	10	Kg/t
✓ Oxygen consumption	30	Nm3/t
✓ Lime consumption	40	Kg/t

TELESCOPIC FURNACE

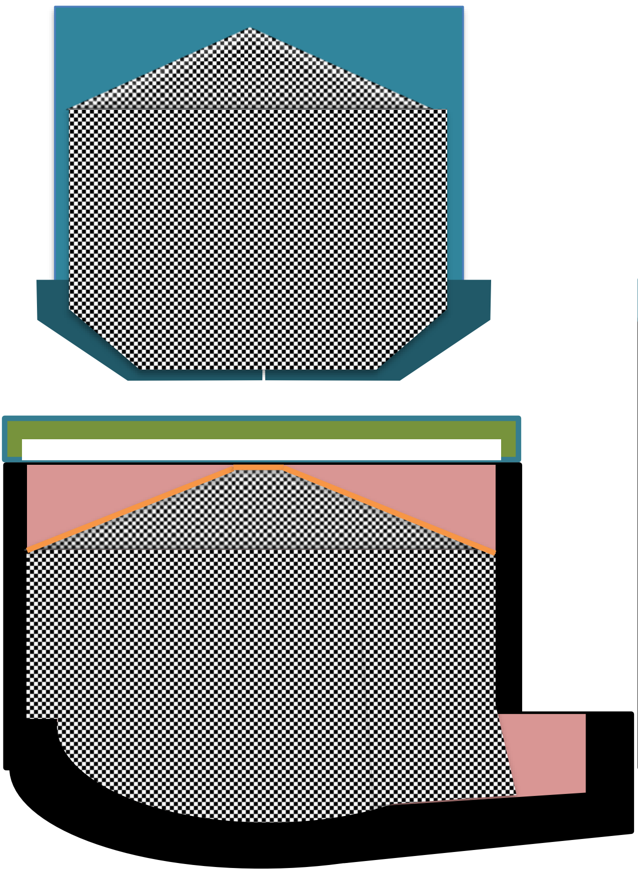
INTECO FUCHS

PATENTED

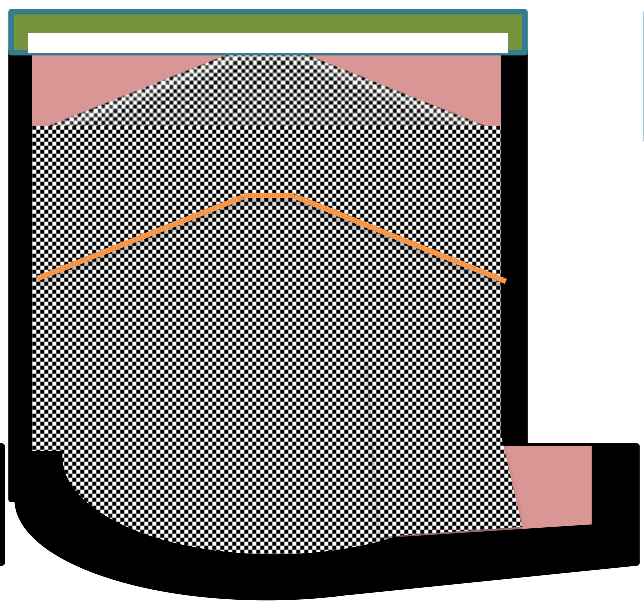
Concept

Standard EAF

2 bucket 55% / 45%

