

Port construction and rehabilitation using Resilient and Sustainable Sheet Pile Solutions



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ArcelorMittal Sheet Piling

Batumi
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Giurgiu Port



Photo courtesy PORR Romania

POTI Port



Photo courtesy Prime Concrete

In 2024, we have delivered the longest King Pile solution out of EU

- mainly silty sand, limestone, sand,... with SPT going as high as 50 in some locations / layers



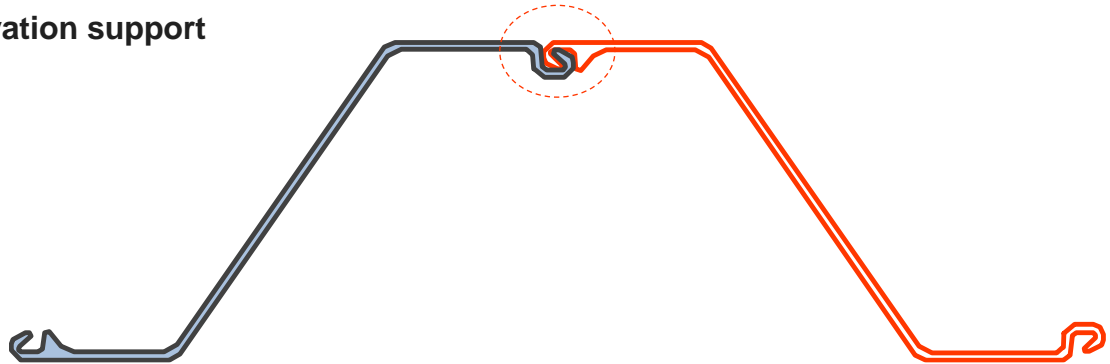
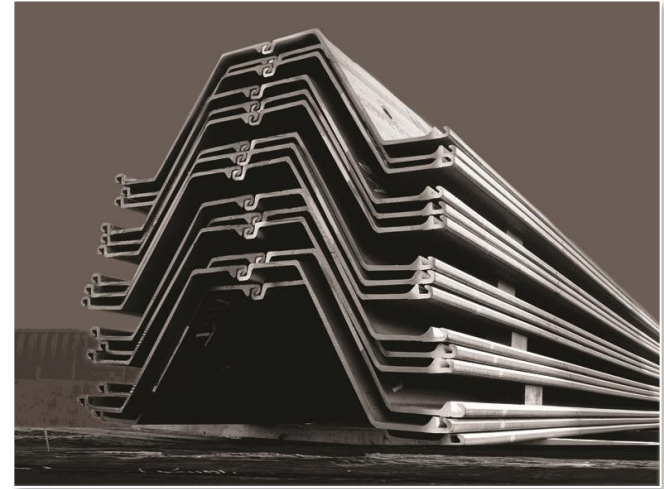
Steel Sheet Piles

Definition

Sheet piles are:

- sections of sheet materials made of steel*
- with interlocking edges that are driven into the ground
- to provide earth retention and excavation support

*but also other materials



Hot Rolled Steel Sheet Piling Mills and product range



Mill's capacity

Belval
Luxembourg

AZ-600
AZ-700
AZ-800

AS-500

PU-600
AU-750

Dabrowa
Poland

GU-600

GU-400

Differdange
Luxembourg

HZ-M

Production of SSP. HRSSP mills



* Cold formed pipes

* Cold formed sheet piles

Production of SSP

Belval (LU)

Differdange (LU)

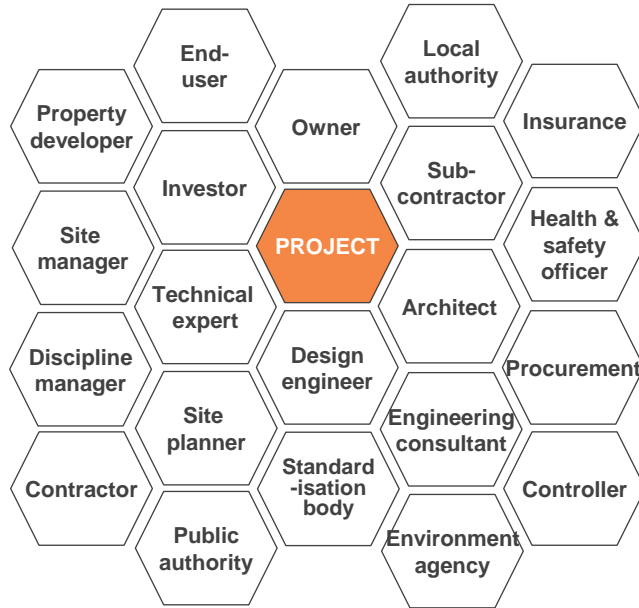
Dabrowa (PL)

Messempre (FR) (Cold Formed)

Heijningen (NL) (Cold Formed)

Who is the audience ?

