28 February 2023, UIC headquarters, Paris

Zero Waste Railways II – Circular outflows

Welcome Message

Katy Beardsworth, Network Rail

Chair of the UIC Circular Economy Sector

The agenda today

08:30	**Registration and welcome coffee**
09:00	**Opening and keynote speech** • Katy Beardsworth, Circular Economy Sector Chair • Isabelle De Keyzer, Senior Advisor/Coordinator of the UIC CE sector • Leyla Acaroglu PhD, Lead disrupter Q&A
10:05	**Best practices from the rail sector towards circular outflows** • Bénédicte Gourmandin, SNCF Réseau, Short loop sustainable rails: The Green Rail project • Ilse de Vos - van Eekeren, Dutch Railways 99% Circular Train Modernisation • Pieter Schreuder, University Zwolle, Reuse of thermoset composites to close the loop in the railway sector
11:05	**Coffee Break**
11:20	• Martijn Wolf, Eurospec, New Circular specifications for rolling stock • Katy Beardsworth, Network Rail, The SurPlus App, an internal marketplace for rail equipment
12:00	**Lunch Break**
13:00	• Bruno Muller, Porterbrook, Case study on end-of-life rolling stock • Heike Kiefer, Swiss Federal Railways, Werkstadt Zurich – how to reconstruct an entire industrial area in a sustainable and circular way
13:40	**Extending the lifetime of products, Supply industry** • Camille Rozannes, Alstom • Estelle Barré & Shreya Uday Sonar, Schneider Electric (Railsponsible Supplier Award winner)
14:20	**Coffee Break**
14.30	**Addressing the impacts** • Brieuc Saffré, Circulab, Interactive session, work in small groups
16:30	**Wrap up by Sector Chair and summary by Flatland**
17:00 – 19:00	😀🍺 Evening Drinks Reception – UIC Lobby

Keynote

Dr Leyla Acaroglu

Lead Disrupter, Unschool

Best practices exchanges

« How to make
rail outflows circular?»

Bénédicte Gourmandin

Engineer in circular economy

Network Technical Direction of SNCF Réseau.

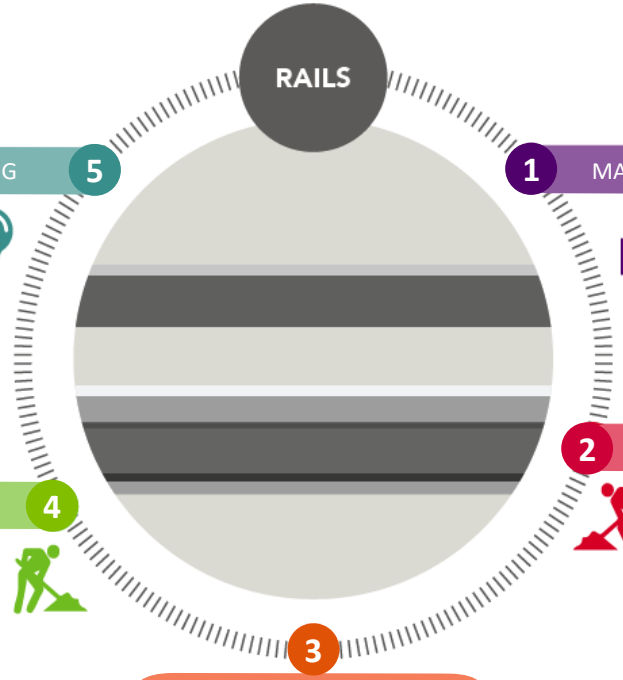
CIRCULAR OUTFLOW

+ The Green Rail Project

TOUT SE TRANSFORME

THE LIFE CYCLE OF RAIL

The idea of the green rail project is to improve the life cycle of the rail at every stage, from the manufacture to the end of life



154 000 tons
melted in steel plant in 2022
Or 2 800 km of rail

50 000 tons treated via the green steel project with two electric steel plant

Steel (NF EN 13 674-1)
Different types of lengths (18m to 432m)

155 000 tons
used in 2022
Or 2 800 km of rail

75% of inflows use recycled rail to create new rail

5 700 tons
reused in 2022
Or 95 km of rail

86% of the reused rail originated form our industrialised process of the reuse of high velocity rail
14% from the reuse of rail from one worksite to the other

155 000 tons
collected in 2022
Or 2 800 km of rail

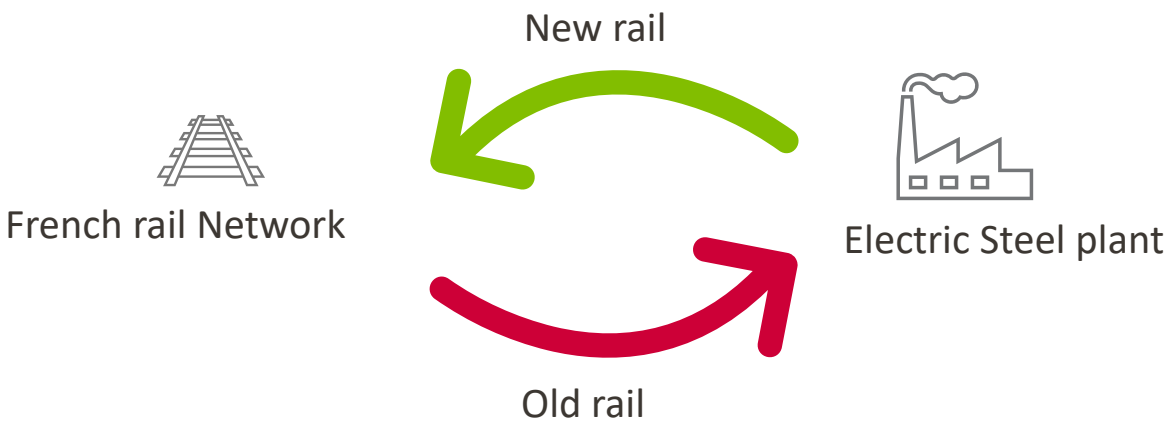
100% of the outflows traced

THE DIAGNOSIS

How to promote the electric steel plant sector ?

An inter-dependent partnership

To make a new rail, the electric steel plant sector need a secure supply of old steel



An environmental gain
- Less logistics
- Less extractions of raw materials
- Support of French industry

THE EXPERIMENT

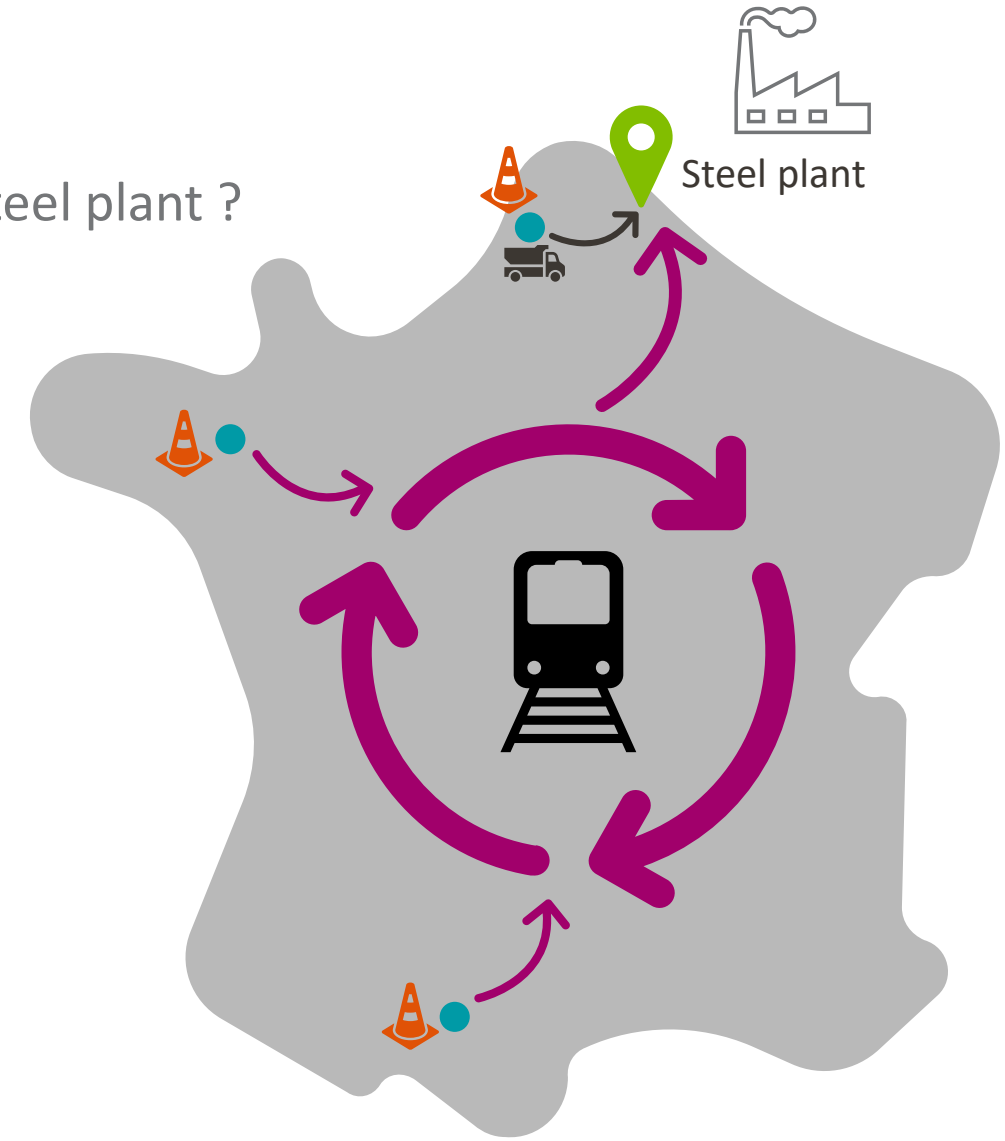
Is the green rail as performant as a new classic rail ?

The first convoy of old rail and the creation of 144 blooms

An mandatory step toward the certification of the green rail

THE INDUSTRIALISATION

How to create an efficient and sustainable supply of the steel plant ?



The idea to plug the outflow to the inflow train

+ Organise the worksites to evacuate the old rail via train
+ Construct the economic flow between SNCF Réseau and the steel plant
+ Attain the objective of 40 000t of old rail delivered in 2022

THE GREEN RAIL PROJECT IN NUMBERS

For the year 2022

35%

OF RECYCLED RAIL IN NEW RAIL

Number limited by the concentration of Molybdenum and Arsenic

200$ktCO_2e$

SAVED

By the transition from foundry to electric steel plant

SNCF RÉSEAU
ACTOR OF THE CIRCULAR ECONOMY

CONTACTS

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Engineer in circular economy
Network technical direction
+33 6 14 96 23 41
benedicte.gourmandin@reseau.sncf.fr

FIND US

www.sncf.com

TOUS SNCF
AMBITION RÉSEAU

SNCF
RÉSEAU

Ilse de Vos

Co-chair CE Sector

Manager Circular Business, Dutch Railways (NS)

99% circular train modernization

‘waste does not exist’

Ilse de Vos van Eekeren

Dutch Railways (NS)

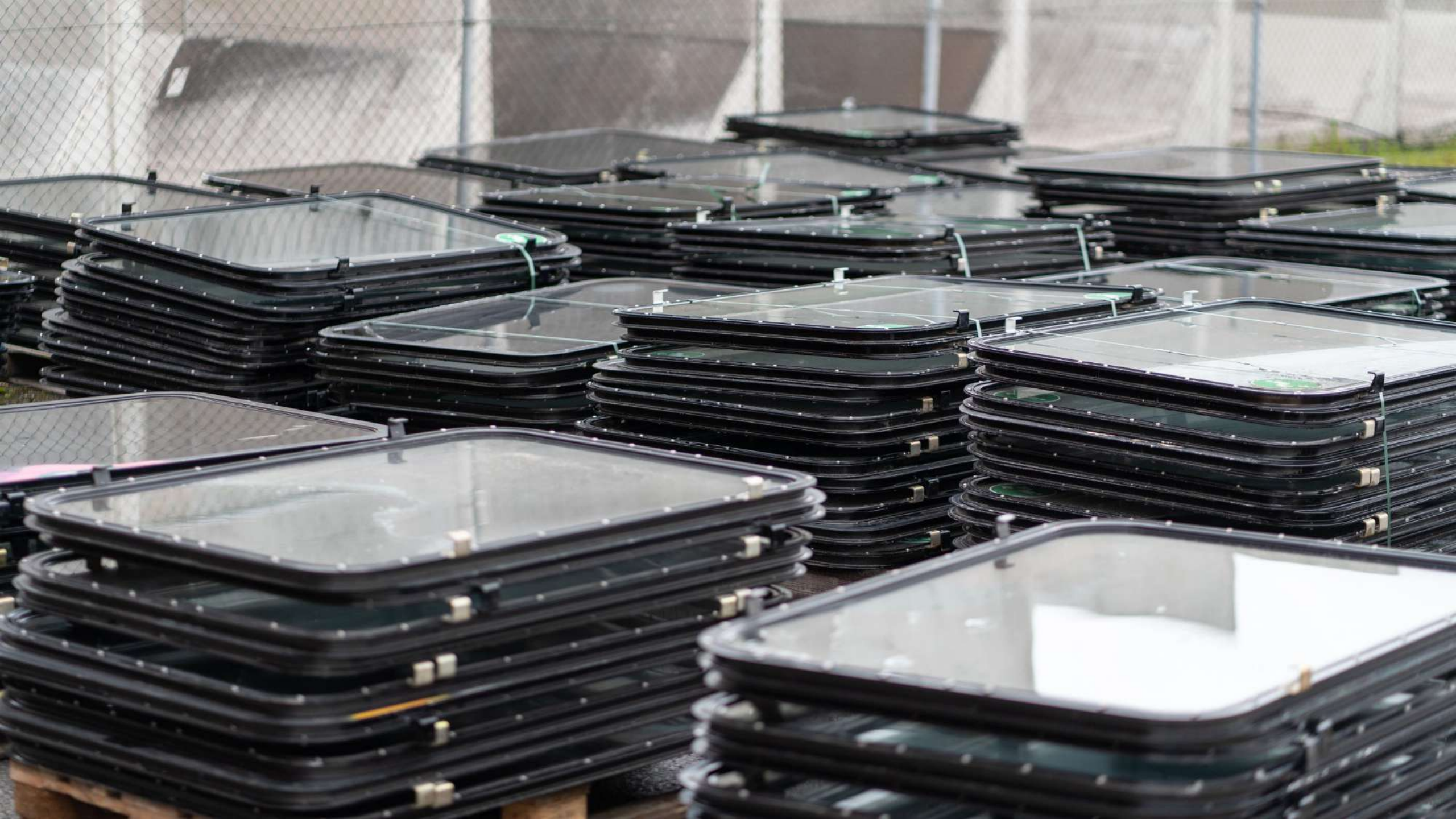

EMB 0277
NEDTRAIN


Deze treinvloer heeft 5.7 miljoen km door Nederland gereden.

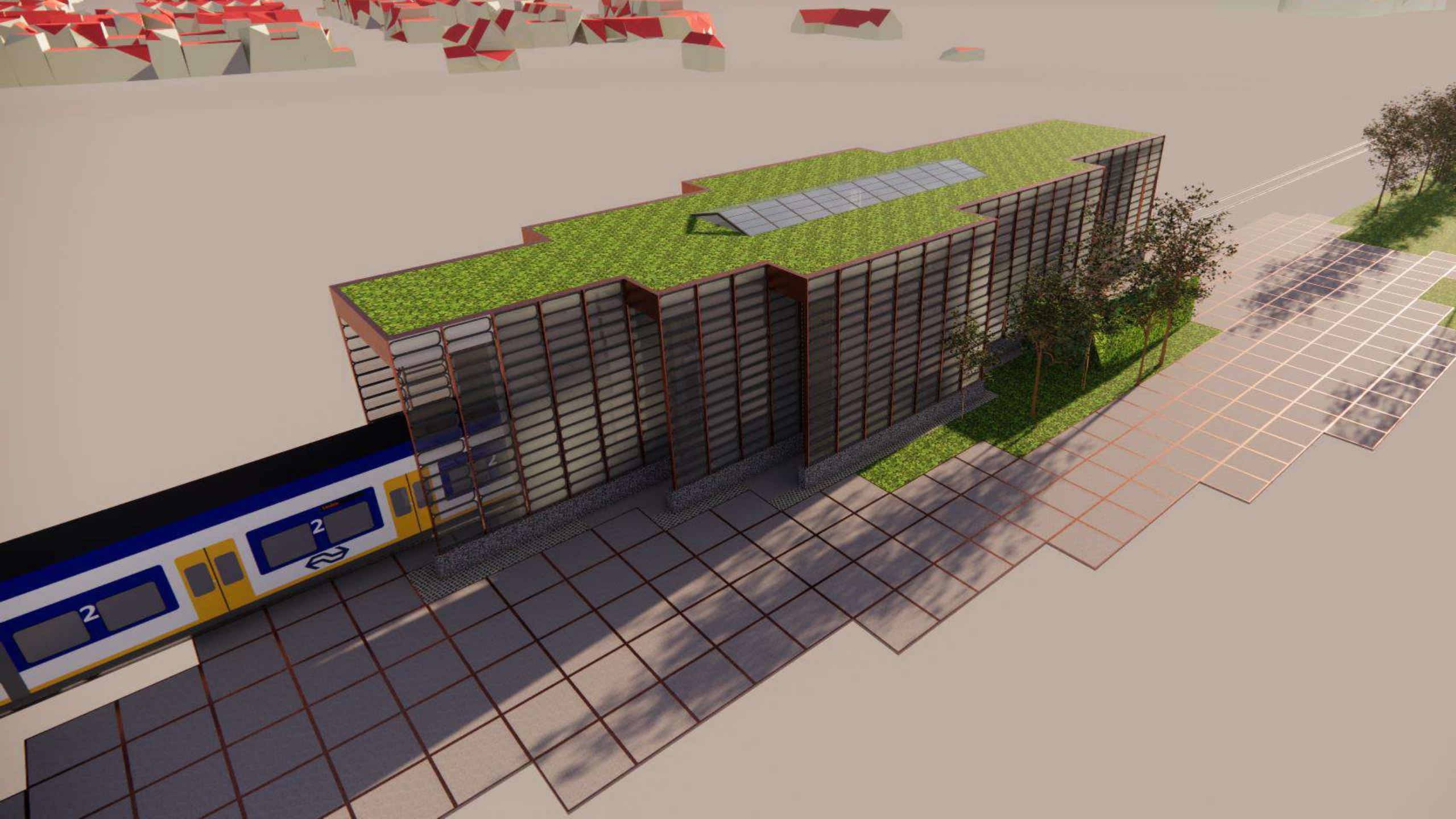

Strategiecommunicatie


Dit bureaublad was eerst een
treinplafond van NS


2




Stalling Noord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Welkom in de
Upcycle Shop
ns.nl/duurzaam
7 t/m 15
november
LEGO

Strategiecommunicatie


Rail Away Europe
DE MOOISTE EUROPESE TREINREIZEN
Martin Kers en Hans Bouman
VERJONGD STADSHART
EEN NIEUW UTRECHT CENTRAAL

www.ns.nl/upcycle

Last 1%

Gezocht: creatieve ondernemers die de oude stoelzittingen van NS treinen een hoogwaardig én grootschalig tweede leven kunnen geven.

