Zero Waste Railways II – Circular outflows
Welcome Message

Katy Beardsworth, Network Rail
Chair of the UIC Circular Economy Sector
## The agenda today

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30</td>
<td>Registration and welcome coffee</td>
<td></td>
</tr>
</tbody>
</table>
| 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                                                          | 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 |
| 13:00 |                                                                      |         |
| 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 | 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
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.

1. MANUFACTURE
   - Steel (NF EN 13 674-1)
     - Different types of lengths (18m to 432m)
2. FIRST USE
   - 155 000 tons used in 2022
     - Or 2 800 km of rail
     - 75% of inflows use recycled rail to create new rail
3. REMOVED & COLLECTED
   - 155 000 tons collected in 2022
     - Or 2 800 km of rail
     - 100% of the outflows traced
4. REUSE
   - 5 700 tons reused in 2022
     - Or 95 km of rail
     - 86% of the reused rail originated from our industrialised process of the reuse of high velocity rail
     - 14% from the reuse of rail from one worksite to the other
5. RECYCLING
   - 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

86% of the reused rail originated from our industrialised process of the reuse of high velocity rail
14% from the reuse of rail from one worksite to the other
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 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$_2$e SAVED

By the transition from foundry to electric steel plant
SNCF RÉSEAU
ACTOR OF THE CIRCULAR ECONOMY
CONTACTS

Bénédicte GOURMANDIN
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
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)
Dit bureaublad was eerst een treinplafond van NS
Strategiecommunicatie
www.ns.nl/upcycle
Last 1%
Gezocht: creatieve ondernemers die de oude stoelzittingen van NS treinen een hoogwaardig én grootschalig tweede leven kunnen geven.

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.
NEXT STEPS: smarter design (R0-R1-R2)
Thank you...
Pieter Schreuder
BSc, Civil Engineering
Researcher, Windesheim University of Applied Sciences
Zwolle, The Netherlands
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 CO₂-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
Structural calculations on products with re-used EoL composite

Long-term properties, weathering and simulation

EN 1990
Structural safety, serviceability and durability

EN 1991
Actions on structures

EN re-used composite
Design en detailing

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
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
**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!

独立测试机构
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
Thank you for your attention!
Coffee break
Martijn Wolf
Consultant, Ricardo Rail Netherlands
Advisor for the Dutch Railway Operator NS on environmental topics
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
- OBB
- 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 lifecycle.

- 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.

- \(\rightarrow\) **A EuroSpec** document can bridge the gap, by providing an integrated approach for specifying circular properties of new rolling stock.

**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 international climate agreements, resource scarcity, increased legislation and an increasing public flavour towards sustainable resource consumption, railway operations 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) and high amount of recycled material and rapidly renewlable materials used in new rolling stock construction. A longer lifetime and faultless 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:
- **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
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

<table>
<thead>
<tr>
<th>Name</th>
<th>MPG-SPG</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>Mass in kg</th>
<th>Number of products (optional)</th>
<th>Use of irreversible connections</th>
<th>Irreversible Connection Type</th>
<th>Percentage virgin content</th>
<th>Percentage recycled content</th>
<th>Percentage rapidly renewable content</th>
<th>Recyclability</th>
<th>Biodegradable percentage</th>
<th>Justification why not recyclable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailer body</td>
<td>B</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>123456</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle underframe</td>
<td>B-B</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>23456</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal (ferrous metals or non-ferrous metals)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>23456</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainless steel</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>111111</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side walls</td>
<td>B-C</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>205</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal (ferrous metals or non-ferrous metals)</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminium</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle floor and roof</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>ID</th>
<th>Requirement classification</th>
<th>Requirement-text</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIRC.12</td>
<td>RE</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>CIRC.13</td>
<td>CH</td>
<td>For the calculation of the recyclability rate, use can be made of the Material Recovery Factors as given in the Unife R 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.</td>
<td>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.</td>
</tr>
<tr>
<td>CIRC.14</td>
<td>RE</td>
<td>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 15398:2-2:2008 Railway Applications – Designation system for railway vehicles - Part 2: Product groups;</td>
<td>The systems to be analysed are described by referring to this railway standard which is known to the Suppliers.</td>
</tr>
<tr>
<td>CIRC.15</td>
<td>RE</td>
<td>The calculation shall include the recyclable and non-recyclable materials, adding up to the total unit mass.</td>
<td></td>
</tr>
<tr>
<td>CIRC.16</td>
<td>RE</td>
<td>The calculation shall be based on the final product design.</td>
<td></td>
</tr>
</tbody>
</table>
EuroSpec Circularity – the deliverable