- Each construction project has a lot of stakeholders, each with different levels of influence and with varying interest in the nature of the building materials.
- Our message and the information we deliver must be tailored to the audience to convince them of the benefits of our solutions:



Sustainability of sheet piling solutions

From decarbonization goals to EcoSheetPile™ Plus

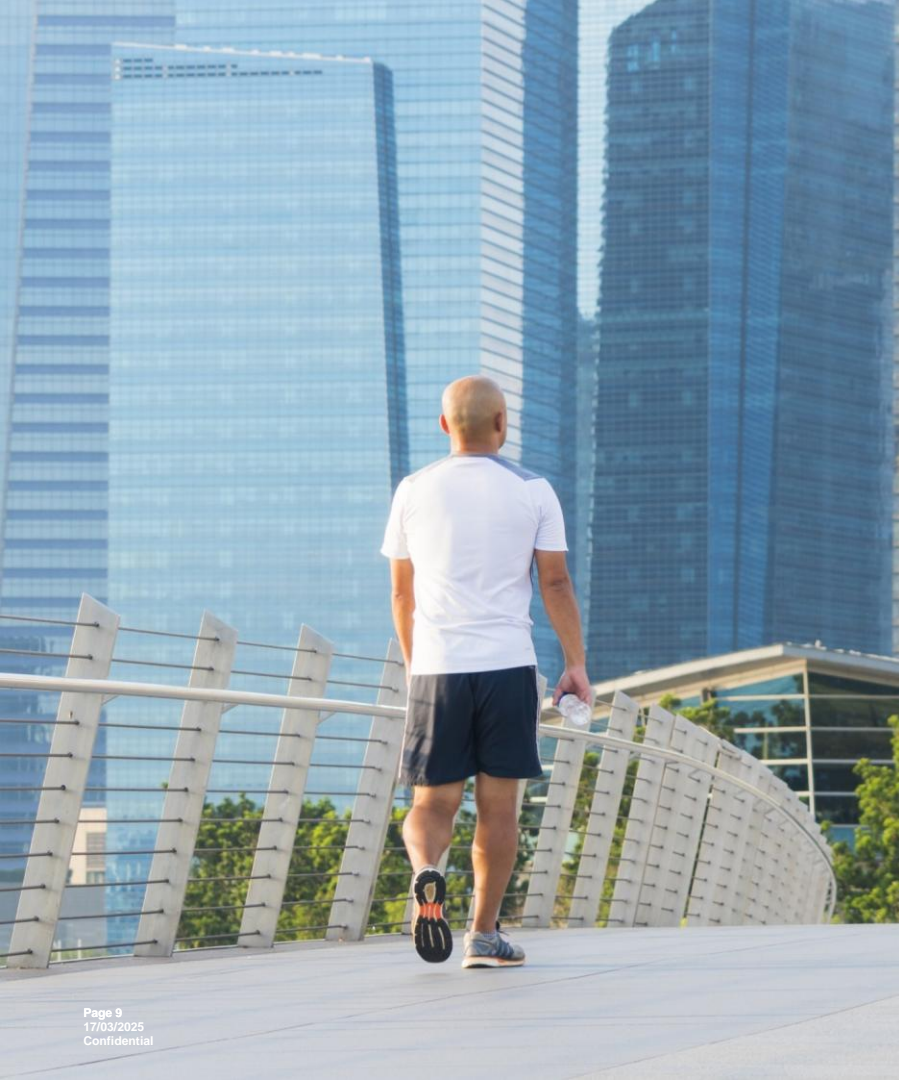
Shilton RICA

courtesy to François FOHL

ArcelorMittal Sheet Piling



Port of Brest, France ©
Bouygues TPRF



Climate **emergency** is a driver to decarbonise the construction market (38% of global CO₂-emissions in 2019 *)

“ *By 2030, all new buildings, infrastructure and renovations will have at least 40% less embodied carbon with significant upfront carbon reduction, and all new buildings must be net zero operational carbon.*

By 2050, new buildings, infrastructure and renovations will have net zero embodied carbon, and all buildings, including existing buildings, must be net zero operational carbon.”