Brief | Q&A (1) | Updates

Volg challenge

Op dit moment geeft NS haar dubbeldekstreinen een tweede leven door modernisering, waardoor deze trein weer 20 jaar lang reizigers kan vervoeren. Met het hergebruik van materialen in de trein en het hergebruik, hoogwaardige recycling en upcycling van materialen die niet terug de trein in gaan, krijgt nu 98,8% van de trein een tweede leven. Hier zijn we heel trots op, maar we zijn er nog niet. De ambitie is 100% circulaire treinen!


1,5 m
Houd 1,5 meter afstand
1,5 m
Houd 1,5 meter afstand

NEXT STEPS: smarter design (R0-R1-R2)

Thank you…

Pieter Schreuder

BSc, Civil Engineering

Researcher, Windesheim University of Applied Sciences

Zwolle, The Netherlands

University of Applied Sciences Windesheim

Structural re-use of traditional thermoset composites

Zero-Waste Workshop

Paris, 28 February 2023

Pieter Schreuder BSc., Dr. Ir. Albert ten Busschen
Professorship for Polymer Engineering
Windesheim University of Applied Sciences
Zwolle, The Netherlands

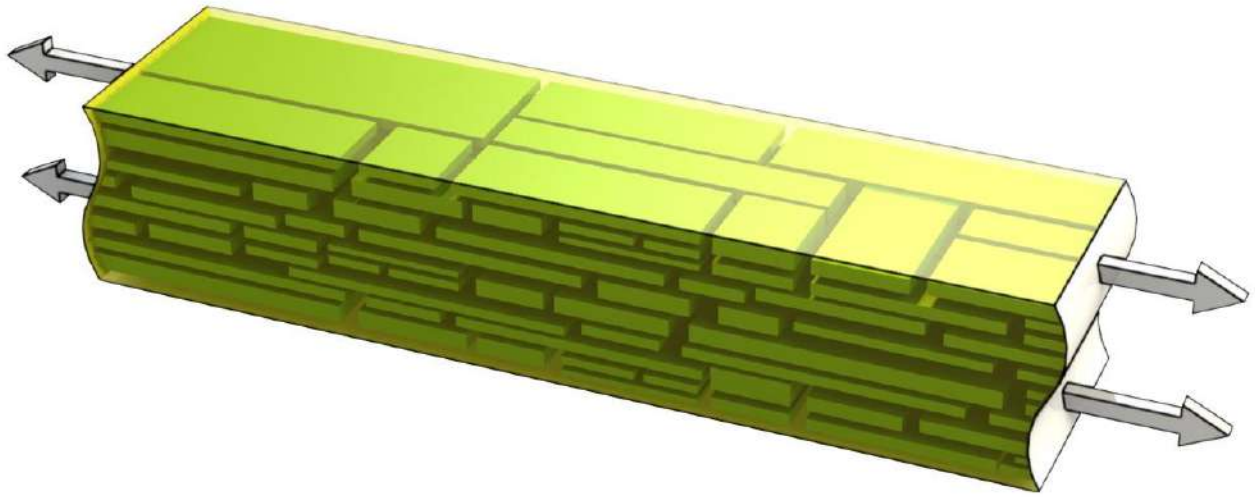
Windesheim method of structural re-use

- Development of structural re-use since 2015
- Scaled up to industrial technology
- Good business case for cost and CO_2-footprint
- 80+ partners involved from industry, knowledge institutes and governmental agencies

- EuCIA recognizes the Windesheim-method as ‘re-use of composite properties’
- Contribution to IntechOpen-book on *Waste Material Recycling in the Circular Economy*
- Contribution in progress in book on *Composite Recycling*
- Dutch awards for the method: Delta Premie and RAAK-Award
- JEC Innovation Award 2022 (category Building and Infrastructure)

Windesheim method of structural re-use

- Leave the composite structure intact
- Machine EoL composite into smaller, oblong pieces (flakes, strips)
- New life as reinforcing elements in new composite products
- Addition of virgin resin necessary to embed pieces of EoL composite
- New products: strong and water-resistant
- Suitable for composites products of larger weight and simple shapes (profiles, panels)



Contribution to mechanical strength of new products

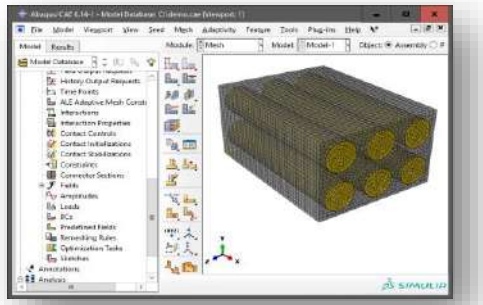
Design parameters based on tests

EN 1990
Structural safety, servicablility and durability

EN 1991
Actions on structures

EN re-used composite
Design en detailing

Structural calculations on products with re-used EoL composite

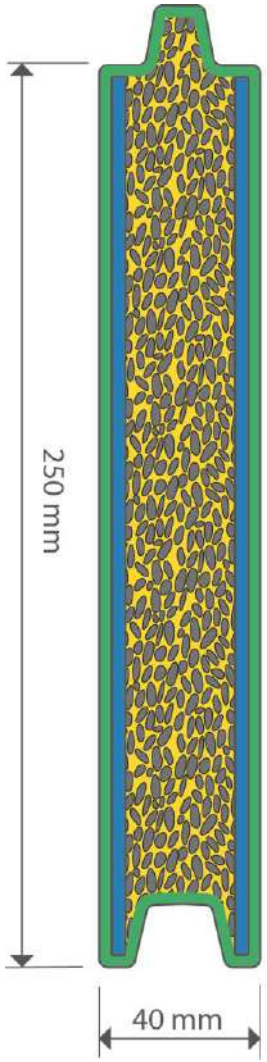


Long-term properties, weathering and simulation

Full-scale tests on EoL composite

Demonstrator: retaining wall

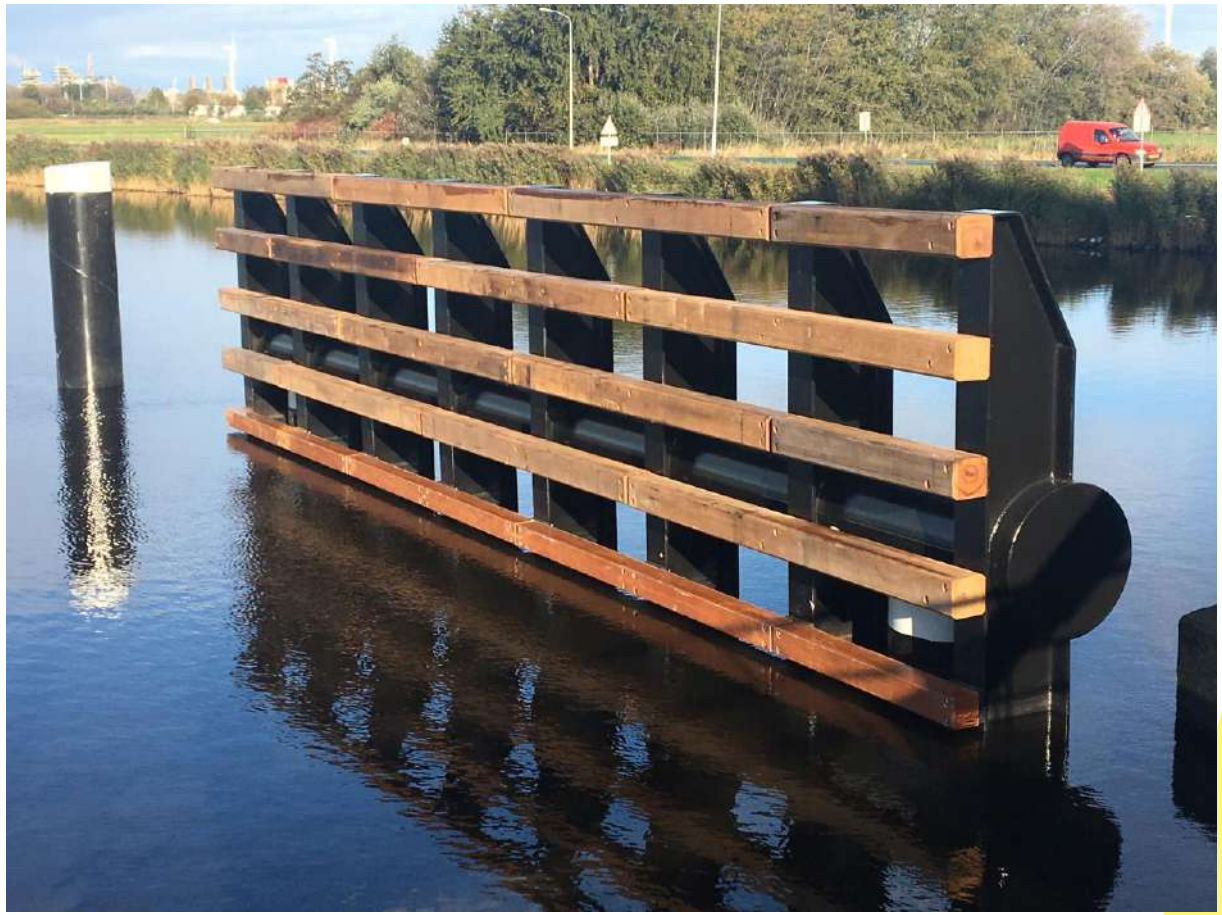
- Profile cross-section 40 x 250 mm
- Tongue and groove
- Profile length 3.5 m
- 80 profiles produced and installed
- Beatrix lock-gate in Almere



Installation of retaining wall

Demonstrator: guiding beams

- Beams of 4 m length
- Cross-section 200 x 200 mm
- 112 meter of profile produced
- Installed in 4 guiding structures
- Two lowest rows around the water line
- Heemkes bridge in Delfzijl



Guiding structure near Heemkes bridge

Demonstrator: crane mats

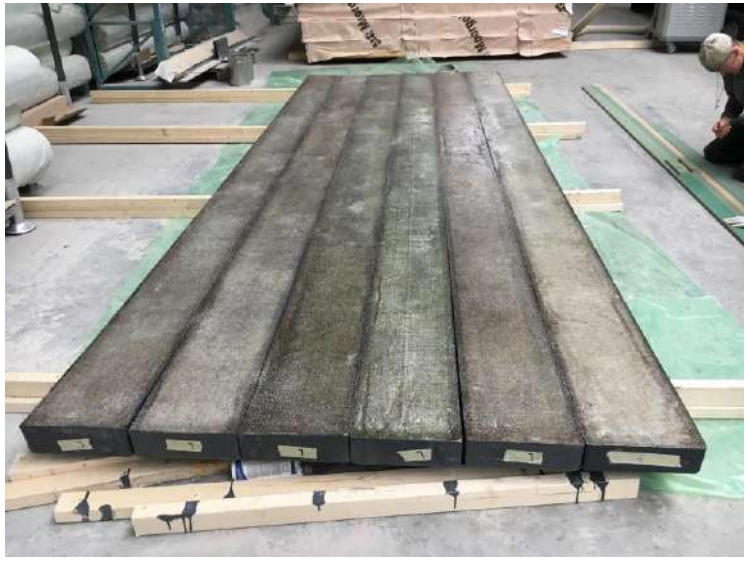
- Crane mat made from 5 beams of 5 m
- Cross-section of beam: 200 x 200 mm
- Crane mat tested in practice

Crane mat test with heavy vehicle

Crane mats of Welex at a building site

Demonstrator: bridge decks

- Deck profiles of 95 x 245 x 2000 mm
- Designed for specific mechanical properties, verified by mechanical testing
- Installed at Dinzer bridge, Friesland



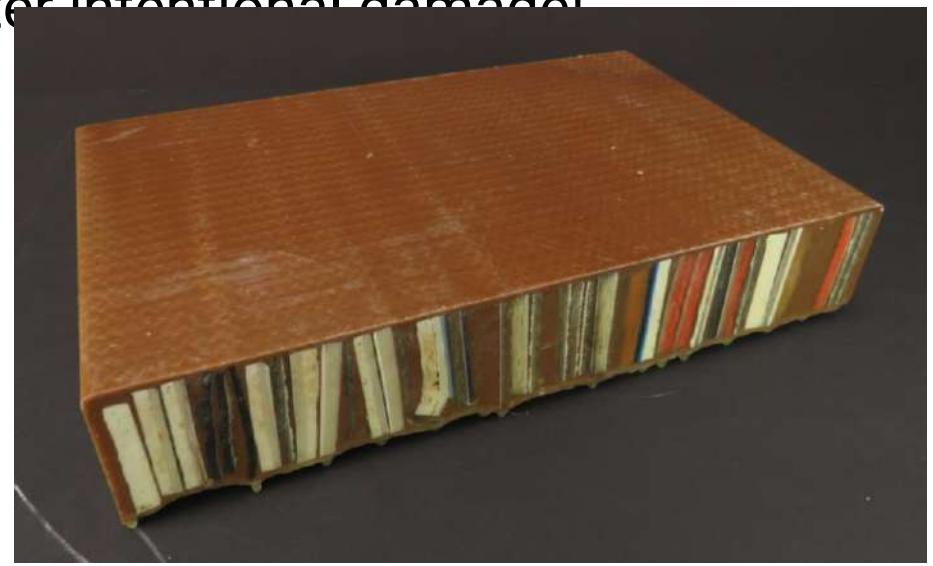
Production of deck profiles with re-used EoL composite

Installation of the bridge deck of re-used composite

Environmental safety

- EoL composite may contain harmful contaminations
  - e.g. anti-fouling at boat hulls or old gelcoats with metal-based pigments
- Study into potential leaching of harmful substances
- Tests on EoL based composite from re-used contaminated EoL boat strips
- No harmful substances were found to leach from the profile, not even after intentional damage!

independent test institute



Development: railroad tie (‘sleeper’) of re-used train composite

- Circularity within Dutch Railways (NS)
- Solution for EoL composites from train revisions
- Re-use in rail-infra, e.g. sleepers
- Development of sleeper in ERJU-project

University of Applied Sciences Windesheim

Thank you for your attention!