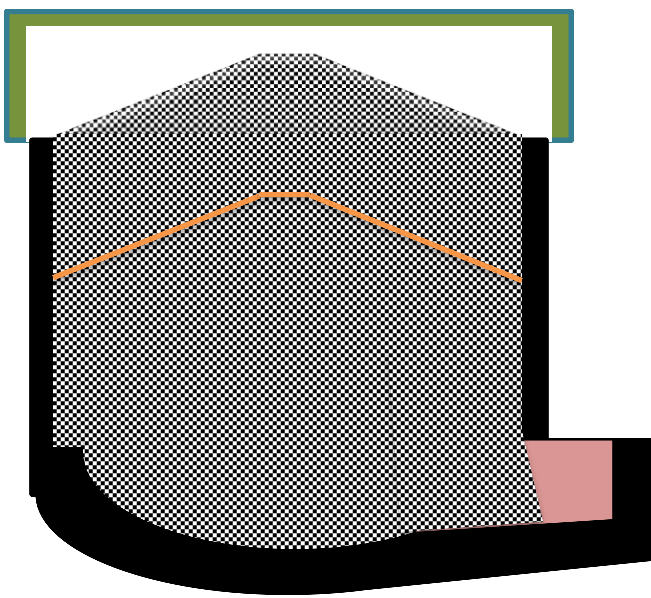


Single bucket furnace



Single bucket furnace

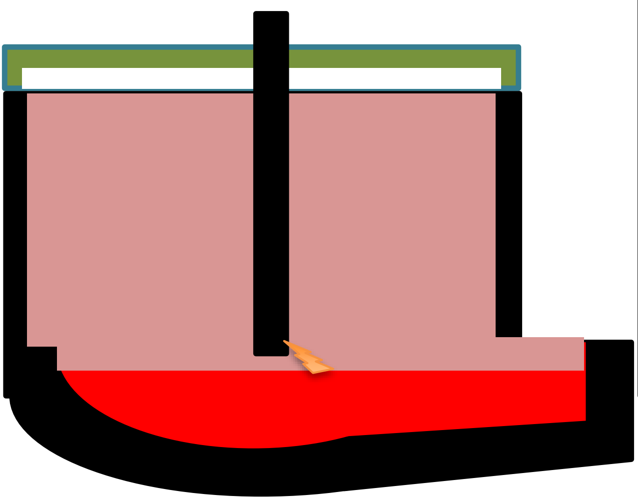
Telescopic



Concept

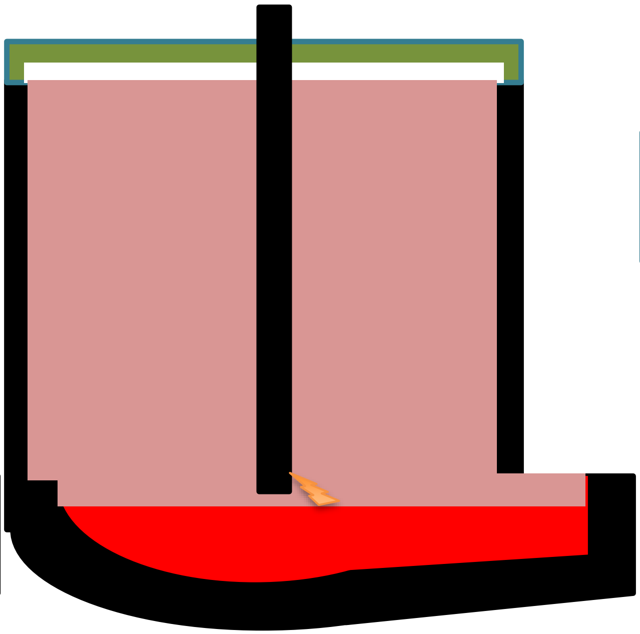
Standard EAF

2 bucket 55% / 45%