World Green Building Council
Extract from *Bringing embodied carbon
upfront*

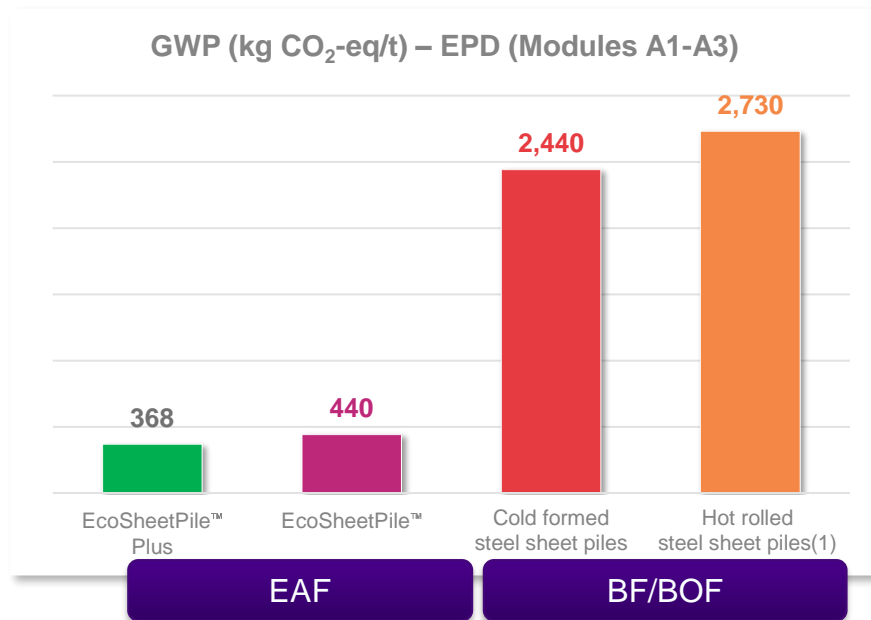


WORLD
GREEN
BUILDING
COUNCIL

Global Warming Potential – summary

Program Operator EPDs

- EAF: MRPI (NL) – 2023
- BF/BOF: IBU e.V. (DE)



EAF vs BF/BOF
⇒ reduction of GWP
factor ≈ 7

EAF = Electric Arc Furnace

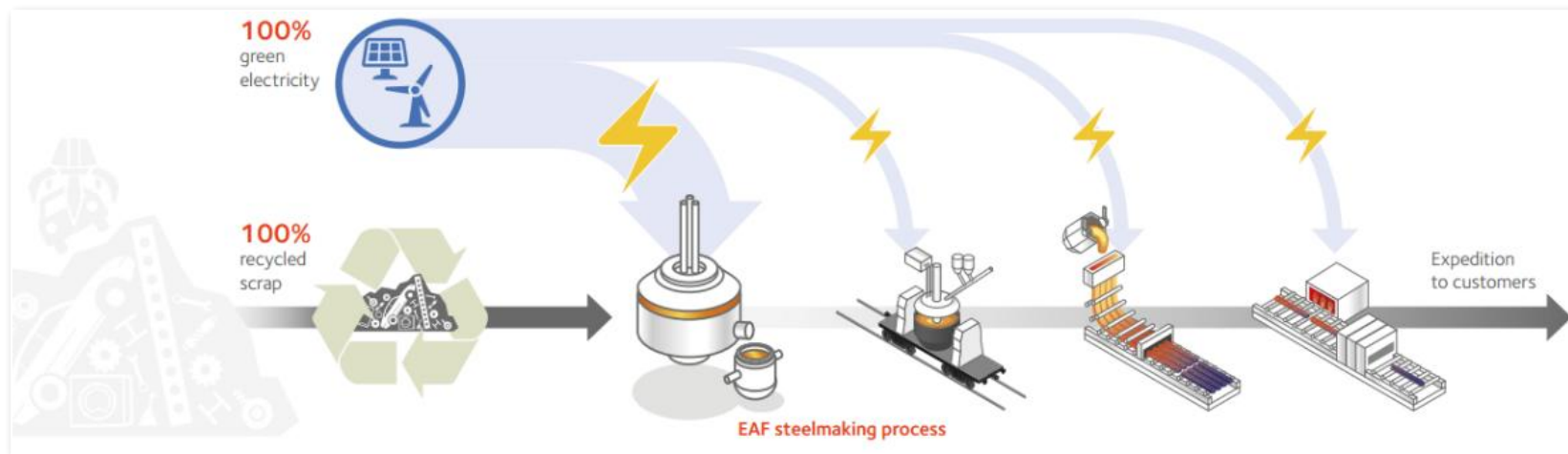
BF/BOF = Blast Furnace / Basic Oxygen Furnace

GWP = Global Warming Potential according to an **EPD** (Environmental Product Declaration) from IBU e.V. Values for **Modules A1 – A3** (Production)