Coffee break

Martijn Wolf

Consultant, Ricardo Rail Netherlands

Advisor for the Dutch Railway Operator NS
on environmental topics

EuroSpec Circularity Requirements

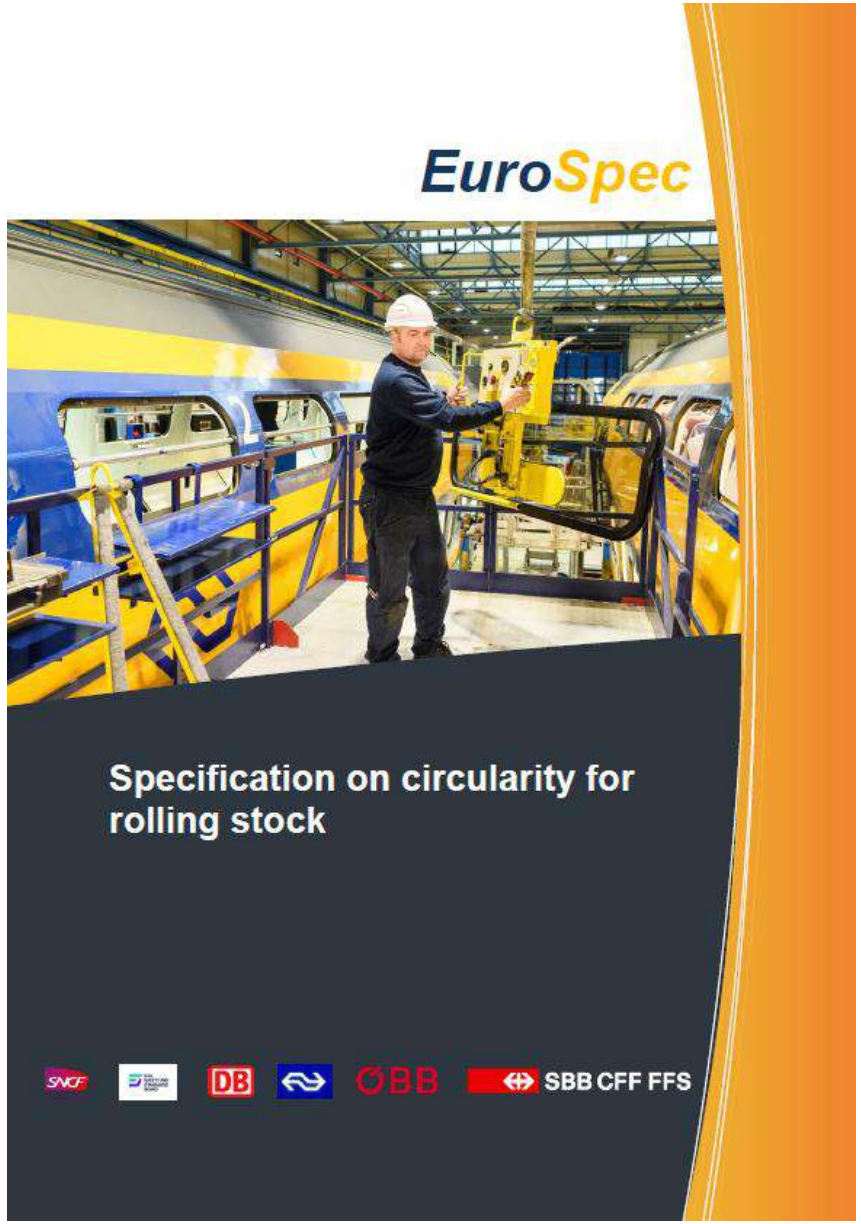
Zero Waste Railways Workshop

Martijn Wolf

28 February 2023, Paris

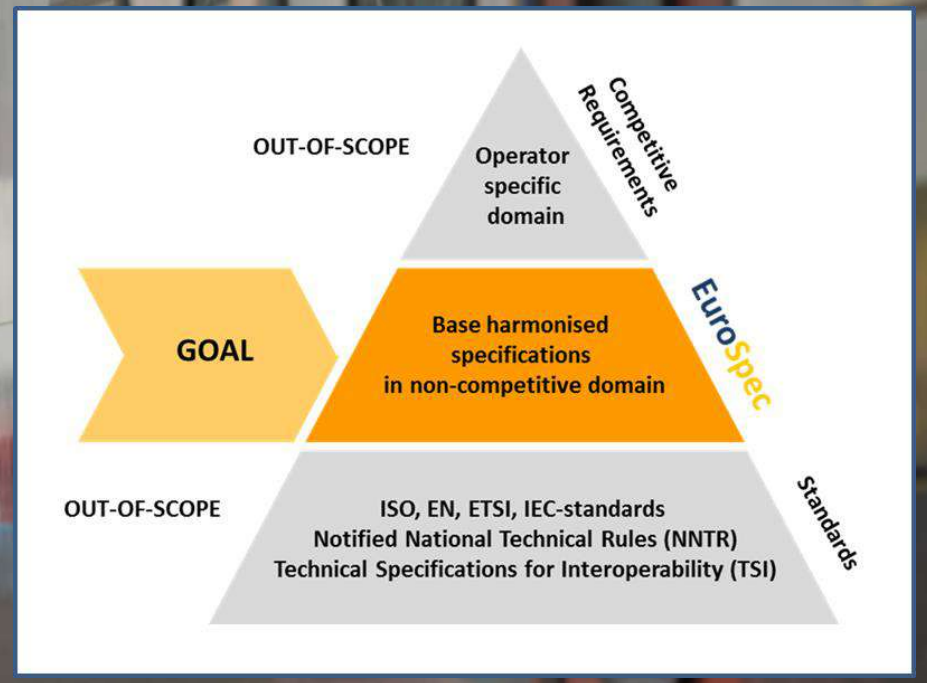
Contents

- Background EuroSpec
- Applied Circularity principles
- The EuroSpec Circularity requirements
- Future outlook



Background EuroSpec

- Started in 2011
- Lean approach and organisation
- Initiative at member level
- Focus on passenger trains and loco's
- In addition to the regulatory framework and without overlap with other initiatives. No duplication
- From user-perspective
- Deliverables are free for everyone
- Manufacturers and suppliers part of reviewing process

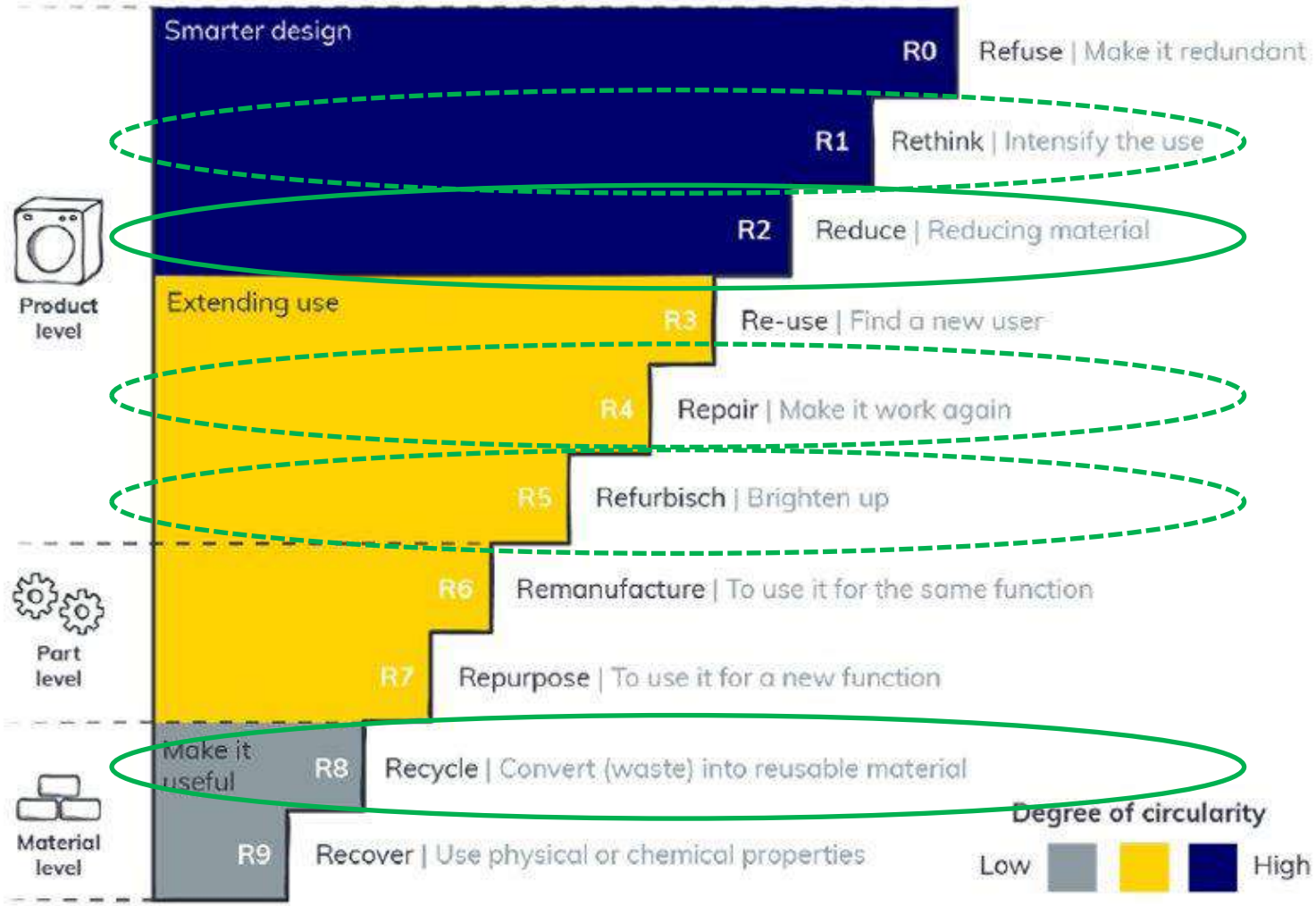


The Members

SNCF · RAIL SAFETY AND STANDARDS BOARD · DB · ÖBB · SBB CFF FFS

Applied Circularity principles

- Circularity requirements focus
- Indirect focus



EuroSpec Circularity- background

- Started March 2021: DB, NS, RSSB/ Porterbrook, SBB, SNCF, **Ready February 2023**
- Railway transport is one of the most **sustainable** means of transport.
- But also a sector with a **high** material resource consumption through the lifecylce
- Ideally: **low** amount of virgin material, and high-end **reuse** or **recycling** at the end.
- Stimulate **circular** material flows and reduce **linear** material flows
- Most influence during the **procurement**
- However, **lack** of standards to specify circular properties, focus mainly on recycling.
- →A **EuroSpec** document can bridge the gap, by providing an integrated approach for specifying circular properties of new rolling stock.

EuroSpec

Project Brief EuroSpec

"Circular material lifecycles for Rolling Stock"

1. Project definition

Railway transport is one of the most sustainable means of transport. However, the rail sector is also a sector with a high material resource consumption, mainly due to the continuous process of replacing obsolete rolling stock and material usage during maintenance. Due to (inter)national climate agreements, resource scarcity, increased legislation and an increasing public favour towards sustainable resource consumption, railway operators are forced to manage their material consumption associated with rolling stock replacement more sustainably. One way to achieve this is by incorporating requirements during procurement, that stimulate circular material flows and reduce linear material flows (take-make-dispose) during the asset lifecycle.

Ideally, circular rolling stock is characterized by a circular design with high amount of circular material inflow (thus low amount of *virgin* material content[1] and high amount of recycled material and rapidly renewable materials) used in new rolling stock construction, a long lifetime and high-end reuse or

EuroSpec Circularity- Background

Benefits:

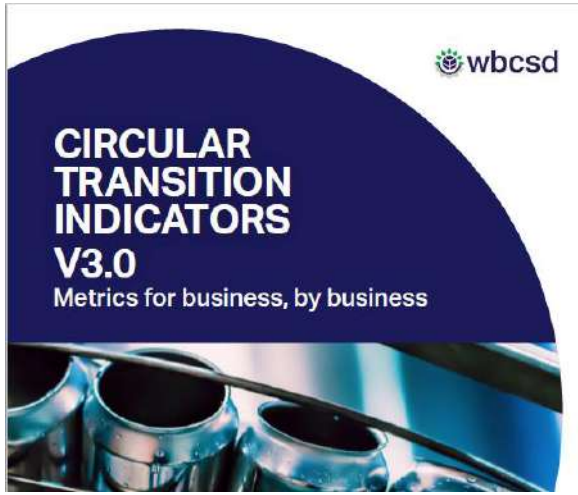
- High-end reuse and recycling →**higher residual value** of the obsolete rolling stock
- Reuse of recycled materials leads to a **reduced emission** of greenhouse gases, decreasing the ecological footprint
- Application of **mono-materials** and **reversible connection** methods, additionally aids maintenance and refurbishment processes
- The decreased use of virgin materials:
  - reduces (indirect) involvement in **social and geopolitical** issues resulting in a higher level of corporate social responsibility.
  - makes the procurement process for rolling stock **more resilient** to international tensions or crises, due to the reduction of geographical dependencies for virgin resources.

EuroSpec Circularity- How

Use as much as possible **existing** definitions and standards:

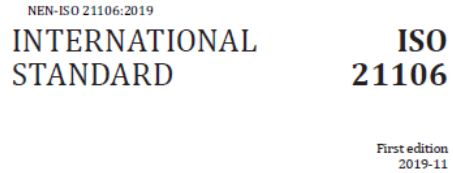
- EuroSpec uses the (slightly adapted) definition for the circular economy as defined by the **World Business Council for Sustainable Development** (WBCSD)

- EuroSpec uses the definitions for **Circular transitions indicators** of the WBCSD as can be found in the report circular transition indicators v3.0. This includes for example definitions for circular inflow, circular outflow, reuse, etc.



EuroSpec Circularity- How

- EuroSpec refers to **existing Standards** like:
  - ISO 21106:2019 Railway Applications – Recyclability and recoverability calculatio method for rolling stock.
  - EN 15380-2:2006 Railway Applications - Designation system for railway vehicles - Part 2: Product groups.
- **Cooperate** with the supplier in the design process. Share mutual experiences
- Include the whole **supply chain**, including sub-suppliers
- The Industry (**Unife**) has reviewed the draft requirements


NEN-ISO 21106:2019

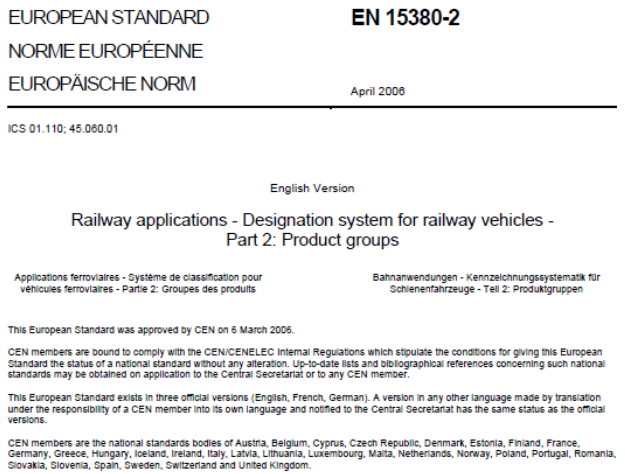
INTERNATIONAL STANDARD

ISO 21106

First edition
2019-11

Railway applications — Recyclability and recoverability calculation method for rolling stock

Applications ferroviaires — Méthode de calcul de recyclabilité et valorisabilité pour matériel roulant


EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 15380-2

April 2006

ICS 01.110; 45.060.01

English Version

Railway applications - Designation system for railway vehicles - Part 2: Product groups

Applications ferroviaires - Système de classification pour véhicules ferroviaires - Partie 2: Groupes des produits

Bahnanwendungen - Kennzeichnungssystematik für Schienenfahrzeuge - Teil 2: Produktgruppen

This European Standard was approved by CEN on 6 March 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EuroSpec Circularity– What?

- Materials passport:
  - the input materials: the mass percentage of recycled content, virgin content and rapidly renewable content;
  - the output materials: the mass percentage of recyclable and non-recyclable content
  - the use of irreversible connections (this includes connections which change material properties or damage materials when reversed, e.g. glue).
  - % circular inflow

							PRODUCT DESIGN (only answer for Tier 1 / Tier 2)			MATERIALS (only answer for Tier 3 / Tier 4)					
Name	MPG-SPG	T1	T2	T3	T4	Mass in kg	Number of products (optional)	Use of irreversible connections	Irreversible Connection Type	Percentage virgin content	Percentage recycled content	Percentage rapidly renewable content	Recyclability Percentage	Biodegradable percentage	Justification why not recyclable
Trainset name						1234567		No							
Vehicle body	B	x				123456		No							
Vehicle underframe	B-B		x			23456		No							
Metals (ferrous metals or non-ferrous metals)				x		23456				65	35	0	100	0	text
Stainless steel					x	12345				65	35	0	100	0	text
…					x	11111				0	0	0	100	0	text
Side walls	B-C		x			205		Yes	Glue/adhesive - irreversible						
Metals (ferrous metals or non-ferrous metals)				x		5				100	0	0	100	0	text
Aluminium					x	5				50	50	0	100	0	text
…				x		200				100	0	0	0	0	text
Vehicle fitting out	C	x				12345		No							

EuroSpec Circularity– What?