- [https://eurospec.eu/circularity/](https://eurospec.eu/circularity/)

- Published 6 February 2023
Future outlook

- Use of EuroSpec – Return of Experience
- 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
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
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

Invested in new rolling stock

Invested each week in the UK supply chain

Whole life asset management
Porterbrook sustainability strategy overview

<table>
<thead>
<tr>
<th>Play our part in growing rail’s modal share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilise private investment &amp; green finance</td>
</tr>
<tr>
<td>Asset reliability</td>
</tr>
<tr>
<td>Promote rail and active travel in our business and communities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minimise our environmental impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invest in green traction</td>
</tr>
<tr>
<td>New build design</td>
</tr>
<tr>
<td>Supply chain sustainability</td>
</tr>
<tr>
<td>Asset upgrades</td>
</tr>
<tr>
<td>Scope 1 &amp; 2 targets</td>
</tr>
<tr>
<td>Biodiversity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prepared for a changing climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>New rolling stock</td>
</tr>
<tr>
<td>Existing assets</td>
</tr>
<tr>
<td>Site and operations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Develop a high-performing and inclusive workforce to drive change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health, safety &amp; wellbeing</td>
</tr>
<tr>
<td>Diversity &amp; inclusion</td>
</tr>
<tr>
<td>Skills &amp; talent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adopt the highest standards of corporate governance and behaviours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational safety</td>
</tr>
<tr>
<td>Governance structure</td>
</tr>
<tr>
<td>Reporting &amp; benchmarking</td>
</tr>
</tbody>
</table>

Key focus for rolling stock circularity
Rolling stock circularity ambitions and touchpoints

The ambition...

Waste to landfill by 2025 (government policy)

Circular design is incorporated as standard for all assets & projects
End of first life vehicles

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

Fate of end of first life vehicles over the last 5 years

- 51% SCRAP DISPOSAL
- 18% CHARITABLE DONATIONS
- 31% COMMERCIAL SALE

- SCRAP DISPOSAL
  - To our customers, commercial organisations, heritage railways

- 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
Reusing our end of first life vehicles

Ensuring our vehicles will be looked after
An initial check on:
- Individuals
- Companies
- Not-for-profit companies, social enterprises, schools etc.

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?

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)
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
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 (“Werkstädter”).
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
- Railings
- Indoor Lightening
- Scrap tracks as crash protection
- Crane girder for hanging gallery
- Waste wood as acoustic elements
- Station lightening «Railbeams»
- Catenary masts
- Railbeams
- Catenary masts
- Scrap tracks as crash protection
Re-Use Example: Catenary masts

Rail Infrastructure

First life

Second life

Direct Re-Use

Refurbished, Re-Use

Indirect Re-Use (New):
Ceiling pillar
Re-Use Example: Rail Beam

Outdoor Lighting
Train Stations

First life

Railbeam exterior
(aluminium) as cladding for
the commodity lifts

Second life

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

1. We are where mobility is needed

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

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.

COLLABORATE
by developing environmental programs and initiatives with our stakeholders

ECODESIGN
by assessing environmental footprint and by integrating environmental objectives when designing our products and solutions

TRANSFORM
By encouraging parts and products’ reuse at the end of their life cycle and by participating in the development of closed-loop solutions

EXTEND
By deploying innovative solutions aimed at increasing our product’s lifespan and by promoting repair and reuse

RECYCLE
by proposing local waste recycling initiatives through multi-stakeholder partnerships

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 circular economy 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 ecodels
- 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 strategy

© ALSTOM SA 2021. All rights reserved. Information contained in this document is indicative only. No representation or warranty is given or should be relied on that it is complete or correct or will apply to any particular project. This will depend on the technical and commercial circumstances. It is provided without liability and is subject to change without notice. Reproduction, use, alter or disclosure to third parties, without express written authorisation, is strictly prohibited.
Design and supply
*Our ecodesign approach*

**Regiolis for France – Environmental life cycle analysis**

25% energy reduction in solutions

100% of newly developed solutions eco-designed

<table>
<thead>
<tr>
<th>Phase</th>
<th>Impact by phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>35.5%</td>
</tr>
<tr>
<td>Assembly</td>
<td>4.5%</td>
</tr>
<tr>
<td>End of life</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>5.5%</td>
</tr>
<tr>
<td>Delivery to customer</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>Energy in operation</td>
<td>54%</td>
</tr>
</tbody>
</table>