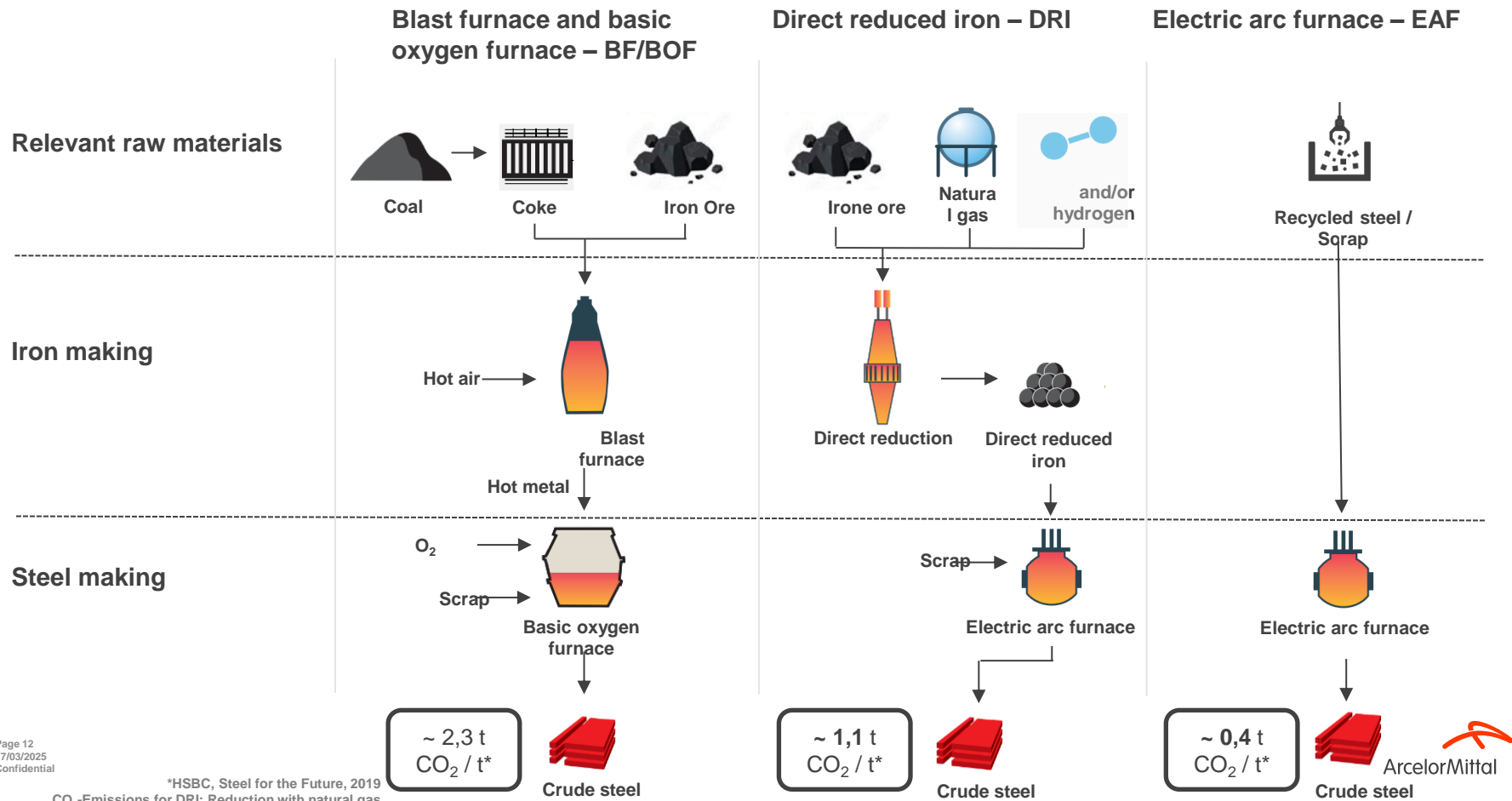
⁽¹⁾ Background report “EPDs of ArcelorMittal construction steel products – Sheet Piling”. Thinkstep AG, Nov. 2016 (Confidential, unpublished)

ArcelorMittal's XCarb® *recycled and renewably produced*

steels produced in an **electric arc furnace (EAF)** using high levels of **scrap** and **100 % renewable electricity**. The electricity used comes from renewable sources such as **wind and solar**, and is supplied via a recognised *Guarantee of Origin (GoO)* scheme.

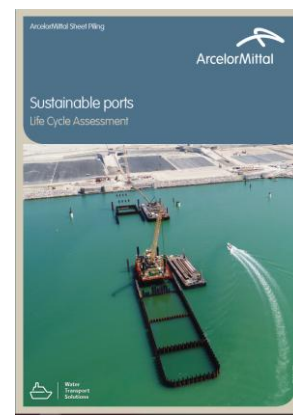
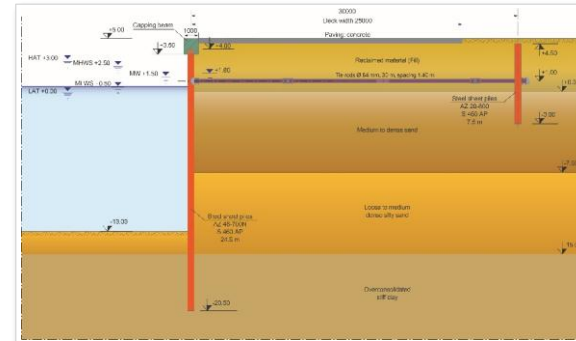
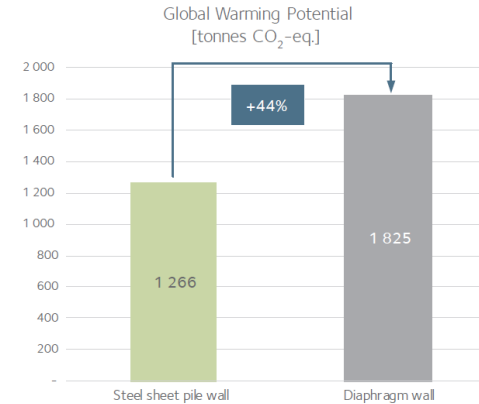