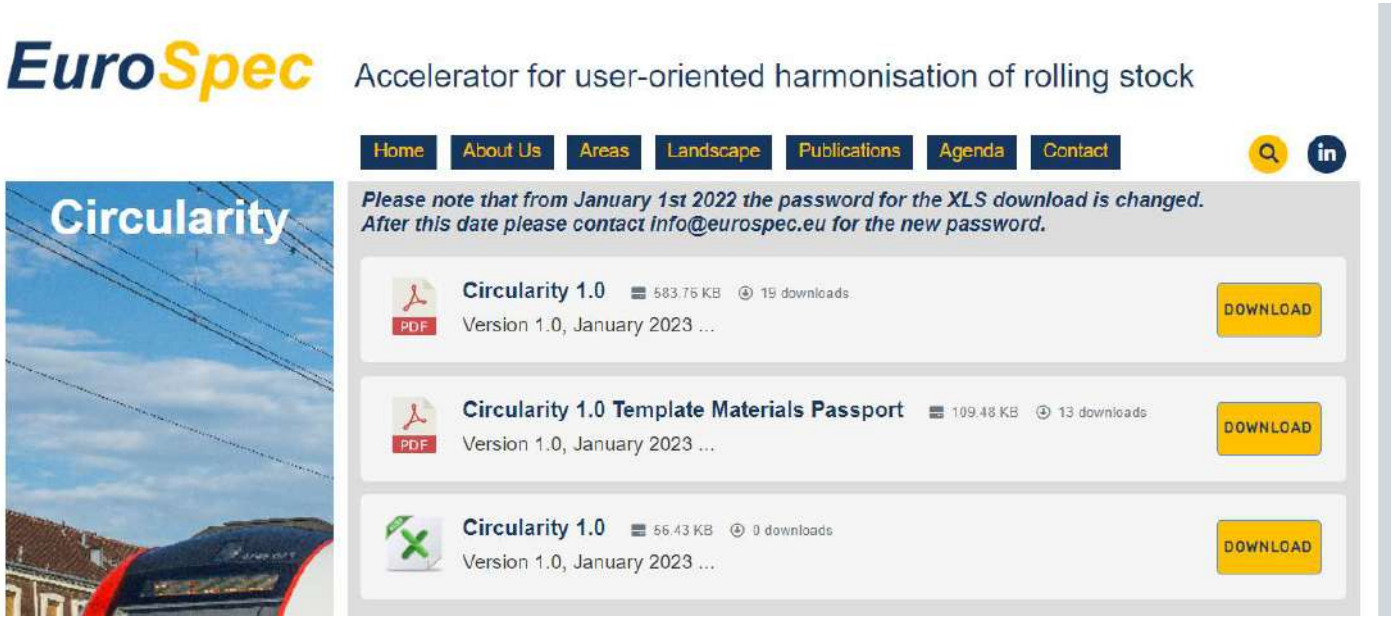
- The Train Set shall have a recyclability rate of at least 95% of the total Train Set mass
- The supplier shall give a justification for the materials which cannot be recycled and why an alternative recyclable material cannot be used.

ID	Requirement classification	Requirement-text	Rationale
CIRC.12	RE	The unit shall have a recyclability rate of at least 95% of the total unit mass by calculating the recyclability rate in accordance with ISO 21106:2019 Railway Applications – Recyclability and recoverability calculation method for rolling stock.	The more parts of the unit that can be recycled, the more circular products can be manufactured. The higher the percentage, the larger the impact on circularity. For the calculation of the recycling percentage, a specific Railway standard is chosen which is known to the Suppliers.
CIRC.13	CH	For the calculation of the recyclablity rate, use can be made of the Material Recovery Factors as given in the Unife UNI-LCA-001 methodology, Annex A OR the supplier can use a source as defined in section 5.3 of the ISO 21106:2019. The latter needs approval from the customer.	The supplier can choose for the standard UNIFE values or use better values if new innovative recycling methods are available. The latter needs approval from the customer.
CIRC.14	RE	The calculation shall be based on the total unit mass, subdivided into the main and subproduct groups and Annex A.1 as defined in EN 15380-2:2006 Railway Applications - Designation system for railway vehicles - Part 2: Product groups;	The systems to be analysed are described by referring to this railway standard which is known to the Suppliers.
CIRC.15	RE	The calculation shall include the recyclable and non-recyclable materials, adding up to the total unit mass.	
CIRC.16	RE	The calculation shall be based on the final product design.	

EuroSpec Circularity – the deliverable

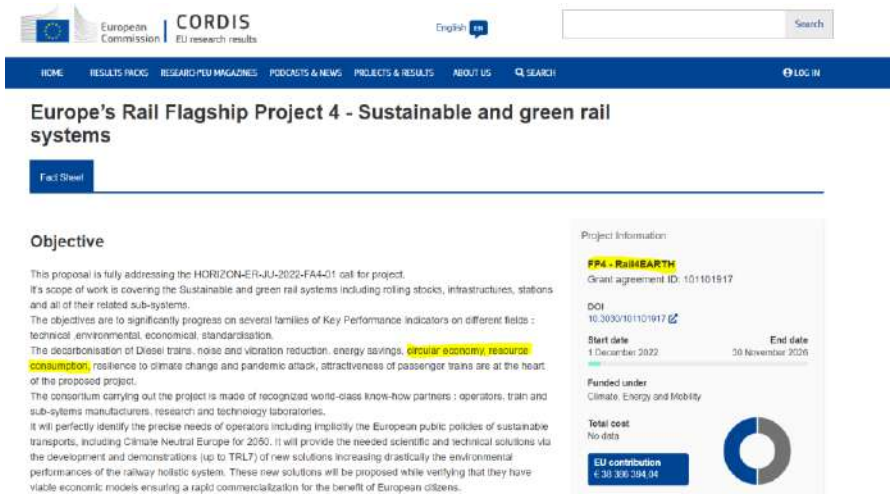
- https://eurospec.eu/circularity/

- Published 6 February 2023



Future outlook

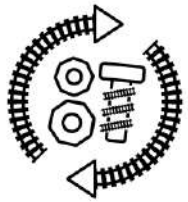
- Use of EuroSpec – Return of Experience
- UIC Circular Economy sector - https://uic.org/sustainability/circular-economy/
- Environmental specifications for new rolling stock - Update of UIC Leaflet 345 (IRS30345)
- Europe's Rail –Rail4Earth Circular Economy & Ecolabels



Questions and discussion

Katy Beardsworth

Circular Economy Strategy Manager,
Network rail



Katy Beardsworth - Circular Economy Strategy Manager

Network Rail

SUR+

1. The Problem
2. The Solution
3. The Successes
4. The Challenges
5. Case Studies
6. The Future

1. The Problem

Business over-orders materials to complete projects without delay, leading to surplus stock

This surplus stock cannot currently be sent back to the supplier and sometimes ends up as waste

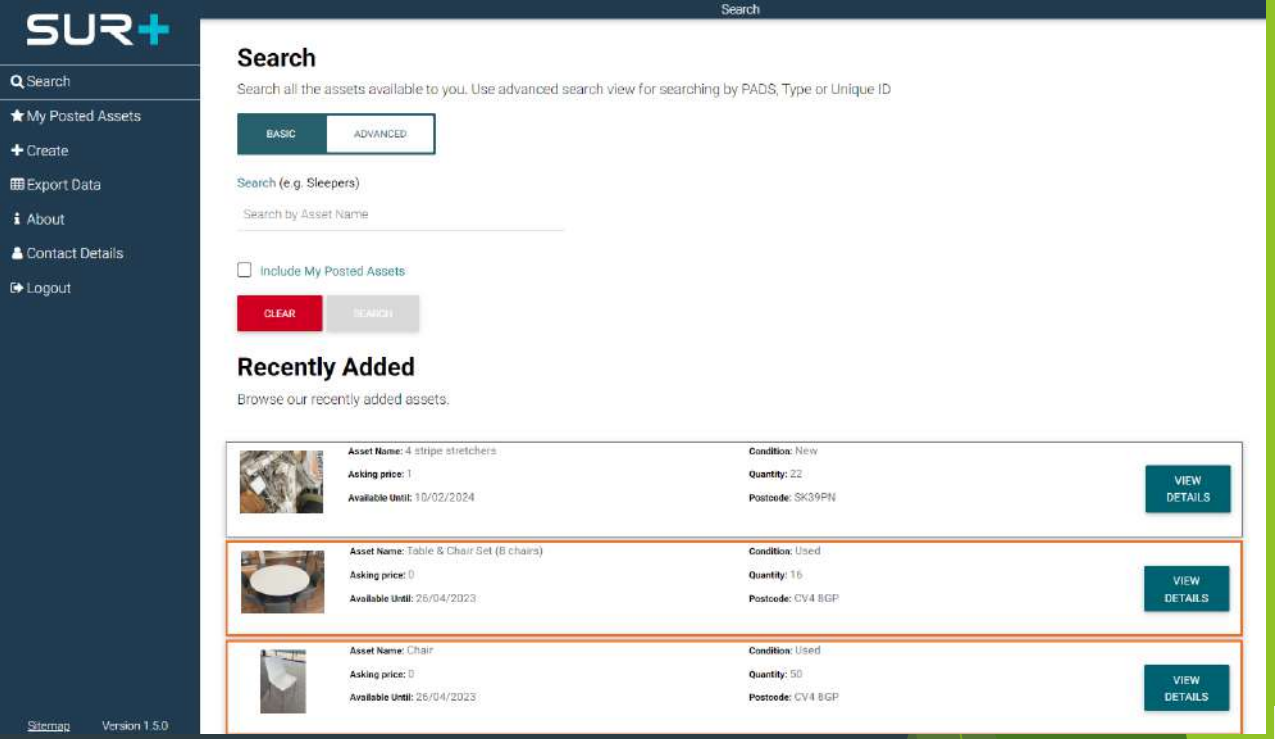
Results in monetary losses, overcrowding at storage sites, and encourages unsustainable practices

Surplus assets unaccounted for, offline and “invisible” to rest of business

The Problem: inefficient asset management process leading to losses of public money and the generation of unnecessary waste and emissions

2. The Solution

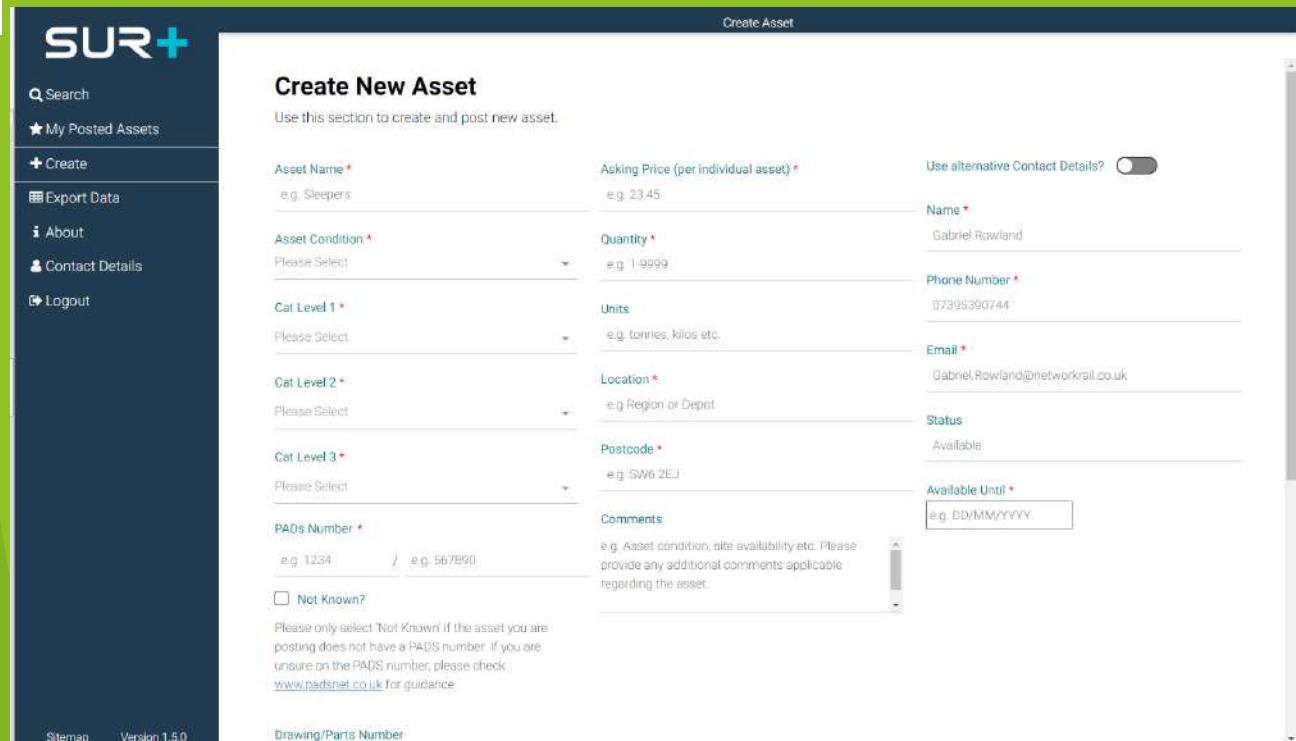
- Surplus – Network Rail's asset exchange platform
- Allows advertisement & exchange of assets nationally across the business
- Way of logging surplus stock, can be searched for, viewed, & ordered for reuse elsewhere in the business
- Centralised digital bank of assets
- Improves visibility of offline assets



NetworkRail

Asset search function to search for, view, and order assets for projects

Create asset function to upload surplus assets



3. The Successes

- Inspires sustainable growth by aiming to repurpose offline stock & generate less waste
- Cost savings to buyer - assets can be bought at a reduced price to avoid & reduce procurement of virgin materials
- Cost savings to seller - eliminates costs arising from waste carrying, processing & landfill tax
- Assets can be obtained quicker than procuring virgin materials
- Network Rail can save **£94.15 per ton** of surplus stock diverted from landfill
- Reduces waste & the extraction of raw materials, supporting goal of zero waste to landfill & reducing carbon emissions

4. The Challenges

- Initially became a dormant site due to lack of training, marketing, staff resource & functionality
- Action: Surplus was relaunched with new updates & improved functionality
- Currently only available for internal use, work being done to open access up to external partners
- Not mandatory to use, an extra job for someone to photograph & upload assets
- Working on engagement & promoting through periodic newsletters

5. Case Studies

A construction manager used Surplus to sell excess signalling equipment after a project finished - £250,000 worth of cable was sold for reuse for £120,000 and £66,000 worth of LED signal heads were sold for £22,000

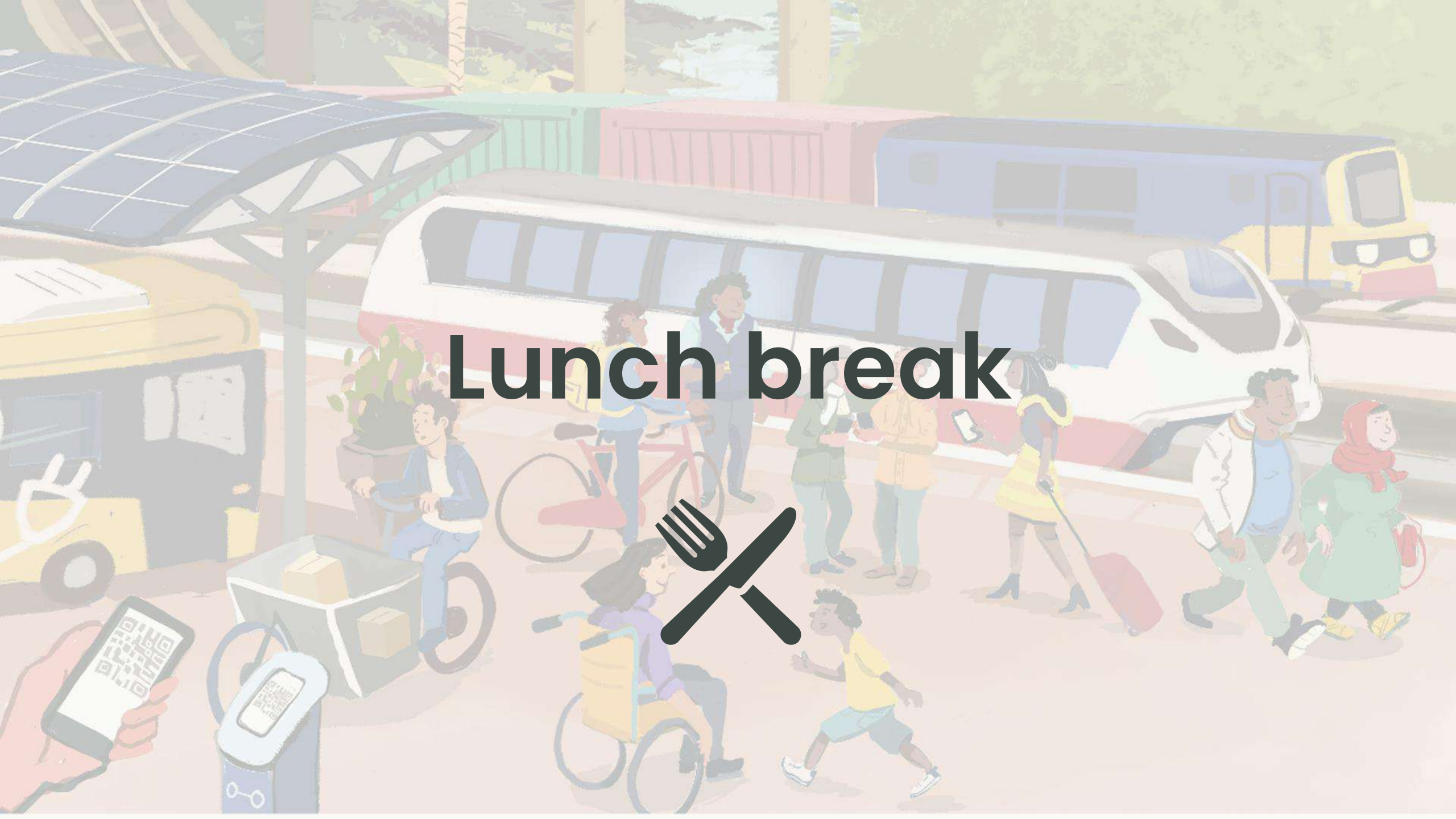
Concrete Troughing - A Liverpool yard was found to have 150 pallets (**value of £90,000** worth of troughing lids). Yard capacity is 500 pallets (**£300,000 worth** of troughing lids). Once the yard is full with 500 pallets, there will be enough to complete an entire 15km track renewal project reusing surplus troughing lids (**£300,000 savings**) and saving 500 tons of concrete troughing going to landfill (**£35,000 savings**).