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**

- Energy efficiency
- Efficient use & greener materials
- Noise reduction
- Air quality
- End of life / Circular economy
- Healthier Mobility™
- Inclusivity

In 2021/22: 51% ecodesigned solution and 22% energy reduction
Design and supply
Ex. Avelia Horizon™ – Main targets

<table>
<thead>
<tr>
<th>Category</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>+20%</td>
</tr>
<tr>
<td>Acquisition costs</td>
<td>-20%</td>
</tr>
<tr>
<td>Energy consumption (traction efficiency, aerodynamics)</td>
<td>-20%</td>
</tr>
<tr>
<td>Maintenance costs (predictive maintenance, remote diagnostics)</td>
<td>-30%</td>
</tr>
<tr>
<td>Recycled content</td>
<td>20%</td>
</tr>
</tbody>
</table>
Design and supply

Efficient use of materials & greener materials

- **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

- 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

Up to 36% of the train environmental impact caused by preventive maintenance

This relative impact growing with the decarbonisation of energy

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

- Replacement / overhaul / repair of Parts
- Other maintenance activities (visual checks, greasing, cleaning...)

Av. 78%

Our levers:

Life extension
Digitalization, obsolescence management, predictive maintenance

Renovation / reparation
Identify repairable parts, 3D printing

Reuse / Resell
Components evaluation for second-hand use

*On Regional
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 table tops 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

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

© ALSTOM SA 2021. All rights reserved. Information contained in this document is indicative only. No representation or warranty is given or should be relied on that it is complete or correct or will apply to any particular project. This will depend on the technical and commercial circumstances. It is provided without liability and is subject to change without notice. Reproduction, use, alter or disclosure to third parties, without express written authorisation, is strictly prohibited.
Manage waste and recycle
*End of life management*

**Design for recyclability & recycled content**

- **i.e Smart Metropolis**
  - Recycled content
    - 25% Recycled content
      - Glass
      - Steel
      - Thermoplastic
      - Aluminium
  - Renewable content
    - 17% Renewable content
      - Wood
      - Textile
  - Dismantling manuals available to achieve optimised recyclability / recoverability

- **Recyclable material**
  - 94.7% Recyclable material
      - Metal
      - Thermoplastic

- **Recoverable material**
  - 98.4% Recoverable material
      - Metro average recyclability rate

**Developing 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 REQ:** “Quality reconditioning” for refurbished electronics
More to come!
Innovations for a circular economy

Employees and Alstom 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
Shreya Udai Sonar
Circularity Senior Program Manager, Global Environmental Team
Schneider Electric

Link to presentation
Circularity at Schneider Electric
<table>
<thead>
<tr>
<th></th>
<th>Agenda</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Sustainability at Schneider</td>
</tr>
<tr>
<td>2</td>
<td>Circularity Metrics &amp; Governance</td>
</tr>
<tr>
<td>3</td>
<td>Three examples of successful circularity implementation</td>
</tr>
</tbody>
</table>
Schneider Electric provides energy and automation digital solutions for efficiency and sustainability

Key figures for 2021

- 5% of revenues devoted to R&D
- €29 billion 2021 revenues
- 43% of revenues in new economies
- 128,000+ Employees in over 100 countries

A well-balanced global presence

2021 Revenues breakdown

- 26% Western Europe
- 29% North America
- 31% Asia Pacific
- 14% Rest of World

Two business:

<table>
<thead>
<tr>
<th></th>
<th>Energy management</th>
<th>Industrial automation</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>€22.2 billion</td>
<td>€6.7 billion</td>
</tr>
<tr>
<td></td>
<td>77%</td>
<td>23%</td>
</tr>
</tbody>
</table>

Confidential Property of Schneider Electric | Page 3
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
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
<table>
<thead>
<tr>
<th></th>
<th>Agenda</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Sustainability at Schneider</td>
</tr>
<tr>
<td>2</td>
<td>Circularity Metrics &amp; Governance</td>
</tr>
<tr>
<td>3</td>
<td>Three examples of successful circularity implementation</td>
</tr>
</tbody>
</table>
We are on our way to meet our **2025 ESG targets**