Steelmaking – 3 main routes



LCA comparison – Port structures (based on Tractebel's study - 2018)

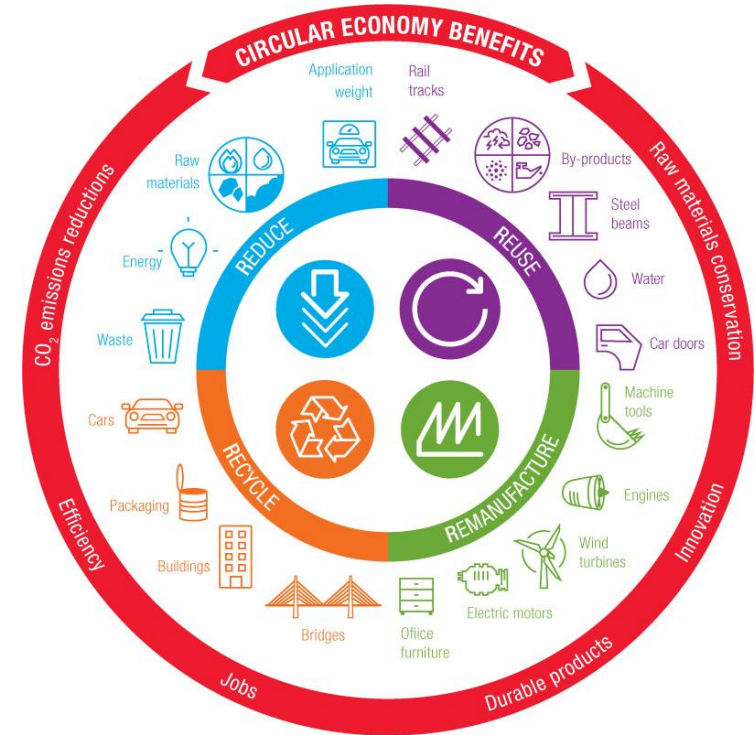
- 200 m cruise ship terminal built in a Belgian port (-13.0 m)
- Assessed through a **Life Cycle Analysis (LCA)** – peer-reviewed
- Project specific LCA considers
 - Production (**cradle to gate**)
 - **Installation** and **deconstruction** after service life
 - **Recycling** of steel and partially concrete (option)
 - Transport of the key construction materials
- Difference in Global Warming Potential (GWP, **CO₂-eq. emissions**) is **44%**, compared to a diaphragm wall.
- Notes
 - Steel sheet piles can be recovered easily and either reused (quite rare after 50 years) or 100% recycled,
 - LCA uses the EcoSheetPile™ EPD of ArcelorMittal



Steel sheet piles: A product in the sense of circular economy

Steel sheet piles score particularly well on the following principles of the circular economy:

- **Reduce:** Through optimization of sheet piling solutions, the used profiles have become lighter and lighter over the past decades (- 50 %), while still meeting the same requirements.
- **Reuse:** Steel sheet piles can be used and reused up to 10 times for temporary applications, thus reducing the environmental impact each time the sheets are re-used. ArcelorMittal also offers rental and sale of second-hand sheet piles.
- **Recycle:** Steel is a permanent material. It can be 100% recycled without any loss of quality. Steel sheet piles from Luxembourg are out of 100 % recycled steel.