An assessment of surplus assets stored at 3 regional distribution centres (Warrington/Bristol/Leeds) found assets worth a value of £1,150,477.10

6. The Future

- Continuing app updates to improve engagement, efficiency & functionality
- Releasing periodic newsletters to key stakeholders on Surplus content & updates
- Working on improved communication to the business & boosting engagement & use
- Collaborating with external contractor partner Skanska on allowing them to use Surplus, savings already made and potential to save hundreds of thousands of pounds in the future

Lunch break



Bruno Muller

Director of Strategy and Sustainability

Porterbrook

Zero Waste Rolling Stock

UIC Zero Waste Workshop, February 2023

Porterbrook has been at the heart of the UK rail network for over 25 years and currently owns around a quarter of the national passenger rail fleet.

c.4,000 rail vehicles

>£3bn

Invested in new rolling stock

>£3m

Invested each week in the UK supply chain

Whole life asset management

Porterbrook sustainability strategy overview

Play our part in growing rail's modal share

- Mobilise private investment & green finance
- Asset reliability
- Promote rail and active travel in our business and communities

Minimise our environmental impact

- Invest in green traction
- New build design
- Supply chain sustainability
- Asset upgrades
- Scope 1 & 2 targets
- Biodiversity

Key focus for rolling stock circularity

Prepared for a changing climate

- New rolling stock
- Existing assets
- Site and operations

Develop a high-performing and inclusive workforce to drive change

- Health, safety & wellbeing
- Diversity & inclusion
- Skills & talent

Adopt the highest standards of corporate governance and behaviours

- Operational safety
- Governance structure
- Reporting & benchmarking

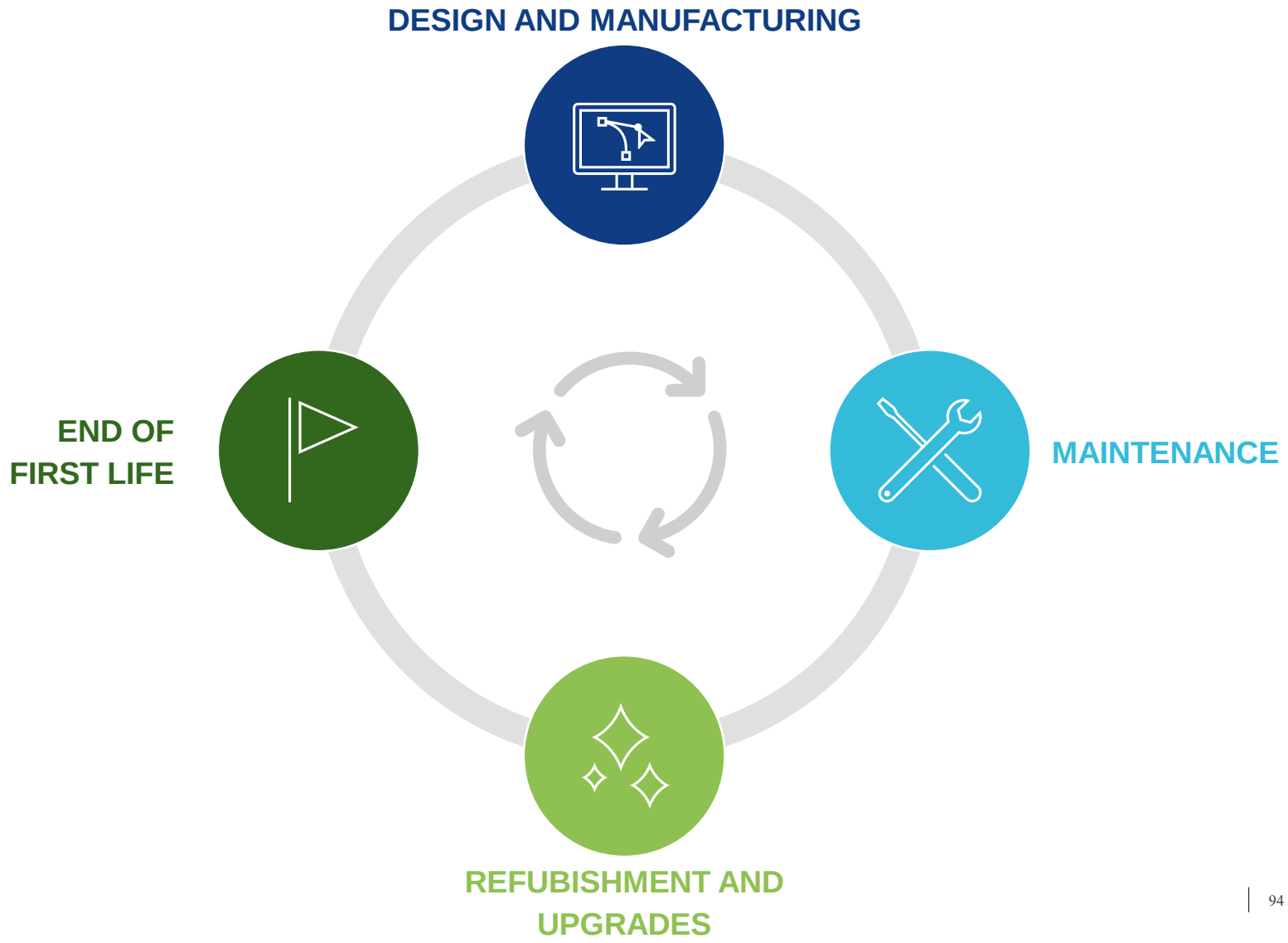
INVESTMENT ASSET MANAGEMENT ORGANISATION

Rolling stock circularity ambitions and touchpoints

The ambition…

0 Waste to landfill by 2025 (government policy)

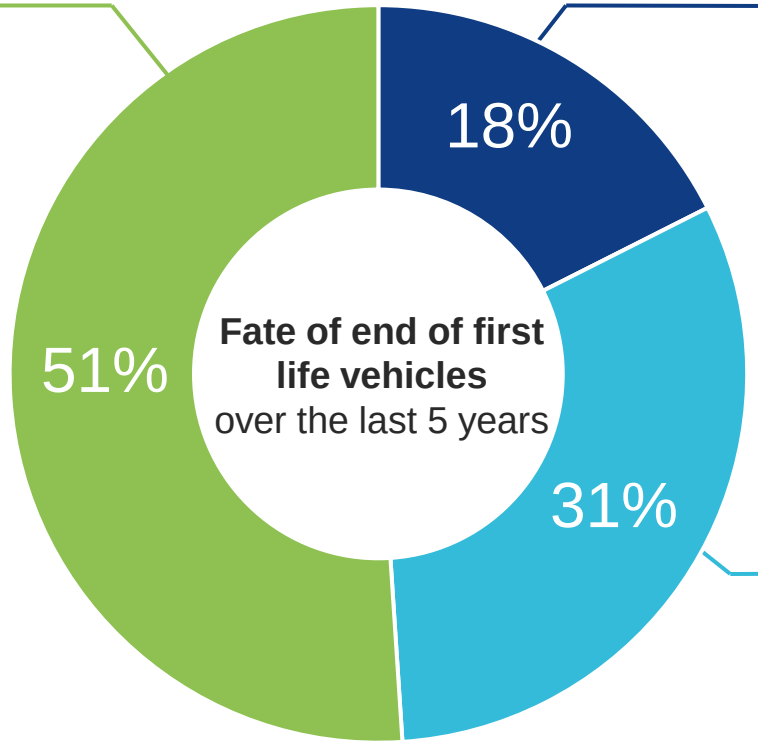
Circular design is incorporated as standard for all assets & projects



End of first life vehicles

SCRAP DISPOSAL

Our current recycling rate for end-of-life vehicles is 91% (2022)



CHARITABLE DONATIONS

To heritage railways, charitable organisations, schools, and emergency services

COMMERCIAL SALE

To our customers, commercial organisations, heritage railways

Reusing our end of first life vehicles

Image Credit: Jason Hynes and the National Railway Museum

Reusing our end of first life vehicles

Background checks

Ensuring our vehicles will be looked after

An initial check on:

- Individuals
- Companies
- Not-for-profit companies, social enterprises, schools etc.

Practical considerations

Ensuring that the potential new owner can make an informed decision

- How will it be used?
- How often will it be used?
- Is the space available appropriate?
- Is there an appropriate path for delivery?

Documentation

Ensuring that Porterbrook is protected

- Owners are not allowed to sell the train for use on the rail network
- Operation documents are retained by Porterbrook and held for 10 years
- Removal of vehicle from R2 (UK wide vehicle database)

Case Study: School donation and delivery, Essex

In 2021, we donated two carriages to Upshire Primary Foundation School in Essex, to become an additional classroom and library. The library space was also offered to the local community for events

Key considerations

Is there an appropriate path for delivery?

- Hauling abnormal loads
- Vehicles turning circles
- Removal of signs and fences

Is the space available appropriate?

- Need for toilets, electricity
- Ground to withhold up to 70 tonnes
- Donation of 16 lorries worth of ballast
- Track donated by Network Rail

Approvals

- Police (abnormal load)
- Local council (removal of signs)
- Neighbours

porterbrook

Thank you.

Heike Kiefer

Co-Head of Center of Competence
CE (CoC CE),
Swiss Federal Railways

Werkstadt Zurich

Sustainable and circular transformation of an industrial area

Heike Kiefer, Co-Head CoC CE, Swiss Railways

28.02.2023

Some hard facts about the industrial area

Site area: 43,000 m2

Gross floor area: 18'450 m2 (short and medium term)

Floor area: 105'000 m2 (long-term)

Open space: 5100 m2

Event hall: 1000 m2

- consists of several historical construction phases along Zurich Hohlstrasse, created in 1905 and enhanced until 1919.
- all the buildings on the site form a compact urban structure with streets and courtyards, uniform materialisation with yellow brick façades.
- manufacturing and industry focussed mainly on the outskirts of cities over the past 100 years. With the shift from an industrial society to an increasingly knowledge-based economy, new needs, conditions and opportunities for inner-city craft and production locations are required.

Principles of the transformation project

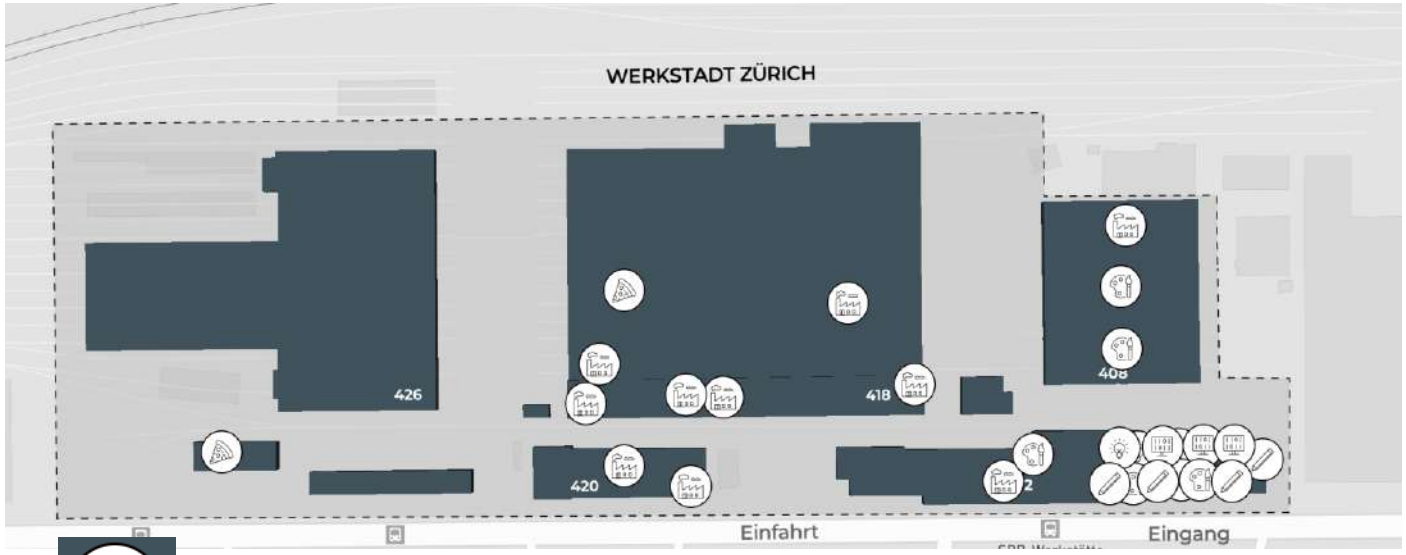
Werkstadt Zurich project

- is establishing itself as a workplace for urban production.
- sees itself as part of the circular economy and stands for sustainable interior development.
- cultivates a respectful approach to the historic building stock.
- is part of the city of Zurich and a meeting place in the neighbourhood.
- transforms itself in dialogue with the users (“Werkstädtler”).

Sustainability strategies of the Werkstadt area: Consistency, efficiency and sufficiency

- The existing buildings and facilities as well as the surroundings are preserved and converted wherever possible. A systemic approach means that the entire life cycle of the buildings and facilities is considered. Materials can be directly reused or recycled in the sense of the circular economy.
- Energy efficiency gains and quality improvements as well as the networking of buildings and uses are ensured by an intelligent distribution system for energy, gas & water (multi-energy grid). Result: lowest possible emissions during construction and operation.
- Specific measures such as tree planting or the preservation of ecologically valuable ruderal areas improve the microclimate and ensure climate-adapted and ecological development.

Future-oriented and sustainable community mix…



- Manufacturing & Urban production
- Art & culture
- Think tanks
- Architecture & Design
- IT & Gaming
- Food & Beverage

…and new attractive area of the neighborhood

CE: Collection map of secondary materials

Sanitary equipments

Catenary masts

Railings

Indoor Lightening

Station lightening «Railbeams»

Catenary masts

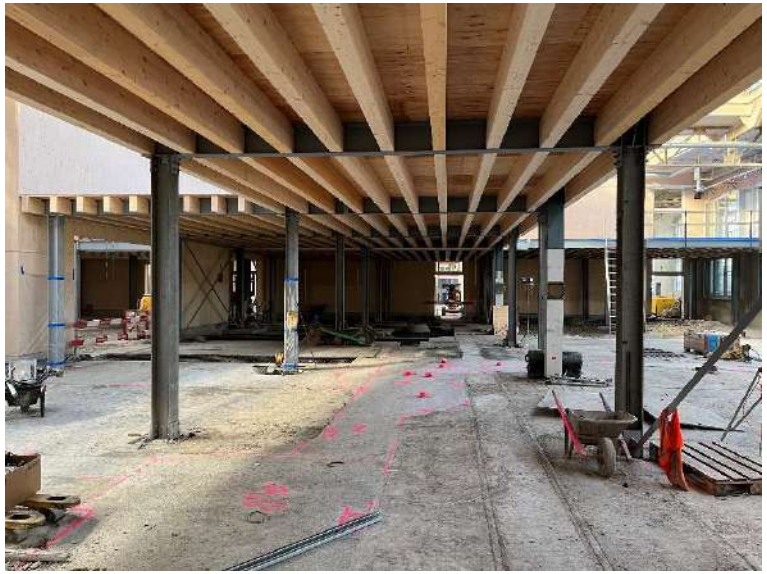
Waste wood as acoustic elements

Crane girder for hanging gallery

Scrap tracks as crash protection

Re-Use Example: Catenary masts

Rail Infrastructure



Second life

Direct Re-Use

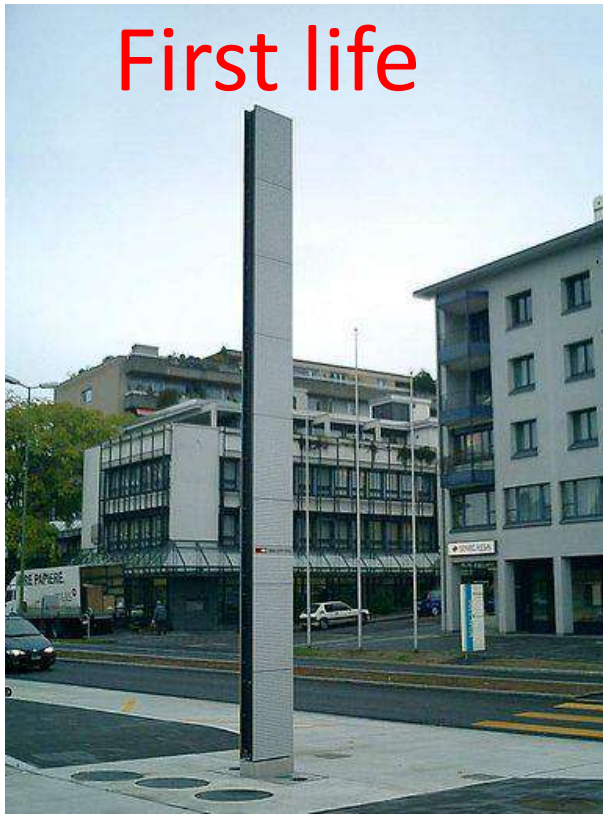
Refurbished, Re-Use

Indirect Re-Use (New):