<table>
<thead>
<tr>
<th>GLOBAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Grow our <strong>impact revenues</strong> to 80%&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>2. Help customers save and avoid 800 million of tonnes of CO₂ emissions</td>
</tr>
<tr>
<td>3. Reduce by 50% CO₂ emissions from top 1,000 suppliers&lt;sup&gt;1&lt;/sup&gt; operations</td>
</tr>
<tr>
<td>4. Increase to 50% green material content in our products</td>
</tr>
<tr>
<td>5. 100% primary and secondary packaging free from single-use plastic and using recycled cardboard</td>
</tr>
<tr>
<td>6. 100% strategic suppliers who provide decent work to their employees</td>
</tr>
<tr>
<td>7. Level of confidence of our employees to report unethical conduct</td>
</tr>
<tr>
<td>8. Increase gender diversity in hiring (50%), front-line management (40%), leadership teams (30%)</td>
</tr>
<tr>
<td>9. Provide access to green electricity to 50M people</td>
</tr>
<tr>
<td>10. Double hiring opportunities for interns, apprentices and fresh graduates</td>
</tr>
<tr>
<td>11. Train 1M people in energy management</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>+ LOCAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Country and Zone Presidents with local commitments that impact their communities</td>
</tr>
</tbody>
</table>

---

1. As per by Schneider Electric definition and methodology

© 2022 Schneider Electric, All Rights Reserved | Page 7
<table>
<thead>
<tr>
<th>CLIMATE</th>
<th>RESOURCES</th>
<th>TRUST</th>
<th>EQUAL</th>
<th>GENERATIONS</th>
<th>LOCAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 150 Zero-CO₂ sites</td>
<td>5 15% energy efficiency in our sites</td>
<td>12 Deploy a ‘Social Excellence’ program through multiple tiers of suppliers (baseline to be defined in 2021)</td>
<td>18 &lt;1% pay gap for both females and males</td>
<td>22 &gt;90% of employees undergo digital upskilling through the Digital Citizenship program and digital transformation training</td>
<td>25 50,000 volunteering days since 2017</td>
</tr>
<tr>
<td>2 100% substitution with SF6-Free medium voltage technologies</td>
<td>6 80% of product revenues covered by Green Premium™</td>
<td>13 100% of employees trained every year on Cybersecurity and Ethics</td>
<td>19 60% subscription in our yearly Worldwide Employee Share Ownership Plan (WESOP)</td>
<td>23 Systematic career review and development plan for all employees ten years before retirement</td>
<td></td>
</tr>
<tr>
<td>3 90% of electricity sourced from renewables</td>
<td>7 One-third of corporate vehicle fleet comprised of electric vehicles (100% by 2030)</td>
<td>14 0.38 or below Medical Incident rate</td>
<td>20 100% of employees paid at least a living wage</td>
<td>24 75% employee engagement score</td>
<td></td>
</tr>
<tr>
<td>4 15% CO₂ efficiency in transportation</td>
<td>8 100% of sites with local biodiversity conservation and restoration programs</td>
<td>15 Halve the weight of safety units recalled</td>
<td>21 3X the number of employee-driven development interactions on the Open Talent Market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90% of electricity sourced from renewables</td>
<td>9 200 ‘Waste-to-Resource’ sites</td>
<td>16 In the Top 25% in external ratings for Cybersecurity performance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 420,000 metric tons of avoided primary resource consumption through ‘take-back at end-of-use’ since 2017</td>
<td>11 100% of sites in water-stressed areas have a water conservation strategy and related action plan</td>
<td>17 4,000 suppliers assessed under our ‘Vigilance Program’</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

©2020 Schneider Electric. All Rights Reserved
Schneider Electric’s Circularity journey: ramping up from 2015 onwards

2015
- Schneider Electric joins the Ellen MacArthur Foundation
- Schneider Electric launches eco-design approach

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

2019
- Schneider Electric wins The Circulars award

2019 - 2020
- #9 in Fortune’s Change the World list for Circular Economy

2020-2021
- Partnering in The Circulars Accelerator

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

- Extract less resources from the Earth
- Limit global temperature increase to 1.5°C
- Eliminate waste and pollution
- Create local value
Work with the **ecosystem, prioritize actions and bring value**

**ECOSYSTEM**
- Academics, associations and NGOs
- Suppliers
- Clients
- Peers and circularity pioneers

**REDUCE MATERIAL USE AND ENABLE CIRCULAR PRODUCTS**
- Design with less (natural) resources
- Design long lasting, repairable and recyclable products