Circular economy

REDUCE

Lighter sections
(AZ-800)
High strength steel

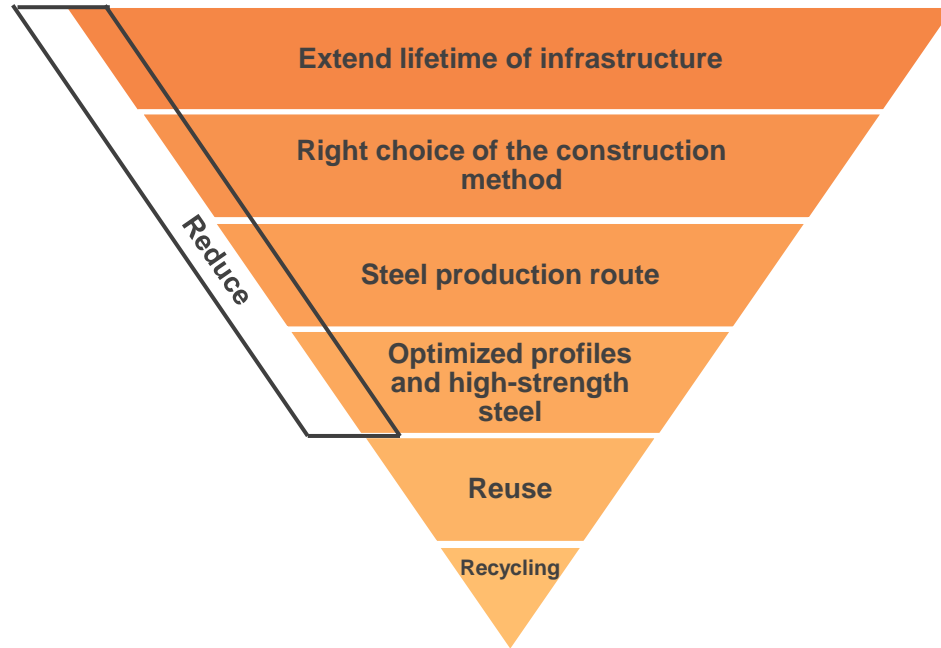
REUSE

- rental
- sales with buy-back option
- sales of second hand

RECYCLE

steel is **100 %**
recyclable
&
ssp out of **100 %**
recycled steel

Optimization potential related to CO₂ emissions in sheet piling solutions



Optimized sheet piling profiles:

- CO₂-efficient (Production + Transport)
 - Cost-efficient
- Faster in installation (Consider soil conditions)
 - Less interlocks = Less seepage



SmartSheetPile Solutions

Objectives :

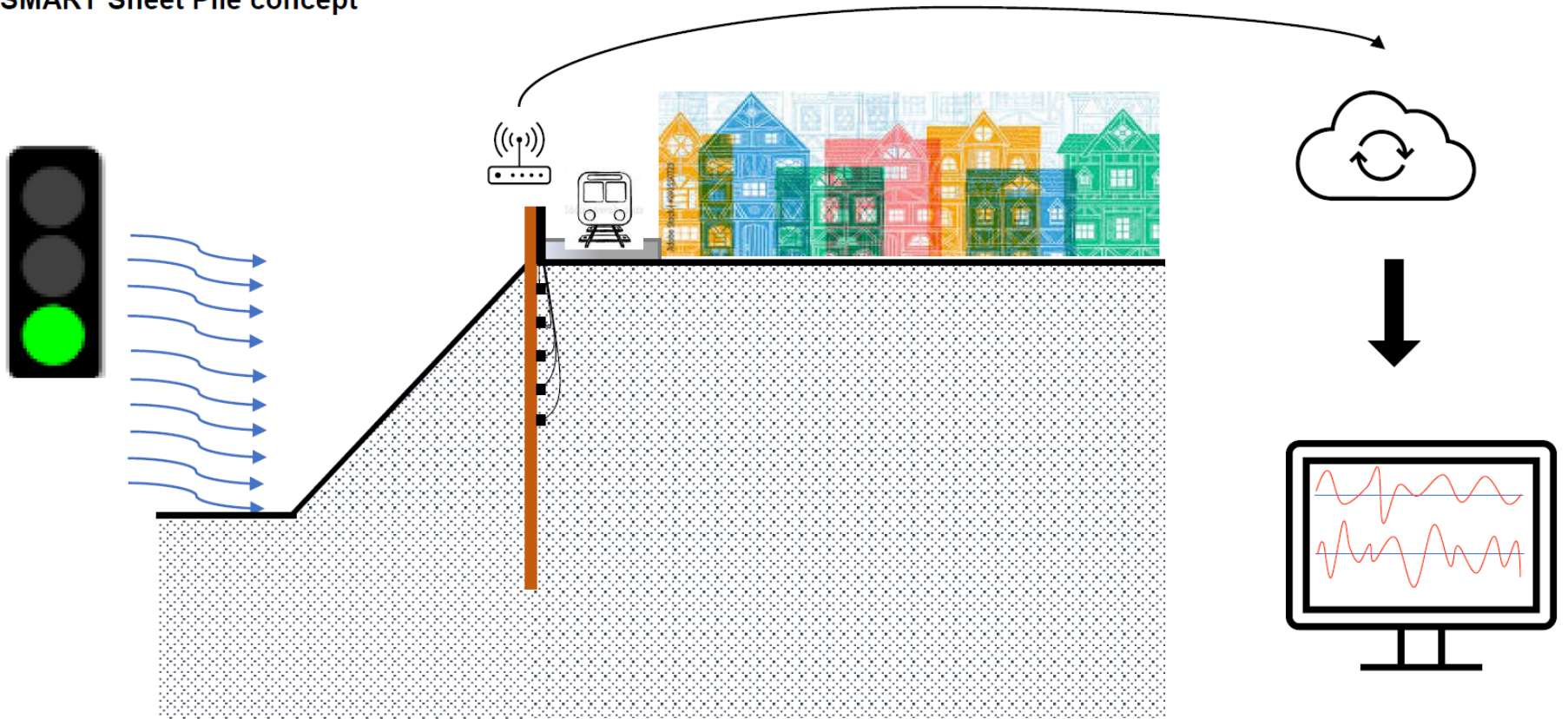
- Real-time remote structural health monitoring
- Support clients and stakeholders in creating a digital twin
- Support creation and use of Artificial Intelligence for big data processing and providing assistance for decision-taking
- Create added value for customers :
 - Secure the structure
 - Minimize hindrance and limit project downtimes
 - Achieve preventive maintenance – reduce operating costs
 - Reveal hidden capacities and detect weak spots – improve project returns
 - Take on the digital transformation, enhance the reliability and the efficiency of sheet pile solutions