Ceiling pillar

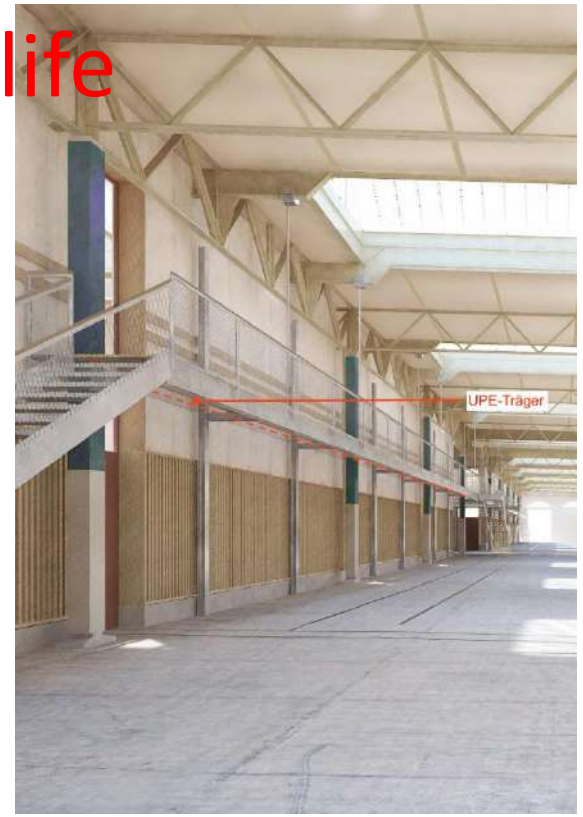
Re-Use Example: Rail Beam

Outdoor Lighting
Train Stations



Railbeam exterior (aluminium) as cladding for the commodity lifts

Railbeam interior (steel bearing structure) for the gallery

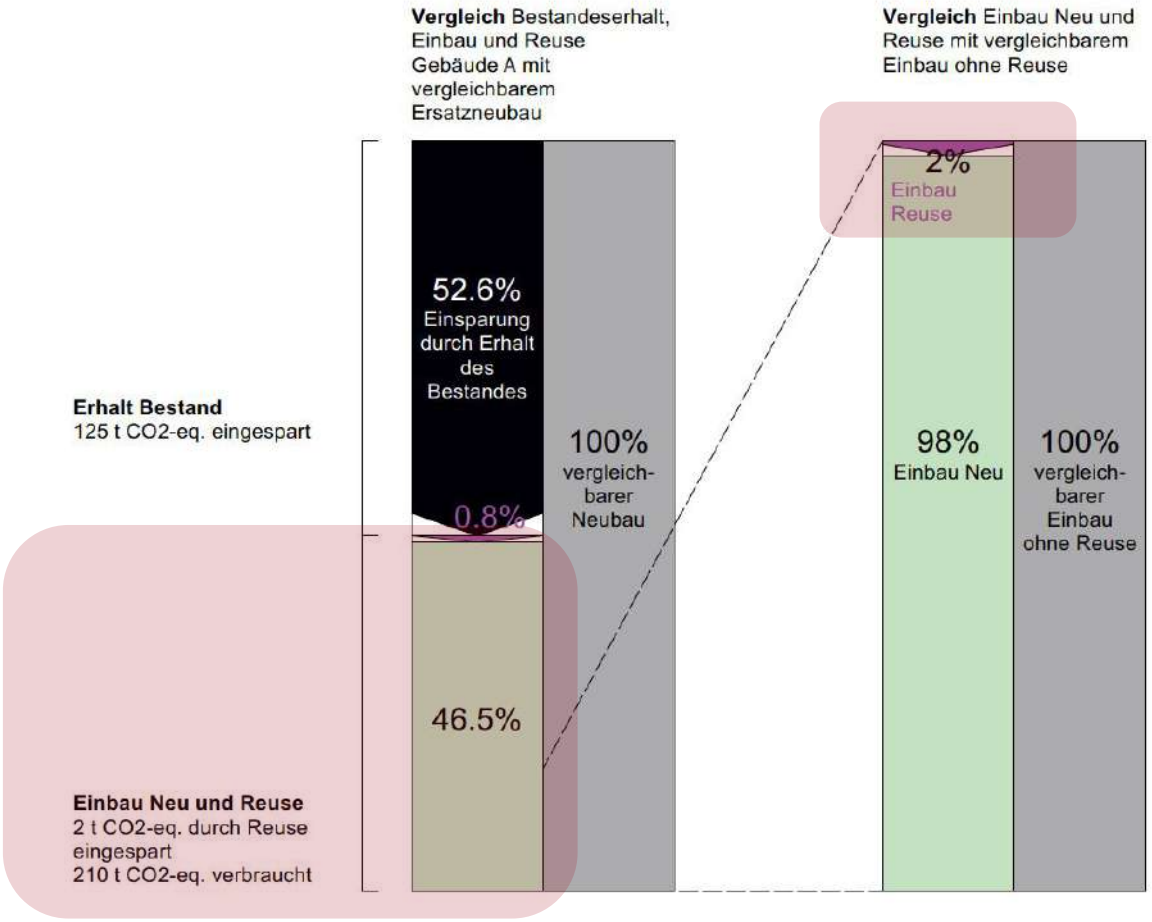


Light as a service - Outdoor lightning
Circular business models for the outdoor lightning

Development and service by third party includes:

- Reinvention of the new technical modules for historic lights
- Lightning service includes only light and luminous intensity
- Service agreement until 2046

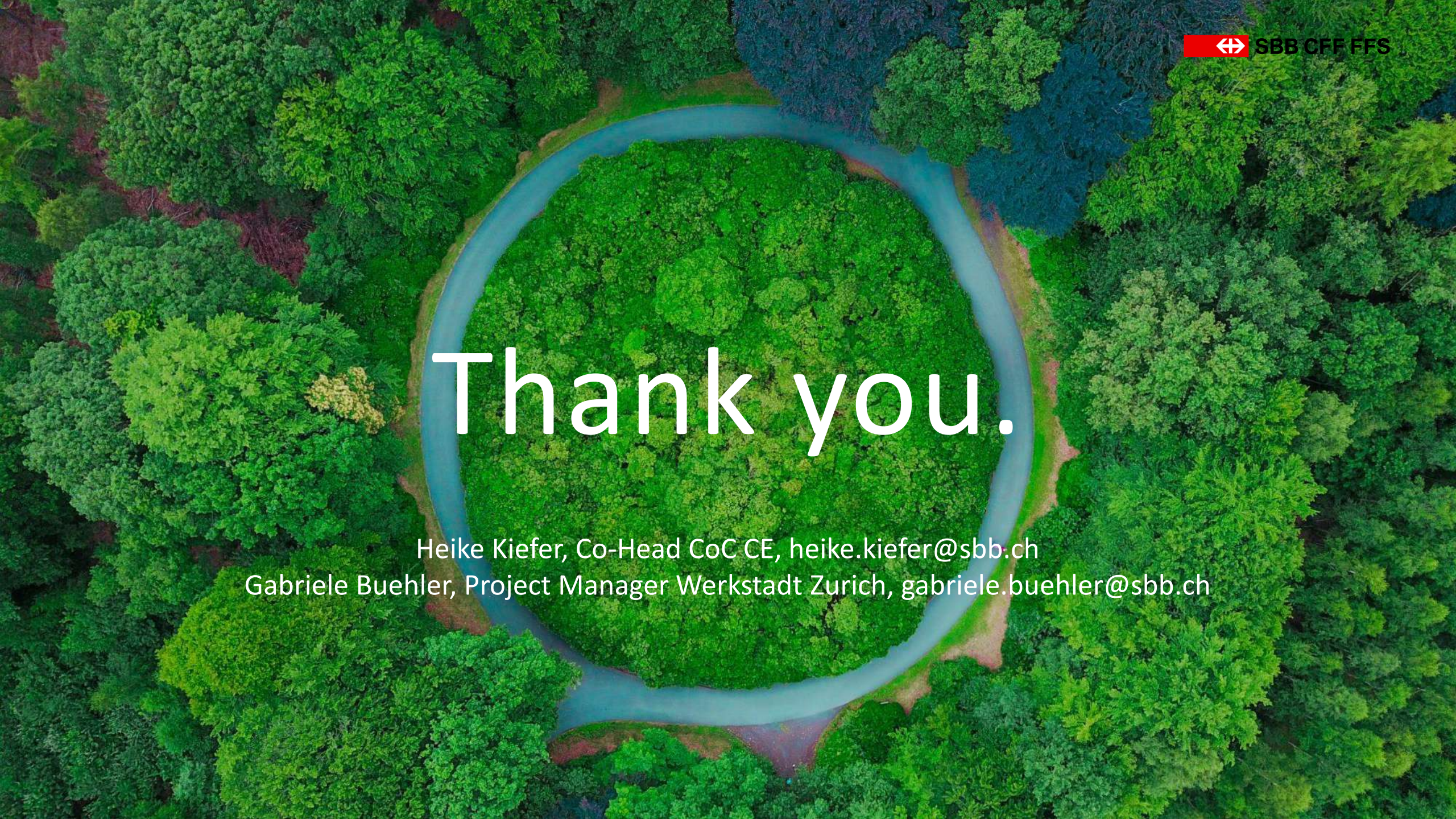
Sustainability and Re-Use:
CO2-eq. Life Asset Building Y (restaurant) as an example



Re-Used parts of the calculation

- Door - Technical room door
- Wooden floor
- Framework ventilation unit - Scaffolding Monobloc (outdoor)
- Wall panel from a school - preservation of historical railing / fall protection / visible
- Wooden partition - separation wall in a toilet

Berechnungsmethode / Datengrundlagen:
Mengenermittlung gemäss Materialpass Madaster und ausgeführten Projektplänen.
Ökobilanzdaten im Baubereich, KBOB / eco-bau / IPB 2009 / 1:2016
Es entfallen die Treibhausgasemissionen von Demontage, Montage und Aufbereitung. Es wird nur der Transport von der Rückbaustelle zum Lager eingerechnet.
Berechnungsmethode anhand von K. Pfäffli, Architekturbüro K.Pfäffli, *Graue Energie und Treibhausgasemissionen von wiederverwendeten Bauteilen*


SBB CFF FFS
Thank you.
Heike Kiefer, Co-Head CoC CE, heike.kiefer@sbb.ch
Gabriele Buehler, Project Manager Werkstadt Zurich, gabriele.buehler@sbb.ch

Camille Rozanes

Alstom

Circular economy at Alstom

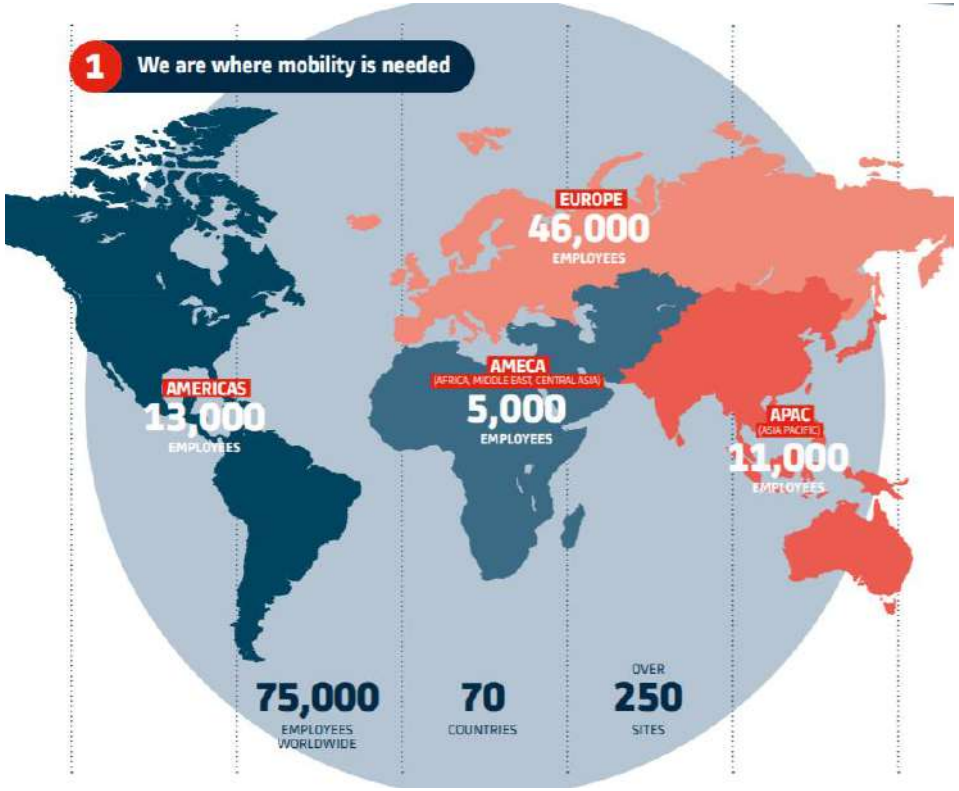
Camille Rozanes

UIC sustainable action week 2023

28/02/2023

ALSTOM
• mobility by nature •

Alstom ambition:
be the leading global innovative player for a sustainable and smart mobility



2 The most complete portfolio of the rail industry

Rolling Stock (incl. Components)

- High Speed
- Regional & Commuter
- Locomotives
- Components
- Metro & Suburban
- Light Rail
- E-bus
- Monorail

Digital & Integrated Systems

- Urban Signalling
- Infrastructure & Telecom
- Signalling & Infrastructure Services
- Mainline Signalling
- Smart Mobility
- Cybersecurity
- Turnkey

Services

- Maintenance & Operations
- Modernisation
- Parts, Repairs & Overhauls
- Digital Services
- Support Services

3 Alstom AiM strategy

GROWTH by offering greater value to our customers

INNOVATION in smarter and greener mobility solutions

EFFICIENCY, powered by digital

Driven by **One Alstom team,** Agile, Inclusive and Responsible

Alstom, creating sustainable value by innovating throughout the life cycle of our solutions

Alstom promotes life cycle thinking and involves its suppliers in order to optimise the environmental footprint of its products and services

Alstom contributes to end of life management through recycling actions to reduce landfill disposal and efficient use of resources in the railway industry

As the life of a train can extend over an average of 30 to 40 years, Alstom offers a range of services that include condition based and predictive maintenance, modernisation and repair, extending the lifespan of the train and systems while improving performance

STRATEGIC PRIORITIES

DESIGN AND SUPPLY

Integrate a circulareconomy approach in the development and supply of our solutions

ACTION PLAN

- Monitoring and reducing resource consumption
- Increasing the use of bio-sourced, recyclable, recycled and renewable materials and promoting ecolabels
- Considering repair and reuse during the design phase

100%
Newly developed solutions ecodesigned by 2025

MAINTAIN AND MODERNISE

Increase components lifetime, promote repair and reuse solutions and develop local repair centres

ACTION PLAN

- Specifying the environmental footprint of maintenance solutions on their lifecycle
- Favouring life extension, repair and reuse approaches
- Creating a second-hand spare parts market for the railway sector

Leader
in green Services

MANAGE WASTE AND RECYCLE

Strengthen waste recycling programmes while developing local businesses, ensure the recycling of critical materials

ACTION PLAN

- Developing and deploying recycling and recovery solutions with our sites
- Participating in recycling channels for critical resources and closed-loop solutions for industry

Onsite recycling rate > 80%
by 2025

Train av. recyclability rate: 92%

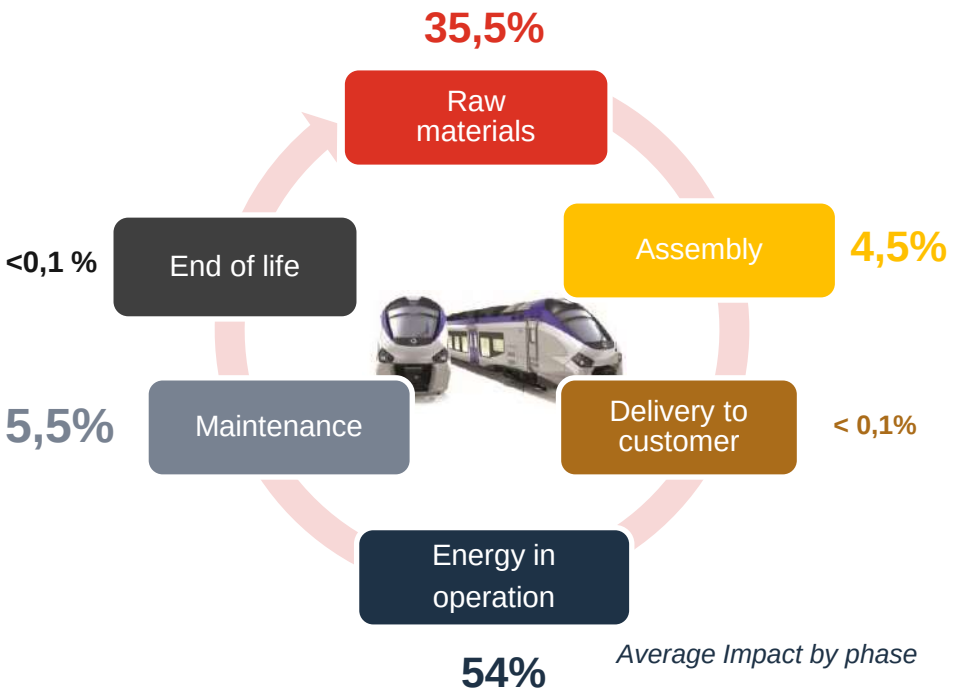
Objectives embedded in Alstom in Motion 2025 stratgegy