**KEEP PRODUCTS IN USE THROUGH BUSINESS MODELS AND OPERATIONS**
- Reuse
- Repair, refurbish, upgrade
- Remanufacture

**RECIRCULATE COMPONENTS AND MATERIALS**
- Repurpose
- Recycle

**CUSTOMER VALUE**
- Quality and trust
- Resilience for supply & operations
- Efficiency in end-of-life management and product take-back
## Agenda

<table>
<thead>
<tr>
<th></th>
<th>Introduction to Sustainability at Schneider</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Circularity Metrics &amp; Governance</td>
</tr>
<tr>
<td>3</td>
<td>Three examples of successful circularity implementation</td>
</tr>
</tbody>
</table>
Ecodesign
Design for reparability & recyclability
### Reparability Index

Schneider’s pilot innovation

#### French Repairability Index

**Anti-waste Law**

Mandatory for household appliances: B2C

<table>
<thead>
<tr>
<th>CRITERION 1: DOCUMENTATION</th>
<th>Grade of the subcriteria /10</th>
<th>Total /100</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.7</td>
<td>2</td>
<td>15.4</td>
</tr>
<tr>
<td>63.5</td>
<td>5</td>
<td>10.5</td>
</tr>
<tr>
<td>8.0</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Reparability index</td>
<td>3.0</td>
<td>0.5</td>
</tr>
<tr>
<td>2.2</td>
<td>1.5</td>
<td>7.6</td>
</tr>
<tr>
<td>7.0</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>1</td>
<td>13.0</td>
</tr>
<tr>
<td>7.0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>17.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Schneider innovation

**Adaptation of repair index: B2B**
Making the link between the Repairability index criteria, product design & operations

<table>
<thead>
<tr>
<th>Design team</th>
<th>Service team</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost of repair</strong></td>
<td>• Less than 30% of new product</td>
</tr>
<tr>
<td>• Reparable on site &amp; by least qualified people</td>
<td>• Easy to dismantle</td>
</tr>
<tr>
<td><strong>Disassembly</strong></td>
<td></td>
</tr>
<tr>
<td>• Less than 7 steps to dismantle</td>
<td></td>
</tr>
<tr>
<td>• One tool for all / Easy to access</td>
<td></td>
</tr>
<tr>
<td>• Reusable fasteners and connectors</td>
<td></td>
</tr>
<tr>
<td><strong>Documentation</strong></td>
<td></td>
</tr>
<tr>
<td>• Complete and transparent</td>
<td>• Available for final customer</td>
</tr>
<tr>
<td><strong>Diagnosis and return</strong></td>
<td>• Take-back &amp; Return option</td>
</tr>
<tr>
<td>• Digital and intuitive diagnosis</td>
<td></td>
</tr>
<tr>
<td><strong>Spare Part Supply</strong></td>
<td>• Available more than 8 years after end of commercialization</td>
</tr>
<tr>
<td>• Available for Final customer</td>
<td>• Available for Final customer</td>
</tr>
</tbody>
</table>
GreenPremium is a journey we **started 15 years ago** on product sustainability.

**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
- Energy Efficient
- SF6 Free
- Take-back
- External Labels
Modernization with EcoFit™
A systems approach to modernization
Remanufacture product take-back
A New Business Model for MasterPact MTZ
Life Is On Schneider Electric
Modernization overview

Minimum Waste & Maximum Energy Efficiency

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.

<table>
<thead>
<tr>
<th>EcoFit™ Life Extension</th>
<th>EcoFit™ Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Essential</strong></td>
<td><strong>Replacement</strong></td>
</tr>
<tr>
<td>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.</td>
<td>Maintain your business continuity with the latest efficient and sustainable innovations.</td>
</tr>
<tr>
<td><strong>Advanced</strong></td>
<td>Replace your aging installation with new green and natively-connected assets ready to begin a long, high-performance service life.</td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>
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.

© 2022 Schneider Electric. All Rights Reserved.
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.
Circular Offer: Minimum waste, Maximizing re-use

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

Compliant with evolving industry standards and legislation

RECYCLE & Recover

SF₆ Recovery
Transport, recycling or destruction certificate for traceability

© 2021 Schneider Electric, All Rights Reserved | Page 26
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!

#UICSSustainabilityActionWeek #MoreTrains #circulareconomy #zerowasterailways