SmartSheetPile

Smart steel solutions for innovative infrastructures

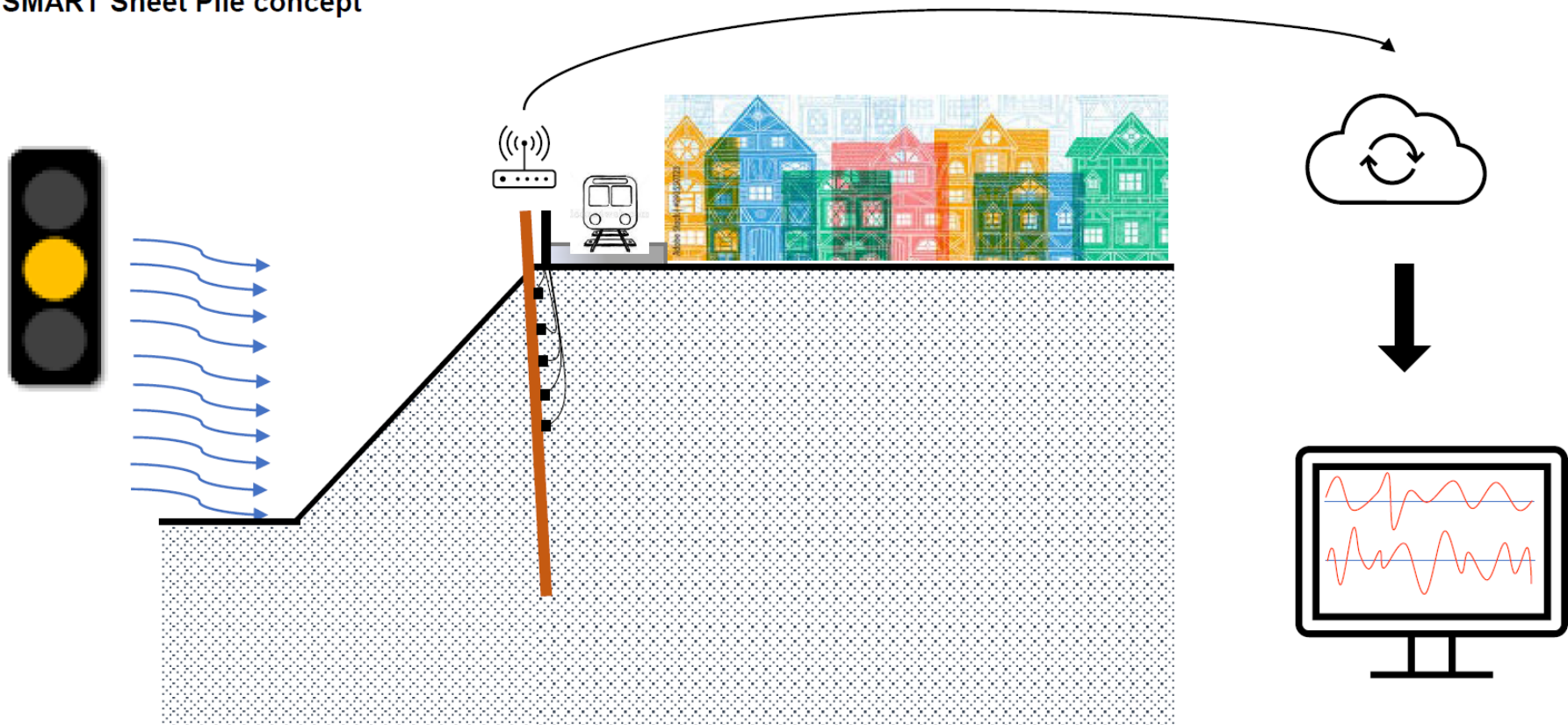


Innovation
SMART Sheet Pile concept



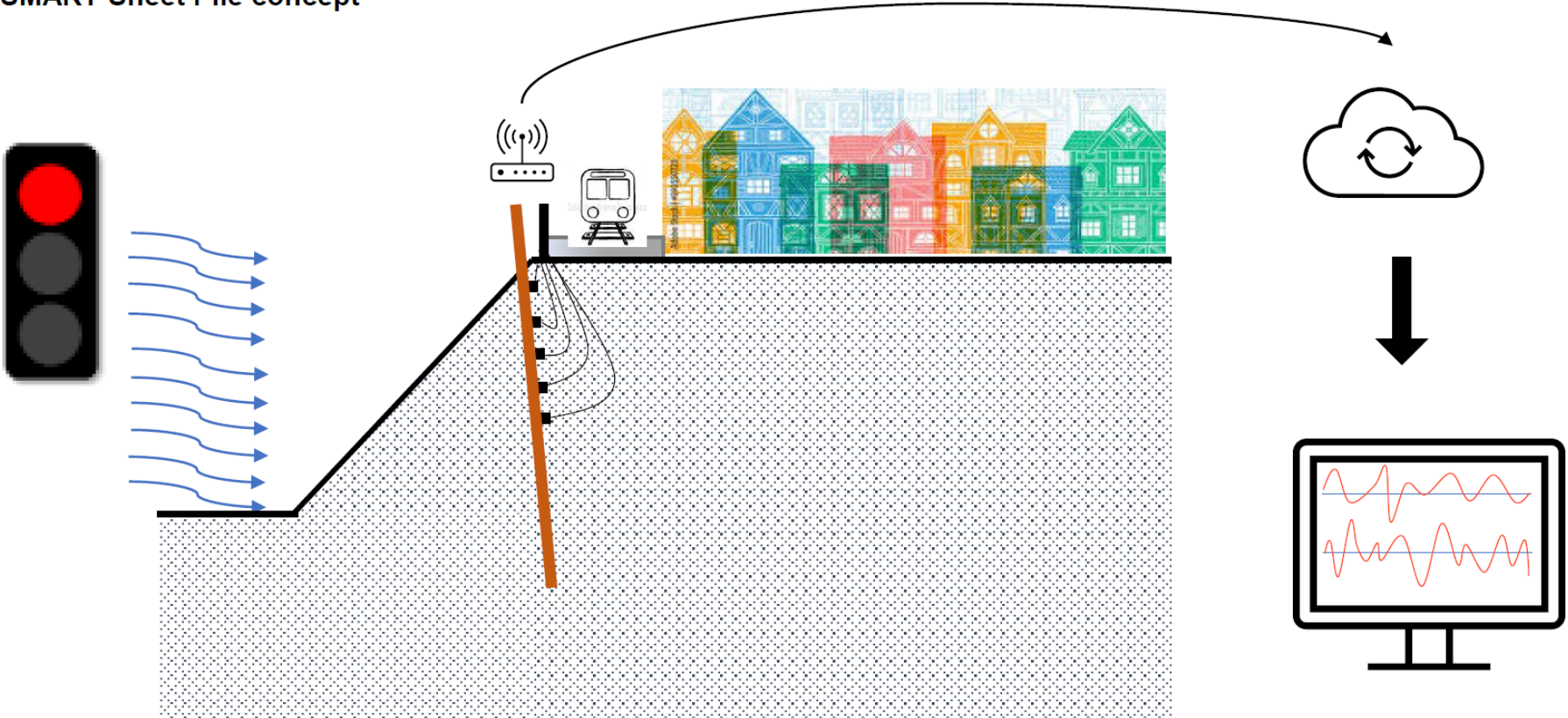
Innovation

SMART Sheet Pile concept



Innovation

SMART Sheet Pile concept



Strategic Objectives: SmartSheetPile

Create value for customers with the power of digitalization

Secure the structure :

- Prevent irreparable damage
- Detect accidental and weather-induced damage
- Early warning of potential catastrophic collapse

Minimize unavailability :

- Avoid unexpected shutdowns (closures)
- Save costs and limit inconvenience to users

Achieve preventive/predictive maintenance :