Design and supply
Our ecodesign approach

25% energy reduction in solutions

100% of newly developed solutions eco-designed

Regiolis for France – Environmental life cycle analysis

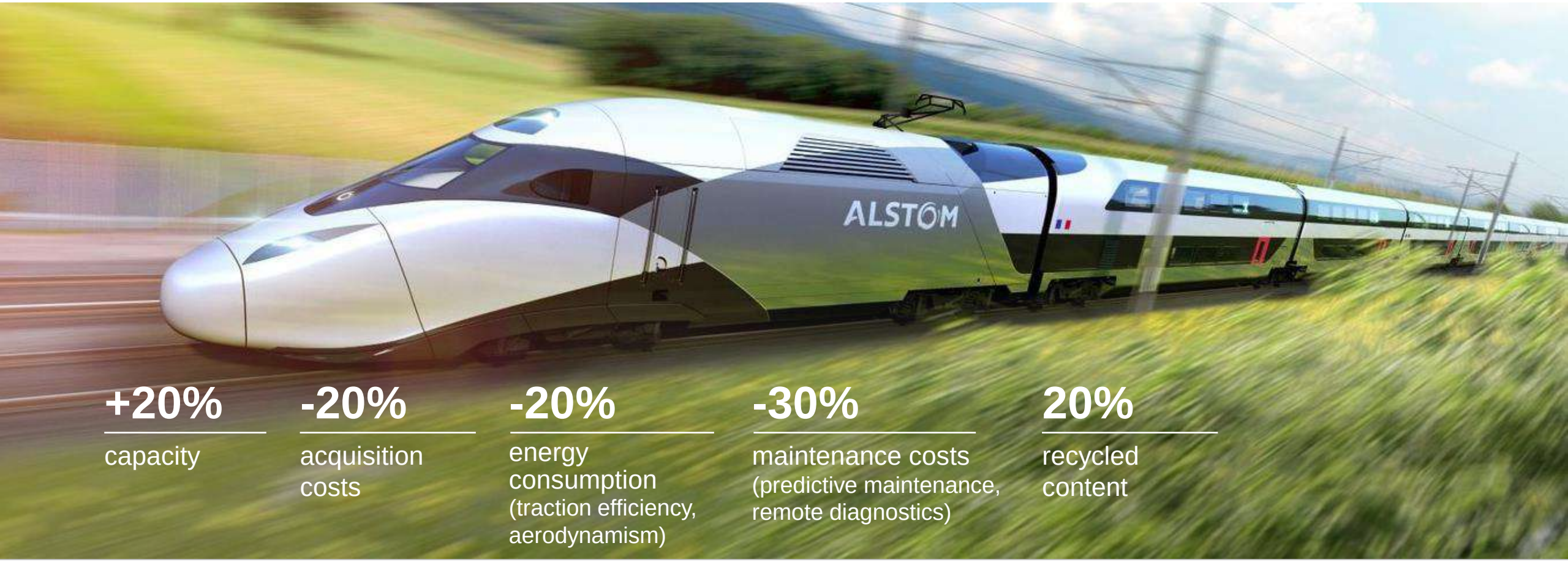


Product life cycle on the example of a Norway metro train
(ratio strongly depends on rolling stock type and energy mix)

Priorities to improve environmental performance & reduce life-cycle costs

In 2021/22: 51% ecodesigned solution and 22% energy reduction

Design and supply
Ex. *Avelia Horizon™ – Main targets*



+20%
capacity

-20%
acquisition costs

-20%
energy consumption
(traction efficiency, aerodynamism)

-30%
maintenance costs
(predictive maintenance, remote diagnostics)

20%
recycled content

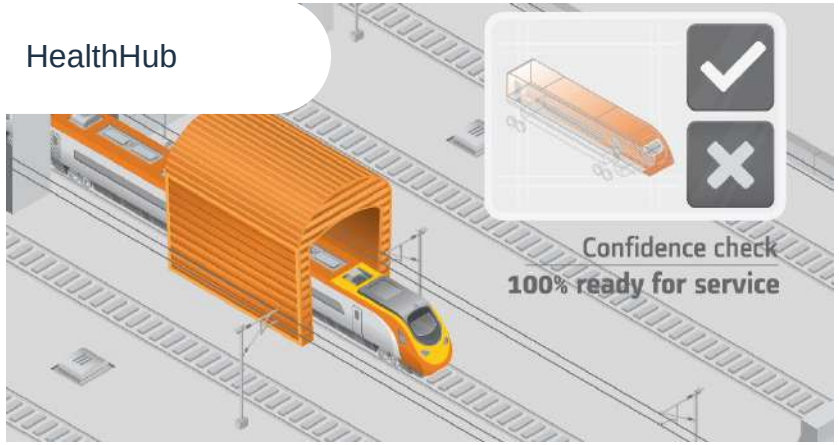
Design and supply
Efficient use of materials & greener materials

-30%
reduction from Purchased Goods by 2030

25 %
recycled content in RS solutions

- **Resources Intensity Reduction :** light design, 3D printing, miniaturisation, dimensioning to needs, predictive maintenance
- **Low impact materials** : natural resources, recycled content, Low hazardous substances content (REACH), eco-label

HealthHub



- Recycled plastic from bottles for floor foam for Trenitalia trains
- Ecolabeled wood panel used for for Sydney Metro floors
- Biosourced oil for flange Lubricant

Collaboration with our suppliers is key

Maintain and modernise
Environmental impact of Services activities is driven by parts management

*On Regional

Up to 36%

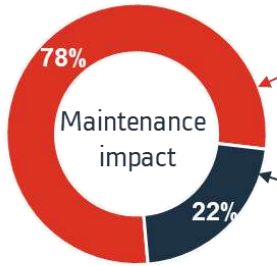
of the train **environmental impact** caused by preventive maintenance

This relative impact **growing** with the **decarbonisation of energy**

Av. 78%

Of **maintenance impact** caused by **Replacement / Overhaul / Repair of Parts**

-> This includes Raw materials, Transport, Installation and End of life



Replacement / overhaul / repair of Parts

Other maintenance activities (visual checks, greasing, cleaning…)

Our levers:

Life extension

Digitalization, obsolescence management, predictive maintenance

Renovation / reparation

Identify repairable parts, 3D printing

Reuse / Resell

Components evaluation for second-hand use STATION ONE

Maintain and modernise
Use of green materials for modernisation

Avanti, UK – Pendolino modernisation

- Largest interior refurbishment project in the UK
- Work alongside Angel Trains, one of Britain's leading train asset management companies

⇒ **5,145 new table-tops** manufactured from **PET form from 100% recycled beverage bottles** (=700,000 bottles)

⇒ 100% biodegradable wool for the new carpets

⇒ Former carets **converted into Solid Recovered Fuels** for the cement industry

- Looking for solutions to reuse and recycling of 25 000 seats in partnership with waste management provider

New tabletops made of recycled materials for Pendolino trains in the UK.

Maintain and modernise
StationOne - marketplace for sustainable parts & repair supply

Unique catalog from rail sector vendors

Discover our Circular Economy section

STATION ONE

Secondhand parts & equipment

- **Secondhand inventory**
- Yellow machines / infrastructure equipment
- **Circular economy** for parts and equipment
- Access stock and extra inventory

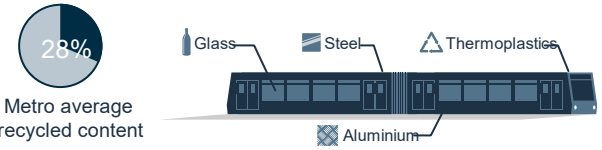
- Engaged with European stakeholders (EU-Rail) and initiatives for **investing in digital platforms for circular economy**

Manage waste and recycle
End of life management

Design for recyclability & recycled content

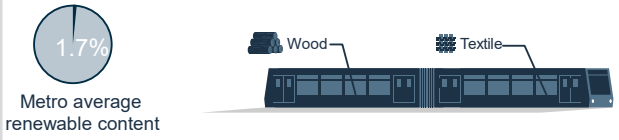
i.e Smart Metropolis

Recycled content

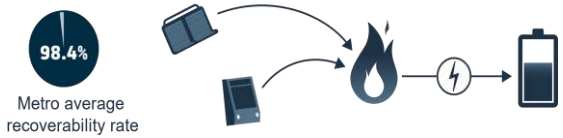


Recyclable material

Renewable content



Recoverable material



⇒ **Dismantling manuals available**
to achieve optimised recyclability / recoverability

Developping re-use & Expanding lifespan

i.e Managing obsolescence

20 Driver Display Units reused from labs & upgrade projects

↓

Other Operator to extend system lifespan & await ETCS modernization 2026.

↓

- 30 % Environmental impact Avoided cost of redesign

⇒ **LABEL RECQ:** “Quality reconditioning” for refurbished electronics

More to come!
Innovations for a circular economy

Employees and Altom alliance suppliers invited to submit their ideas during a five-week Innovation Race

- 900 ideas submitted
- Selection of projects by experts and Presentation at Alstom Innovation kiosk

⇒ **11 projects** integrating the Collaborative Innovation Programme

www.alstom.com

ALSTOM

• mobility by nature •

Shreya Udai Sonar

Circularity Senior Program Manager,
Global Environmental Team

Schneider Electric

Link to presentation

Circularity at Schneider Electric

Life Is On Schneider Electric

Agenda

1	Introduction to Sustainability at Schneider
2	Circularity Metrics & Governance
3	Three examples of successful circularity implementation

Schneider Electric provides energy and automation digital solutions for efficiency and sustainability

Key figures for 2021

5% of revenues devoted to R&D

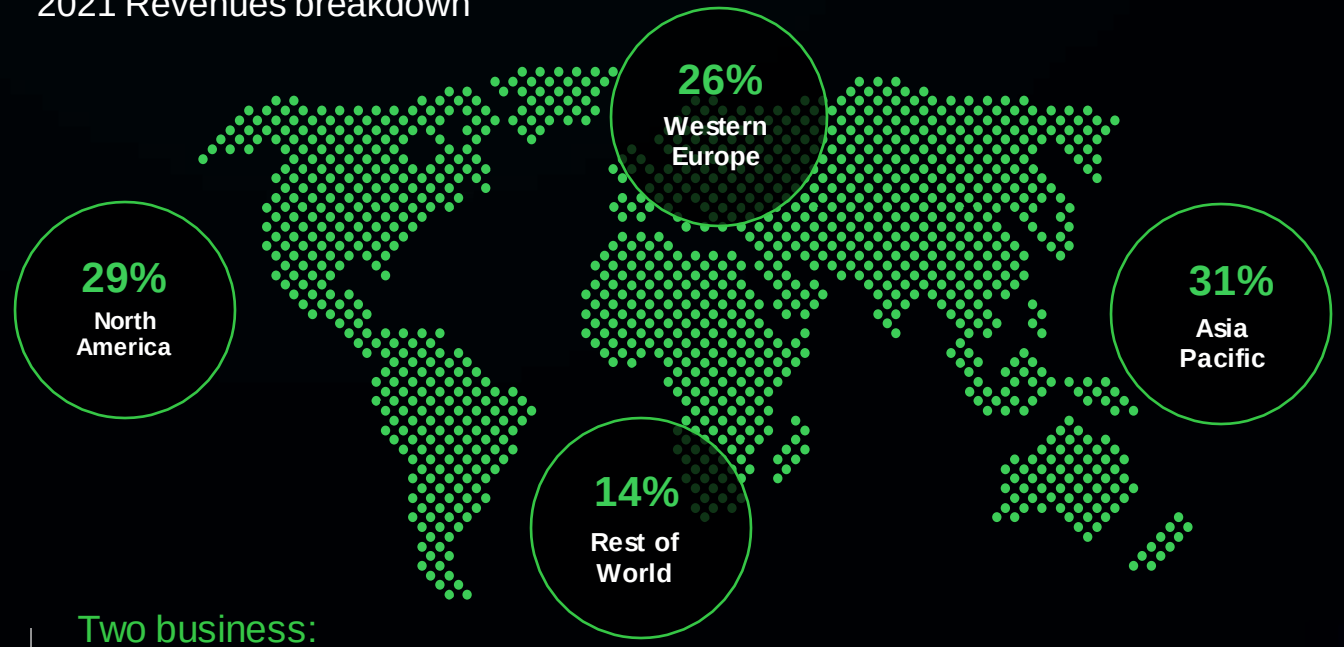
€29billion
2021 revenues

43%
of revenues in new economies

128,000+
Employees in over 100 countries

A well-balanced global presence

2021 Revenues breakdown

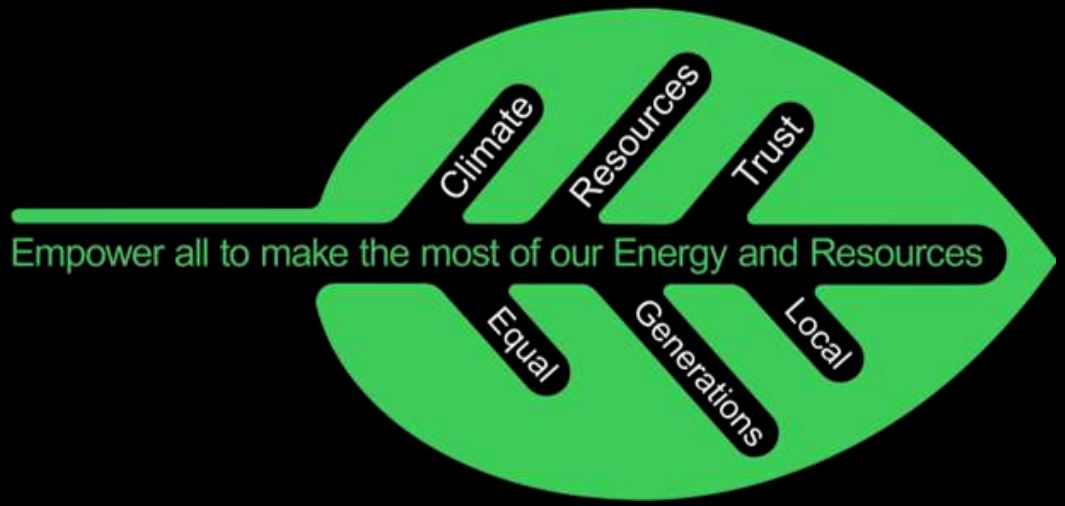


Two business:

Life Is On Schneider Electric

In early 2021, we launched our new ESG strategy

6 Long-term Commitments



5 GLOBAL

Act for a **climate** positive world

Be efficient with **resources**

Live up to our Principles of **Trust**

Create **equal** opportunities

Harness the power of all **generations**

+1 LOCAL

Empower **local** communities

Life Is On | Schneider Electric

Leading ESG by example in our ecosystem

A Global 100 **Most Sustainable Corporation**

12th consecutive year in the list - 7th in 2023

MOODY'S | ESG Solutions

Included in **World** 120 and **Europe** 120 indices

ecovadis

The **top 1%** (among 100,000 companies) **Platinum** medal

CDP

On the **Climate A-list** for 12th year in a row

Dow Jones Sustainability Indices

Powered by the S&P Global CSA

1st in our industry Included in **World** and **Europe** indices

Life Is On | Schneider Electric

Agenda

1	Introduction to Sustainability at Schneider
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We are on our way to meet our 2025 ESG targets

CLIMATE

RESOURCES

TRUST

EQUAL

GENERATIONS

GLOBAL

1. Grow our Impact revenues to 80%[1]
2. Help customers save and avoid 800 million of tonnes of CO_2 emissions
3. Reduce by 50% CO_2 emissions from top 1,000 suppliers' operations
4. Increase to 50% green material content in our products
5. 100% primary and secondary packaging free from single-use plastic and using recycled cardboard
6. 100% strategic suppliers who provide decent work to their employees
7. Level of confidence of our employees to report unethical conduct
8. Increase gender diversity in hiring (50%), front-line management (40%), leadership teams (30%)
9. Provide access to green electricity to 50M people
10. Double hiring opportunities for interns, apprentices and fresh graduates
11. Train 1M people in energy management

2021-2025
SCHNEIDER
SUSTAINABILITY
IMPACT

+ LOCAL

100% Country and Zone Presidents with local commitments that impact their communities

Employees | **Investors** | **Suppliers** | **Customers & partners** | **Local communities & institutions**

1. As per by Schneider Electric definition and methodology

Life Is On | Schneider Electric

2021-2025

SCHNEIDER SUSTAINABILITY ESSENTIALS

CLIMATE

1. **150 Zero-CO_2** sites
2. **100%** substitution with **SF6-Free** medium voltage technologies
3. **90% of electricity** sourced from **renewables**
4. **15% CO_2 efficiency** in **transportation**

RESOURCES

5. **15% energy efficiency** in our sites
6. **80%** of product revenues covered by **Green Premium™**
7. **One-third of corporate vehicle fleet** comprised of **electric vehicles** (100% by 2030)
8. **100% of sites** with local **biodiversity conservation and restoration programs**
9. **200 'Waste-to-Resource'** sites
10. **420,000 metric tons** of avoided **primary resource consumption** through 'take-back at end-of-use' since 2017
11. **100%** of sites in water-stressed areas have a **water conservation** strategy and related action plan

TRUST

12. Deploy a '**Social Excellence**' program through multiple tiers of suppliers (baseline to be defined in 2021)
13. **100%** of employees trained every year on **Cybersecurity and Ethics**
14. **0.38** or below **Medical Incident** rate
15. **Halve** the weight of **safety units recalled**
16. In the **Top 25%** in external ratings for **Cybersecurity** performance
17. **4,000 suppliers** assessed under our '**Vigilance Program**'