Single bucket furnace

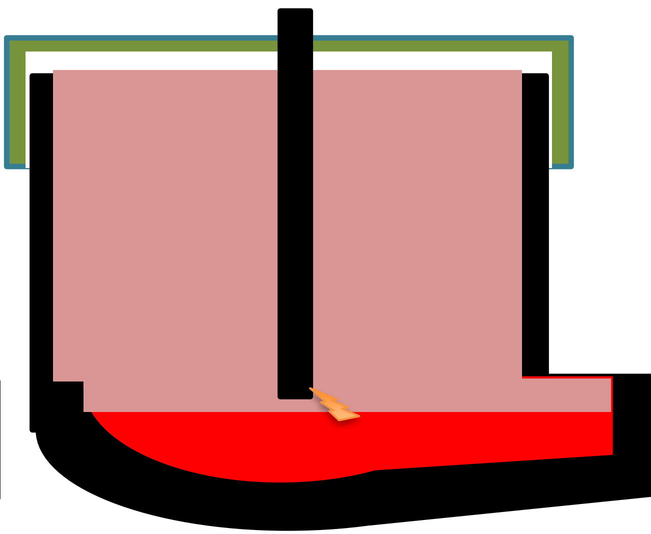
Electrodes too long



Single bucket furnace

Telescopic

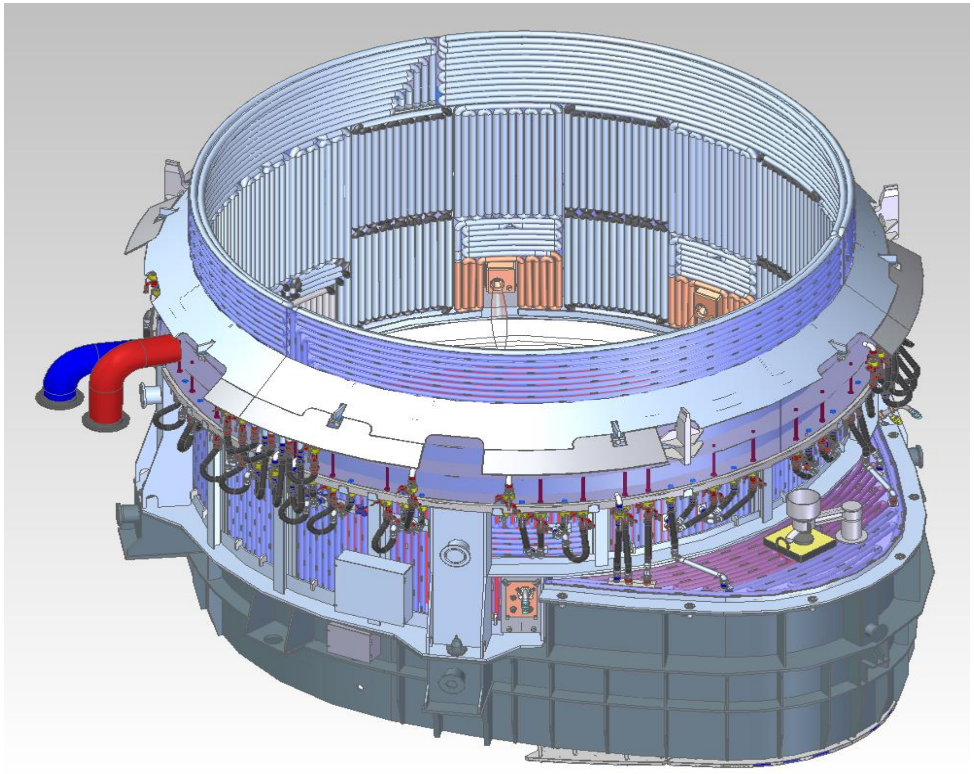
During the melting the roof follows the electrodes get down