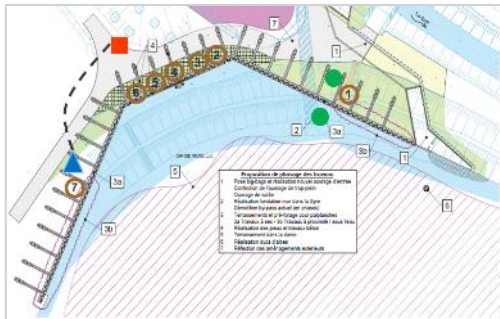
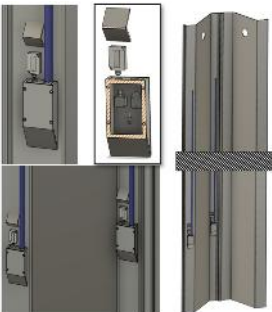
- Know when and where maintenance is needed
- Remove the need for costly inspections and unscheduled repair works

Take on the digital transformation :

- Integrate collected data in the digital twin of the structure
- Have a multi-dimensional overview of the structure's performance and interaction with the surroundings
- Effective asset management

Reveal hidden capacities and detect weak spots :

- The data collected gives accurate information on structural health
- Usage of structure can be optimized to benefit from its full potential
- Improve project returns
- Lifetime extension



Let's stay connected!



ArcelorMittal