EQUAL

18. **<1% pay gap** for both females and males
19. **60% subscription** in our yearly Worldwide Employee Share Ownership Plan **(WESOP)**
20. 100% of employees paid at least a **living wage**
21. **3X** the number of employee-driven development interactions on the **Open Talent Market**

GENERATIONS

22. **>90% of employees** undergo **digital upskilling** through the **Digital Citizenship** program and **digital transformation** training
23. Systematic **career review and development plan** for all employees **ten years before retirement**
24. **75% employee engagement score**

LOCAL

25. **50,000 volunteering days** since 2017

Schneider Electric's Circularity journey: ramping up from 2015 onwards

Schneider Electric joins the **Ellen MacArthur Foundation**

2015

Schneider Electric launches eco-design approach

Schneider Electric wins **The Circulars award** **2019**

#9 in Fortune's Change the World list for Circular Economy

Partnering in **The Circulars Accelerator**

2020-2021

2015 - 2017

Circular Economy KPIs included in our Schneider Sustainability Impact (SSI) dashboard 2015-2017

2018 - 2020

Circular Economy KPIs continue to be included in our SSI 2018 -2020

2021-2025

Circular Economy KPIs in new SSI 2021-2025

Global Circular program scale-up

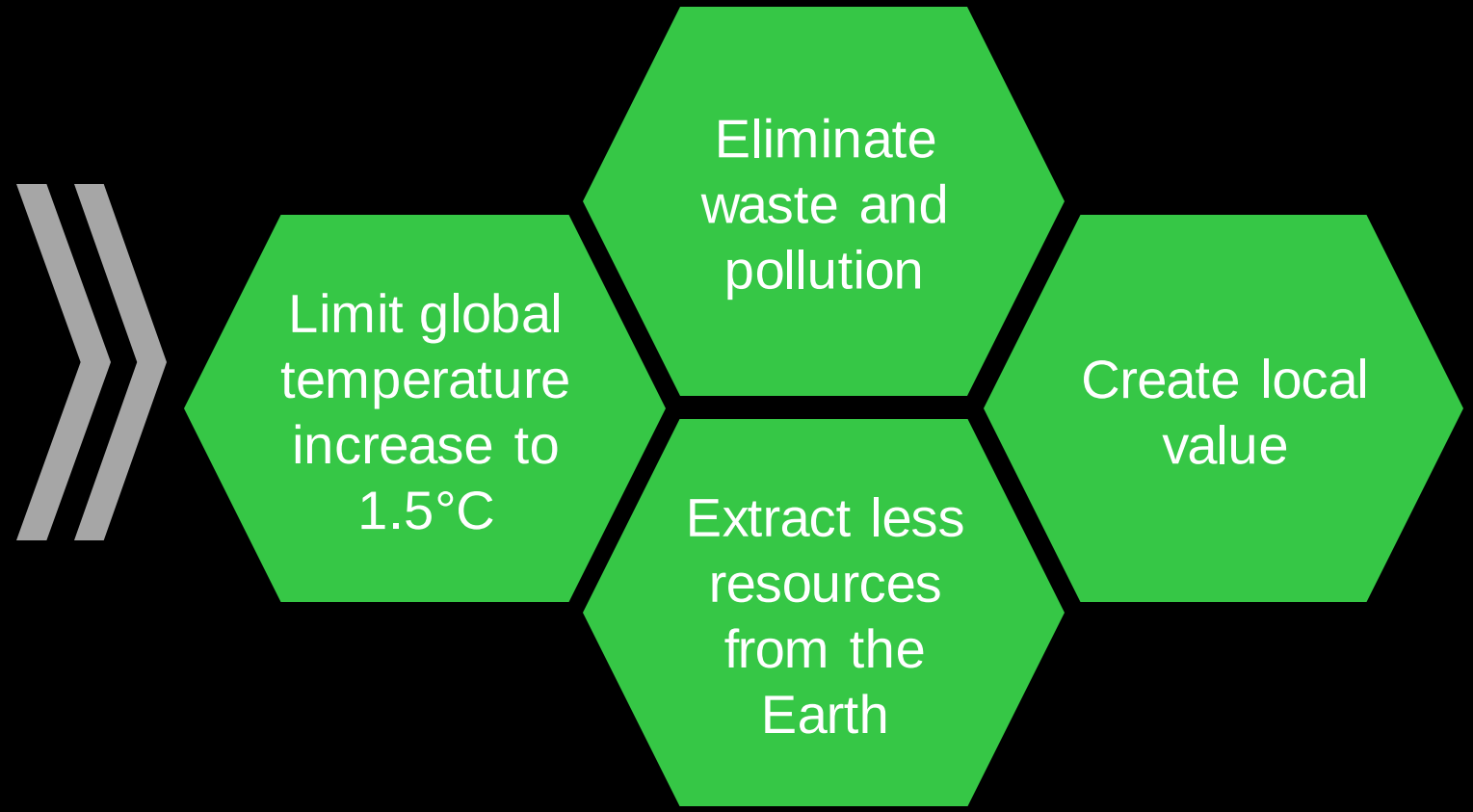
We are here

Circularity as an agnostic sustainability enabler

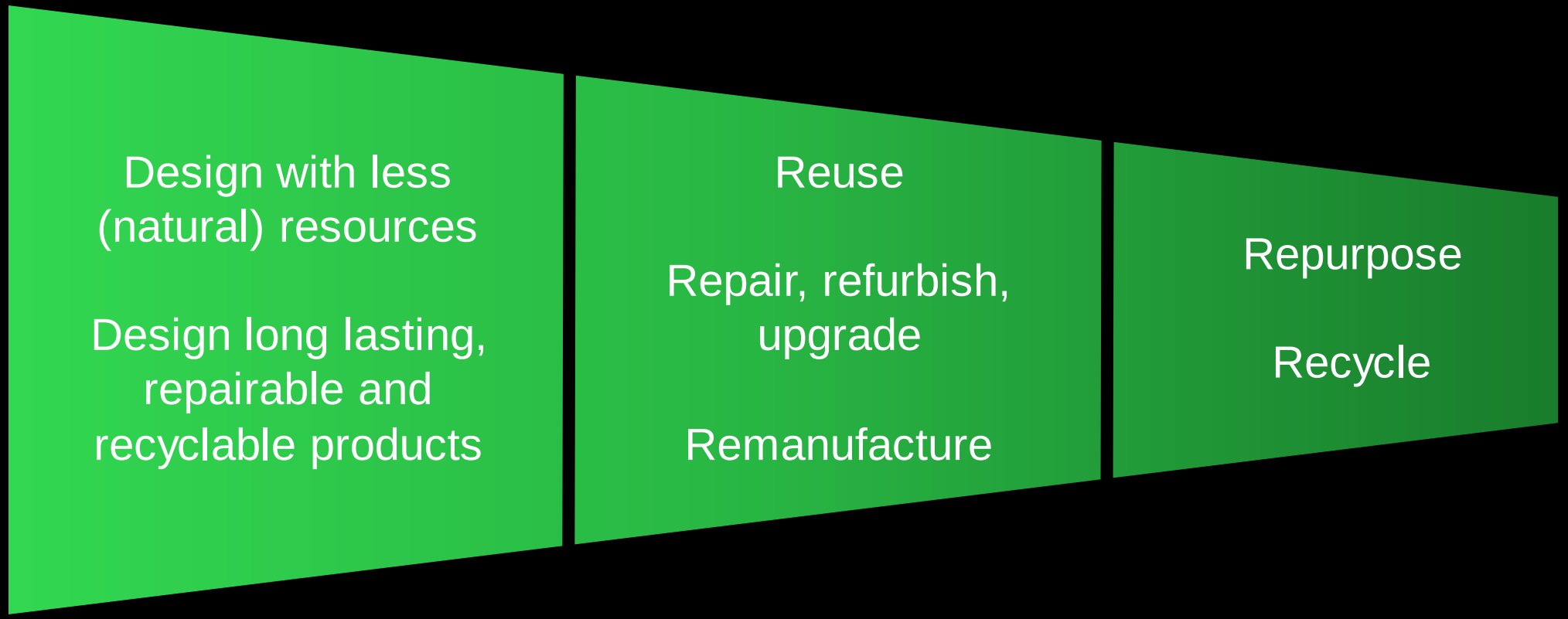
RETAIN VALUE

Use less resources & regenerate

Keep materials & products in use



Work with the ecosystem, prioritize actions and bring value



Agenda

1	Introduction to Sustainability at Schneider
2	Circularity Metrics & Governance
3	Three examples of successful circularity implementation

Ecodesign

Design for reparability & recyclability

Reparability Index

Schneider’s pilot innovation

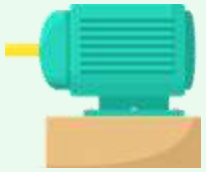
French Repairability Index

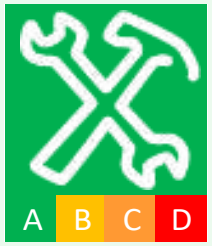
Anti-waste Law

Mandatory for household appliances: B2C

Schneider innovation

Adaptation of repair index: B2B





Making the link between the Repairability index criteria, product design & operations

	Design team	Service team
Cost of repair	• **Reparable on site & by least qualified people**	• Less than 30% of new product • Easy to dismantle
Disassembly	• **Less than 7 steps to dismantle** • **One tool for all / Easy to access** • **Reusable fasteners and connectors**	
Documentation	• **Complete and transparent**	• Available for final customer
Diagnosis and return	• **Digital and intuitive diagnosis**	• Take-back & Return option
Spare Part Supply		• Available more than 8 years after end of commercialization • Available for Final customer

GreenPremium is a journey we started 15 years ago on product sustainabiliy…..

Trust

Minimal use of hazardous substances in, and beyond, compliance with most rigorous regulations (EU & China RoHS, REACh, CA prop 65…).

Transparency

Digital environmental disclosure (PEP)

Circularity Profiles to provide guidance on responsible product **end of life** treatments

Transparent environment attributes (ie: Mercury / Lead / PVC Free / potential recyclability)

Sustainable Packaging

Performance

Lower Impact Materials

Durability

Energy Efficient

Repairability

SF6 Free

Take-back

External Labels

Green Premium™ Sustainable performance, by design

Modernization with EcoFit ™

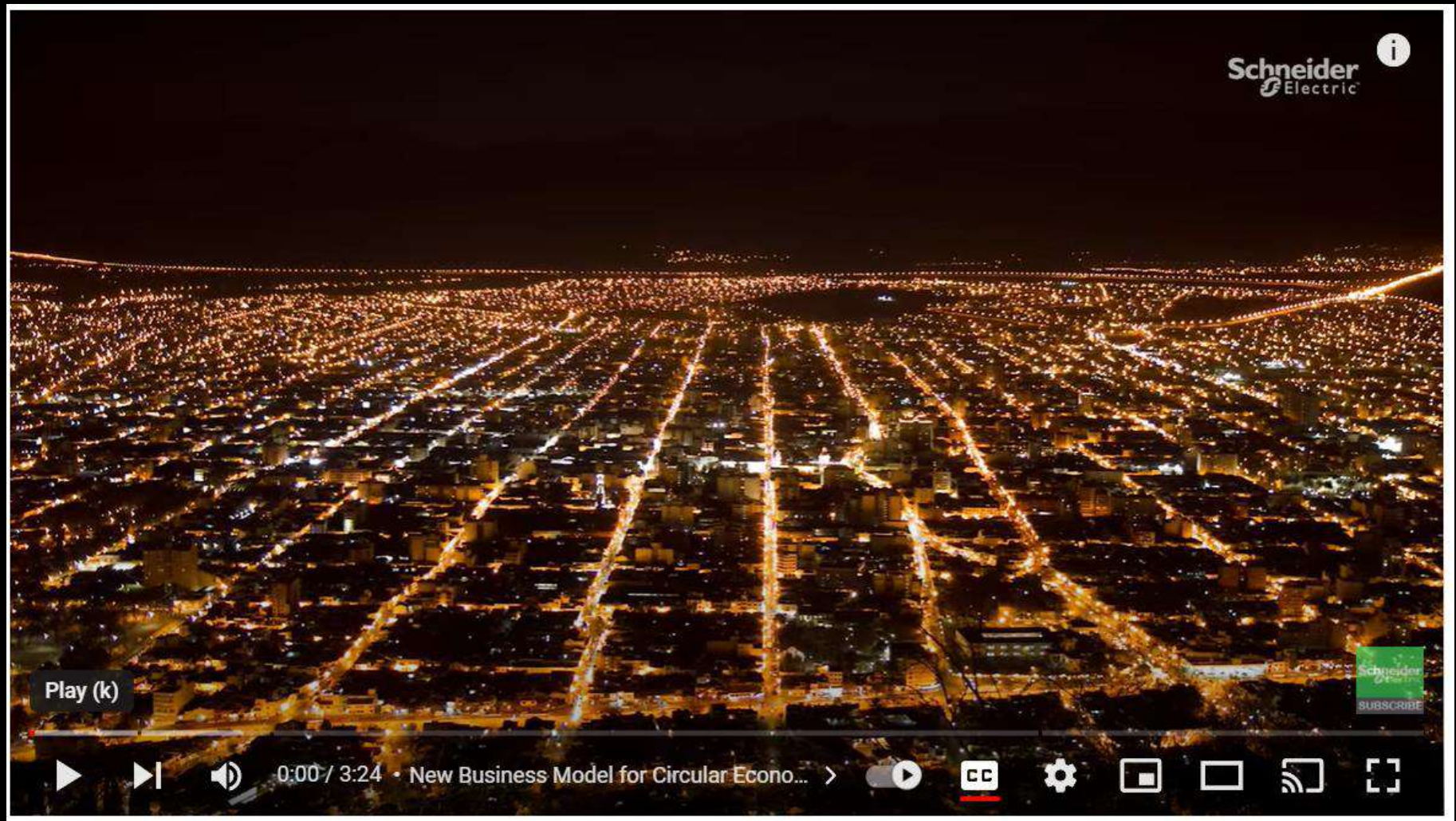
A systems approach to modernization

Life Is On Schneider Electric

Life Is On | Schneider Electric

Remanufacture product take-back

A New Business Model for MasterPact MTZ



New Business Model for Circular Economy MasterPact MTZ | Schneider Electric

Schneider Electric
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Life Is On | Schneider Electric

Modernization overview

Minimum Waste & Maximum Energy Efficiency

LV and MV Switchgear

UPS, batteries, Cooling

Drives

Automation

REFRESH:
Upgrade your existing equipment

REVIVE:
Replace the core components

RENEW:
Replace with new equipment

Run and protect your business with EcoFit.

Supported by our qualified services experts, give new life to your aging equipment with low-carbon footprint solutions. Then connect them to get the latest insights about the health of your installation to accelerate your sustainable and digital journey.

Schneider Electric helps you make the right choice to revitalize your aging systems to balance between controlling the costs to maintain your installations and keep them running at peak performance. It is easy to get reliable and efficient operations with EcoCare exclusive memberships to maintain, optimize and unlock the longevity of your electrical and power automation system.

EcoFit™
Life Extension

Essential

Unleash the power of connectivity with smart sensors, sub-assemblies and software updates. Upgrade your non-communicating equipment into connected assets to monitor and capture information on the health of your installation. Repair and fix your equipment to extend his life

Advanced

Preserve your legacy investment and extend the lifespan of your equipment to help you reduce your CO2 footprint. Retrofit the core components of your equipment with the latest, environmentally-friendly technology to help ensure your equipment keeps running like new while complying with new standards.

EcoFit™
Replacement

Maintain your business continuity with the latest efficient and sustainable innovations.

Replace your aging installation with new green and natively-connected assets ready to begin a long, high-performance service life.

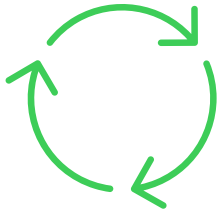
Life Is On | Schneider Electric

Modernization with native connectivity

Refurbish existing assets

Add new features, refurbish your equipment before complete end of life.

Only feeder shutdown, no cable, cubicle or civil work modification.



Refresh may be performed and spread along the time thanks to refurbishment campaign.

Upgrade with last IoT technology to improve reliability and open the door to condition-based maintenance and predictability.

Extend life and maximize uptime

Monitor your electrical assets thanks to Asset Connect

Upgrade with last IoT technology to improve reliability and leverage condition-based maintenance and predictability.

Get real-time situational awareness of your entire power system and receive actionable business intelligence reporting.

Business continuity is equally important. Outages reduce profitability and can threaten your resiliency.

Continuous monitoring of overheating and other events, as a fire risk reduction strategy.

Receive expert recommendations and tools to optimize the performance of your critical equipment.

Life Is On Schneider Electric

Circular Offer: Minimum waste, Maximizing re-use

Compliant with evolving industry standards and legislation

TAKE BACK
We collect your all your equipment, not limited to Schneider Electric brand

8,000
tons of batteries collected globally for recycling in 2020.

REFURBISHED
Circular Certified Offer for maximizing re-use of assets

Schneider Electric
Circular Certified

RECYCLE
& Recover

SF_6 Recovery
Transport, recycling or destruction certificate for traceability

Coffee break

Addressing the impacts with the circular business canvas

Brieuc Saffré, CEO

Circulab

Brieuc Saffré

CEO

Circulab

Wrap up and key takeaways

thanks for Watching!

#UICSustainabilityActionWeek #MoreTrains
#circulareconomy #zerowasterailways