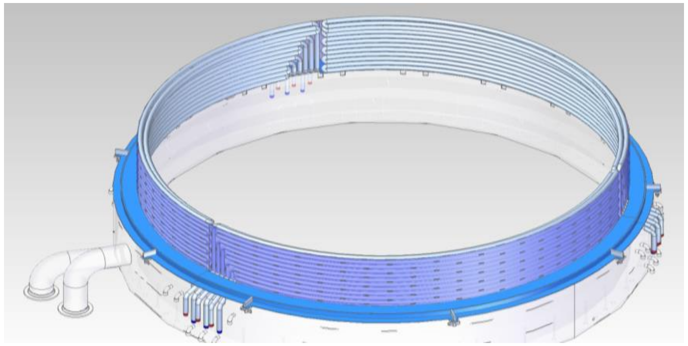
System concept

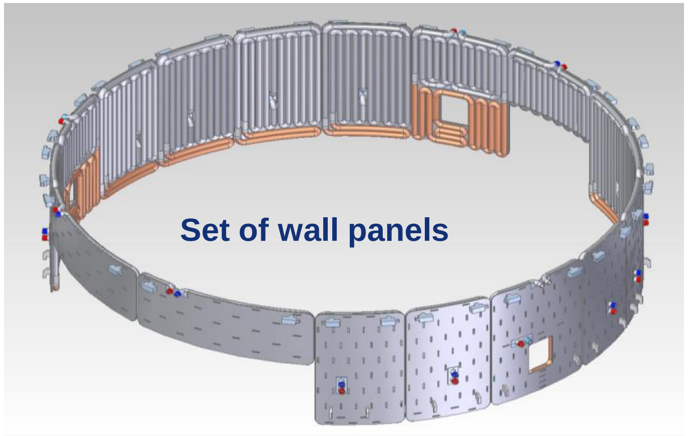
DESIGN FEATURES

UPPER & LOWER SHELL



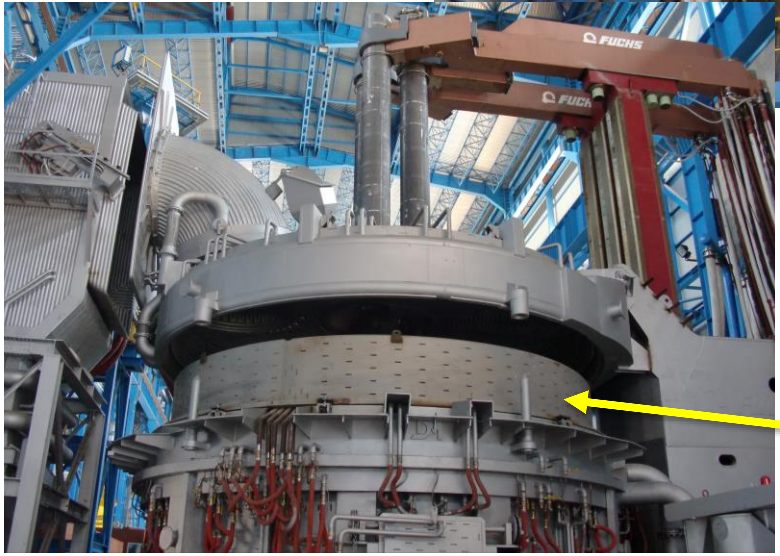
Set of telescope panels





Set of wall panels

Bastug furnace



Telescopic roof

Telescopic upper shell

Collected data

2017	TOTAL HEATS	BUCKET/ HEAT	POWER ON TIME, min	POWER OFF TIME, min	TAP TO TAP TIME, min	PRODUCTIVITY GOOD BILLETS, t/hour	CHARGE WEIGHT, ton	GOOD BILLETS WEIGHT ton	GOOD BILLETS YIELD FROM CHARGE, %	AVG POWER, MW	SPECIFIC EAF ENERGY kWh/t CHARGE	SPECIFIC EAF ENERGY, kWh/t GOOD BILLETS	SPECIFIC O2 TOTAL, Nm3/t GOOD BILLETS	SPECIFIC O2 INJECTORS, Nm3/t GOOD BILLETS	SPECIFIC GAS, Nm3/t GOOD BILLETS	SPECIFIC CARBON TOTAL, kg/t GOOD BILLETS	SPECIFIC LIME kg/t GOOD BILLETS
Single Bucket Heats	7778	1	34.6	9.8	44.4	226.8	184.3	167.2	90.79	108.0	337.9	373.4	31.03	30.60	5.27	12.36	51.42
Two-Bucket Heats	2731	2	38.7	11.8	50.5	199.6	186.5	167.4	89.83	105.2	363.6	406.2	28.31	27.88	5.12	12.64	49.70
Three-Bucket Heats	29	3	38.4	13.7	52.2	181.1	184.1	157.4	85.56	104.2	363.1	425.8	34.05	33.61	5.79	11.37	51.25
All Heats	**10538**	**1.264**	**35.7**	**10.3**	**46.0**	**219.6**	**184.8**	**167.2**	**90.53**	**107.3**	**344.6**	**382.0**	**30.33**	**29.91**	**5.23**	**12.43**	**50.97**

More than 10,500 heats processed

REAL AVERAGE Energy consumption 354 KWh/t of liquid steel

Thank You

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